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# Single Versus Hybrid Models: Impact of Sport Education Associated with Nonlinear Pedagogy in a University Sport Program

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High jump athlete in mid-flight, performing the Fosbury Flop technique with maximum extension and control over the bar.
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## Abstract

The aim of this study was to assess the impact of a hybrid Sport Education (SE) and Nonlinear Pedagogy (NLP) program, in comparison to a single NLP program, on pre-service teachers' motivation and satisfaction during their initial training. The programs were implemented in football teaching at the university level, with the aim of preparing participants to apply these approaches in educational contexts. Participants were 67 pre-service teachers divided into two groups. One group experienced a hybrid SE+NLP program, and the second group experienced the NLP program. A 2 (pedagogical model) x 2 (test time) multivariate analysis of variance was performed. Results showed significant pre-post differences in students' intrinsic motivation, amotivation, and satisfaction with the teaching-learning process (teaching, interaction with others, and fun/enjoyment) only in the hybrid SE+NLP program. These results showed that SE can complement models such NLP to produce positive outcomes. If the goal is to ensure that future in-service teachers can implement pedagogical models effectively, proper training at the college level is required.

**Keywords:** autonomous motivation, pre-service team sports, satisfaction, self-determination theory

## Introduction

Shulman (2005, p. 52) defined signature pedagogies as the "types of teaching that organize the fundamental ways in which future practitioners are educated for their new professions." Through them, future professionals are educated to think, to perform, and to act with integrity. Parker et al. (2016) believed that signature pedagogies help bridge the theory-practice gap, providing strategies to help present and future PE teachers think about the purpose of schooling, the nature of the discipline, and their role as educators. Shulman (2005) highlighted that signature pedagogies can operate at three levels or dimensions: 1) surface structure: "concrete, operational acts for teaching and learning, of showing and demonstrating, of questioning and answering, of interacting and withholding, of approaching and withdrawing"; 2) deep structure: "a set of assumptions about how best to impart a certain body of knowledge and know-how"; and 3) implicit structure: "a moral dimension that comprises a set of beliefs about professional attitudes, values, and dispositions". Teacher education in general, and physical education (PE) teacher education in particular, also have signature pedagogies that describe how teaching and learning are conducted and how future PE teachers are prepared. In this context, Hordvik et al. (2017) identified Sport Education (SE) as a signature pedagogy.

Traditionally, teachers have led sports instruction by directing most learning decisions, limiting students' autonomy (Gil-Arias et al., 2020). Direct instruction, especially in university settings training future PE teachers, has been criticized for insufficiently supporting student autonomy (Pizarro et al., 2019). Autonomy-supportive environments promote adaptive outcomes such as intrinsic motivation and teamwork, contrasting with the usually directive nature of sports teaching (Mossman et al., 2022). One of the theoretical foundations used to understand students' motivation is Self-Determination Theory (SDT; Ryan & Deci, 2017), applied both in academic (Vasconcellos et al., 2020) and sports contexts, where it has led to training programs such as Empowering Coaching. SDT highlights that motivation lies along a continuum, where three levels of self-determination are distinguished (Ryan & Deci, 2000): a) autonomous motivation: participation for the pleasure of carrying out the activity; b) controlled motivation: participation to achieve other objectives such as social recognition or external rewards; and c) amotivation: lacking reasons for participating (Deci & Ryan, 2000). According to the Hierarchical Model of Motivation (HMM; Vallerand, 2001), the class climate created by the teacher's pedagogical framework can promote and/or thwart students' basic psychological needs (BPN), and consequently, their type of motivation. In this regard, Saiz-González et al. (2024) have uncovered that pedagogical models can produce a positive impact on the students´ BPNs, but it must be determined which of them. Direct instructional frameworks have been criticized because they may not be the best fit for the demands of contemporary education (Litchfield & Dempsey, 2015). In contrast, student-centered pedagogical models have been proposed to foster students' autonomy, allowing them to influence their learning process (Gil-Arias et al., 2020).

Among the pedagogical models that adopt this approach, Sport Education (SE) is probably the most widely implemented and studied in primary and secondary education (Evangelio et al., 2018). SE aims to help participants develop as autonomous and enthusiastic learners while remaining competent through participation in a complete and contextualized sports experience (Siedentop et al., 2019). This model creates an autonomy-supportive context in which students can make decisions and explore alternative roles that require social interaction and teamwork (Chu & Zhang, 2018). The literature provides evidence of the positive effects that SE can have on students' intrinsic motivation (Gil-Arias et al., 2020). A recent umbrella review uncovered that Sport Education (SE) is the pedagogical model most widely implemented and studied in primary and secondary education (Fernandez-Rio & Iglesias, 2022), but it has been scarcely implemented in initial teacher education at the university level. To our knowledge, only a few studies have been published involving pre-service PE teachers experiencing SE in their university context, adopting the role of students, and "living the curriculum" (Oslin et al., 2001). Hordvik et al. (2017) conducted a self-study with 12 pre-service teachers experiencing a 12-lesson SE unit and uncovered challenges in bridging theory and practice when learning and teaching the model. Liu and Hastie (2021) assessed 18 university students' calorie consumption in a SE-based tennis class. There appears to be a gap in the literature regarding initial teacher education and pedagogical models that needs to be filled.

In the quest to improve teaching quality, one of the initiatives undertaken has been the hybridization of pedagogical models, whose complementary application could overcome limitations present when they are used in isolation (Shen & Shao, 2022). Again, SE has been the most extensively hybridized model (Fernandez-Rio & Iglesias, 2022; Pizarro et al., 2025), with models like Teaching Games for Understanding (TGfU; Gil-Arias et al., 2020) or Teaching for Personal and Social Responsibility

(González-Víllora et al., 2019). The positive effects that the implementation of hybrid models could bring at the motor, cognitive, affective, and social levels are evident, considering the nested and hierarchical interaction of constraints and effects at different coordinative levels (Balagué et al., 2019). Despite the positive effects of combining SE with different game-based approaches, it has never been hybridized with the Nonlinear Pedagogy (NLP) approach. Empirically verified approaches, such as ecological psychology and dynamical systems theory (Araújo et al., 2019), offer new conceptual perspectives and provide a solid theoretical justification to use NLP during games and sports learning processes. In contrast to other proposals, instead of prescribing movement patterns to students and providing direct feedback on what they need to correct, the main objective of the teacher is to ask questions to students aimed at recognizing possible functional behaviors and the search for possible alternative motor solutions by leveraging the intrinsic processes of self-organization during learning (Pizarro et al., 2019).

Since there is little information on the use of SE in university contexts, and even less in university physical education programs and in combination with NLP, the present study aimed to take a step further in pedagogical model research. The primary goal was to assess the impact of a hybrid SE+NLP program, compared to a single NLP program, on pre-service teachers' motivation and satisfaction during their initial training. The initial hypothesis was that SE would be a beneficial addition to the single model.

## Method

### Participants

The current study was conducted in two universities located in central Spain. Participants were 67 students (*M* age = 20.70; *SD* age = 1.89, 11 females and 56 males) in their first year of the Sport Sciences degree, where they were trained to become PE teachers. All participants experienced the content of soccer; 28 did so through an SE+NLP program (in one university), and 39 through an NLP-only program (in the other participating university). Both groups received two weekly 55-minute sessions over six weeks, for a total of 12 sessions. Students had previously experienced units in other team sports (e.g., basketball) but they had not experienced any pedagogical model. Professors in both groups had 4-5 years of experience using both instructional approaches at the university level.

The present study was approved by the Ethics Committee for Research with Human Beings of the leading university (UNNE-2022-0013) and was conducted in accordance with the principles of the Declaration of Helsinki (2013). Written informed consent was obtained from all participants.

### Data Collection

*Motivation.* The Spanish version (Ferriz et al., 2015) of the Perceived Locus of Causality Questionnaire (Goudas et al., 1994) was used. All items began with the stem: "I participate in the soccer lessons… " and consisted of 24 items that measure six forms of motivation: intrinsic motivation (e.g., "Because I enjoy learning new abilities."); integrated regulation (e.g., "Because I believe that sport is in accordance with my values."); identified regulation (e.g., "Because it is a good way to learn lots of things that could be useful to me in other areas of my life."); introjected regulation (e.g., "Because I would like the teacher to think that I am a good student."); external regulation (e.g., "Because I have to do it."); and amotivation (e.g., "But I don't know why."). Each type of regulation was composed of four items, and previous research in the sport education context has provided support for the factor structure and internal reliability of this measure (Goudas et al., 1994).

*Satisfaction*. The Spanish version (Sicilia et al., 2014) of the Physical Activity Class Satisfaction Questionnaire (Cunningham, 2007) was used. All items began with the stem: "Show your satisfaction level in PE …" and included 45 items distributed across nine dimensions. In this study, only eight dimensions were measured: teaching (e.g., "the teacher's enthusiasm during classes"); relaxation (e.g., "the way my mind can switch off"); cognitive development (e.g., "what I learn regarding technical-tactical skills"); interaction with others (e.g., "the interaction I had with others in the class"); normative success (e.g., "my ability to do better than other classmates"); fun and enjoyment (e.g., "the pleasant experiences I had in the class"); mastery experiences (e.g., "the opportunity to learn new skills"); and diversionary experience (e.g., "I feel exhilarated during the class."). Previous research in educational contexts has demonstrated acceptable reliability of the instrument (Gil-Arias et al., 2020).

The items of both questionnaires were anchored on a Likert scale ranging from one (strongly disagree) to five (strongly agree).

## Intervention

After an initial evaluation, the intervention began. One study group experienced the hybrid program (SE+NLP), while the other study group received a program based only on NLP. However, both intervention programs were conducted over 12 lessons (six weeks), scheduled for 55 minutes twice a week.

*Sport Education component*. The structure of the program was designed according to the main features of SE (seasons, affiliation, formal competition, record keeping, final event, and festivity), and it included three phases. (a) Learning phase (lessons 1–7): In the first lesson, students were divided into three teams of six or seven students (mixed gender and ability), which persisted throughout the season (teams were formed using guidelines from Siedentop et al., 2019). In each group, students selected three roles (fitness leader, first coach, second coach, captain, equipment manager, statistician) that best fit their interests and/or personal strengths. These roles changed after two lessons, so that every student could experience three. Also, in this first lesson, students played matches (5 vs. 5), where they were introduced to the roles (e.g., the fitness leader developed the warm-up). From lesson 2 to 7, each learning task was designed by the professor based on the NLP framework. However, both, professors and pre-service PE teachers directed some learning tasks or had responsibilities (see "Roles and duty responsibilities" in Table 1). To support students' autonomy, the professor offered two tasks for each part for students to choose from. (b) Formal competition phase (lessons 8–11): All teams participated in different competition matches, and new roles appeared (e.g., referee, linesman, etc.). Contrary to the learning phase, the roles changed every lesson. (c) Final event (lesson 12): A final culminating event was carried out to decide the champions, followed by an awards ceremony (winning team; most original team; most organized team; fair play award; best refereeing team). During the formal competition phase, the professor gathered data on these elements. Records were made public throughout the program for each team to see their progress

**Table 1**
*Season plan for the SE component*

| Lesson | Phase | Format | Roles and duty responsibilities |
|---|---|---|---|
| 1 | Learning phase | Teacher-directed instruction within-team practice<br>5 vs. 5<br>Initial match | Development of team identity.<br>Roles.<br>Explanation of the model and competition format. |
| 2-7 | Learning phase | Shared-directed instruction<br>Student-directed:<br>Within-team practice<br>1 vs. 1⇨2 vs. 2⇨3 vs. 3<br>+<br>Teacher-directed:<br>With two teams<br>5 vs. 5 | Fitness leader conducted warm-up (5′).<br>Second coach conducted the first task (15′).<br>First coach conducted the second task (15′).<br>Teacher conducted the third task (15′).<br>Fitness leaders conducted cool down (5′).<br>Captain encouraged teammates and helped them.<br>Equipment manager gathered the equipment.<br>Statistician collected data with a checklist to analyze the team (decision-making and execution of technical-tactical skills). |
| 8-11 | Formal competition phase | Student directed instruction<br>5 vs. 5<br>Championships for season points<br>Scrimmages with opposing teams | *Groups that played the match:*<br>Equipment manager gathered the equipment.<br>Fitness leader conducted the general warm-up.<br>Second coach conducted the specific warm-up with a technical-tactical task.<br>Using the statistical report, the first coach and captain conducted a pre-match talk. The first coach did not play the match to give instruction to the players.<br>*Groups that did not play the match:*<br>Referee, two liners, and VAR controlled compliance with game rules.<br>Fourth official/delegate completed the match sheet.<br>Journalist wrote a report.<br>Photographer took pictures and interviewed a player after the match. |
| 12 | Final event | Student directed instruction<br>5 vs. 5<br>Culminating event<br>Festivity<br>Final match | All duties were performed (playing and non-playing teams' roles)<br>The mascot (new role) appeared with the responsibilities of the photographer. |

**Table 2**
*Game phases and tactical principles which are focused to learn*

| Lesson | Game phase | Tactical principles |
|---|---|---|
| 1 | | Learning focused on rules and formations. |
| 2 | Attacking phase | *Space:* Width and depth in attack.<br>*Support the attack:* Supporting the player with the ball. |
| 3 | Attacking phase | *Mobility:* Interchange of positions, occupation and creation of space, creation of passing lines, maintaining possession.<br>*Penetration:* Attacking the goal, creating numerical and spatial advantages. |
| 4 | Defending phase | *Containment:* Individual marking of the player with the ball to stop or delay opponent's attack.<br>*Concentration:* Denying width and depth in the opponent's attack. |
| 5 | Defending phase | *Defensive cover:* Supporting the teammate marking the player with the ball. |
| 6 | Attacking transition phase | *Mobility:* Occupation and creation of space.<br>*Penetration:* Attacking the goal, creating numerical and spatial advantages. |
| 7 | Defending transition phase | *Balance:* Covering space and free players and cutting passing lines. |
| 8 | Attacking phase | *Space, Support the attack.* |
| 9 | Defending phase | *Containment, Concentration, Defensive cover.* |
| 10 | Attacking transition phase | *Mobility, Penetration.* |
| 11 | Defending transition phase | *Balance.* |
| 12 | | All phases of gameplay |

*Nonlinear Pedagogy component*: each learning task was designed according to the characteristics of NLP: representative learning design; development of information-movement couplings; manipulation of constraints; dynamization of exploratory behavior; and reduction of conscious movement control (see details in Chow, 2013). For example, smaller formats from 1 vs. 1 to 5 vs. 5 were used to increase students' game involvement (modification representation); small-sided games with numerical superiority in attack, such as 2 vs. 1 or 4 vs. 3, were used to adapt the complexity of the task according to the players' skill level (tactical complexity); and constraints were modified, such as replacing goals with zones to arrive with passes to emphasize mobility —interchange of positions and creating passing lines— to modify game rules and emphasize specific tactical and technical learning objectives (modification exaggeration).

Thus, the main goal pursued by the professor is always to increase the functional diversity potential of the learner in his or her search for adaptive responses (Pizarro et al., 2019). In this sense, students were not instructed on the movement patterns they had to execute, nor were they provided with direct feedback on what they had to correct or on how to formulate questions.

Finally, each lesson was focused on the learning of a different game phase and tactical principles: attacking phase, defending phase, attacking transition phase and defending transition phase (see Table 2).

In both intervention programs, the format was the same: lessons were highly structured (warm-up, first task, second task, third task, and cool down), increasing the number of players and the technical-tactical complexity as they progressed. However, there were some differences: (a) while in the SE+NLP program pre-service PE teachers directed tasks, in the NLP program the professor was the instructional leader, setting the learning goals and directing the tasks; and (b) while in the SE+NLP program groups were persistent across lessons, in the NLP program groups changed in every task.

**Table 3**
*Instructional checklist*

| | Items | Present | Absent |
|---|---|---|---|
| 1 | Groups of students go to a designated home area and begin warming up with their group, conducted by the fitness leader. | | |
| 2 | Students warm up as a whole class under the direction of the teacher. | | |
| 3 | Students practice under the direction of the teacher and teammates (shared-directed instruction). | | |
| 4 | Students practice under the direction of the teacher. | | |
| 5 | Students perform specialized roles within their group/team. | | |
| 6 | Students are players, without other specialized roles. | | |
| 7 | The lesson is highly structured: warm-up, first task, second task, third task, and cool down. | | |
| 8 | All the tasks are small-sided games (contextualized context). | | |
| 9 | Learning focuses on both technical and tactical skills. | | |

## Instructional and Treatment Validity

The fidelity of both intervention programs was assessed using a pre-designed checklist. Based upon the instructional checklist of Gil-Arias et al. (2020), items 1, 3, 5 and 2, 4, 6 (Table 3) enabled researchers to assess professors' fidelity to both programs (with SE and without SE, respectively), while items 7, 8, 9 helped researchers to examine professors' fidelity to the NLP component (see Pizarro et al., 2019).

## Data Analysis

The statistical program SPSS v24.0 was used for data analysis and processing. Preliminary testing was conducted to check for homogeneity of variances and normality. Levene's and Kolmogorov–Smirnov tests were performed to confirm the assumptions of homogeneity of variances and normality of distribution, respectively ($p > .05$).

For each group (SE+NLP and NLP) at each of the two different phases (pre-intervention and post-intervention), means and standard deviations were calculated. To compare between-group and within-group differences in the dependent variables (motivation and satisfaction), a repeated-measures analysis of variance, MANOVA 2x2 (Test-Time x Group) was conducted. Analysis of differences was performed by means of multivariate contrasts, which are reported in this type of analysis.

Effect sizes were calculated using the partial eta-squared statistic ($\eta_p^2$). Effect sizes above .01 were considered small, above .06 medium, and above .14 large [small ($\eta_p^2 \geq .01$), medium ($\geq .06$), and large ($\geq .14$)]. The level of statistical significance was set at $p \leq .05$, with a 95% confidence interval for differences.

# Results

## Between-Group Pre-Intervention and Post-Intervention Analysis

Regarding *motivation*, the multivariate contrasts showed that there were significant differences in the pre-intervention phase between the two study groups: $\Lambda$ Wilks = .745; $F(6, 60) = 3.423$; $p = .006$; $\eta_p^2 = .255$; $SP = .919$. However, these differences were not found in the post-intervention phase: $\Lambda$ Wilks = .902; $F(6, 60) = 1.089$; $p = .380$; $\eta_p^2 = 0.098$; $SP = .396$.

Regarding *satisfaction*, the multivariate contrasts showed that there were significant differences between the two study groups both in the pre-intervention phase: $\Lambda$ Wilks = .787; $F(9, 57) = 1.712$; $p = .107$; $\eta_p^2 = .213$; $SP = .719$ and in the post-intervention phase: $\Lambda$ Wilks = .701; $F(9, 57) = 2.703$; $p = .011$; $\eta_p^2 = .299$; $SP = .920$.

## Within-Group Pre-Post-Intervention Analysis (Motivation)

The multivariate contrasts showed that there were significant pre-post differences in the SE+NLP group: $\Lambda$ Wilks = .803; $F(6, 60) = 2.460$; $p = .034$; $\eta_p^2 = .197$; $SP = .789$. However, these differences were not found in the NLP group: $\Lambda$ Wilks = .892; $F(6, 60) = 1.209$; $p = .314$; $\eta_p^2 = 108$; $SP = .439$.

**Table 4**
*Descriptive statistics and pairwise comparison of different forms of motivation between the two phases*

| Variable | Group | Pre-intervention | | Post-intervention | | Typical error | *p* | 95% confidence interval (CI) |
|---|---|---|---|---|---|---|---|---|
| | | *M* | *SD* | *M* | *SD* | | | |
| Intrinsic motivation | SE+NLP | 5.33 | 0.73 | 5.91 | 0.86 | 0.187 | .003* | [-0.954; -0.206] |
| | NLP | 5.91 | 0.77 | 5.77 | 0.66 | 0.159 | .399 | [-0.182; 0.452] |
| Integrated regulation | SE+NLP | 5.86 | 0.88 | 6.15 | 0.75 | 0.154 | .068 | [-0.593; 0.021] |
| | NLP | 6.56 | 0.58 | 6.39 | 0.68 | 0.130 | .188 | [-0.087; 0.433] |
| Identified regulation | SE+NLP | 5.60 | 1.03 | 5.91 | 0.74 | 0.167 | .066 | [-0.646; 0.021] |
| | NLP | 6.26 | 0.59 | 6.11 | 0.77 | 0.141 | .280 | [-0.128; 0.436] |
| Introjected regulation | SE+NLP | 4.04 | 0.05 | 3.97 | 1.15 | 0.232 | .759 | [-0.393; 0.535] |
| | NLP | 4.17 | 1.26 | 3.94 | 1.13 | 0.197 | .233 | [-0.156; 0.630] |
| External regulation | SE+NLP | 3.19 | 0.07 | 2.83 | 1.12 | 0.258 | .171 | [-0.158; 0.872] |
| | NLP | 2.85 | 1.51 | 2.48 | 1.06 | 0.219 | .094 | [-0.065; 0.808] |
| Amotivation | SE+NLP | 2.18 | 0.85 | 1.62 | 0.61 | 0.217 | .012* | [0.129; 0.996] |
| | NLP | 2.09 | 1.52 | 1.76 | 1.06 | 0.184 | .080 | [-0.040; 0.694] |

*Note. M* = mean; *SD* = standard deviation; *$p < .05$.

**Table 5**
*Descriptive statistics and pairwise comparison of different forms of satisfaction between the two phasess*

| Variable | Group | Pre | | Post | | Typical error | *p* | 95% confidence interval (CI) |
|---|---|---|---|---|---|---|---|---|
| | | *M* | *SD* | *M* | *SD* | | | |
| Teaching | SE+NLP | 6.08 | 0.97 | 6.60 | 0.94 | 0.204 | .013* | [-0.925; -0.111] |
| | NLP | 6.38 | 1.30 | 5.92 | 1.19 | 0.173 | .009* | [0.117; 0.806] |
| Relaxation | SE+NLP | 6.34 | 1.27 | 6.90 | 0.98 | 0.226 | .016* | [-1.010; -0.109] |
| | NLP | 7.05 | 1.04 | 6.93 | 0.89 | 0.191 | .533 | [-0.262; 0.501] |
| Cognitive development | SE+NLP | 6.04 | 1.20 | 6.30 | 0.96 | 0.209 | .211 | [-0.682; 0.154] |
| | NLP | 6.61 | 0.96 | 6.33 | 1.04 | 0.177 | .123 | [-0.077; 0.631] |
| Interaction with others | SE+NLP | 6.63 | 1.15 | 7.21 | 0.82 | 0.223 | .011* | [-1.028; -0.139] |
| | NLP | 7.11 | 1.02 | 6.88 | 0.89 | 0.189 | .209 | [-0.137; 0.616] |
| Normative success | SE+NLP | 4.79 | 1.49 | 4.86 | 1.50 | 0.294 | .809 | [-0.660; 0.517] |
| | NLP | 4.68 | 1.65 | 4.44 | 1.55 | 0.250 | .341 | [-0.259; 0.738] |
| Fun and Enjoyment | SE+NLP | 6.60 | 1.15 | 7.27 | 0.72 | 0.224 | .004* | [-1.115; -0.219] |
| | NLP | 7.03 | 1.08 | 7.12 | 0.68 | 0.190 | .622 | [-0.474; 0.286] |
| Mastery Experiences | SE+NLP | 5.84 | 1.26 | 6.57 | 0.82 | 0.208 | .001* | [-1.142; -0.311] |
| | NLP | 6.58 | 1.11 | 6.57 | 1.02 | 0.176 | .885 | [-0.326; 0.378] |
| Diversionary Experiences | SE+NLP | 6.18 | 1.25 | 6.70 | 0.88 | 0.216 | .019* | [-0.949; -0.087] |
| | NLP | 6.58 | 1.18 | 6.57 | 0.81 | 0.183 | .972 | [-0.359; 0.371] |

*Note. M* = mean; *SD* = standard deviation; *$p < .05$.

The comparisons in pairs between the different phases of the study are presented for each group (Table 4). For the SE+NLP group, significant differences in favor of the post-intervention phase were found in intrinsic motivation ($p = .003$) and amotivation ($p = .012$). For the NLP group, no significant differences were found in any type of motivation. These changes in the SE+NLP group reflected medium-to-large effect sizes (e.g., $\eta_p^2 \approx .20$), indicating meaningful practical impact.

### Within-Group Pre-Post-Iintervention Analysis (Satisfaction)

The multivariate contrasts showed that there were significant pre-post differences in the SE+NLP group: Λ Wilks = .691; $F(9, 57) = 2.829$; $p = .008$; $\eta_p^2 = .309$; $SP = .933$. However, these differences were not found in the NLP group: Λ Wilks = .681; $F(9, 57) = 1.209$; $p = .319$; $\eta_p^2 = .319$; $SP = .945$.

The comparisons in pairs between the different phases of the study are presented for each group (Table 5). For the SE/NLP group, significant differences in favor of the post-intervention phase were found in teaching ($p = .013$), relaxation ($p = .016$), interaction with others ($p = .011$), fun and enjoyment ($p = .004$), mastery experiences ($p = .001$), and diversionary experiences ($p = .019$). No differences were found in cognitive development and normative success. For the NLP group, significant differences in favor of the pre-intervention phase were found only in teaching ($p = .009$). Significant improvements in several satisfaction variables for the SE+NLP group also showed medium-to-large effects (e.g., $\eta_p^2 \approx .30$), supporting their practical relevance.

## Discussion

The basic goal of the present study was to assess the impact of a hybrid SE+NLP program, in comparison to a single NLP program, on pre-service teachers' motivation and satisfaction during their initial training. Results showed significant improvements only in the students that experienced the hybrid program.

The initial hypothesis was that SE would be a beneficial addition to the single model, and results confirmed it. Regarding the first dependent variable, motivation, only participants in the hybrid group significantly increased their intrinsic motivation (autonomous motivation) and significantly decreased their amotivation after the intervention program. Previous studies showed that learning scenarios that support autonomy could be achieved using SE (Wallhead & Ntoumanis, 2004). However, this is the first study conducted in a university PE program with pre-service teachers. Students' roles have been identified as essential to help students gain control over the class, promoting their feelings of autonomy (Perlman, 2011). According to the SDT (Ryan & Deci, 2017), autonomy is promoted if teachers take the students´ perspective into consideration, allowing them to choose some aspects of the process. In the hybrid SEM+NLP program, students chose three roles both in the learning phase and formal competition, which probably favored the increase in their feelings of autonomy support (MacPhail et al., 2008). Findings from the present study reinforce the effectiveness of SE in promoting students' choice in sport units (Perlman, 2011). In addition, through NLP, modified games (SSG; small-sided games) create learning environments in which students develop decision-making processes. Consequently, through SSG, teachers can also promote students' on-task autonomy, facilitating their active exploration of a landscape of available individual and collective affordances to provide opportunities for potential performance solutions (Chow et al., 2015). A recent meta-analysis showed that the more autonomous forms of motivation, characterized by enjoyment and valuation of the activity, are likely to appear when students feel that there is an environment that supports their BPNs such as autonomy (Vasconcellos et al., 2020).

Regarding the NLP group, results did not change after the intervention. Previous research indicated that in some single GBA implementations in educational contexts, it was difficult to observe participants' skill development and tactical awareness (Harvey & Jarrett, 2014). In hybridizations, this problem was addressed by having students perform the role of student–coach, where the learning environments were co-designed (Woods et al., 2021). This could be the reason why the hybrid SEM+NLP program produced better results than the single NLP model program (González-Víllora et al., 2019). These positive outcomes are supported by medium-to-large effect sizes, underscoring the practical educational value of the hybrid SE+NLP model. Thus, results indicate that there is a need to add SE to GBAs (e.g., NLP) to increase students' intrinsic motivation and decrease their amotivation.

Regarding *satisfaction*, the results showed that students in the SEM+NLP group significantly increased several variables after the intervention program: teaching, relaxation, interaction with others, fun and enjoyment, mastery experiences, and diversionary experiences. For the NLP group, no changes were observed, except a decrease in teaching. Regarding *teaching* and *interaction with others*, the results obtained are aligned with previous studies that found SE to be a context that allows for positive social connections between peers and with the teacher (Clarke & Quill, 2003) and comfort in speaking with classmates and with teachers (Kinchin & O'Sullivan, 2003). This could be attributed to the use of consistent teams and fair play guidelines, key elements in SE (Perlman, 2011). The appropriate guidance of the whole process by the professor,

focusing on the students' roles being performed correctly, could also explain the increase in the *teaching* dimension (Leo et al., 2020). Furthermore, the professor interacted with the students who performed the coach role, guiding the teaching-learning process, where interrogative feedback had critical importance. In contrast, there were no changes in the NLP group. These results are aligned with the methodology used (NLP), which focuses on *in situ* learning without emphasis on declarative knowledge. The students in this group probably solved the game situations without interacting with the professor and/or reflecting on their own learning with others (Chow, 2013). Thus, these results seem to indicate that the teacher should interact with students and use interrogative feedback whenever possible.

*Relaxation, fun, enjoyment* and *diversionary experiences* are terms that represent similar ideas, and they all increased only after experiencing the SE+NLP model. Previous literature indicated that enjoyment can be promoted through SE when students perform fun roles (e.g., mascot), which can enhance students' creativity and enjoyment through priming strategies (Sassenberg et al., 2017). In addition, SE includes a final event or festivity, which represents a closure based on fun and recognition for the work carried out throughout the program (Siedentop et al., 2019). Therefore, SE added value a plus to the NLP program, expanding its effects in the participating pre-service PE teachers.

Regarding *mastery experiences*, the results obtained in favor of the SE+NLP group, could be explained by the transfer of autonomy from the teacher to the students to lead tasks throughout the lessons, since performing roles such as coach or fitness leader has been found to increase participants' learning (Wallhead & Ntoumanis, 2004). Thus, it is recommended to allow students to lead tasks in order to foster mastery experiences. On the other hand, the main objective of SE is to develop cultured and competent sports individuals (Siedentop et al., 2019), and the results from the present study indicate that students felt that they learned (mastery experiences) only in the SE+NLP group.

SE has been identified as a signature pedagogy (Hordvik et al., 2017), in which pre-service teachers adopt the role of students to "live the curriculum" (Oslin et al., 2001). Signature pedagogies such as SE educate future PE teachers to think, perform and act with integrity in their profession (Shulman, 2005). The results of the present study indicate that SE can be added to NLP to produce positive changes in the initial training of future PE teachers (e.g., intrinsic motivation, interaction with others, enjoyment, mastery). Thus, if we want in-service PE teachers who can correctly implement pedagogical models such as SE in the future, we need to train them properly in college by bridging the theory-practice gap (Parker et al., 2016) and moving from the surface structure of signature pedagogies to the deep and implicit structures (Shulman, 2005) to produce significant changes in teacher training and meaningful impacts in students. Baseline differences in motivational variables were detected between groups. Although the MANOVA interaction analysis helps isolate change over time, these initial disparities may have influenced the magnitude of the effects. Therefore, the results should be interpreted with caution.

## Conclusion

The results from the present study indicate that SE can be added to NLP, increasing pre-service PE teachers' autonomous motivation and satisfaction with their classes. Thus, to generate a favorable learning environment that involves students in decision-making and promotes their autonomy and leadership, PE teachers should use strategies such as allowing students to perform roles like coach or fitness leader (i.e., leading tasks), and using interrogative feedback and small-sided games to practice the sport. To our knowledge, this is the first study to combine SE and NLP. The combination of these consolidated pedagogical approaches opens unexplored lines of investigation for researchers and new teaching perspective for practitioners.

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