

Cognitive and ecological–dynamic approaches to enjoyment in youth volleyball: A comparative analysis

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Published online: July 31, 2025

Accepted for publication: July 15, 2025

DOI:10.7752/jpes.2025.07170

Abstract

Introduction: In recent years, Volley S3 has gained recognition as an innovative sport that prioritizes children's enjoyment and overall experience, revitalizing the traditional methods of teaching volleyball to children and adolescents. Enjoyment is essential in the learning process because it increases learner engagement and promotes the development of positive motor skills and sport-related experiences. Additionally, enjoyment is related to reduced dropout rates in youth sports, encouraging sustained participation and long-term commitment to physical activity. The aim of this exploratory study is to investigate the levels of enjoyment reported by children practicing Volley S3, comparing two teaching methodologies: the cognitive approach and the ecological–dynamic approach. **Material and Methods:** The study involved twelve children with an average age of 11 years (± 0.9), who participated in eight training sessions. Four sessions used the cognitive approach, and four used the ecological–dynamic approach, ensuring each child experienced both methods. Data were collected using the Italian version of the Physical Activity Enjoyment Scale (PACES-It), which recorded positive, neutral, and negative responses to the two teaching styles. **Results:** Findings revealed a higher proportion of positive feedback for the ecological–dynamic approach (80%) compared to the cognitive approach (36%), along with decreases in neutral (19% vs. 52%) and negative feedback (5% vs. 12%). **Discussion:** These findings indicate that flexible learning environments, characterized by athlete–environment interaction, variability of practice, and student autonomous discovery, consistent with the ecological dynamics framework, can increase young athletes' motivation and engagement. **Conclusions:** In conclusion, this study stimulates reflection on teaching methods and goals in youth sports, especially in Volley S3, encouraging coaches and educators to create student-centered environments that foster positive, meaningful, and engaging physical experiences.

Keywords: Motor Learning; Volley S3; Sport Teaching Methods; Children; PACES-It Questionnaire

Introduction

In recent years, Volley S3 has emerged as an innovative sport discipline that prioritizes the learner's experience and enjoyment of play, revitalizing the traditional methods of teaching volleyball during childhood and adolescence. Considering the central role enjoyment plays in motivation and sustained sport participation (McCarthy et al., 2008), it is essential to identify pedagogical strategies that effectively foster it. In this context, enjoyment has been recognized as a predictor of continued sport involvement and a crucial factor in reducing dropout rates among youth athletes (Gardner et al., 2017).

Compared to the earlier Mini-volley model—which emphasized the repetition of technical gestures through analytical, isolated drills focused on execution accuracy (Kioumourtzoglou et al., 2022; Zetou et al., 2002)—Volley S3 places the child and their experience at the forefront, promoting integrated and motivating motor development. The Mini-volley model aligns with the cognitive approach, where learners are expected to acquire fixed, reproducible movement patterns by storing a generalized motor program in memory that contains the commands necessary to execute a series of actions with the same invariant characteristics (Schmidt, 2003). In this framework, movements were often detached from real game situations, and learners were treated as passive recipients rather than active participants in processing stimuli (Araújo, 2009). In contrast, Volley S3 is situational and exploratory, emphasizing continuous interactions between the individual and the environment as essential for facilitating decision-making and action execution (Headrick et al., 2015; Travassos et al., 2012). Based on the principles of ecological dynamics, sports performance is understood as an ongoing process of an athlete's co-adaptations in space and time to identify the most functional action possibilities for achieving their goals (Duarte et al., 2012).

This approach views the athlete as a non-linear dynamic system (Coppola et al., 2021) and focuses on the system's self-organization in relation to individual, task, and environmental constraints (Coiro et al., 2025; Renshaw & Chow, 2019), generating the sensorimotor interactions that underpin motor control (Davids et al., 2008). In this theoretical framework, Volley S3 tailors motor experiences to the child's current developmental

level, emphasizing exploration and creativity (Zahno, 2024; Coppola et al., 2024a; Marinšek & Lukman, 2022), as well as variation and variability (Chow et al., 2011). This approach allows learners to experiment with different movement options rather than repeatedly attempting the same solution to a problem. Variability enhances the movement system's adaptability and flexibility (Newell & James, 2008), providing the necessary fluctuations (Davids et al., 2003) to respond effectively to environmental demands, thereby improving motor control, learning, and adaptation (Barbado et al., 2012).

To personalize training loads, technical skill development, rules, and to enhance variation and variability in practice, the Italian Volleyball Federation (FIPAV) organizes Volley S3 into three progressively challenging levels—White, Green, and Red (Guida Pratica ufficiale, FIPAV, 2024). At each level, coaches can manipulate constraints to facilitate learner acquisition and promote the emergence of diverse motor solutions (Newell, 1991), creating environments that encourage creative adaptation and variable affordances (Gibson, 1979). The coach plays a crucial role: through their teaching style, they influence learner development. A prescriptive style—aligned with the cognitive approach and characterized by clear instructions, corrective feedback, and ideal models (Gray, 2020)—may be effective for early technical learning but can restrict learner autonomy and creativity. In contrast, a heuristic teaching style—based on ecological–dynamic principles (Pesce et al., 2019), practice variability (Costa et al., 2025; Coppola et al., 2025), and learning through exploration and trial and error—enables learners to experiment with creative motor strategies, thereby fostering adaptation, enjoyment, and motivation (Romano et al., 2023; Hristovski et al., 2011).

In this context, affordances personalize and shape motor experiences, enabling all learners to participate actively and adaptively based on their individual prerequisites, thereby supporting the development of competencies transferable to various life situations (Coppola et al., 2024b). These competencies, often referred to as soft skills, include problem-solving, critical and creative thinking, flexibility, and adaptability—all essential for the learner's holistic development (Sipii et al., 2024).

Enjoyment is a fundamental component of the learning process (Baena-Extremera et al., 2012); engaging and enjoyable training sessions allow children to learn effectively while maintaining high levels of participation, enhancing skill development (Hassinger-Das et al., 2017), and fostering positive motor and sport experiences (Wiersma, 2001).

Despite the use of training methodologies based on both cognitive and ecological–dynamic approaches in volleyball, scientific literature offers limited insight into how each affects the subjective experience of enjoyment in young Volley S3 athletes. Advancing knowledge in this area is essential to developing training methods that are not only technically effective but also personally fulfilling for children.

Rodríguez de Souza-Pajuelo et al. (2021), Sgrò et al. (2020), and Ntoumanis (2005) demonstrated that learners who experienced enjoyment tended to be intrinsically motivated and achieved better learning outcomes. Thus, the aim of this exploratory study is to analyze the enjoyment levels of children practicing Volley S3 by comparing training sessions based on the cognitive and ecological–dynamic approaches, with the goal of developing effective training methodologies for this sport. A within-subject experimental design was used to control for individual differences and assess the impact of teaching approach on enjoyment.

Material and Methods

Sample

The study sample included twelve children—six girls and six boys—with an average age of 11 years (± 0.9), all practicing Volley S3 at the Red level. They trained twice weekly in one-hour sessions. Participation was granted after obtaining written informed consent from the children's parents or legal guardians. The study was performed in accordance with the ethical principles outlined in the Declaration of Helsinki (WMA, 2013).

Instruments

To evaluate the children's perceived enjoyment during training sessions, the study used the Italian version of the Physical Activity Enjoyment Scale (PACES-It), validated by Carraro et al. (2008). PACES-It is a psychometric tool comprising 16 items—9 positive and 7 negative—that assess the level of subjective enjoyment experienced during physical activity. Participants respond on a five-point Likert scale, ranging from 1 ("completely disagree") to 5 ("completely agree"). The questionnaire provides an overall enjoyment profile by distinguishing positive, neutral, and negative attitudes toward the activity. High scores on the positive scale combined with low scores on the negative scale indicate a high level of enjoyment in physical activity (Carraro, 2012).

Procedures

Prior to the experimental phase, a pilot study was performed with a sample comparable to that of the main study to verify the correct implementation of the training protocols for both approaches. An informational meeting was then held with the participant's parents or tutors to explain the research objectives and procedures and to obtain informed consent. The investigation consisted of eight one-hour training sessions: four sessions followed the cognitive approach, and four the ecological–dynamic approach, ensuring that each child experienced both methods. Each session began with a standardized warm-up, followed by a core phase featuring drills focused on volleyball fundamentals (setting, forearm pass, serve, and spike) tailored to the respective approach. Each session concluded with a cool-down period. Sessions using the cognitive approach were

characterized by repetitive, stereotyped technical drills performed analytically and detached from real game situations. In contrast, ecological–dynamic sessions featured exercises that encouraged variation, variability, exploration, and creativity through constraint manipulation. Within this framework, it is crucial to design representative learning environments where task constraints during training closely mirror those encountered in actual performance. At the end of each session, athletes completed the PACES-It questionnaire to evaluate their perceived enjoyment of the activity.

Data Processing and Analysis

Data were analyzed using descriptive statistics in Microsoft Excel. For each participant, the percentages (%) of positive, neutral, and negative feedback recorded via PACES-It for both teaching approaches (cognitive and ecological–dynamic) were calculated. The data were summarized using the mean, standard deviation ($\pm$ SD), and minimum and maximum values—all expressed as percentages—to highlight differences in enjoyment perception between the two methods. Results were then presented in bar charts for a clear comparative visualization.

Results

The results on enjoyment levels are based on the analysis of feedback provided by the children at the end of training sessions performed using the two teaching approaches—the cognitive and the ecological–dynamic. Data processing allowed for quantifying, in percentage terms (%), the distribution of positive, neutral, and negative feedback for each approach, taking into account every athlete participating in the study. For feedback classification, the following scheme was used:

- scores of 4 and 5 on positive items, and scores of 1 and 2 on negative items, were classified as *positive feedback*;
- a score of 3 was considered *neutral feedback* for all items;
- scores of 1 and 2 on positive items, and scores of 4 and 5 on negative items, were classified as *negative feedback*.

Table I. Mean percentages (%), standard deviations ($\pm$ SD), and minimum and maximum values of positive feedback for both approaches compared.

	COMPARISON OF POSITIVE FEEDBACK	
	Ecological–dynamic approach	Cognitive approach
Minimum value	64%	19%
Maximum value	95%	48%
Mean ($\pm$ SD)	80% ($\pm$ 16%)	36% ($\pm$ 8%)

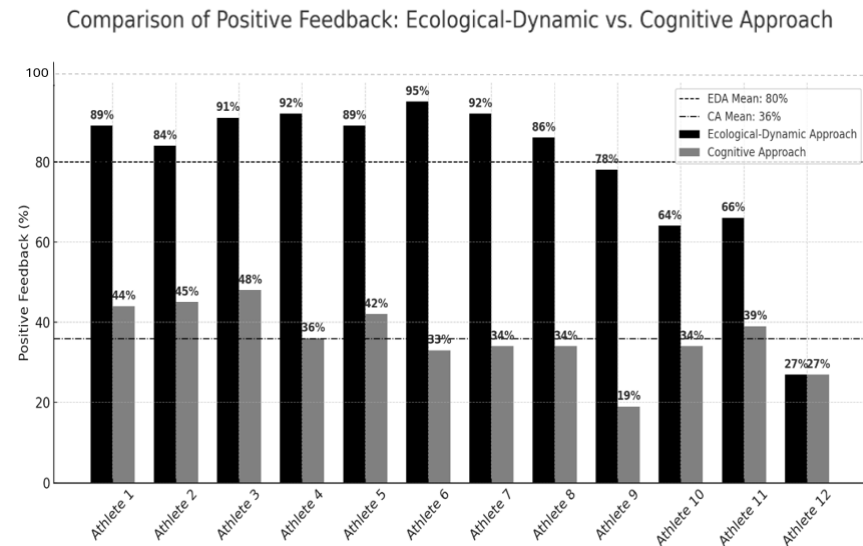


Figure I. Positive feedback rates for twelve athletes under the Ecological–Dynamic (EDA) and Cognitive Approaches (CA). Dashed lines indicate the mean values for each approach (EDA = 80%, CA = 36%).

Table I and Figure I show the percentages of positive feedback collected from each athlete under both approaches. Values for the ecological–dynamic approach (shown in black) range from 64% to 95%, with a mean of 80% ($\pm$ 16%). Values for the cognitive approach (shown in grey) range from 19% to 48%, with a mean of 36% ($\pm$ 8%).

Table II. Mean percentages (%), standard deviations ($\pm$ SD), and minimum and maximum values of neutral feedback for both approaches compared.

	COMPARISON OF NEUTRAL FEEDBACK	
	Ecological–dynamic approach	Cognitive approach
Minimum value	5%	44%
Maximum value	55%	67%
Mean ($\pm$SD)	19% ($\pm$ 14%)	52% ($\pm$ 7%)

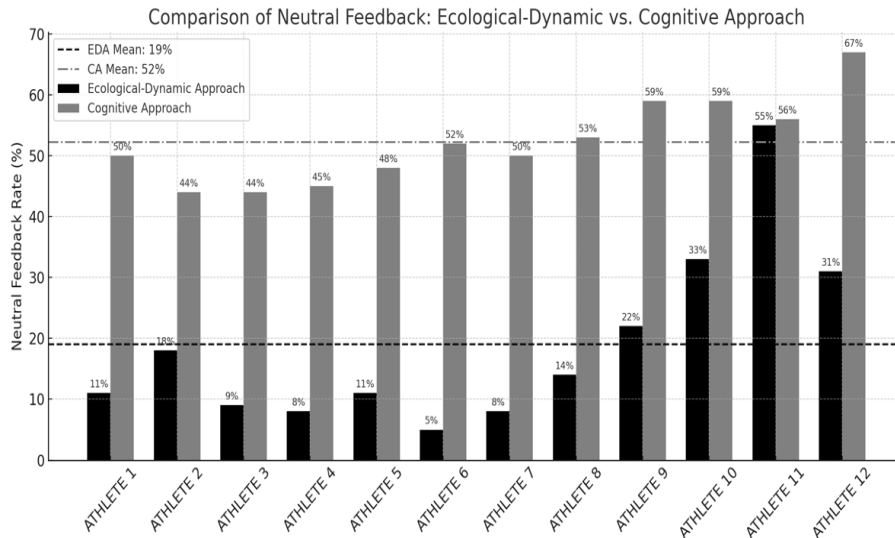


Figure II. Neutral feedback rates for twelve athletes comparing the Ecological–Dynamic (EDA) and Cognitive Approaches (CA). Dashed lines indicate the respective mean values (EDA = 19%, CA = 52%). Table II and Figure II show the percentages of neutral feedback. For the ecological–dynamic approach (represented in black), values range from 5% to 55%, with a mean of 19% ($\pm$ 14%). In contrast, the cognitive approach (represented in grey) shows percentages ranging from 44% to 67%, with a mean of 52% ($\pm$ 7%).

Table III. Mean percentages (%), standard deviations ($\pm$ SD), and minimum and maximum values of negative feedback for both approaches compared.

	COMPARISON OF NEGATIVE FEEDBACK	
	Ecological–dynamic approach	Cognitive approach
Minimum value	0%	6%
Maximum value	8%	22%
Mean ($\pm$SD)	5% ($\pm$ 2%)	12% ($\pm$ 5%)

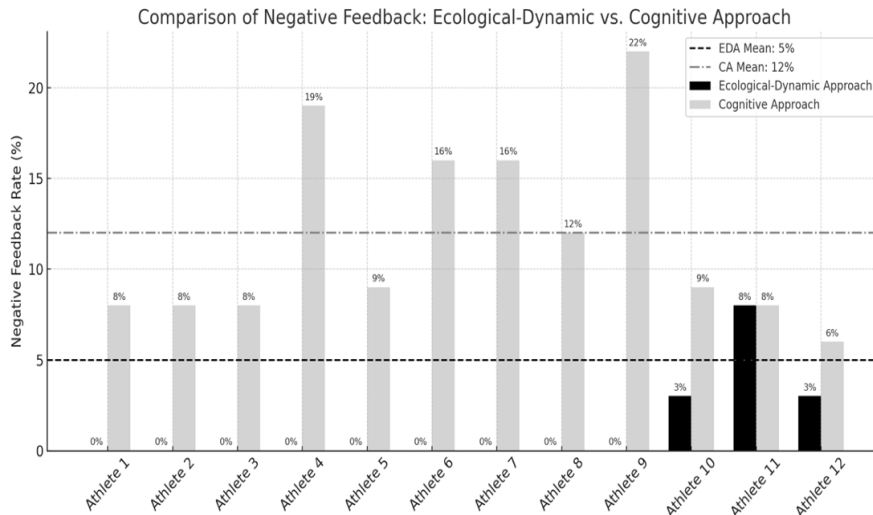


Figure III. Negative feedback rates for twelve athletes under the Ecological–Dynamic (EDA) and Cognitive Approaches (CA). Mean values are indicated by dashed lines: 5% for EDA and 12% for CA.

Table III and Figure III show the percentages of negative feedback. For the ecological–dynamic approach (depicted in black), values range from 0% to 8%, with a mean of 5% ($\pm 2\%$). For the cognitive approach (depicted in grey), percentages range from 6% to 22%, with a mean of 12% ($\pm 5\%$).

Table IV. Summary of mean percentages (%) and standard deviations ($\pm$ SD) for all feedback categories across both approaches.

	SUMMARY AVERAGES OF ALL FEEDBACK		
	Positive feedback	Neutral feedback	Negative feedback
Cognitive approach	36% ($\pm 8\%$)	52% ($\pm 7\%$)	12% ($\pm 5\%$)
Ecological–dynamic approach	80% ($\pm 16\%$)	19% ($\pm 14\%$)	5% ($\pm 2\%$)

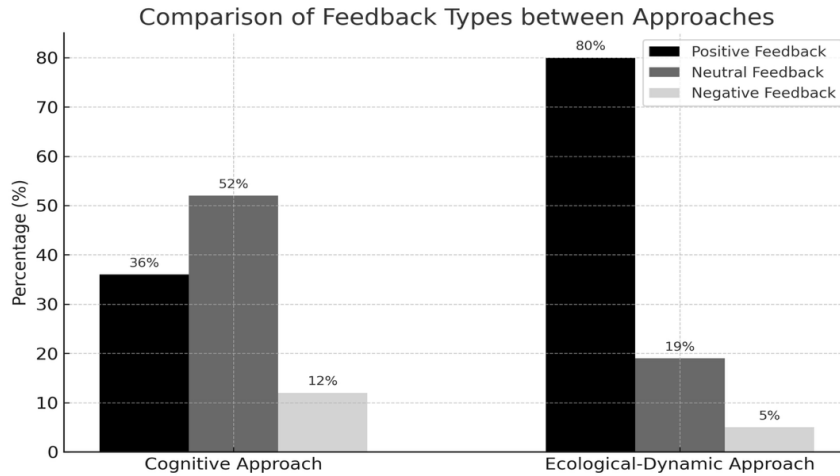


Figure IV. Summary of all feedback percentages (%) collected for the Cognitive and Ecological–Dynamic approaches.

Table IV and Figure IV show the overall mean percentages of all feedback collected for each approach.

- *Positive feedback* (shown in black): 36% for the cognitive approach and 80% for the ecological–dynamic approach.
- *Neutral feedback* (shown in dark grey): 52% for the cognitive approach and 19% for the ecological–dynamic approach.
- *Negative feedback* (shown in light grey): 12% for the cognitive approach and 5% for the ecological–dynamic approach.

Discussion

The results of this study show a substantially higher proportion of positive enjoyment feedback in the ecological–dynamic approach compared to the cognitive approach (80% vs. 36%). In contrast, the cognitive approach elicited more neutral (52% vs. 19%) and negative (12% vs. 5%) feedback than the ecological–dynamic approach, reflecting differing participant experiences. Specifically, the ecological–dynamic approach yielded a mean of 80% ($\pm 16\%$) positive feedback, with individual values ranging from 64% to 95%. In contrast, the cognitive approach had a mean of 36% ($\pm 8\%$) positive feedback, with values ranging from 19% to 48%. This comparison suggests that ecological dynamics—focused on athlete–environment interaction (Araújo et al., 2023), high levels of practice variation and variability (Seifert et al., 2013), and learner autonomy in discovery—promote more engaging and positive participation in motor activities.

These findings align with the studies of Button et al. (2021) and Araújo (2009), who argue that learning environments based on variability, situational adaptation, and perception–action coupling enhance intrinsic motivation, reduce performance anxiety, and stimulate motor creativity. The flexible, participatory nature of ecological dynamics allows learners to take an active role in their own development, allowing acquired competencies to be linked to functional behaviors that emerge in specific performance contexts (Seifert & Davids, 2016). Regarding neutral feedback, the cognitive approach yielded a mean of 52% ($\pm 7\%$), with values ranging from 44% to 67%, while the ecological–dynamic approach averaged 19% ($\pm 14\%$), ranging from 5% to 55%. Negative feedback averaged 12% ($\pm 5\%$) for the cognitive approach (range of 6%–22%) and 5% ($\pm 2\%$) for the ecological–dynamic approach (range of 0%–8%). The distribution of responses recorded by PACES-It indicates a more positive perception of the motor experience in sessions performed with the ecological–dynamic approach, as reflected by the lower proportions of neutral (19% vs. 52%) and negative (5% vs. 12%) feedback.

Volley S3 itself is an educational approach consistent with ecological–dynamic principles. Its progressive levels, the ability to manipulate constraints by adjusting rules and playing spaces, and the design of drills that encourage peer interaction and motor problem-solving are key elements reflecting this framework. Supporting this perspective, studies by Menezes-Fagundes et al. (2025), dela Cruz (2024), Moura et al. (2024), and Jorge Rodrigues et al. (2022) demonstrate that, through small-sided volleyball games, manipulating constraints such as court size, net height, or the number of players effectively guides learners' skill acquisition and promotes adaptive behaviors. Furthermore, the study suggests that training using the cognitive approach is associated with lower levels of enjoyment among learners.

This may be attributed to the prescriptive, highly structured nature of the drills, which focus on the repetition of an ideal technical movement. As Casey and Kirk (2020) highlight, this approach can impact learners' cognitive, affective, and social dimensions, potentially limiting their holistic development. Similarly, Allender et al. (2006) emphasize that negative experiences during physical activity discourage young people from participating in sport and motor practice. Regarding practical implications, the results of this exploratory study indicate that training with an ecological–dynamic approach promotes higher levels of enjoyment in children practicing Volley S3. Coaches could adopt methods that emphasize interaction with the environment, practice variation and variability, and active learner engagement. In this approach, the coach acts as a facilitator of learning, designing training and play environments that encourage creativity, problem-solving, and situational adaptation (Myszka et al., 2023). The ability to tailor motor experiences through Volley S3's progressively challenging levels also respects individual prerequisites, promoting inclusion, motivation, and the development of transferable skills. Training sessions featuring substantial variation and variability—key aspects of ecological dynamics (Seifert et al., 2013)—may thus enhance not only technical and tactical skills but also emotional, relational, and social growth, supporting learners' holistic development.

Conclusions

This study examined children's perceived enjoyment levels during Volley S3 training sessions structured using two different teaching methods: the cognitive approach and the ecological–dynamic approach. The results demonstrate that training based on ecological–dynamic principles led to higher enjoyment levels in children practicing Volley S3 compared to the traditional cognitive approach. In this study, the greater proportion of positive feedback alongside fewer neutral or negative responses suggests that a variable and flexible learning environment—focused on the children and interaction between teammates—can be more engaging and motivating for young athletes. These findings also underscore the importance of designing learning environments that accurately represent the tasks to be performed and encourage active participation and exploration by the children, as emphasized in ecological dynamics. Therefore, it is essential for coaches and teachers to adopt methodologies that go beyond repetitive practice of ideal techniques, fostering learners' discovery and adaptability. In line with the educational goals of Volley S3, the ecological–dynamic approach appears particularly well-suited to supporting children's motor, cognitive, and socio-emotional development.

This study has some limitations: the small sample size and brief intervention period restrict the ability to make conclusions that fully represent the population of young Volley S3 athletes. Additionally, as an exploratory study, further research is needed to assess the effectiveness of the two approaches over a longer timeframe and with a larger sample. Despite these limitations, this study stimulates reflection on teaching methodologies and objectives in youth sport, particularly in Volley S3, motivating coaches and educators to create student-centered environments that promote positive, meaningful, and engaging physical experiences.

Supporting agencies The authors did not report any funding agencies.

Disclosure of interest The authors declare that they have no competing interests.

Ethical considerations These trials were performed in accordance with the ethical principles outlined in the Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects (WMA, 2013).

Consent to participate The athletes' parents signed an informed consent form, authorizing their participation in the study.

Data availability statement Data are available upon request.

Acknowledgments The authors would like to thank Falcon Scientific Editing (<https://falconediting.com>) for proofreading the English language in this paper.

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