The Impact of Artificial Intelligence Technology on Table Tennis

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Abstract

The integration of artificial intelligence (AI) technology into table tennis has significantly transformed various aspects of the sport, including gameplay, training, and match analysis. This research focuses on evaluating the role of artificial intelligence (AI) in table tennis, particularly among university students. The primary objective of the study is to assess how artificial intelligence (AI) technologies can enhance training methods, optimize player performance, and boost engagement among players, coaches, and fans. Additionally, the study aims to address challenges such as accessibility and ethical concerns that may arise during the adoption of these advanced technologies. By using a quantitative analysis approach, including linear regression methods, this research provides a data-driven understanding of artificial intelligence (AI)'s potential to revolutionize table tennis. The findings highlight several important outcomes. artificial intelligence (AI) -powered tools like training robots, performance-tracking systems, and personalized feedback mechanisms have demonstrated a significant positive impact on training efficiency and gameplay. The study establishes a strong correlation between students' familiarity with artificial intelligence (AI) technology and their acceptance of artificial intelligence (AI)-based table tennis methods, with results showing an encouraging level of enthusiasm for these innovations. However, the research also reveals a balanced perspective, as some students express a preference for traditional training methods. The study identifies barriers such as limited accessibility to artificial intelligence (AI) tools and ethical issues like data privacy, which need to be addressed to enable wider adoption. The research benefits multiple groups. University students gain access to advanced training tools that cater to their individual needs, making practice more effective and engaging. Coaches and trainers can use artificial intelligence (AI)-driven insights to optimize training programs and improve player strategies. Sports researchers and developers can build upon these findings to innovate artificial intelligence (AI) applications in sports. Furthermore, universities and sports organizations can enhance student participation and training quality by adopting artificial intelligence (AI) technologies. Lastly, table tennis enthusiasts of all skill levels can leverage artificial intelligence (AI) tools to refine their techniques and improve their overall performance, making the sport more inclusive and accessible.

***Keywords*:** *Artificial Intelligence, Table Tennis, University Students, Education, Sport and Technology*

1. Introduction

People have engaged in diverse sports globally for an extended period. They encompass team sports, individual sports, racquet sports, combat sports, aquatic sports, and others. They possess distinct needs and regulations. Sports facilitate social ties, enhancing general well-being and promoting a healthy lifestyle. The benefits are more flexibility, higher muscular strength, and better cardiovascular fitness. Sports like soccer and basketball, as well as activities like running and swimming, help people get to know each other, work together, and communicate better. This kind of social interaction is important for improving mental health, lowering loneliness, and making people happier in general. People yearly change and improve the rules and surroundings of the game. Cooperation and integration with technologies in sports have significantly developed and become more pervasive across all parts of the sector today. Cave and Miller (2015) assert that technology is becoming beneficial for professional athletes, novices, and casual enthusiasts to engage in the activity.

A small ball is hit across a table by two players using rackets. There is a net positioned between the two players. This sport is called table tennis. People all over the world enjoy playing table tennis for fun. It's played in homes, schools, clubs, and community groups. Its ease of access, which requires little space and gear, has helped it become very famous around the world. artificial intelligence (AI) is changing the future of table tennis by creating better training tools, more advanced data, and providing more ways for fans to get

involved. The change from simple technology to advanced artificial intelligence (AI) has made skills much better in many other areas, such as table tennis. According to Suman DC (2022), people use sports technology to achieve corporate goals and success by means of personal development. The collecting of data, which involves assessing and monitoring player performance, is significantly enhanced by artificial intelligence (AI) technology. Artificial intelligence (AI)-powered training aids, such as robotic hands and autonomous table tennis ball launchers, facilitate the development of more complex strategies and enhance practice efficiency. These new technologies, which are driven by artificial intelligence (AI), are pushing the limits of how well athletes perform and how they are analyzed. They also make it easier to handle the training and coaching of athletes.

Artificial intelligence (AI) systems may be able to collect specific information about every part of a game, such as the speed of the ball, its spin rate, where shots are made, and where players are placed. Machine learning lets data be automatically processed to find trends, strengths, and weaknesses in how well a player is doing. It might be hard for a player to return balls that are hit at a certain position or with a certain spin. Artificial intelligence (AI) could figure out these tendencies and suggest specialized lessons, making it easier to make training plans that fit each person's needs. Artificial intelligence (AI)-powered video analysis systems could also break a game into play-based routines that coaches and athletes could use to study important events, such as how players move during long rallies or make decisions when they are under a lot of pressure. This analytical method helps players improve their tactical strategies by helping them figure out not only what went wrong but also why it went wrong in the first place. So, artificial intelligence helps athletes make better decisions based on facts that help them make changes during the game.

2. Objectives

The main objective of this study is to assess how artificial intelligence (AI) technologies can enhance training methods, optimize player performance, and boost engagement among players, coaches, and fans. The other objectives of this research paper are as follows:

1. Evaluate the impact of artificial intelligence (AI) technology on table tennis sport, which includes training methods, coaching, and a data-driven feedback system.
2. Analyze the relation between university students and artificial intelligence (AI)-based table tennis sports and examine how they influence their university lifestyle of sports.
3. Measure the correlation between students' familiarity with artificial intelligence (AI) technology in their daily lives and their receptiveness to artificial intelligence (AI)-based advancements in table tennis.
4. Determine the potential barriers and challenges, such as accessibility and ethical concerns, associated with integrating artificial intelligence (AI) technologies into table tennis.

3. Literature Review

Philip Omoregie has written a study paper that looks at different ways that changes in technology have affected sports performance. Technology has changed not only how sports are played but also how athletes train and heal (Omoregie, 2016). In the past, technologies like picture finishes and electronic timing systems have made competitions more accurate and fairer. More recently, technologies like artificial intelligence (AI) and GPS have expanded the ways that performance can be tracked, and developing strategies can be made (Feenberg, 1999; Miah, 2004).

The literature review demonstrates how technology has changed the way athletes do their jobs. From old inventions to cutting-edge artificial intelligence (AI) and genetic engineering, technology keeps pushing the limits of sports. But putting technology into sports also comes with a lot of problems, especially when it comes to upholding moral standards and making sure everyone has equal access to modern technologies. In the future, researchers must look into these issues while also pushing how technology can improve safety and performance. One sport that would be evidenced as having particularly important levels of perceived accessibility and low barriers to engagement is table tennis, which is becoming more apparent as a valuable

marketing asset among students. This group can be characterized as tech-savvy, interested in sports, and eager to engage in both social and physical activities. Since students form a large part of the market for many sports and recreation activities, it is important to know how to effectively market table tennis among them. A study shows that cost-friendly activities, which include equipment and accessories such as table tennis, are preferred in line with students' preferences (Kim et al., 2020).

Students at the secondary and tertiary levels are the special buying segment, which has a lot of potential in the market. This is more particularly so in the World Wide Web, whereby they are active, primarily engaging in social activity and most of the time they engage in social activities which may include affiliation to a given activity which provides a feeling of togetherness. From the study, it was concluded that 90% of the students use the intended social media platforms at least once a day, and 75% of the students are in touch with the type of brands and activities that are related to the interest of their study programs (Lee, 2023). Cheng (2019) argues that events should be held on campus, as this increases students' participation and fosters togetherness. It will include inviting the public through events like "Table Tennis Open Day," and "Campus Championship," with the aim of getting both participants and spectators to keep the spirit going and developing an interest that would span several years. In the words of Gonzalez (2020), merchandise gives brands a way of creating loyalty if it appeals to their target demographic and their values and/or identity. Creative logos and the use of limited special items will require a lot of awareness within the student community, hence ensuring that businesses gain high recognition within a short span.

Through better player performance, training optimization, and increased fan involvement, artificial intelligence (AI) has been fast changing the sports sector. A sport that mostly depends on accuracy, speed, and technique, table tennis has also started to gain from artificial intelligence inclusion. With an eye toward the influence of artificial intelligence technology in table tennis—especially in relation to linking clients—players, coaches, and fans—with artificial intelligence (AI)-driven solutions for tailored training, performance analysis, and engagement—this overview of the literature.

Sports have experienced explosive expansion in artificial intelligence applications recently. Artificial intelligence (AI) tracks player performance, analyzes game strategies, and offers real-time comments across various sports, including football, basketball, and tennis (Leidig et al., 2021). In the realm of sports, the application of computer vision and machine learning has allowed automated performance tracking and data collection that provide insights not readily available through human observation alone (Zhan & Elmaghraby, 2020). Through systems that track player motions, examine match strategies, and replicate gameplay, artificial intelligence has revolutionized coaching.

By offering a thorough study of motions, ball speed, spin, and player reactions, artificial intelligence (AI) can be a vital tool in table tennis, bridging the distance between the player and technology (Han et al., 2019). Recent research indicates that artificial intelligence systems using motion sensors and high-speed cameras can precisely track ball speed and spin. The gathered information is then examined to give the player real-time comments on racket angles, footwork, and shot timing, therefore improving their technique. Using machine learning techniques, artificial intelligence (AI)-based systems like the " Artificial intelligence (AI) coach" advise tactics to enhance gameplay and forecast the course of the ball (Chen et al., 2020). These systems can also suggest customized workouts depending on the shortcomings of the player, therefore enabling athletes to participate in self-paced, customized training programs.

Whether they are players, coaches, or table tennis aficionados, connecting consumers with artificial intelligence systems calls for designing interfaces that enable artificial intelligence (AI) insights to be easily available and useful. Through interactive platforms like mobile apps and smart tables that offer instantaneous performance feedback, they represent one of the most powerful ways artificial intelligence (AI) interacts with table tennis consumers (Zhu & Tang, 2022). These systems let users define customized training goals, track statistics over time, and track their development.

Apps that link to artificial intelligence (AI)-enabled table tennis robots, for instance, may replicate actual matches and change difficulty depending on the player's degree of expertise. Following every game, players can get comments that help them to hone their technical abilities and strategy. These apps also let

users compare their performance with others, therefore encouraging worldwide community participation and rivalry. Furthermore, artificial intelligence (AI) systems included in smart rackets or table tennis robots can monitor a player's performance in real-time and modify drills based on it, therefore providing a more customized training environment. Artificial intelligence (AI) links coaches with comprehensive performance data of their players, therefore enabling better judgments about training schedules and match strategies.

Beyond player ability, artificial intelligence helps to improve table tennis fan involvement. Live matches are captured and analyzed using artificial intelligence (AI)-powered cameras and algorithms, therefore offering spectators with real-time data visualizations. Artificial intelligence (AI) systems can point out pivotal events in a game, provide statistical analysis, and even replicate results depending on present gameplay trends. This makes the sport more interesting and approachable by helping to close the technical gap between casual viewers and its elements. Additionally, raising fan involvement are interactive artificial intelligence (AI)-powered tools that let supporters examine shots and forecast game results (Bishop & James, 2021). By immersing fans in a data-driven experience and thereby strengthening their relationship with the game, these developments help them to get closer to the sport.

Although the integration of artificial intelligence into table tennis has great advantages, it is difficult to guarantee that artificial intelligence (AI) systems are easily available and understandable. Some artificial intelligence (AI)-based platforms' complexity can be a deterrent to adoption, particularly among amateur players and coaches who might not be tech-aware. Improving user interfaces and increasing the simplicity of artificial intelligence (AI) systems will be main priorities of future developments. Furthermore, deserving of consideration are issues about data protection and ethical artificial intelligence (AI) application in sports. Gathering and keeping enormous volumes of player information calls for explicit rules and protection since it begs issues about who owns the data and how it is used.

Table tennis has been profoundly affected by artificial intelligence technology since it offers capabilities to raise player performance, change coaching strategies, and boost fan involvement. Whether they are fans, coaches, or players, linking consumers with artificial intelligence (AI)-driven solutions will transform the way the sport is experienced, watched, and practiced. Further incorporation of artificial intelligence will help table tennis by improving artificial intelligence (AI) applications and addressing usability issues.

4. Research Methodology

This research paper is designed to use quantitative analysis by collecting numerical data on how artificial intelligence (AI) technology can impact table tennis across various fields like training, practicing, playing matches, and university tournaments. The objective insights are collected from students' points of view and how artificial intelligence (AI)-based table tennis can affect their interests and interactions with table tennis in university lifestyle. The target number of students for this research will be 50 to 60 who are international students of Rangsit University International College. The quantitative analysis method will use survey questions, which have balanced opinions for observing different insights from students from Rangsit University International College. Google Form is used to collect data and share it via the internet to answer 20 different questions. The expected duration of this survey will be about a month to collect answers and store them on a table using Google Sheets. After them, the results of the data in the table will be formatted for statistical analysis. The statistical analysis methods are t-test graphs and linear regression methods. From these, the impact of artificial intelligence (AI) technology on table tennis will be analyzed to get the objective outcome results for this research paper.

The objective of the questions is to determine the situations of sports fields like table tennis in educational institutions (universities, colleges) and how the upcoming futuristic technology like artificial intelligence will impact them. The questions are divided into four sections. The first section is demographic, such as age, gender, and education level. The demographic data can be obtained from this section and support

the research paper. In the second section, questions about table tennis in university lifestyle. The questions research how often students engage and participate in table tennis and how table tennis is popular in universities. This will show the connection between students and universities. The third section is researching Artificial Intelligence (AI) technology that can be integrated into human lifestyles. This could show how students are familiar with artificial intelligence (AI) technologies, not only in their lives but also in their recreation time, like sports and hobbies.

This section researches how artificial intelligence (AI) is related to table tennis and students' interests and concerns regarding artificial intelligence (AI) in their lifestyle for the future. The last section of the survey is about artificial intelligence (AI)-based table tennis. This is the main objective of this research paper and how table tennis improved compared to traditional ways. Artificial intelligence (AI)-tools, real-time feedback tracking, and automatic training robots are examples of future techniques for table tennis, and the analysis of these techniques for students can be found in this research. After the collection of the data survey, a t-test graph will be used to analyse it first. T-test graphs are used to distribution simple means and visualize how collected answers are going on. For phase I and phase II data answer collection, a T-test graph will be used to analyze. After this step, linear regression analyzation is used with Phase III data answers collection. If there are no changes in the linear regression graph, the independent variables should change and start the analysis process again. This is how to analyze data for this research paper, and the flow chart is shown in Figure (1).

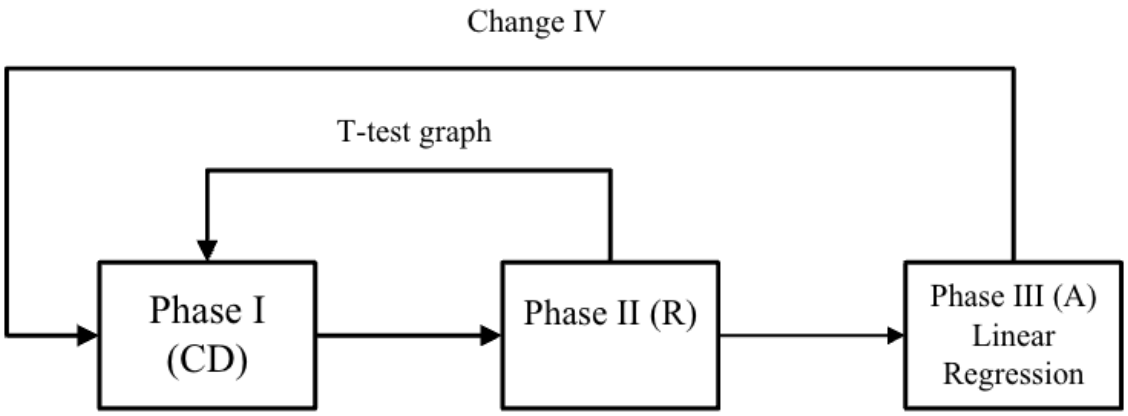

Figure 1 Data analyzation process of survey answers

5. Results and Discussion

5.1. Results

The research method used for this paper is the quantitative analysis method. The experimental research method includes two main parts in this research paper. The first part is creating normal distributions of each part of the questions from the survey form. The three parts of the survey form are Part I: Table Tennis in University, Part II: Artificial intelligence (AI)Technology in Daily Life, and Part III: Artificial intelligence (AI) based Table Tennis. Part I and II are Independent Variables and Part III is Dependent Variable. In the first main part, the bell curve of normal distribution is calculated using the answers of the survey form. These three graphs can be shown in Figures 2, 3, and 4.

The average answers for each part of the questions from the survey are Part I: 2.75, Part II: 2.3, and Part III: 2.75, as calculated in Microsoft Excel. The standard deviations for each part of the survey are 0.56, 0.34, and 0.17 as calculated in Microsoft Excel. This research data is used to draw the normal distribution

graph for the three relative parts. From the graph, the highest part of the bell curve s observed around a rating of 3 for Part I and III, 2 for Part II. The survey form's rating system is a 5-point skill system that includes Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree. Another part of the survey is linear regression. In this part, the average answer of each survey student is calculated by Microsoft Excel. Two linear regressions are calculated by Microsoft Excel. The first one is between Part I: "Table Tennis in University" (Independent Variable), and Part III: "Artificial intelligence (AI) based Table Tennis" (Dependent Variable). The second one is between Part II: "AI Technology in Daily Life" (Independent Variable), and Part III: "Artificial intelligence (AI) based Table Tennis" (Dependent Variable). The graphs of the first linear regression analyses are shown in Figures 5, 6, and 7.

The regression statistics for the first graph are Multiple R: 0.97, R Square: 0.94, Adjusted R Square: 0.92, Standard Error: 0.71, and Observations: 63. The coefficients are 0.97 and 0, respectively. The graphs of the second linear regression analysis are shown in Figures 8, 9, and 10. The regression statistics for the second graph are Multiple R: 0.97, R Square: 0.94, Adjusted R Square: 0.92, Standard Error: 0.71, and Observations: 63. The coefficients are 0.97 and 0, respectively.

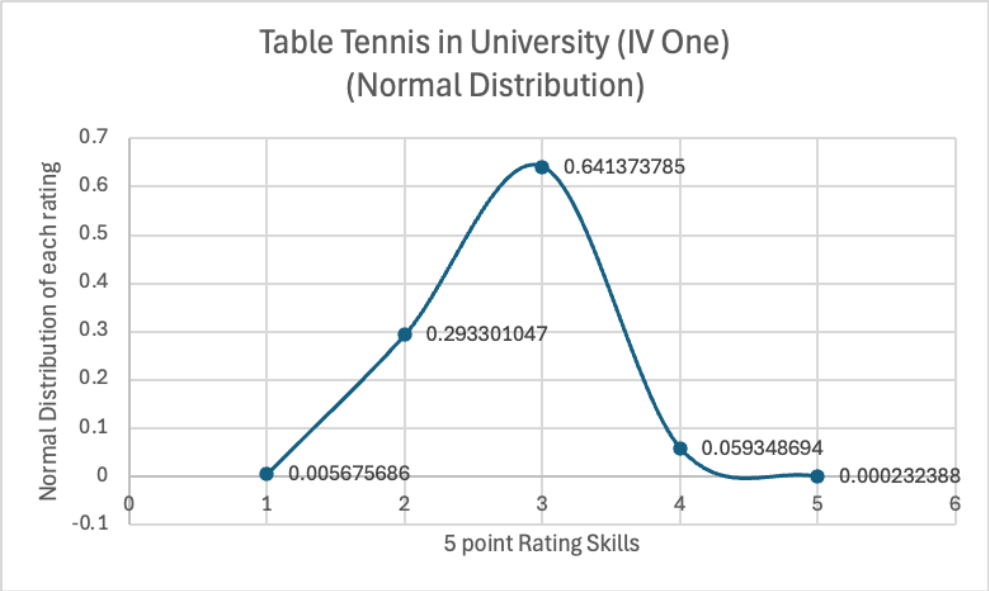

Figure 2 Normal Distribution of Table Tennis in University

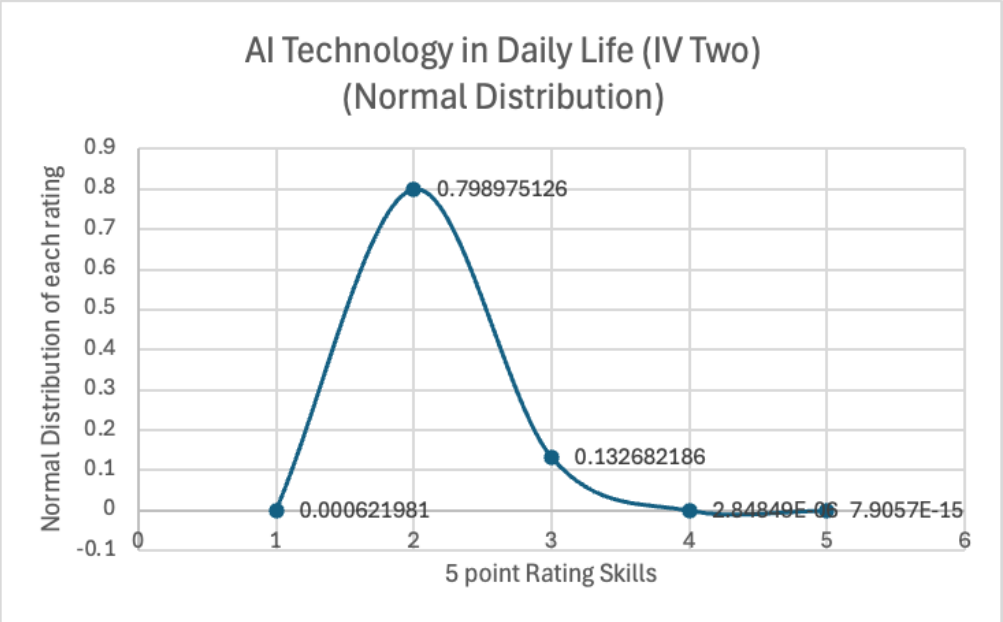

Figure 3 Normal Distribution of AI Technology in Daily Life

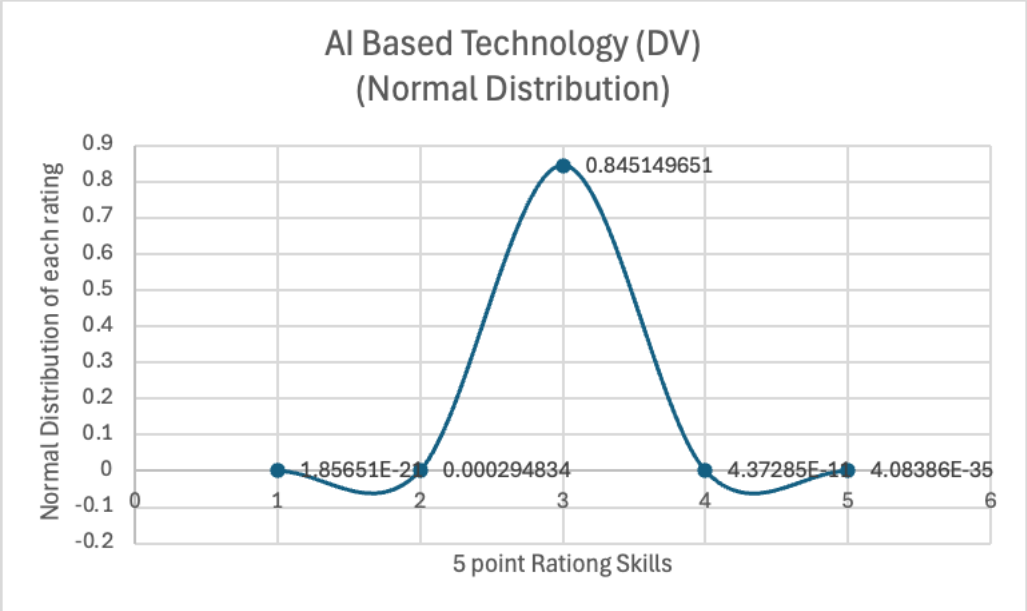

Figure 4 Normal Distribution of AI Based Technology

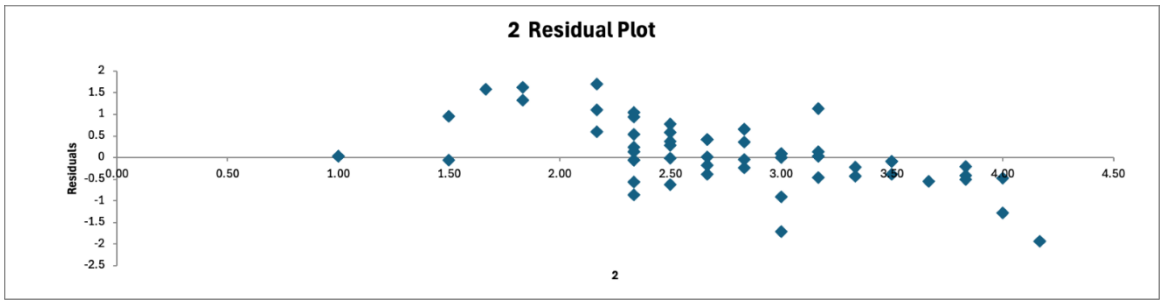

Figure 5 Residual Plot of fist linear regression

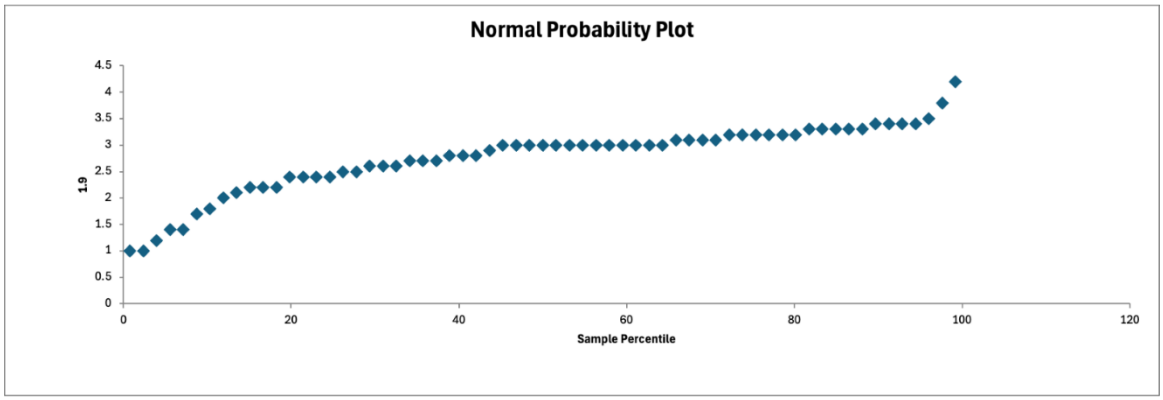

Figure 6 Normal Probability Plot of first linear regression

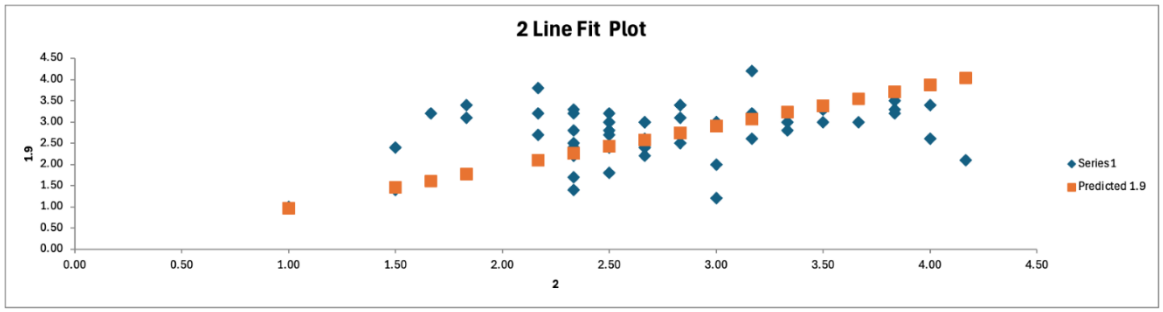

Figure 7 Line Fit Plot of first linear regression

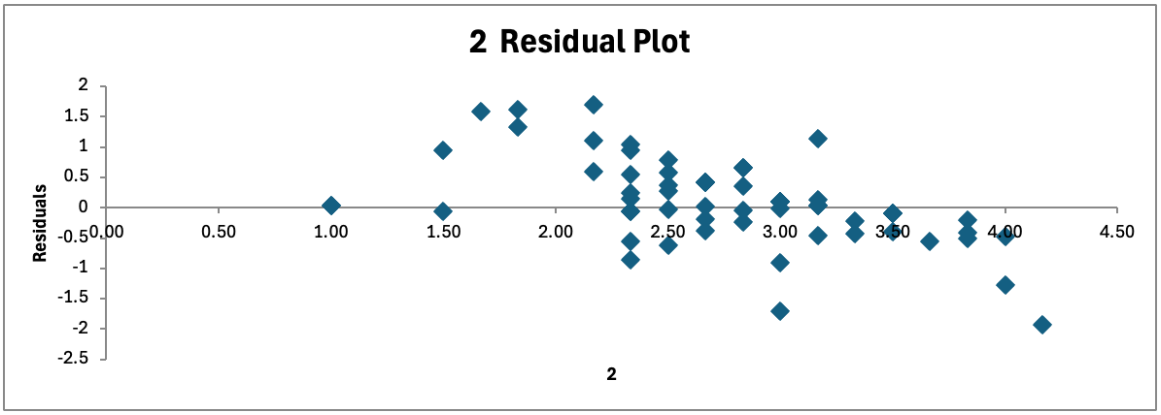

Figure 8 Residual Plot of second linear regression

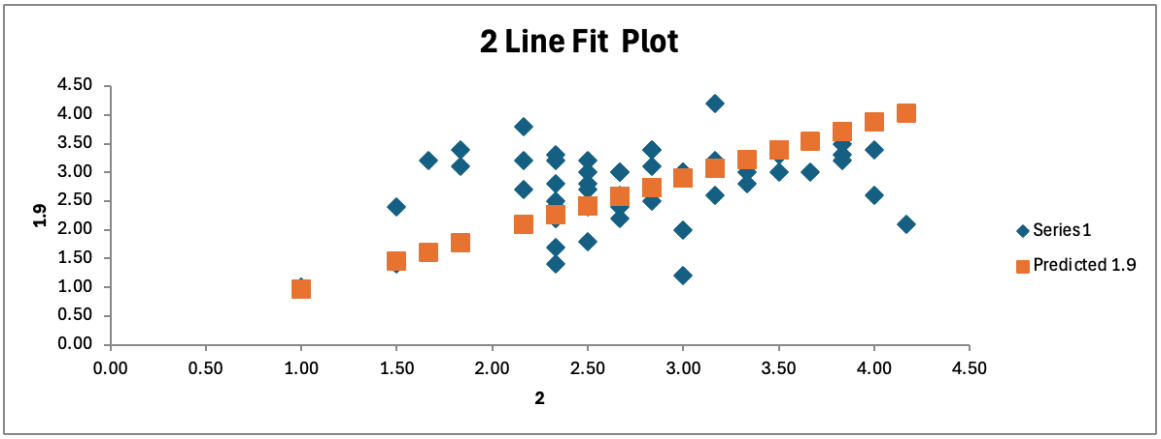

Figure 9 Normal Probability Plot of second linear regression

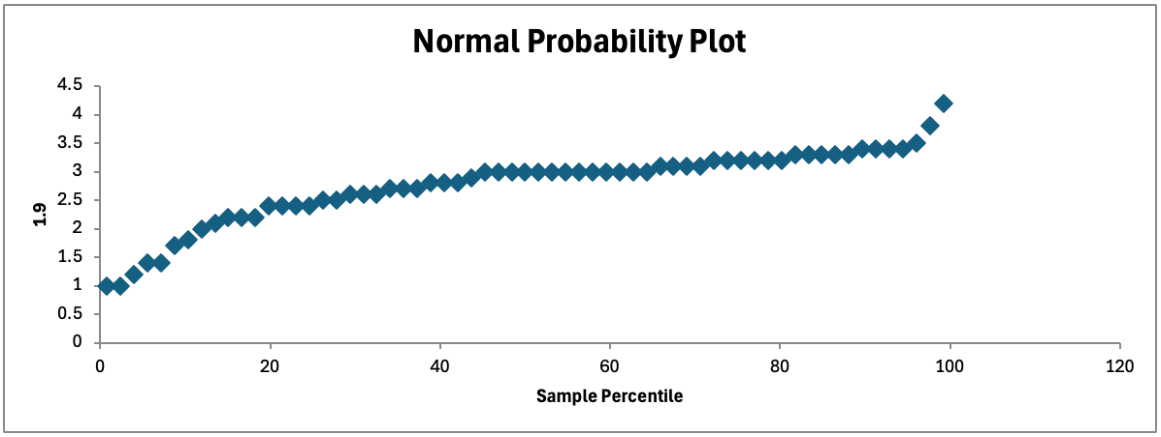

Figure 10 Line Fit Plot of second linear regression

5.2 Discussion

The impact of artificial intelligence (AI) technology on table tennis is researched and made a survey in this paper. Google Form survey is used, and liner regression analysis method is used to measure the survey's findings. There are two parts for findings of research paper, T-shape graph, and Linear Regression Distribution Graph. The first part includes three graphs, which are university in table tennis, artificial intelligence (AI) technology in daily life, and artificial intelligence (AI)-based technology.

The first section, university with table tennis, of t-graph's average mean is between 2 and 3.5 which means that students are likely to play not only table tennis but also many other sports. The survey answer of overview is “Agreed” which means that table tennis sport has positive in university campus. The second one is artificial intelligence (Al) technology in daily life and t-graph's average mean is 2. This finding is a higher positive view from university students that they want to use of artificial intelligence (AI) technologies in daily life. The last one is artificial intelligence (AI) related to Table Tennis and the average mean is 3. The use of AI technologies in table tennis is a balanced view. This means that some want to upgrade with artificial intelligence (AI) technologies when some prefer to maintain traditional style.

In linear regression, there are two relations between independent variable and a dependent variable. This will show how these two are related to each other strongly or not. The first relation is between table tennis in university and artificial intelligence (AI) based technology for table tennis. The value of multiple R is 0.96, which means it has a strong relationship between these two variables. The second relation is also the same with multiple R 0.96, which is between artificial intelligence (AI) technology in daily life and artificial intelligence (AI) technology for table tennis. They also have a strong relationship. Therefore, two linear regression analyses for two independent variables and one dependent variable have strong relationships between them. An unexpected finding is that these two relations are the same. From this, the use of artificial intelligence (AI) technologies in table tennis has a lot of impact on table tennis in university and artificial intelligence (AI) technologies in daily life.

The results derived from the images reveal significant insights into the impact of artificial intelligence (AI) technology on table tennis and its acceptance among university students. The normal distribution graphs (Figures 2, 3, and 4) indicate that most respondents expressed moderate to positive views regarding the integration of artificial intelligence (AI) in table tennis, with average ratings of 2.75 for "Table Tennis in University" and " Artificial intelligence (AI)-based Table Tennis," while " Artificial intelligence

(AI)Technology in Daily Life" showed a slightly lower mean of 2.3, highlighting varied levels of familiarity with artificial intelligence (AI). These results suggest that while students generally recognize the value of artificial intelligence (AI), there is a need for greater exposure and education about its applications in sports. The linear regression analysis (Figures 5 to 10) further confirms a strong positive correlation (R = 0.96) between students' engagement in university table tennis and their acceptance of artificial intelligence (AI) technologies, as well as between their familiarity with artificial intelligence (AI) in daily life and its adoption in table tennis. The residual and line fit plots validate the robustness of these models, showing minimal errors. These findings emphasize that students with higher exposure to artificial intelligence (AI) are more inclined to embrace its use in enhancing training efficiency and gameplay. Additionally, they highlight the potential for artificial intelligence (AI) to revolutionize table tennis by providing personalized training, advanced performance tracking, and strategic insights, while also identifying barriers such as limited accessibility and ethical concerns. Addressing these challenges through targeted awareness campaigns and user-friendly artificial intelligence (AI) solutions could significantly broaden artificial intelligence (AI) adoption and its transformative impact on the sport.

Artificial intelligence (AI) technology-based table tennis will be highly demanded in many universities if the advanced of playing table tennis in school campus. Students will change from traditional playing and training to advanced technologies, such as advanced skills training and personalized training. The impact of artificial intelligence (AI) technologies will attract many potential university players to the higher demand of playing table tennis. And the use of artificial intelligence (AI) technology in daily life will have a positive impact on playing artificial intelligence (AI)-based table tennis. The students know the helpful and useful technologies, such as studying and exploring. Therefore, they want to explore these technologies in table tennis.

6. Conclusion

In conclusion, this research paper demonstrates that table tennis with artificial intelligence (AI)-technology will be high impact on university students and vice versa, their exploration impact on improvement of advanced table tennis technologies. The findings of this research reveal that artificial intelligence (AI)-powered tools, such as training robots, performance-tracking systems, and personalized feedback mechanisms, significantly enhance training efficiency and gameplay in table tennis. The study shows a strong correlation between students' familiarity with artificial intelligence (AI) technology and their willingness to adopt artificial intelligence (AI)-based methods, reflecting enthusiasm for integrating technology into the sport. However, some students still value traditional approaches, highlighting the need for a balanced adoption strategy. Barriers such as accessibility to artificial intelligence (AI) tools and ethical concerns, including data privacy, were also identified as challenges. This research highlights that table tennis integrated with artificial intelligence (AI) technology has a high impact on university students, while their exploration and interaction with advanced artificial intelligence (AI) tools contribute to the development of artificial intelligence (AI) technologies within the sport. The study’s limitation lies in surveying only Rangsit University students, suggesting that future research should include a broader demographic, especially those who actively play table tennis, for more comprehensive insights. Furthermore, future studies could focus on market analysis or the technical aspects of artificial intelligence (AI) technologies in table tennis to explore broader applications and improvements. This research benefits students, coaches, developers, institutions, and enthusiasts by paving the way for artificial intelligence (AI)-driven innovations that make the sport more engaging, inclusive, and advanced. Among different research papers, this one is emphasis on table tennis sport which is different from others. For further research should focus on market analysis or the technical analysis of table tennis sport which focus on artificial intelligence (AI) technologies. For further extension, this research could explore broader applications and technical advancements of artificial intelligence (AI) in table tennis. Future studies may focus on market analysis to assess the economic feasibility and adoption

potential of artificial intelligence (AI) tools among diverse demographics. Additionally, investigating the development of advanced artificial intelligence (AI) systems, such as real-time coaching assistants, wearable devices for performance tracking, and virtual reality training, could provide significant innovations.

7. Acknowledgement

We would like to express our heartfelt gratitude to everyone who contributed to the successful completion of this research paper. Firstly, we thank the Faculty of International Business, Rangsit International College, for providing us with the resources and academic support necessary for this study. We are deeply grateful to our advisor, Arjun Bille, and our mentor, Dr. Anna, whose guidance, insights, and constructive feedback have been invaluable throughout the research process. We extend our appreciation to the international students of Rangsit University International College, who participated in our survey and provided valuable data for our study. Special thanks go to our co-authors, Aung Ye Htut, Sai Kyaw Than Lwin Hein, Kaung Htet Aye, and Aung Phone Pyae, for their collaboration and dedication in conducting this research. Lastly, we acknowledge the inspiration and knowledge provided by previous researchers and the technological advancements in artificial intelligence, which served as the foundation of this paper. Thank you all for your support and contributions to this project.

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