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Original Article

Comparative analysis of flipped learning versus traditional teaching methods in basketball technical ınstruction: Effect on students' psychomotor achievement levels

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Abstract
This research was conducted during the 2023-2024 academic year with the participation of 30 students (16 female, 14 male) enrolled in the Physical Education and Sports Teaching Department at Gazi University. Before the study, both experimental and control groups underwent a pretest assessment. The experimental group received conventional basketball classes along with a structured 6-week program consisting of educational videos and informational cards prepared by the researcher. These materials were shared with the participants via a mobile application (WhatsApp group). According to the statistical analysis of the pre-and post-test results, it was revealed that the participants in the experimental group demonstrated significant improvements in psychomotor skills compared to the control group. Specifically, the experimental group exhibited a substantial increase from the mean scores in the pre-test (2.81 ± 0.978) to the post-test (3.67 ± 1.080), indicating a statistically significant difference between them ($t=4.235$, $p<0.05$). Similarly, the control group also showed a significant increase from the mean score in the pre-test (1.91 ± 0.774) to the post-test (2.46 ± 0.724) ($t=3.335$, $p<0.05$). The findings suggest that the participants in the experimental group demonstrated significant improvements in various basketball skills after the six-week program. Overall, both teaching methods were statistically effective in enhancing basketball skills ($p<0.05$). In conclusion, both methods were statistically effective in improving basketball skills. Despite the statistically significant increase in certain psychomotor skill levels (such as left-handed spin moves, cuts, and change of direction) in favor of the experimental group, it can be concluded that both flipped learning and traditional methods effectively teach basketball skills.
Keywords: Flipped Learning, Teaching Methods, Psychomotor Skills

Introduction

Education modernization, positioned as a foundational trajectory within global educational reform and development, is supported by collaborative efforts at local, national, and international levels. This transformative process spans various educational domains. The incorporation of information technology is crucial for advancing the modernization of educational processes (Oseredchuk et al., 2022).

The contemporary era is experiencing significant transformations in information technology, leading to unprecedented shifts in the widespread adoption of educational technology. Characterized by constant change and rapid advancements across diverse domains, including scientific knowledge, the current epoch is witnessing a paradigmatic shift. Electronic learning emerges as a method supporting the educational process, transitioning from the stage of rote learning to one of creativity, interaction, and skill development. E-learning encompasses all electronic forms of teaching and learning, utilizing cutting-edge methods in education and publishing, harnessing computers, storage media, and networks (Khateeb et al., 2019).

Facilitating the integration of modern information technology into the education system and advancing education modernization through its effective utilization constitutes a pressing contemporary challenge. In the 21st century, the swift evolution of the Internet, coupled with the emergence of innovative technologies and media, has not only reshaped societal habits and work methodologies but has also initiated a global wave of education informatization under the "Internet+" framework (Zhao, 2020). Consequently, education finds itself at a juncture marked by profound changes in informatization (Shi, 2021).

Effecting the incorporation of modern information technology into the education system and propelling education modernization through its strategic deployment are urgent tasks facing society today. The rapid evolution of the Internet and associated technologies since the 21st century has not only altered people's habits and work methodologies but has also sparked a global movement towards education informatization, primarily based on the "Internet+" paradigm (Zhou, 2020). Hence, education is undergoing a transformative phase marked by profound changes in informatization (Shi, 2021). The pervasive influence of digital technology in society has seamlessly extended into educational settings, including the realm of physical education (PE) (Collins and Halverson, 2018; Koekoek and van Hilvoorde, 2018). Notably, in the United Kingdom, a significant majority of

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primary (94%) and secondary (97%) school headteachers reported the integration, expansion, or upgrading of technology in their schools following the onset of the COVID-19 pandemic (Department for Education, 2021). On a global scale, the Programme for International Student Assessment (PISA) 2021 Information and Communications Technology (ICT) Framework emphasizes the widespread adoption of technology in learning, encompassing activities like homework and leisure pursuits such as social media engagement (OECD, 2019). As technology continues to infiltrate education, a critical challenge arises: does the escalating use of these digital tools genuinely contribute to the intended educational outcomes? The surge in available digital tools, ranging from iPads and smartwatches to video games, is accompanied by didactical and learning frameworks designed to guide these evolving educational processes.

Flipped Learning is characterized as a didactic approach supported by practical applications (Østerlie, Sargent, Killian, Garcia-Jaen, García-Martínez & Ferriz-Valero, 2022). In this context, Flipped Learning is acknowledged for affording students the flexibility to progress at their own pace (Autapao & Minwong, 2018), contributing to enhanced student success (Adams & Dove, 2018). Recent literature reviews indicate its favorable influence on students' classroom engagement (Huang, 2023) and problem-solving skills (Zhao & Kang, 2020; Sumadyo, Santoso, Sensuse & Suhartanto, 2021).

Flipped Learning, fortified by practical applications, is recognized as a significant pedagogical approach applicable to physical education and sports lessons (PE) (Sargent & Casey, 2019). Physical education, distinguished by its emphasis on practice and activity, incorporates Flipped Learning without overlooking the cognitive dimension of the course. A substantial knowledge foundation in sports education is crucial in constructing a robust physique or executing proper motions.

Flipped Learning represents an innovative pedagogical approach with an inherent technological component. By disseminating instructional materials outside the traditional classroom setting through online video accompaniment, the educational emphasis shifts from a teacher-centered model to one centered around student learning. These extracurricular materials, aligned with the prescribed course content as determined by the instructor, are systematically presented (Bergmann & Sams, 2012). This restructuring allows for an increased allocation of time within the course for reinforcing exercises pertinent to the covered subjects (Basset et al, 2020) The Flipped Classroom model represents a sophisticated pedagogical approach to education and teaching; however, its effective implementation necessitates the availability of high-quality teaching resources. The advent of online open courses has precipitated shifts in learning paradigms, fostering self-directed learning, fragmented learning, and learning devoid of temporal and spatial constraints. These transformations introduce novel concepts to the discourse on teaching and learning reform (Du et al, (2021).

Autonomous learning and exploration facilitated by mobile science and technology in the realm of physical education empower students to attain proficiency in sports skills, process knowledge, develop technical understanding, foster concept comprehension, and build experiential expertise. Such self-directed learning contributes positively to achieving a smooth progression in course practice, enhancing skill mastery, and providing a degree of constructive assistance (Crawford, & Fitzpatrick, 2015).

Within the context of college physical education in Taiwan, students primarily select courses based on their individual interests or school assignments. Due to the heterogeneity among students, the traditional teaching approach poses challenges for instructors in catering to the diverse needs of all students. Aside from variations in individual students' digestion of knowledge and understanding, the differences in physical structure between male and female students also impose constraints on physical education instruction, making it challenging to attain enhanced teaching effectiveness (Bodsworth, & Goodyear, 2017).

In basketball, for instance, players must be acquainted with basketball concepts, techniques, and rules to ensure the smooth flow of the game. Therefore, whether participants have a comprehensive understanding of basketball or not becomes a crucial matter. In the execution of basketball movements, players depend on strength, endurance, reaction time, and coordination abilities. Consequently, the body structure and physical capabilities of the players play a pivotal role in the execution of movements (Walta, & Nicholas, 2015).

Material & methods

Participants

Experimental research is a type of study aimed at establishing cause-and-effect relationships, conducted directly under the control of the researcher. In such research, the data of interest are generated directly by the researcher. In the pretest-posttest control group model, two groups are created through random assignment; one is designated as the experimental group, and the other as the control group.

This study encompasses research involving first-year students in the Physical Education and Sports Teaching program at the university 2023-2024 education year, with a total of 30 participants (16 female and 14 male students). The research is designed as an investigation into the psychomotor levels related to a basketball course taught using both flipped and traditional methods. Therefore, it is structured as an experimental study utilizing a pretest-posttest control group model.

Procedure

In the conducted research, Pre-Tests were administered to the selected Experimental and Control groups of athletes before the commencement of the study. The students in the Experimental group, in addition to their regular attendance in basketball lessons, were provided with pre-planned 6-week instructional videos and informational cards prepared by the researcher. These materials were shared with the students through the mobile application. Conversely, the Control group continued with regular basketball lessons over the 6 weeks. Following the conclusion of the 6-week instructional program, Post-Tests were administered to both groups, marking the conclusion of the data collection phase. Before attending the classes over the 6 weeks, essential basketball skills prepared by the researcher were demonstrated, and informational cards related to these skills were shared via the mobile application group.

Students were engaging in their lessons by reading information cards and watching fundamental basketball training videos prepared by the researcher before each class. The first 15 minutes of each session were dedicated to a question and answer session related to the acquired knowledge, followed by practical application of the movements they had observed. This instructional method persisted for 6 weeks, culminating in final assessments marking the end of the term.

In the research, within-group Pre-Test – Post-Test evaluations were conducted, and the Basketball Psychomotor Attainment Level was analyzed using Dependent Samples T-Test analysis at the significance levels of (<0.001 and <0.005). The between-group Pre-Test – Post-Test evaluations were examined using Independent Samples T-Test analysis at the significance levels of (<0.001 and <0.005).

Statistical Analysis

The 'Basketball Psychomotor Domain Enhanced Model 2 Observation Scale,' meticulously crafted by Dr. Seyfi SAVAŞ with the input of experts, was utilized for the assessment of psychomotor domain skills. This scale encompasses comprehensive procedural steps that cover all facets of a basketball lesson, serving as a refined instrument to discern and evaluate psychomotor competencies in the context of basketball instruction.

Implementation of all full-field techniques (Assessment scoring 100%) The candidate dribbles from position No. 1 two times with the right hand, then delivers a chest pass to (C) and Vkat to position number 2. He takes the pass from No. 2 Position (C) then throws a right layup after jab step (step deception) to the left. He then makes his box out and rebound moves, giving him an overhead pass to (C) again. He then takes a pass from (C) with a layup to position 3, and after dribbling 2 times with the left hand, he changes hands between the legs (left hand to right hand).

After getting the ball in his right hand, he heads toward position No. 4, applies two frontal change-of-hand moves, first from right hand to left hand and then from left hand to right hand on his way to Zone No. 4, and reaches Position No. 4 by dribbling with the right hand again. Here he again makes the cross-leg change of hands (right hand to left hand) dribbles to position No. 5 with a left hand and throws a left layup. Once the left tourniquet is complete, he again makes box out and rebound moves and dribbles with the left hand, heading for position No. 6. At position 6, he makes the move to change hands from the back and moves to position 7 with the right hand. He makes his rear move with the right hand at No. 7, heading for position No. 8. When he approaches position number 8, he makes the stuttering move, then jumps shoots, and completes the moves.

Scoring: Zero points were "not observed," 1 point was "poor," 2 points were "moderate," 3 points were "good," 4 points were "very good," and 5 points were "excellent" (Savaş & Sural, 2016).

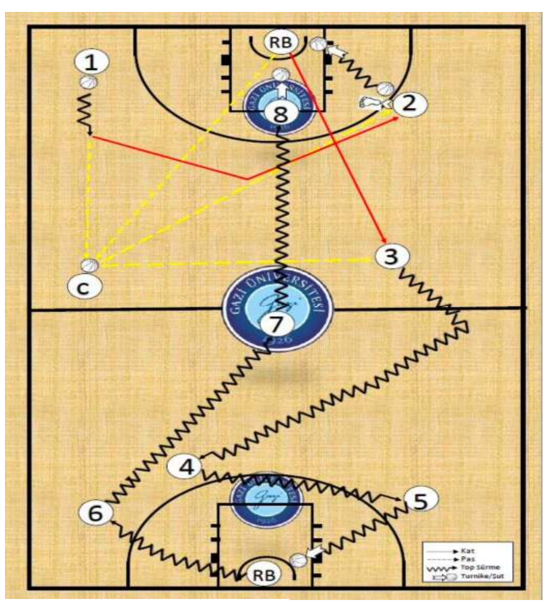

Figure 3. the basketball psychomotor measurement course

Result

Analysis of Inter-Group Differences in Basketball Observational Scale Pre-Tests between Control and Experimental Groups

Table 1.

Basketball	Groups	N	X± Sd	t	p
Right-hand Dribble	Experimental	16	3,34±0,924	2,426	0,014
	Control	14	2,69±0,725		
Chest Pass	Experimental	16	2,92±0,959	2,245	0,070
	Control	14	2,51±0,897		
V-Cut	Experimental	16	3,12±1,159	2,321	0,065
	Control	14	2,31±0,755		
Receiving Pass	Experimental	16	3,17±1,204	1,695	0,066
	Control	14	2,32±0,862		
Jab Step	Experimental	16	2,34±0,865	-,731	0,437
	Control	14	2,45±0,885		
Right Layup	Experimental	16	2,62±0,435	,361	0,708
	Control	14	2,22±0,852		
Rebound	Experimental	16	2,31±0,934	1,568	0,171
	Control	14	2,77±0,750		
Over head Pass	Experimental	16	2,91±0,961	1,975	0,058
	Control	14	2,11±0,649		
Left side Cut	Experimental	16	3,28±0,789	4,181	0,000
	Control	14	2,79±0,746		
Left Hand Dribble	Experimental	16	3,20±0,834	2,257	0,034
	Control	14	2,09±0,974		
Left-hand Dribble Between Legs	Experimental	16	2,33±0,937	2,354	0,022
	Control	14	1,96±0,750		
Crossover Right	Experimental	16	2,53±0,937	2,856	0,009
	Control	14	1,96±0,730		
Crossover Left	Experimental	16	2,29±1,068	1,905	0,088
	Control	14	2,20±0,774		
Right-Hand Dribble Between Legs	Experimental	16	2,36±1,081	2,450	0,039
	Control	14	1,37±0,882		
Left layup	Experimental	16	2,49±0,893	3,384	0,002
	Control	14	1,31±0,796		
Rebound	Experimental	16	2,63±0,997	2,634	0,039
	Control	14	1,83±0,760		
Dribble with Backhand Change	Experimental	16	2,98±0,856	3,464	0,002
	Control	14	1,39±0,842		
Reverse Dribble Move	Experimental	16	2,54±1,143	2,902	0,007
	Control	14	1,73±0,636		
Stutter Step Move	Experimental	16	2,54±1,134	4,017	0,000
	Control	14	1,47±0,641		
Jump Shot	Experimental	16	2,33±0,855	2,327	0,017
	Control	14	1,36±0,663		

Table 1 shows the observational scale for basketball pre-test revealed statistically significant differences ($p<0.05$) in the mean scores of Right-Hand Dribbling, V-Cut Move, Left Cut Move, Ball Reception, and Left-Hand Dribbling, Left Leg Dribble, Frontal Cross Over Dribble (Right), Frontal Cross Over Dribble (Left), Right Leg Dribble, Left Turnstile, Rebound, Backward Cross Over Dribble (Left), Reverse Move (Right Hand Dribble), Stutter Step Move (Dribble), and Jump Shot between the control and experimental groups.

However, no statistically significant differences ($p<0.05$) were found in the mean scores of Ball Reception, Jab-Step, Dribbling, Right layup, Chest Pass, Rebound, Overhead Pass, and Frontal Cross Over Dribble (Left) between the two groups.

Analysis of Inter-Group Differences in Basketball Observational Scale Post-Tests between Control and Experimental Groups

Table 2.

Basketball	Groups	N	X± Sd	t	p
Right-hand Dribble	Experimental	16	3,96±0,848	5,323	0,000
	Control	14	2,64±0,735		
Chest Pass	Experimental	16	3,89±1,109	2,344	0,031
	Control	14	2,90±0,867		
V-Cut	Experimental	16	3,38±0,896	3,930	0,000
	Control	14	2,31±0,756		
Receiving Pass	Experimental	16	3,45±1,183	2,034	0,024
	Control	14	3,08±0,724		
Jab Step	Experimental	16	3,65±1,065	2,303	0,043
	Control	14	2,49±0,656		
Right Layup	Experimental	16	3,63±1,677	1,480	0,080
	Control	14	2,93±0,789		
Rebound	Experimental	16	3,90±1,085	4,567	0,000
	Control	14	2,77±0,730		
Over head Pass	Experimental	16	3,33±0,957	3,669	0,001
	Control	14	2,41±0,802		
Left side Cut	Experimental	16	3,78±1,088	3,627	0,002
	Control	14	2,61±0,479		
Left-Hand Dribble	Experimental	16	3,79±1,028	3,353	0,003
	Control	14	2,67±0,832		
Left-hand Dribble Between Legs	Experimental	16	3,65±1,224	4,249	0,000
	Control	14	1,92±0,630		
Crossover Right	Experimental	16	3,75±1,925	5,287	0,000
	Control	14	1,76±0,760		
Crossover Left	Experimental	16	3,73±1,173	4,875	0,000
	Control	14	2,00±0,724		
Right-Hand Dribble Between Legs	Experimental	16	3,69±1,178	4,197	0,000
	Control	14	2,14±0,844		
Left layup	Experimental	16	3,96±0,924	5,812	0,000
	Control	14	1,59±0,659		
Rebound	Experimental	16	3,83±0,977	6,078	0,000
	Control	14	1,91±0,786		
Dribble with Backhand Change	Experimental	16	3,34±0,822	3,309	0,003
	Control	14	2,93±0,636		
Reverse Dribble Move	Experimental	16	3,66±0,862	6,348	0,000
	Control	14	1,67±0,776		
Stutter Step Move	Experimental	16	3,69±0,946	8,087	0,000
	Control	14	1,29±0,611		
Jump Shot	Experimental	16	3,36±0,964	5,226	0,000
	Control	14	2,24±0,735		

Table 2 shows the observation scale for the Control and Experimental Groups in basketball revealing statistically significant differences in mean scores ($p<0.05$) for Right-hand Dribble, V-Cut Move, Cut to the Left, Receiving Pass, Left-hand Dribble Between Legs, Dribble with Frontal Hand Change (Cross Over) (Right), Dribble with Frontal Hand Change (Cross Over) (Left), Right-hand Dribble Between Legs, Left-hand Pivot, Rebound, Dribble with Backhand Change (Cross Over) (Left), Reverse Dribble Move (Right Hand), Stutter Step Move (Dribble), Jab-Step Move, Rebound, Overhead Pass, and Dribble with Frontal Hand Change (Cross Over) (Left), and Jump Shot.

Statistically significant differences were not observed in the mean scores of Dribbling and Receiving Passes with Right Pivot and Chest Pass ($p<0.05$).

The results of the Paired Samples T-test conducted to assess the significance of the difference between the Pre-Test and Post-Test results of the experimental group on the Psychomotor Development Test are as follows.

Table 3.

Experimental Group	X± Sd	t	p
Pre-Test	48,19 ±15,08	-12,05	0,000
Post-Test	72,67±17,54		

According to the results of the table3, the pre-test and post-test results of the experimental group's psychomotor test have been provided. According to the findings, a significant difference was observed between the pre-test and post-test ($p<0.05$). Students participating in basketball lessons through the flipped learning method have shown a positive impact on their psychomotor skills.

The results of the Paired Samples T-test conducted to assess the significance of the difference between the Pre-Test and Post-Test results of the control group on the Psychomotor Development Test are as follows.

Table 4.

Control Group	X± Sd	t	p
Pre-Test	44.91±0,774	-6,435	0,000
Post-Test	50,46±0,724		

According to the results of the table 4, the pre-test and post-test results of the control group's psychomotor test have been provided. According to the findings, a significant difference was observed between the pre-test and post-test ($p<0.05$). Students participating in basketball lessons through the traditional method have shown a positive impact on their psychomotor skills.

Discussion

Østerlie (2020) conducted a study to understand how middle and high school students experience the flipped learning model implemented in physical education and sports classes and to examine the impact of this model on students' motivation and learning. A mixed-methods design was employed in this research, collecting both quantitative and qualitative data. The participants consisted of a total of 338 middle and high school students from 6 public schools in Norway. Various measurement tools, such as the expectancy-value survey, situational motivation scale, and physical fitness knowledge test, were used, and semi-structured focus group interviews were conducted.

In the study conducted by Panagiotis. A (2006), the impact of multimedia computer-assisted instruction (MCAI), traditional instruction (TI), and combined instruction (both traditional and multimedia computer-assisted) (CI) on learning rule violations in basketball was investigated. Seventy female first-year university students were randomly assigned to three groups: MCAI, TI, and CI, each receiving five hours of training. A multimedia software program was developed for this study. All students completed a pre-test, a post-test, and a retention test. To assess knowledge of rule violations, students filled out a 25-item questionnaire (written test) and evaluated 10 basketball scenarios presented through video (video test). Scores from each test were summed to provide a total score.

Regarding the written exam, the results showed that students in all groups improved their knowledge of rule violations. However, only students in the TI and CI groups retained this knowledge and demonstrated improvement in the retention test. Additionally, the TI group showed significantly more retention than the MCAI group in both the written test and overall performance. On the other hand, the instructional type did not impact performance in the video, and students' progress was temporary. It can be observed that physical education students can learn basketball rules through TI and CI.

The participating classes were divided into experimental and control groups, with both groups covering topics related to endurance, coordination, and strength over 3 weeks. The research results indicate that the implementation of the flipped learning model in physical education and sports classes enhances students' learning levels and motivation in these subjects. Furthermore, it is emphasized that the flipped learning model positively influences students' autonomy by fostering autonomous motivation. Additionally, the study underscores the benefits of using digital tools in physical education and sports classes.

Conclusions

The psychomotor skill levels in basketball were assessed through pre-tests and post-tests in Experimental (n=16) and Control (n=14) groups. In comparing the within-group pre-test and post-test averages, a statistically significant difference is observed between the experimental and control groups. It is noted that the average of the experimental group has increased more compared to the control group.

The statistical analysis of the research based on the pre-test and post-test results indicates significant improvements in psychomotor skills among participants in both experimental and control groups, particularly favoring the flipped learning method group. In the experimental group, the mean score increased from 2.81 (±0.978) in the pre-test to 3.67 (±1.080) in the post-test, showing a statistically significant difference (t=4.235, p<0.05). Similarly, in the control group, the mean score increased from 1.91 (±0.774) in the pre-test to 2.46 (±0.724) in the post-test, also demonstrating a statistically significant difference (t=3.335, p<0.05).

Comparing the pre-test values between the experimental and control groups, statistically significant differences were observed in the average scores of right-handed dribble, V-cut, left-side cut, passing, left-handed dribble, dribbling between legs with left hand, crossover dribble from the front (right), crossover dribble from the front (left), dribbling between legs with right hand, left-handed spin move, rebounding, left-handed behind-the-back dribble, right-handed reverse dribble, stutter step dribble, and jump shot (p<0.05). However, there were no statistically significant differences in the average scores of passing, jab step, chest pass, dribbling, right-handed spin move, rebounding, overhead pass, and crossover dribble from the front (left) (p<0.05).

When comparing the post-test values between the experimental and control groups, statistically significant differences were observed in the average scores of right-handed dribble, V-cut, left-side cut, passing, left-handed dribble, dribbling between legs with left hand, crossover dribble from the front (right), crossover dribble from the front (left), dribbling between legs with right hand, left-handed spin move, rebounding, left-handed behind-the-back dribble, right-handed reverse dribble, stutter step dribble, jab step, rebounding, overhead pass, and crossover dribble from the front (left), as well as jump shot (p<0.05). However, there were no statistically significant differences in the average scores of dribbling, chest pass, right-handed spin move, and passing (p<0.05).

According to the research findings, it can be observed that the experimental group showed significant improvements compared to the control group in several basketball skills, particularly in dribbling, passing, cutting movements, and shooting, following the six-week program. Both methods were found to be statistically effective in improving basketball skills (p<0.05). Additionally, while there was a statistically significant increase in some fundamental skills in favor of the experimental group (such as left-handed spin moves, cuts, and change of direction), it can be said that both flipped learning and traditional methods are effective in teaching basketball skills.

In conclusion, both methods were found to be statistically effective in improving basketball skills. Despite the statistically significant increase in certain psychomotor skill levels (such as left-handed spin moves, cuts, and change of direction) in favor of the experimental group, it can be concluded that both flipped learning and traditional methods are effective in teaching basketball skills.

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