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Determination and Comparison of Motivation Levels in Adolescent Girls During Simultaneous and Delayed Observational Learning of Targeting Skills with a Racket

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A B S T R A C T

Objective: This study aimed to determine and compare the motivation levels of adolescent girls during simultaneous and delayed observational learning of targeting skills with a racket.

Methods and Materials: This quasi-experimental study involved 40 girls aged 16 to 18, randomly divided into two groups: simultaneous observational learning and delayed observational learning. The protocol lasted for three days, and the task involved performing a forehand strike in clay tennis with the non-dominant hand toward a concentric target on the ground. On the first day, the pre-test was conducted, followed by the acquisition phase, and after a one-hour rest, the post-test. The retention test was conducted on the second day, and the transfer test on the third day. The motivation questionnaire was completed after the pre-test, after the acquisition phase, and before the retention test. For the simultaneous group, the video was played concurrently with the participants' performance, whereas for the delayed group, the participants started hitting after the video ended. To determine the effects of the independent variables, the present study's data were analyzed using SPSS software version 26. Descriptive statistics were used to draw graphs, calculate the mean and standard deviation, and inferential statistics (multivariate analysis of variance) and a 2 (group) × 4 (test) analysis of variance with repeated measures on the test factor were used to examine the total score of the motivation questionnaire.

Findings: The results of this study indicated that there was a significant difference in motivation between the simultaneous and delayed observational learning groups.

Conclusion: The mean total motivation score for the delayed observational learning group was higher than that of the simultaneous observational learning group.

Keywords: *Motivation, Observational Learning, Simultaneous Observational Learning, Delayed Observational Learning*

1. Introduction

Motor skill learning plays a crucial role in performing daily tasks. It is widely evident and clear that improvement in behavior and consistency in task execution are possible through practice. Learning, which is generally defined as relatively permanent changes in behavior as a result of interaction with the environment and gaining experience, enables living organisms to acquire exceptional capabilities (Schmidt & Lee, 2019; Schmidt & Wrisberg, 2008). To facilitate learning, methods such as demonstrating the skill to learners can be employed so that they can directly observe the components of the action through observational learning. Observational learning can occur in various ways, for example, by watching videos or pictures of skilled and expert performers (Crone et al., 2021; Hamedi et al., 2018; Karami et al., 2022). A common principle for skill demonstration is that the demonstrator must accurately perform and show the movement, as more precise demonstrations lead to better learning outcomes (Hamedi et al., 2018; Kaefer & Chiviacowsky, 2021; Karami et al., 2022). Many studies have shown that observing both skilled and novice models leads to better learning (Crone et al., 2021; Hamedi et al., 2018; Karami et al., 2022). Additionally, motivation is one of the most important topics in sports psychology as it is related to the principle of participation and non-participation in sports. Motivation consists of internal mechanisms and external stimuli that drive and direct behavior. Motivations are divided into biological and social motivations; for example, hunger, thirst, and sexual desire are biological motivations, while the need for achievement, affiliation, autonomy, and regulation are considered social motivations. The discussion of motivation in sports mostly focuses on achievement motivation, which manifests as competitiveness. In general, motivations are either intrinsic or extrinsic. Intrinsic motivations include interest in participating in sports and personal growth, while extrinsic motivations include rewards, prizes, and praise (Abbasi et al., 2020; Kaefer & Chiviacowsky, 2021).

In this regard, the results of the study by Hamedi et al. (2018) on three groups—control, skilled model observation, and skilled model observation with metacognitive activity—showed significant differences between the groups. In other words, their results indicate that the use of metacognitive strategies has a significant impact on students' performance (Hamedi et al., 2018). Karami et al. (2022) examined the effect of separate and combined modeling on learning dynamic balance in young non-athlete women and found that skilled modeling and self-modeling methods can be used to improve dynamic balance and performance (Karami et al., 2022). Additionally, the results of Abbasi et al. (2021) showed that self-talk in sports, through the mediating role of sports motivation, had a significant impact on the sports anxiety of female student-athletes (Abbasi et al., 2020). Kron et al. (2021) found in their research that although there was no significant difference in performance and final outcome between learners in simultaneous and asynchronous imitation groups, a noticeable decrease in performance quality from imitation to independent simulation was easily observable for the simultaneous group learners (Crone et al., 2021). However, there is still limited research on observational learning and its combination with motivation. Consequently, the researcher intends to compare the motivation levels of adolescent girls during simultaneous and delayed observational learning of targeting skills with a racket to determine whether motivation is higher in simultaneous or delayed observational learning.

2. Methods and Materials

2.1. Study Design and Participants

This quasi-experimental study was conducted using field data collection methods. The participants were 40 girls aged 16 to 18 years, randomly selected from secondary schools in the city of Fariman, Razavi Khorasan Province. These 40 participants were randomly divided into two groups of 20: the simultaneous observational learning group and the delayed observational learning group. Inclusion criteria for participants were: age between 16 to 18 years, female gender, physical health, right-handedness, having reached puberty, and no previous experience in clay tennis. Exclusion criteria included absence on any of the study days, use of any sedative or drowsiness-inducing drugs, and any illness during the study period.

2.2. Measures

2.2.1. Motivation

The primary measure used was the "Sport Participation Motivation Questionnaire" (SPMQ) (Gill et al., 1983). This questionnaire assesses various motivational factors for sports participation and includes intrinsic motivation factors such as skill development (learning), energy release, group acceptance, and belonging to friends, as well as extrinsic motivation factors like fame (ambition), significant others,

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and excitement (competition). The SPMQ consists of 30 items, each scored on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The reliability of the SPMQ has been confirmed with a Cronbach's alpha of 0.89, and its validity has been established through factor analysis (Abbasi et al., 2020).

2.3. *Intervention*

On the first day, after an introductory session on how to hold the racket and explaining the forehand stroke, participants took a pre-test consisting of 10 trials. The acquisition phase then began, consisting of 60 trials, with each trial's score recorded. After the acquisition phase, participants rested for one hour and then performed 10 trials as a post-test. On the second day, a 10-trial retention test was conducted from a distance of 5 meters, and on the third day, a transfer test was conducted from a distance of 7 meters. During all phases, when the ball first hit the target, the score was recorded based on the scoring circles, and a score of zero was given if the ball landed outside the circles.

For the simultaneous observational learning group, a video of a skilled individual performing the clay tennis forehand stroke was played via a data projector, allowing participants to observe while performing the stroke. For the delayed observational learning group, participants started their stroke after the video ended.

Participants completed the SPMQ at three points: after the pre-test, after the acquisition phase, and before the retention test.

2.4. *Data analysis*

Data analysis was performed using SPSS software version 26. Descriptive statistics were used to draw graphs and calculate the mean and standard deviation. Inferential statistics, specifically a 2 (group) × 4 (test) repeated measures analysis of variance (ANOVA), were used to examine the overall motivation scores. Multivariate analysis of variance (MANOVA) was also employed to assess the effects of independent variables. Significance levels were set at $p < 0.05$ for all tests.

3. Findings and Results

This section presents the findings from the study, including both descriptive and inferential statistics. The data were analyzed to compare the motivation levels of adolescent girls during simultaneous and delayed observational learning of targeting skills with a racket.

Table 1

Descriptive Statistics

Variable	Group	Pre-test (M ± SD)	Acquisition (M ± SD)	Retention (M ± SD)	Transfer (M ± SD)
Total Score	Simultaneous Observational	35.45 ± 5.23	38.70 ± 5.12	37.20 ± 5.50	36.15 ± 5.30
	Delayed Observational	35.60 ± 5.40	41.75 ± 5.60	40.25 ± 5.45	39.20 ± 5.38
Belonging to Friends	Simultaneous Observational	3.5 ± 0.5	3.8 ± 0.5	3.7 ± 0.5	3.6 ± 0.5
	Delayed Observational	3.6 ± 0.5	4.0 ± 0.6	3.9 ± 0.6	3.8 ± 0.6
Group Acceptance	Simultaneous Observational	3.4 ± 0.4	3.7 ± 0.4	3.6 ± 0.4	3.5 ± 0.4
	Delayed Observational	3.5 ± 0.5	4.0 ± 0.5	3.9 ± 0.5	3.8 ± 0.5
Learning	Simultaneous Observational	3.5 ± 0.5	3.8 ± 0.5	3.7 ± 0.5	3.6 ± 0.5
	Delayed Observational	3.6 ± 0.6	4.1 ± 0.6	4.0 ± 0.6	3.9 ± 0.6
Energy Release	Simultaneous Observational	3.5 ± 0.5	3.8 ± 0.5	3.7 ± 0.5	3.6 ± 0.5
	Delayed Observational	3.6 ± 0.5	4.0 ± 0.6	3.9 ± 0.6	3.8 ± 0.6
Excitement and Competition	Simultaneous Observational	3.5 ± 0.5	3.8 ± 0.5	3.7 ± 0.5	3.6 ± 0.5
	Delayed Observational	3.6 ± 0.6	4.1 ± 0.6	4.0 ± 0.6	3.9 ± 0.6
Significant Others	Simultaneous Observational	3.5 ± 0.5	3.8 ± 0.5	3.7 ± 0.5	3.6 ± 0.5
	Delayed Observational	3.6 ± 0.5	4.0 ± 0.6	3.9 ± 0.6	3.8 ± 0.6
Fame and Ambition	Simultaneous Observational	3.4 ± 0.4	3.7 ± 0.4	3.6 ± 0.4	3.5 ± 0.4
	Delayed Observational	3.5 ± 0.5	4.0 ± 0.5	3.9 ± 0.5	3.8 ± 0.5

Table 1 shows the mean and standard deviation for the total score and subscales of motivation in both simultaneous and delayed observational learning groups across the pre-test, acquisition, retention, and transfer stages.

The results of show that the mean and standard deviation of stressful life events are 207.6 (85.8), behavioral inhibition/activation system are 38.85 (7.59), and the mean and standard deviation of addiction tendency are 160.48 (17.97).

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The Kolmogorov-Smirnov test significance level for all variables is greater than the significance level of 0.05 ($p > 0.05$), confirming the normality assumption for these variables. Additionally, based on the Central Limit Theorem in statistics, given the large sample size ($n > 30$), it can be assumed that all variables follow a normal distribution.

Table 2

The Results of Analysis of Variance

Variable	Source	SS	df	MS	F	p	η^2p
Belonging to Friends	Test	58.50	2	29.25	5.10	0.009	0.12
	Group	14.85	1	14.85	1.30	0.20	0.03
	Test × Group	11.34	2	5.67	0.99	0.30	0.01
	Error (within groups)	435.60	76	5.73			
Excitement and Competition	Test	40.70	2	20.35	8.1	0.001	0.3
	Group	10.85	1	10.85	1.0	0.30	0.02
	Test × Group	10.34	2	5.17	1.02	0.35	0.02
	Error (within groups)	382.50	76	5.03			
Intrinsic vs Extrinsic	Test	102.5	4	25.62	10.02	0.001	0.2
	Group	51.6	2	25.8	4.05	0.02	0.18
	Test × Group	38.2	4	9.55	3.78	0.006	0.09
	Error (within groups)	387.8	152	2.55			

Table 3

The Results of Analysis of Variance

Variable	Stage	U	N	p	Significant Difference
Group Acceptance	Pre-test	145.5	40	0.10	No
	Acquisition	120.5	40	0.03	No
	Retention	83.5	40	0.001	Yes
Learning	Pre-test	325.5	40	0.02	No
	Acquisition	310	40	0.007	Yes
	Retention	92	40	0.003	Yes
Energy Release	Pre-test	135.5	40	0.20	No
	Acquisition	125.5	40	0.10	No
	Retention	90.5	40	0.05	No
Significant Others	Pre-test	130.5	40	0.20	No
	Acquisition	125.5	40	0.10	No
	Retention	90.5	40	0.05	No
Fame and Ambition	Pre-test	130.5	40	0.20	No
	Acquisition	125.5	40	0.10	No
	Retention	90.5	40	0.05	No

Table 4

Friedman Test Results

Variable	Test	χ^2	df	p	Significant Difference
Group Acceptance	Delayed Group	15.31	2	0.001	Yes
	Simultaneous Group	0.52	1	0.52	No
Learning	Delayed Group	26.3	2	0.001	Yes
	Simultaneous Group	10.4	2	0.005	Yes
Energy Release	Delayed Group	12.5	2	0.002	No
	Simultaneous Group	13.64	2	0.001	Yes
Significant Others	Delayed Group	12.9	2	0.002	Yes
	Simultaneous Group	0.71	2	0.7	No
Fame and Ambition	Delayed Group	11.8	2	0.003	Yes
	Simultaneous Group	5.15	2	0.07	No

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Due to the non-normal distribution of the subscale data in all stages and groups, multivariate analysis of variance (MANOVA) was used. Additionally, for each subscale, appropriate tests according to the data distribution were utilized.

3.1. Intrinsic Motivation: Belonging to Friends

For the subscale "Belonging to Friends," due to the normal distribution of data and non-significant difference between the groups in the pre-test ($t(38) = 0.7$, $p = 0.4$), a 2 (group) × 3 (test) repeated measures ANOVA was used. Mauchly's test of sphericity was met ($p > 0.05$). The results showed a significant main effect of the test ($F(2, 76) = 5.1$, $p = 0.009$, $\eta^2p = 0.4$), but no significant main effect of the group ($F(1, 38) = 1.3$, $p = 0.2$, $\eta^2p = 0.03$) or interaction effect ($F(2, 76) = 0.99$, $p = 0.3$, $\eta^2p = 0.01$). Post-hoc tests indicated a significant difference between the pre-test and acquisition ($p = 0.001$) and between the pre-test and retention ($p = 0.02$), with higher scores in the acquisition and retention stages. No significant difference was observed between acquisition and retention ($p = 0.5$).

3.2. Intrinsic Motivation: Group Acceptance

The normal distribution was confirmed for the simultaneous observational learning group across all stages but not for the delayed observational learning group. Therefore, the Mann-Whitney U test was used for between-group comparisons, repeated measures ANOVA for within-group comparisons for the simultaneous group, and the Friedman test for the delayed group. Bonferroni correction adjusted the significance level ($\alpha = 0.01$). The Mann-Whitney U test showed no significant difference between the groups in the pre-test ($U = 145.5$, $N = 40$, $p = 0.1$) and acquisition ($U = 120.5$, $N = 40$, $p = 0.03$), but a significant difference in the retention stage ($U = 83.5$, $N = 40$, $p = 0.001$), with higher ranks in the delayed group. The Friedman test showed a significant main effect of the test for the delayed group ($\chi^2(2, N = 20) = 15.31$, $p = 0.001$), with significant differences between the pre-test and retention ($p = 0.01$). No significant differences were found for the simultaneous group ($F(1, 38) = 0.52$, $p = 0.2$, $\eta^2p = 0.09$).

3.3. Intrinsic Motivation: Learning

Given the non-normal distribution of data for both groups across all stages, the Mann-Whitney U test was used for between-group comparisons, and the Friedman test was used for within-group comparisons. Bonferroni correction adjusted the significance level ($\alpha = 0.01$). The Mann-Whitney U test showed no significant difference between the groups in the pre-test ($U = 325.5$, $N = 40$, $p = 0.02$). However, significant differences were found in the acquisition ($U = 310$, $N = 40$, $p = 0.007$) and retention stages ($U = 92$, $N = 40$, $p = 0.003$), with higher ranks in the delayed group. The Friedman test indicated a significant main effect of the test for the delayed group ($\chi^2(2, N = 20) = 26.3$, $p = 0.001$), with significant differences between pre-test and acquisition ($p = 0.002$) and pre-test and retention ($p = 0.001$). No significant difference was found between acquisition and retention ($p = 0.3$). For the simultaneous group, the Friedman test showed a significant main effect ($\chi^2(2, N = 20) = 10.4$, $p = 0.005$), with significant differences between pre-test and retention ($p = 0.006$).

3.4. Intrinsic Motivation: Energy Release

Due to the non-normal distribution of data for both groups across all stages, the Mann-Whitney U test was used for between-group comparisons, and the Friedman test was used for within-group comparisons. Bonferroni correction adjusted the significance level ($\alpha = 0.01$). The Mann-Whitney U test showed no significant differences between the groups at any stage. The Friedman test indicated a significant main effect of the test for the delayed group ($\chi^2(2, N = 20) = 12.5$, $p = 0.002$), with no significant pairwise differences. For the simultaneous group, the Friedman test showed a significant main effect ($\chi^2(2, N = 20) = 13.64$, $p = 0.001$), with significant differences between pre-test and acquisition ($p = 0.002$).

3.5. Extrinsic Motivation: Excitement and Competition

The normal distribution was confirmed for the simultaneous group but not for the delayed group. Therefore, the Mann-Whitney U test was used for between-group comparisons, repeated measures ANOVA for within-group comparisons for the simultaneous group, and the Friedman test for the delayed group. Bonferroni correction adjusted the significance level ($\alpha = 0.01$). The Mann-Whitney U test showed no significant differences between the groups at any stage. The Friedman test indicated a significant main effect of the test for the delayed group ($\chi^2(2, N = 20) = 19.35$, $p = 0.001$), with significant differences between pre-test and acquisition ($p = 0.01$) and pre-test and retention ($p = 0.001$). For the simultaneous group, repeated measures ANOVA showed a significant main effect ($F(1, 38) = 8.1$, $p = 0.001$,

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η^2p = 0.3), with Bonferroni post-hoc tests indicating significant differences between pre-test and acquisition (p = 0.003) and pre-test and retention (p = 0.004).

3.6. Extrinsic Motivation: Significant Others

Due to the non-normal distribution of data for both groups across all stages, the Mann-Whitney U test was used for between-group comparisons, and the Friedman test was used for within-group comparisons. Bonferroni correction adjusted the significance level (α = 0.01). The Mann-Whitney U test showed no significant differences between the groups at any stage. The Friedman test indicated a significant main effect of the test for the delayed group (χ^2(2, N = 20) = 12.9, p = 0.002), with significant differences between pre-test and retention (p = 0.01). No significant difference was found for the simultaneous group (χ^2(2, N = 20) = 0.71, p = 0.7).

3.7. Extrinsic Motivation: Fame and Ambition

Due to the non-normal distribution of data for both groups across all stages, the Mann-Whitney U test was used for between-group comparisons, and the Friedman test was used for within-group comparisons. Bonferroni correction adjusted the significance level (α = 0.01). The Mann-Whitney U test showed no significant differences between the groups at any stage. The Friedman test indicated a significant main effect of the test for the delayed group (χ^2(2, N = 20) = 11.8, p = 0.003), with significant differences between pre-test and retention (p = 0.003). No significant difference was found for the simultaneous group (χ^2(2, N = 20) = 5.15, p = 0.07).

3.8. Comparison of Intrinsic and Extrinsic Motivation

Due to the normal distribution of data, an independent t-test was used for the pre-test stage comparison between the groups. Results showed no significant differences in intrinsic (t(38) = 1.67, p = 0.1) and extrinsic (t(38) = -0.2, p = 0.9) motivation. Therefore, a 2 (group) × 3 (test) repeated measures MANOVA was used for further analysis. Mauchly's test of sphericity was met (p > 0.05). The results showed a significant main effect of the test (F(4, 152) = 10.02, p = 0.001, η^2p = 0.2), group (F(2, 37) = 4.05, p = 0.02, η^2p = 0.18), and interaction effect (F(4, 152) = 3.78, p = 0.

4. Discussion and Conclusion

Based on previous research and literature, as expected, observational learning increased the motivation levels of participants, but this increase was observed only in the delayed observational learning group. More specifically, for both groups, in the context of extrinsic motivation, scores were lower in the pre-test stage, and no significant difference was found between the acquisition and retention stages. Regarding intrinsic motivation in both groups at different stages, it was shown that only at the final stage of completing the questionnaire (after retention) was there a significant difference between the two groups, with the delayed observational learning group having higher intrinsic motivation, according to the means.

Based on the overall questionnaire score, there was a significant difference between the delayed and simultaneous observational learning groups at the retention stage, with the mean overall score of the delayed observational learning group being higher than that of the simultaneous observational learning group. This finding is consistent with the results of Kron et al. (2021), as a significant decrease in performance quality and a drop in performance from imitation to independent practice was easily observable for the simultaneous observational learning group. Therefore, it can be concluded that better execution and performance improvement as a result of delayed imitation can potentially increase participants' motivation levels.

This finding is also consistent with the results of Abbasi et al. (2021), as they examined self-talk in sports through the mediating role of sports motivation and ultimately found significant results (Abbasi et al., 2020). Thus, it can be concluded that probably better execution and performance improvement, which results from delayed and asynchronous imitation of the participants, can increase the level of sports motivation of the participants.

5. Limitations & Suggestions

Given these findings, however, further studies with different tasks, or participants of various age ranges, and even studies on the other gender are needed. Additionally, considering that the training program was short in duration, it is advisable for future research to implement a longer training program to potentially have a greater impact on individuals' progress.

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Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors contributed equally.

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