The Effect of Music on Associative Learning Motor Skill

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ABSTRACT

Background: The goal of this research was to determine the effect of music on associative learning of 3-step pivot layup. Study subjects consisted of 90 healthy right-handed female non-athletes with an age range of 15-18 years. None of the subjects were musicians. They were divided to 6 groups (15 subjects each), consisting of 5 experimental groups and one control group. The basic rules and regulations of basketball were being taught to participants in 2 sessions, each session lasted 2 hours.

Objective: The participants performed the pre-test of 3-step pivot layup at the end of the second session and the exercise started afterwards. Students in the control group had no exercise and had not listened to the music. They just performed the pre-test and post-test. The other 5 groups had 12 exercise sessions, each session lasted 30 minutes and included 10 minutes of warm-up and 20 minutes of exercise.

Results: Participants in the first experimental group had physical exercise, while students of the second experimental group had exercises while listening to music. Third experimental group had listened just for 30 minutes per session and students of the fourth experimental group had listened to music while exercising as well as in non-exercising hours (before going to bed and before physical exercise) for 30 minutes. The fifth experimental group had exercised and listened to music in non-exercising hours (before going to bed and before physical exercise). After applying all variables and teaching them the skills, all the participants were taken acquisition test while the retention test was taken 24 hours after. Each participant performance was being recorded by a camera and being accurately scored by three basketball experts.

Conclusion: The data was being processed using multi-variate analysis of variance (MANOVA) due to the violation of the assumption of sphericity. The results showed that the fourth group had better performance since they had created a combination of music and 3-step layup as well as associative learning while not performing the exercise. This research and its results suggests the coaches to use associative learning of music with exercises to increase the learning level of athletes when it’s impossible to perform physical exercise due to bad weather, athlete’s injury or inappropriate situations.

INTRODUCTION

The core concept in the theory of ‘associative learning’ is reputed to be the contiguity of different elements which leads to their association. This had been shown experimentally by Pavlov in 1927. After the association is established, the conditioned stimulus can lead to emergence of response in the absence of the unconditioned stimulus. Pavlov and some other researchers states that associative learning is actually a connection between the mental images of physical stimuli as a result of their pairing [1, 2]. Therefore, it is possible that while practicing to learn a skill, some of the elements in environment might be paired with the practice process; ‘music’ could be considered as one of these environmental elements. From the multitude of studies carried out to evaluate the effect of music on performance, psychological and physiologic factors and mental imagery, some have shown that music can elevate mood, improve performance, learning and mental imagery and help better resist against lassitude. Music can also improve such cognitive functions as attention, communication and memory both in healthy individuals and patients with Alzheimer’s disease [3]. Few studies have been performed on the effects of music upon learning.

Of these, some studies about music effects on language learning have just considered simple learning and not focused on associative role of music on the learning process. Considering a motor skill as a series of smaller parts (beginning, intermediary and final) and the resemblance of this sequence to the sequence of melodies in a
sonate (Mozart effect), is could be conceptualized that such a music paired with a motor skill practice paradigm can bring about the process of imagery. Thus, considering Gestalt theory and some relevant studies [such as 4, 5 and 6] it might be prudent to state that ‘listening to music while practicing a motor skill can produce a music-skill pair’ such that those who have listened to music during practice could better imagine the practicing of skill and this superiority in imagery might improve their learning and the association of music with practice can facilitate the learning process of that skill in the absence of real practice sessions.

MATERIALS AND METHODS

Subjects: Study subjects consisted of 90 healthy right-handed female non-athletes with an range of 15-18 years (data gathered via personal questionnaire filling). None of the subjects were musicians. They were divided to 6 groups (15 subjects each), consisting of 5 experimental groups and one control group. All the subjects were taught basics of basketball in two sessions (each session, 2 hours). At the end of the second session, a pre-test of layup pivot was given and thereafter, practice commenced. The control group neither attended practice sessions nor received music and just underwent the pre- and post-tests.

Procedure: There were 12 sessions of practice (each session 30 minutes; 10 minutes for warming up and 20 minutes for practicing) for the experimental groups. Group 1 had merely physical practice. group 2 had physical practice as well as music. Group 3 subjects just listened to music for 30 minutes in each session. Subjects of the 4th group practiced for 30 minutes while listening to music; they also listened to music for 30 minutes before bedtime and before each physical practice session in addition to the music that they listened to during the practice sessions. Subjects of the 5th experimental group had physical practice sessions along with listening to music outside the practice sessions (before bedtime and before practice sessions). The timings of the practice sessions of different groups did not have any interference with each other while the sessions was held at matched hours to control the confounding effects of biorhythm. The subjects had a choice of 3 different types of music clips were played by Sony Digital music players (NWZ-B142F) and the subjects 1 After the last practice session, the acquisition test was held. The recall test was held 24 hours later. During each test, three consecutive layup pivot trials after 12 sessions of practice were done and the mean score was calculated. Scoring was done by three Basketball experts and according to the formal rules of Basketball Federation and the criteria mentioned in 3rd edition of Basketball skills & Drills book [7].

Instruments: The performance of subjects was recorded by Cannon video camera (LEGRIA FS406) during the acquisition and recall tests.

Data Analysis: Multivariate analysis was used to analyse the data.

listened to the clips through stereo dynamic headphones.

Results:

Multiple variate analysis of variance by lambda wilk’s trace test showed that there is significant difference between scores of the 6 groups (F = 4.144). To further delineate the exact difference points between groups, the mean score values were compared in pairs in acquisition and retention phases, respectively (tables 1& 2).

Discussion and conclusion

There was a significant difference of performance between group 4 (physical practice + music + off-schedule music) and group 2 (physical practice + music) as well as group 4 and group 5 (physical practice + off-schedule music). Overall, it is evident that performance was better in groups 1, 2, 4 and 5 that the control and 3rd groups. The very difference between interventions in group 4 and groups 1, 2 and 5 is that there is a chance of emergence of a music-lay up pair during practice as well as a chance for association of physical practice during the off-practice hours for group 4; something that was not probable for groups 1, 2 and 5, since the first group lacked music and the 2nd and 5th groups lacked the association (exposure to music either in practice session or during off-practice hours and not both). Absence of significant difference in performances of group 1 (physical practice) with group 2 (physical practice + music during practice) as well as well as group 2 with group 5 (physical practice + off-practice music) reveals that the difference of performance between group 4 and groups 1 and 2 is a result of contingency of music with practice not the mere exposure to music during practice or outside practice time.

The difference between group 4 and groups 1 and 2 alludes to the motivational role of music. During acquisition, no significant difference was seen between the performance of groups 1 and 4; yet, as is evident in tables 4 and 5 and figure 2 (group performances and pair comparisons during retention phase) such a difference became significant in the retention phase. Temporary effects such as fatigue and their resolution during the retention test might explain such a change, since practice includes temporary and persistent effects that influence the acquisition scores. Yet, as temporary effects of practice (such as fatigue, verbal commands, mitigation of motivation, etc.) are performance variables and not learning variables, they fade out during the
retention interval and this accounts for the difference between retention and acquisition scores. On the other hand, since associative learning is one of cumulative type which occurs through orderly tiny steps, it could be said that during the acquisition phase, such a learning type is not strong enough to cause a significant difference between the 4th group and other groups consisting of physical practice. The results of retention test support this view, since the subjects of the 4th group who had the possibility to make the layup-music pair and could associate the physical practice during its absence had the best performance in retention test, which was also significantly different from other groups in retention test. Such a finding may support the role of music in establishing an association and consequently its role in associative learning.

Accordingly, Chikahisa (2006) has shown that music improves learning [8]; Elliott (2005) have also shown that music improves performance [9]. Such studies allude to the motivational role of music in improving performance, whereas the present study did not reveal a significant difference in performances of groups 1 and 2 which does not confirm such a motivational role for music in improving performance. Since the music type used in most previous studies was of energetic type and such studies evaluated variables such as distance passed, heart rate, strength... all of which are related to physiologic factors, the disparity between the results of the present study and those of previous studies could be explained by the different music type and the non-physiologic nature of the dependent variables tested in our study. The better performance of the subjects in 4th group could be explained in another way. It is known that for an association to be established, mere contiguity is not sufficient and there must be a ‘belonging’ factor present between different elements associated together and this leads to better learning and retention. Therefore, the task considered in the present study includes rhythm and steps concordant with the musical rhythm. Group 4 of the present study is the only group in which both belonging and contiguity principles were respected. Therefore, in order to use the association of elements in motor skill learning, one must first consider the situation which the learner faces, and then the belonging element to the situation should be recognized and in the last step, such an association must be established through contiguity.

REFERENCES