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# The Effect of Contextual Interference on Acquisition and Learning Badminton Skills among Children aged from 10 to 12

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## ABSTRACT

Age may limit the effect of contextual interference, but the accurate effect of age on contextual interference is not completely identified. Therefore, the purpose of the study was the effect of contextual interference practice orders on acquisition and learning of badminton skills of 45 female students aged from 10 to 12. Participants were randomly assigned to one of the three groups of blocked, random, and systematically increasing contextual interference. They trained three skills of badminton long serves, short serves, and forehand strokes for 10 sessions after pre-test. The tests consist of Acquisition, immediate retention, and delayed retention were taken after the fifth session, one hour after the end of the tenth session, and 48 hours after the last practice session, respectively. According to the findings of the study, in acquisition test, the blocked group achieved better scores than the random and systematically increasing groups. Although the three groups performed significantly better than pre-test scores in retention test, there was no difference among groups, meaning that contextual interference did not have positive results for children in learning badminton skills. Seemingly, due to the limitations in strategy, our participants were probably confused among the abundant information from the random practices and were not able to use the advantages of contextual interference. So, the benefits of random practice based on forgetting and elaborating hypotheses in this age group, especially regarding discrete motor skill in badminton is in doubt. The authors carefully suggest that elementary school physical education teachers should use blocked practice methods for badminton practice to help children build a suitable motor skills scheme and encourage them to repeat the desired skills because of the motivational feedback of blocked practice as a result of greater success in practice sessions.

**Key Words:** contextual interference, acquisition, retention, learning, badminton.

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## INTRODUCTION

One of the most important factors in the learning process is planning the practice sessions with focus on practice variability, regarding the needs of learners (1). One of the planning methods of the practice variability is a phenomenon called "Contextual interference." Contextual interference is defined as interference in function and learning which is caused by exercising one task in the context of other tasks. The resulted contextual interference effect depends on tasks, age or the way of their presentation in practice session (2). High contextual interference needs more focus for acquiring the skill and problem-solving and increases learning through this process. So, in random practice schedule, since the learner changes the task in every try, more contextual interference is created, a fact which is expected to increase the learning rate, although it provides no good immediate performance. Blocked practice due to its less interference will have better performance, but is not accompanied with better transfer and learning (3).

In the recent years, new forms of practice order are presented by some instructors and researchers to increase the contextual interference effect. An effect called "moderate contextual interference" occurs as a result of a practice order called "systematically increasing practice order". Under this situation, the participant starts to practice with blocked designs, but during the acquisition process, participant reaches to completely random practice situation. In fact, systematically increasing practice is a kind of practice order which is started by blocked practice order and little by little turns to random practice and ends up with complete random practice (1).

There are several factors that can influence the effect of contextual interference; task characteristics (the practice level of difficulty, practice duration)

and participants' characteristics (intelligence, experience, motivation, age) are among the factors that interact with each other and affect acquisition, retention and transfer of motor skills. That is the result of these numerous factors that laboratory and field researches on contextual interference are in conflict (4, 5). For example, Goode and Magill (1986), in a study, showed that the randomly exercising group performed better than the blocked group on retention and transfer tests (6). While Zetou *et al.* (2007) showed that there isn't a significant difference between the performances of the blocked and random groups (7).

Studies have shown that there is a relationship between the contextual interference effect and age in motor skill learning. Age may limit the effect of the contextual interference but the accurate effect of age on the contextual interference is not clear (8). Meanwhile, most of the studies about the contextual interference are done on adults and a few studies have examined the effect of contextual interference on children and teenagers. It should be noted that the amount of contextual interference of a given task in a program is not equal for children and adults, because children have limited information and processing strategies (9). Different results have been observed among children and teenagers. Some studies have supported the positive contextual interference effect in children (10), whereas others have shown no effect of contextual interference among children (11, 12). As the hours defined for sports and educational facilities in Iran schools are limited and the most important factor in learning is the quantity and quality of practice, so in order to overcome this problem, the instructor or teacher should select a good practice order considering nature of the skill (13) to change the large classes and boring practices to a unique opportunity for kids and to prevent children from becoming disinterested in

learning due to the practice methods (based on personal taste) (14). Since badminton is a sport requiring thinking and familiarity with different techniques and often is taken place indoors, regarding the limited space and time in Iran schools, learning each technique requires a lot of time. Systematic practice of badminton techniques, using proper practice techniques, would help the instructors teaching and facilitating the students' learning (14). Therefore, we decided to study the effect of contextual interference on learning badminton motor skills in children aged from 10 to 12 who might provide an appropriate answer to the existing gap in this area.

#### MATERIALS AND METHODS

**Subject.** Forty five female students aged 10 to 12 years old, (Mean  $\pm$  SD: 11.1  $\pm$  1.07) from the number one area in the city of Tabriz volunteered to participate in this study.

**Procedure.** Written consent were taken from students' parents for participation of their children in the study after describing the method and process of the research.

After initial instruction, all participants performed 5 trials of each skill consisting of short and long serves and forehand stroke in pre-test. For measuring these skills, Pool's long serve, French short serve, and forehand strike was used, all of which have desirable reliability and validity (15). It should be noted that the scoring range for short and long serves and for forehand strike were from 0 - 5 and 0 - 4, respectively. Then, the participants were randomly assigned to one of three groups with 15 members; blocked, random, and combination groups and practiced for 10 sessions, each one involving 15 trials of each tasks. Acquisition test, instant retention test, and finally, delayed retention test was taken after the fifth session, 10 minutes after the end of the tenth session, and 48 hours after the last practice session, respectively.

**Statistical Analysis.** Shapiro-Wilk test was first used for checking normal distribution of data. Then, repeated one-way ANOVA was executed by SPSS (version 17) at the significance level of 0.05.

#### RESULTS

For the analysis of the data obtained from this study, we first examined the normal distribution of data by using Shapiro-Wilk and normal distribution of all data was confirmed ( $P > 0.05$ ). Afterwards, since in the results of repeated one-way ANOVA measure, compound symmetry assumption was not met ( $P < 0.05$ ), epsilon correction and Greenhouse-Geisser measure were used. Findings showed that participants' scores in all the practice methods had been significantly better in post-test comparing pre-test. Furthermore, a significant interaction was established between group and time ( $P = 0.000$ ,  $df = 4.91$ , and  $F = 6.042$ ), meaning that there is a significant difference among groups' performances at the different times of measurement. Bonferroni's post hoc test showed that there is no significant difference between groups in the pre-test, ( $P = 0.000$ ,  $df = 2$ ,  $P = 0.99$ ), but in the retention test that was administered immediately after the end of the fifth session, the blocked practice group was better than the other two groups ( $P < 0.05$ ). However, there was no significant difference between the random and systematically increased groups (mean difference = 3.4,  $P = 0.578$ ). In the immediate retention test, only performance of the blocked group was statistically better than the systematically increased group (mean difference = 7.73,  $P = 0.010$ ) and there was no significant difference between the performance of blocked and random groups (mean difference = 6.00,  $P = 0.059$ ) or random and systematically increased groups (mean difference = 1.73,  $P = 1.000$ ). Finally, in the delayed retention test, there was no significant difference among the performances of groups ( $F = 1.276$ ,  $df = 2$ ,

and  $P= 0.290$ ), though the systematically increased practice group seemingly

performed better than the other two groups (Figure 1).

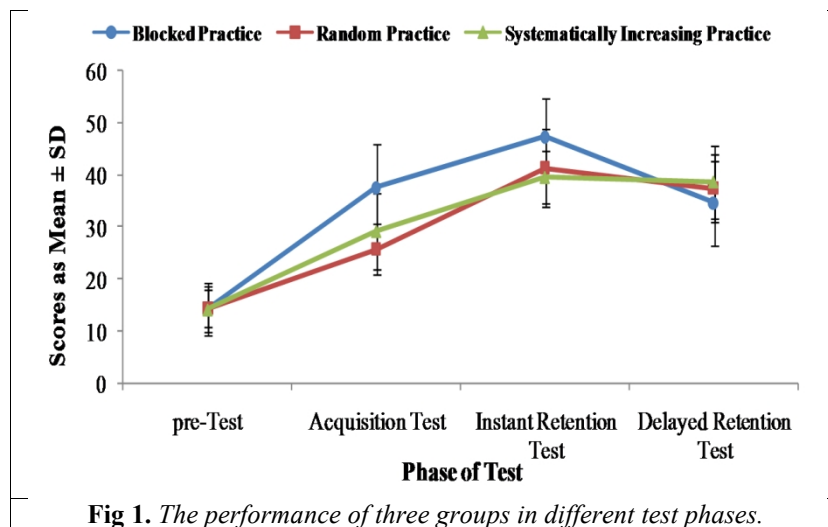


Fig 1. The performance of three groups in different test phases.

## DISCUSSION

According to the findings of research, retention test scores for blocked, random, and systematically increased contextual interference groups were significantly increased comparing with pre-test scores in performing badminton skills. The results of this research is in agreement with Saemi *et al.* (10), Porter *et al.* (16), Lin *et al.* (17), Travlos (18), Fazel *et al.* (19), Pollatou *et al.* (20), Jarus *et al.* (21), and French *et al.* (22).

In fact, the practice is the most important variable affecting learning (14). Therefore, three experimental groups had higher scores in post-test comparing to pre-test after 10 practice sessions, regardless of the type of practice. Performance improvement in the retention test, in comparison with the pre-test, shows that participants had kept skills to some extent in their memory after the retention interval that can be an indicator of information transfer to long-term memory and so, memory improvement and overgeneralization of the information, according to the definition of some experimental psychologists (14).

Also, in the acquisition tests of the fifth and tenth sessions blocked group scored better than random and systematically increased contextual interference groups. Better performance of the blocked group during the acquisition test, perhaps is related to the repetitive nature of the practice program and performing tasks without thinking automatically to some extent, according to elaboration hypothesis. Participants of the blocked practice group recall and perform every skill from short-term memory without interference with other skills. Moreover, according to forgetting or action plan reconstruction hypothesis (23), since participants of blocked group, performed the same skill in different trials, they kept the action plan made in the first trial, on working memory and used it in next trials, therefore their performance was improved.

But in random and systematically increased contextual interference practice groups, since different tasks are performed in different trial, an individual have to put previous trials action plan away and build the next action plan for the future skill, the

performance becomes weaker. These results are in line with the findings of Saemi *et al.* (10), Porter *et al.* (16), Travlos (18), Fazel *et al.* (19), and also is consistent with elaboration (24) and action plan reconstruction hypotheses (23). However, the findings is inconsistent with the findings of Jones and French (2007), Hemayattalab *et al.* (2009) who examined the contextual interferential effect on volleyball skills learning (25). In their study, they could not find any difference between the performances of blocked and random groups in acquisition test (25, 26).

Moreover, the findings showed that in the age group of 10 to 12 years, there is no difference between groups in the retention test, meaning that contextual interference did not seemingly have any positive effect on learning badminton skills in children. These results are inconsistent with the results of Saemi *et al.* (10), Lin *et al.* (17), Porter and Magill (16), Fazel *et al.* (19), Arnone - Bates *et al.* (12), Pollatou and Lee (20), Wulf and Lee (27), Hall and Boyle (28). However, these results are in agreement with the findings of the Cheong *et al.* (29), Feghi *et al.* (30), Bertollo *et al.* (31), Elshahi *et al.* (32), Lotfi *et al.* (5), Whitman (33) and French *et al.* (22). In this regard, some studies have shown that contextual interference have a relationship with age and these differences are related to changes in mental processing capacity during the processing of continuous information (34). Haith (1971), Haith, Morrison, and Shengold (1970) claimed that differences between children of different age groups depends on organizing the information during the information processing (35, 36). Snider (2009) also stated that the age may limit the interference effect, because children have limitations in strategies for information processing (9).

In agreement with present study, Brady (1998) also concluded that a large number of skills in a practice session (random practice)

should not be taught for young children because it can make them confused (37). Therefore, the researchers concluded that young children may need to repeat the same skill to make a motor scheme before the next task. However, this research had been done on young children like children under 10 years old, and studies have rarely been done, regarding the effect of age in older children. Participants in the present study may not be old enough to benefit from the advantages of the contextual interference (11) and encountered with limitation in information processing in random and systematically increased practices (9).

The study done by Del Rey *et al.* (1983) also showed that acquisition scores of blocked group in acquisition test was higher than blocked-random and random groups in performing more complex tasks (38). They mentioned that learning complex tasks by novices causes overload in the beginning, so action planning process changes noticeably. Furthermore, attention elements are high in novices and random programs (like random or systematically increased practices) in such cases lead to an increase in the range of received information and as a result cause to weak performance which is in line with the results of present study (39).

The reason why contextual interference had no positive effect in age group of 10-12 years is probably the lower ages of participants (11, 35, 36). Perhaps, the participants in this study were not old enough to be able to take advantage of contextual interference (11); thus, they got confused by confusing information of the random practice due to the limitations of the strategy (37). Furthermore, it seems that the effect of contextual interference is more sensible in skills that are performed in the longer time and consisted several components. Longer nature means that the participants practice more in every trial and have enough time to adjust the skill (40).

**CONCLUSION**

Since the skills used in this study were discrete motor skills, positive effects of high contextual interference were not observed. So, the benefits of random practice based on the forgetting and elaboration hypothesis in this age group is in doubt, especially in badminton discrete motor skills. The researchers cautiously suggest that physical education teachers of elementary schools should not use the random practice, especially in badminton skills. In contrast, by blocked practice, they may help children to develop a better motor scheme for skills

and encourage them to perform the desirable skills repeatedly because of the motivational feedback of blocked practice as a result of success in the practice sessions. It should be firmly stated that talking about the influence of contextual interference on motor learning and retention of children under 12 years old in badminton skills and other sports skills requires more controlled studies since in this study participants were females and effects of the practice order were examined in closed skills, without applying feedback.

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# تأثیر تداخل زمینه‌ای با تأکید بر تغییرپذیری تمرین بر اکتساب و یادگیری مهارت‌های بدمیتون دختران ۱۲-۱۰ سال

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## چکیده

اگرچه سن، ممکن است تأثیرات تداخل زمینه‌ای را محدود کند؛ اما تأثیر دقیق آن بر تداخل زمینه‌ای کاملاً مشخص نشده است. بنابراین، هدف تحقیق حاضر مقایسه آرایش‌های تمرینی مسدود، تصادفی و ترکیبی در اکتساب و یادگیری مهارت‌های بدمیتون در کودکان ۱۰ تا ۱۲ ساله است. آزمودنی‌های این تحقیق ۴۵ نفر از دانش‌آموزان دختر ۱۰ تا ۱۲ ساله ناحیه ۱ شهر تبریز بودند، که بعد از انجام پیش‌آزمون، بطور تصادفی به سه گروه ۱۵ نفره شامل گروه‌های مسدود، تصادفی و ترکیبی تقسیم شدند، سپس سه مهارت سرویس بلند، سرویس کوتاه و ضربه فوره‌ند را به مدت ۱۰ جلسه تمرین کردند. آزمون‌های اکتساب، یادداری آنی، و یادداری تأخیری به ترتیب بعد از جلسه پنجم، یک ساعت بعد از پایان جلسه دهم، و ۴۸ ساعت بعد از آخرین جلسه تمرین به عمل آمد. تحلیل داده‌ها نشان داد که در آزمون‌های اکتساب و یادداری آنی، گروه مسدود نمرات بهتری را نسبت به گروه‌های تصادفی و ترکیبی به دست آورد. در آزمون یادداری هر چند که عملکرد هر سه گروه نسبت به نمرات پیش‌آزمون به طور معنی‌داری افزایش داشت؛ ولی، هیچ‌گونه تفاوتی بین گروه‌ها وجود ندارد، بدین معنا که ظاهراً تداخل زمینه‌ای نتایج مثبتی در یادگیری به همراه نداشته است. احتمالاً آزمودنی‌های تحقیق حاضر به حد کافی بزرگ نشده‌اند که بتوانند از مزایای تداخل زمینه‌ای استفاده کنند. لذا، بدلیل محدودیت در استراتژی، در میان اطلاعات فراوان حاصل از تمرین تصادفی، سردرگم شده‌اند. بنابراین مزایای تمرین تصادفی بر اساس فرضیه‌های بسط و فراموشی در این گروه سنی بویژه در مهارت‌های مجرد بدمیتون با تردید روبرو است. محققان با احتیاط پیشنهاد می‌کنند که معلمان ورزش دوره ابتدایی برای آموزش مهارت‌های بدمیتون از شیوه تمرینی مسدود استفاده کنند که به کودکان کمک می‌کند هم طرحواره حرکتی مناسبی از مهارت بسازند و هم اینکه به دلیل بازخورد انگیزشی تمرینات مسدود در اثر کسب موفقیت بیشتر در جلسات تمرین، تشویق شوند که مهارت مورد نظر را به دفعات بیشتری تکرار کنند.

**واژگان کلیدی:** تداخل زمینه‌ای، اکتساب، یادداری، یادگیری، بدمیتون.

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