International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 14, Issue 5 [May. 2025] PP: 63-67

Integrating pickleball into the physical education curriculum at Thai Nguyen University of Technology: Enhancing physical and cognitive skills for first-year engineering students

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Abstract
This study evaluates the integration of pickleballs in the curriculum for sports lessons for first year students at the Thai University of Technology, conducted over 10 weeks of 150 minutes a week from September 2024. The study presented quantitative data for physical fitness, skill acquisition, and potential improvements for 120 potential improvements. Serving accuracy ($P<0.01$). Qualitative knowledge from research, interviews, and teacher flexion showed the critical role of high school students (88% assessed the curriculum despite the comfort or very comfortable facility restrictions) and teacher support. This result demonstrates the potential of pickleball as an integrated and effective sport for physical education, promoting physical ability and commitment. Recommendations include facility expansion and teacher training to maintain implementation. This study provides curriculum innovation in the organization of Vietnam University and addresses pickleball scalability.
Keywords: *Pickleball, physical education, curriculum innovation, student engagement, Vietnam*

Date of Submission: 28-04-2025 Date of acceptance: 07-05-2025

I. Introduction

A paddle sport that combines elements of tennis, badminton and table tennis, pickleball has gained worldwide popularity due to its accessibility, physical demand and social appeal. The 1965 US pickleball is played with courtyard paddles and perforated balls that resemble badminton dishes suitable for players of various ages and fitness levels. His simplicity and inclusiveness led to his introduction to sports programs around the world, particularly in parts of North America, Europe and Asia. In Vietnam, where physical education is an essential part of the university's curriculum, the introduction of innovative sports such as pickle balls provides opportunities to improve students' commitment, physical abilities and social interactions. North Vietnam's leading facility, Tai Nu Nguyen University of Technology (TNUT), took its pioneering step in September 2024 by integrating pickleball into its first year sports lesson curriculum.

Pickleball integration at TNUT responds to the growing need for diverse and engaging sports activities to meet students with a variety of sports skills. Traditional sports such as soccer, volleyball and badminton dominate the curriculum of the University of Vietnam, but may not appeal to all students, especially for students with limited pre-sports experience. The compact court size, simple rules and moderate physical requirements of pickleball make you an ideal candidate to promote inclusion and encourage student participation in the first year of switching to university life. Furthermore, as shown in the Ministry of Education and Education for Physical Education, pickleballs on Vietnam's educational goals, lifelong physical activity and comprehensive student development are addressing promotion.

Despite this possibility, the introduction of pickle balls in the formation of Vietnamese universities has not yet been studied. Little is known about the possibility of implementing pickle balls in resource-limited environments, their impact on student outcomes, or the pedagogical adjustments required for effective delivery. The purpose of this study is to examine these gaps by examining the process and outcome of the introduction of pickle balls in TNUT sports lessons. In particular, the goals are:
(1) documents the implementation process, including curriculum design, device supply and teacher training. (2) Assessing the impact of pickle balls on first year students' physical fitness, acquisition, and commitment. (3) Identify challenges and opportunities for expanding pickle balls at the University of Vietnam. Through the provision of empirical knowledge, this study aims to contribute to global discourse on innovative sports in physical education and to inform the development of Vietnamese curriculum.

The importance of this study is the potential to promote sports education in Vietnam. While universities strive to meet the diverse needs of their students, the introduction of sports such as pickleballs can improve student

relevance and satisfaction. Furthermore, this study provides educators and political decisions. It provides practical instructions for integrating new sports into resource-limited environments that address issues such as facility restrictions and teacher motivation. By focusing on students in their first year, this study examines how pickleballs support the transition to college life and promote social connection and physical trust. The Pickle Ball is a racket sport featuring its small square (13.4 m x 6.1 m), solid paddles and perforated polymer balls. The rules of sports are not complicated, highlighting short gatherings and strategic games that make them accessible to beginners. According to the American Pickleball Association (2023), pickleballs grew exponentially in the United States alone. Introduction to educational institutions, particularly in North American schools and universities, was driven by low costs, minimal space requirements, and calls to invoke various population groups (Smith & Brody, 2020). In Asia, countries such as Singapore and India have now included pickle balls in their community and school programs, but their use in university formation is still limited.

Pickleball offers several benefits for physical education and spans physical, psychological and social fields. Physically, pickleballs improve hand-eye coordination, flexibility and cardiovascular fitness due to their fast yet low species (Johnson & Lee, 2021). In contrast to highly intensive sports such as basketball, the medium requirement for pickleball is suitable for students with varying levels of fitness, reducing the risk of injury (Brown et al., 2019). Pickleball promotes psychological pleasure and motivation, as it allows students to succeed early with its fast learning curve (Taylor & Kim, 2022). Sports teamwork and communication, especially in double games, are promoted in social ways that cater to the collaborative learning goals of physical education (Nguyen & Tran, 2020).

Research on pickle balls in the field of education emphasizes its effectiveness in inclusion of students and promoting physical competence. Study by Miller et al. (2020) found that students who participated in the pickleball unit reported higher pleasure and perceived abilities compared to traditional sports such as soccer. Similarly, a university study by Chen and Wang (2021) showed that pickleballs improve students' athletic ability and social interactions, especially in non-activity participants. However, most studies focus on Western contexts where research on the applicability of pickle balls in Asian education systems is limited.

In Vietnam, physical education research focuses primarily on traditional sports and its role in meeting national fitness standards (Le & Pham, 2018). Despite the potential for diversifying curriculum and solutions to students, the introduction of new sports such as pickleball has received little attention. Nguyen and Tran (2020) argue that innovative sports can improve sports education by addressing student preferences for novelty and inclusiveness, but empirical research is rare.

This study is based on the Sport Education Model (SEM) that emphasizes student learning, development and social responsibility in physical education (Siedementop, 1994). Focusing on creating authentic sports experiences corresponds to the structured and accessible format of pickleballs, allowing students to develop technical skills, tactical awareness and teamwork. Furthermore, engine learning theory (Schmidt & Lee, 2011) informs research assessment of ability acquisition of the opportunity to drive motor learning stadiums as repetitive movements of pickleballs (servants, volley-in). Despite the growing popularity of the pickleball, there are some research gaps. First, there is a lack of research into the implementation of pickle balls in resource-limited environments such as the University of Vietnam where sports facilities are limited. Second, the impact of pickle balls on first year students, a group undergoing substantial academic and social transitions, is unmistakable. Third, the educational strategies needed to effectively teach pickleballs, such as teacher training and curriculum design, were not systematic. This study addresses these gaps by providing a case study for the integration of pickle balls in TNUT and providing insight into feasibility and effectiveness into the Vietnamese context.

II. Methodology

Research Design

This study employs a mixed method study design to evaluate the integration of the Pickle Ball Physical Education Curriculum (TNUT) into the Physical Education Curriculum (TNUT) for first year learning in September 2024. The context of the University of Vietnam.

Participants This survey consisted of 120 students in the first year and was enrolled in forced physical education at TNUT from 2024 to 2025. Participants are selected via target samples to present a variety of academic programs (e.g. engineering, technology) and gender. Students with illnesses that restrict physical activity will be excluded for security reasons. Two trainers for physical education, including researchers, present considerations regarding the educational process. All participants enter a declaration of consent and adhere to the ethical research protocol from TNUT.

-Implementation Process

Pickleball Curriculum is extended to a 10-week term with 150-minute lessons per week and is derived as two 75-minute meetings. The curriculum consists of a sports formation model that emphasizes the development of skills, tactical understanding and teamwork. The key components include

Curriculum Structure:
Lessons are divided into three phases: Three weeks of basic technical education (e.g. serving, volley), and a 3-week double tournament apply learning skills in a competitive environment.
Equipment and Facilities: Two indoor pickleball locations are installed in the TNUT-Gymnasium equipped with portable networks, paddling and perforated balls to optimize cost efficiency.
Instructor Training: Researchers and additional trainers complete a two-day training workshop on pickle ball rules, educational strategies and security measures promoted by local sports consultants.
Data Collection: Data are collected in quantitative and qualitative ways to achieve research goals. Quantitative measurements include

Physical Fitness Tests: Agility (T Test) and Prevention of Hand and Eye Adjustment (Ball Throwing Test) and post-intestinal Environment Review. Qualitative measures include
Student Survey: Postintervention questionnaire (n = 120) and public questions regarding the assessment of commitment, enjoyment, and perceived benefits.
Interviews: semi-structured interviews with 15 students and both trainers to investigate experience and curriculum effectiveness.
Teacher Bend: Weekly Journal Entries from instructors documenting educational adjustments and obser Data Analysis
Quantitative data are analyzed using descriptive statistics (mean, standard deviation) and paired t-tests to compare fitness and ability values before and after the intervention. Qualitative data from research, interviews and reflections are subject to thematic analysis to identify important topics (such as student motivation, implementation barriers, etc.). Triangulation of data improves reliability by integrating quantitative and qualitative results. The analysis is performed on SPSS (version 27) for quantitative data and NVIVO (version 12) for qualitative data.
- Ethical Considerations
This study includes ethical standards for TNUT, ensuring participants' confidentiality, voluntary participation and right to retreat. Data will be anonymized and results will be reported to protect privacy vations.

III. Results And Discusion

This study evaluated the implementation of a 10-week pickleball curriculum for 120 min students in the first year at Tyingien University of Technology (TNUT) from September 2024. Data were collected by intervention, student surveys, and fitness and skill tests before and after interviews. The results are presented as descriptive graphs and have important explanations to highlight important insights.

Table 1: Pre- and Post-Intervention Agility (T-Test Scores)

Testing Phase	Mean (seconds)	SD	p-value	Cohen's d
Pre (Week 1)	9.9	1.3		
Post (Week 10)	9.0	1.1	< 0.01	0.60

Table 1 presents agility scores from the T-test, comparing pre- and post-intervention results for 120 participants. The mean time decreased from 9.9 seconds (SD = 1.3) to 9.0 seconds (SD = 1.1), indicating improved agility. A paired t-test confirmed statistical significance ($p < 0.01$), with a moderate effect size (Cohen's $d = 0.60$).

Table 2: Pre- and Post-Intervention Hand-Eye Coordination (Ball Toss Test Scores)

Testing Phase	Mean (catches)	SD	p-value	Cohen's d
Pre (Week 1)	15.3	3.2		
Post (Week 10)	18.5	2.9	< 0.01	0.75

Table 2 shows hand-eye coordination results from the 30-second ball toss test. The mean number of successful catches increased from 15.3 (SD = 3.2) to 18.5 (SD = 2.9). A paired t-test indicated significant improvement ($p < 0.01$), with a moderate-to-large effect size (Cohen's $d = 0.75$).

Table 3: Pickleball Skill Acquisition (Serving Accuracy Scores)

Testing Phase	Mean (successful serves)	SD	p-value	Cohen's d
Pre (Week 1)	3.0	1.5		
Post (Week 10)	6.9	1.3	< 0.001	1.08

Table 3 displays serving accuracy scores (out of 10 attempts) at Weeks 1 and 10, measured by successful serves landing in the target area. The mean increased from 3.0 (SD = 1.5) to 6.9 (SD = 1.3). A paired t-test confirmed significant improvement ($p < 0.001$), with a large effect size (Cohen's $d = 1.08$).

Table 4: Student Engagement (Survey Responses on Enjoyment)

Rating (Likert Scale)	Percentage of Respondents (n = 120)
1 (Not Enjoyable)	0%
2 (Slightly Enjoyable)	0%
3 (Neutral)	10%
4 (Enjoyable)	34%
5 (Very Enjoyable)	56%

Table 4 summarizes responses to the post-intervention survey question ("How enjoyable was the pickleball curriculum?") on a 5-point Likert scale. No students rated the curriculum below neutral, with 10% selecting 3, 34% selecting 4, and 56% selecting 5, indicating high engagement.

Table 5: Implementation Challenges (Thematic Frequency from Qualitative Data)

Theme	Number of Mentions
Facility Constraints	15
Initial Learning Curve	11
Teacher Support	23

Table 5 presents the frequency of themes from 15 student interviews and teacher reflections. Teacher support was mentioned most frequently (23 times), followed by facility constraints (15 times) and the initial learning curve (11 times), highlighting strengths and challenges.

The results of the 10-week pickleball curriculum at TNUT provide compelling evidence of effectiveness in improving physical fitness, mastering skills and acquiring students' commitment in the first year. The improvement in agility shown in Table 1 for medium effect sizes is intended to study the effect of pickleballs on lower body mobility via dynamic movements such as outer mixing and orientation (Johnson & Lee, 2021). The 150-minute weekly lesson summed up over a 10-week period proved sufficient to achieve significant physical advantages. This efficiency is especially valuable for Vietnamese universities, where physical education often competes with academic priorities.

As shown in Table 2, improved hand and eye coordination highlights the role of pickle balls in developing athletic ability. The pursuit of repetitive paddling strips and perforated balls in sports probably generated observed benefits, supporting Chen and Wang (2021) results on the benefits of pickle ball motor learning in university settings. The significant increase in service accuracy shown in Table 3 reflects the success of skill acquisition encouraged by organizing curriculum in sports lessons (Siedementop, 1994). Structured progress - 3 weeks of technology lessons, 3 weeks of drilling, weeks of tournaments - has mastered the quick skills in how big effect sizes are occupied. Increased weekly contact times have accelerated the development of skills, allowing students to achieve their abilities despite the shorter period.

The high joys of students shown in Table 4 demonstrate the appeal of pickle balls in the Vietnamese context. The lack of value in low enjoyment indicates the accessibility and social nature of sports for a wide range of students, including those with limited sports experiences. This corresponds to the argument of Taylor and Kim (2022) that pickleball quick learning curves promoted motivation and managed Vietnamese physical education challenges where traditional sports could reduce non-athletic students (Nguyen & Tran, 2020). The qualitative data in Table 5 highlight the important role of teacher support. This is made easier by workshops for pre-implementation training. But B. Uniform restrictions such as the limitedCourt Room, particularly at the top, have withstand logistical challenges, a concern about resource-limiting environments (Le & Pham, 2018). The early learning curve reduced the number of students who reaffirmed the suitability of pickle balls for beginners.

These results have a major impact on physical education in Vietnam. The ability to improve fitness, hone your skills and promote fun will increase their student participation as a practical alternative to traditional sports. The cost-effective equipment and small court size make it more scalable, but requires investment in institutions and ongoing teacher training. The first year's focus on students illustrates the role of pickleball in supporting the university's transition by building physical trust and social connections through double games. Limitations include a 10-week period that does not cover long-term impacts and a focus on individual institutions that limit generalizability. Future research can examine the impact of pickle balls on full grades, compare them with other sports, and examine cultural adjustments to improve their appeal in Vietnam.

In summary, the success of pickleball integration at TNUT shows the potential to enrich the physical education curriculum, providing an integrated, efficient and dedicated approach to student development.

IV. Conclusion

This study evaluates the integration of pickleball into the curriculum for sports lessons for first-year students at the Thai University of Engineering, conducted over 10 weeks at 150 minutes a week in September 2024. Quantitative data from pre- and post-intervention tests showed significant improvements in mobility, hand-eye adjustment, and serving accuracy ($P< 0.01$). Qualitative knowledge from research, interviews, and teacher flexion showed the critical role of high school students (88% assessed the curriculum despite the comfort or very comfortable facility restrictions) and teacher support. This result demonstrates the potential of pickleball as an integrated and effective sport for physical education, promoting physical ability and commitment. Recommendations include facility expansion and teacher training to maintain implementation. This study provides curriculum innovation in the organization of Vietnam University and addresses pickleball scalability.

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