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**Research article**

**THE EFFECTS OF FEEDBACK FREQUENCIES AMONG CHILDREN ON MOTOR LEARNING SKILL ACQUISITION**

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**Abstract**

*Journal of Sports Science and Physical Education* 3(1): 78–86, 2015 - The purpose of this study was to determine the effects of 100% feedback frequencies, 65% of feedback frequencies and bandwidth feedback on overhand throwing skill among children and motivation of the children during practices. 60 of female students from range of aged 10 to 11 years old are participated in this study (age: M=10.53 years/SD=.503, weight: M=29.11/SD3.08, height=126.68/3.04). All participants practiced 60 trials of overhand throwing accuracy task and the motivation of the participant had been measured by using Intrinsic Motivation Inventory Questionnaire (IMI) ( $r=0.59$ ). Participants were randomly assigned into three group 100% feedback, 65% feedback and bandwidth feedback groups. Learning was inferred from the performance on the delayed (24-hour) retention. To analyze the data, we use mixed-between ANOVA for practice phases, One Way ANOVA for retention test and correlation analysis to measure the relationship between feedback frequencies and motivation. There was no significant result between group ( $F(2, 57) = .286, p = .752$ ) during practices, there is a significant difference on retention test phase ( $p < .004$ ) and there was negative relationship

between all feedback frequencies and motivation (100%:  $r = -.388, p < 0.91$ ), 65%:  $r = -.232, p < 0.24$ , & bandwidth feedback 100%:  $r = -.507, p < .023$ ). In conclusion, to optimize motor learning, Children may require more practice trials with feedback in order to form a more accurate and stable internal representation of a motor skill and increased the motivation.

**Keywords:** *Knowledge of Result, IMI*

**Introduction**

The development of motor skill in sports is important in order to produce future expert athletes. Motor skills in sport usually develop during young age, from basic skills to complex skill of movement. Skill acquisition cannot be easily measured and it must be inferred from changes in behavior over an extended period of time (Magill, 2007). The most important period to develop motor development is in between aged range 4 to 11 years old (Stafford, 2011). In this stage, the child is developmentally and motivationally ready to acquire the fundamental movement skills that are the cornerstones of athletes and sporting development (Stafford, 2011). Feedback (FB) has been considered as a fundamental component of motor learning component (Magill, 2007). Feedback provides information on how well individuals

performed relatively to their goals and how specific behaviours affected a task. There have 2 type of FB which are inherent feedback and augmented feedback. Inherent feedback is information that comes from the sensory system while augmented feedback comes from external sources (Junior, Maia & Tani, 2012). Augmented feedback consists of knowledge of result (KR) and knowledge of performance (KP).

Based on the theory closed-loop by Adam (1971) and schema by Schmidt (1975) proposed that main rule providing KR was “more is always better” especially regarding on the Schedule of frequency. However, study from Kanfer and Ackerman (1989) theorize that feedback frequency will have a positive effect on learning and up to certain point, but once feedback frequencies reach high levels, the cognitive demand on individuals to respond to and process the feedback become overwhelming. Compared with the adult, children have a different in cognitive process such as selective attention and speed of processing information that will increasing with age (Chuah & Maybery, 1999; Ferguson & Bowey, 2005). Barclay and Newell (1980) who used self-paced post KR interval found that 10-11 years old children did not use those intervals efficiency to improve their performance or took more time to process the KR. From there we can conclude that there are differences not only with adult, age factor also influencing the ability of the children on how they respond to different type of feedback. However, there is limited information concerning to the effect of feedback frequencies among children from age 10 to 11 years old especially in Malaysia.

The literature that had been examining the effect feedback frequencies and motivation on children seems to be lacking. The roles of feedback besides providing the information of performance, it's also

functioning to provides the motivation in order to enhances the performance (Coker, 2004). Children may engage in physical education for variety of reasons, including a combination of intrinsic and extrinsic motives (Weiss & Ferrer, 2002). However, extrinsic motivation alone is not enough. Intrinsic motivation is needed to keep them active on learning and discover new skill. Identifying factors related to the facilitation and development of intrinsically motivated behaviors is an important research goal (Badami, Vaezmousavi, Wulf & Namazizadeh, 2011).

Therefore, purpose of this study is to investigate the effects of feedback frequencies among children on learning skill acquisition on their ability to interpreting the amount of feedback learning skill acquisition. It is measured and compared by using overhand tennis throwing accuracy test. The overhand throwing movement skill that will be practices in this study is one of the fundamental movement skill which is classified as bilateral object control that involving large body movements where force is applied to or absorbed (received) from the external objects. This study also wants to investigate the relationship between motivation and feedback frequencies that had been provided to the participant.

## **Methods**

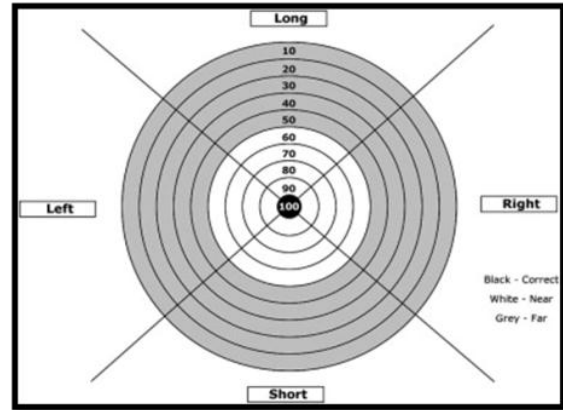
### ***Participant***

Sixty of 10 to 11 years old healthy female school children participated in this study. Informed consent was obtained from the school, the parents and guardians were provided their assent. Each of the participants had no prior experience with the experimental task and was not aware of the specific purpose of the study. The selected participants will be randomly assigned to 100% feedback group, 65% feedback group and bandwidth feedback group.

### ***Apparatus and Task***

The task that had been used in this study was adopted from previous study that has been conducted by Chiviawosky et al., (2008) and Sabzi et al., (2012). Participants were required to throw the tennis ball by using overhand throw with their non-dominant hand while wearing the opaque swimming goggles to cover their vision at the target that has been placed on the floor. Concentric circles with radii of 10, 20, 30, 40, 50 and up to 100 cm were drawn around the target to assess the throwing accuracy. The feedback frequencies that had been used were 100%, 65% and bandwidth feedback for selected group. 100% frequencies the feedback was given in every trial and for 65% frequencies will be faded progressively faded across 6 blocks of 10 trials in following manner. For block one- 100%, block two- 75%, block three with 50%, block 4 with 25%, block 5 with 10% and block 6 with no feedback at all. Overall they only received 39 trials only. While for Band width only received feedback when the score is less than 50. Intrinsic Motivation Inventory (IMI) was used to measure the level of motivation of the participant after practiced. The questionnaires were consisting of 3 subscales including items related interest/enjoyment, perceived competent and effort/important subscales to measure the participant intrinsic motivation. Internal consistency of each subscale calculated by using the Cronbach alpha statistic. They were high in consistencies with interest /enjoyment sub scaled was 0.88, perceived competence with 0.81, and effort/important with 0.8.

**Figure 1:** Schematic of the target and zone areas used for providing feedback.



### ***Procedures***

Participants were randomly assigned into 100% feedback group and 65% feedback (faded) and bandwidth feedback frequencies. The participants had received augmented feedback with selected frequency after every trial during the acquisition phase. The practice phases contained with 6 blocks that consist of 10 trials (6x10). Participants were prevented to see the target area during practice using the opaque swimming goggles. However, they are allowed to see the target area before practiced while receiving the instruction by the experimenter. During the practice session, the instructor guided the participants on how to do the accurate throw. The participants took their rest between the practice block. The target area was divided into four quadrants and knowledge of result has been provided in term of direction and distance from the target center. The participants were informed whether the throw was long, short left, right based on the four quadrant. The IMI questionnaires have been distributed at the end of the practice session. Approximately after 24 hour of practice phase, the retention phase conducted. The retention phase contained with 1 block that consist of 10 trials, during the test participants were again prevented to see the target area while tossing. No feedback was provided during the test.

### ***Statistical Analysis***

Descriptive statistic was used to determine the mean, standard deviation of age, weight, height and gender of the participant. In this study consist of three groups. The data were analyzed in three groups x 6 block of 10 trials using mixed between–within ANOVA on trials block were conducted for accuracy score for acquisition data. For retention test we used one-way ANOVA to analyze the data score. To analyze the relationship between feedback frequencies and intrinsic motivation we used correlations analysis. The statistics were performed using SPSS 20.0 and an alpha level of 0.5 was used for all statistical tests.

### **Results**

#### ***Practice Phases***

There was no significant interaction between groups of feedback frequencies and practice phases, Wilk Lambda = .76,  $F(10,106) = 1.559$ ,  $p = .129$ , partial eta squared=.128. There was a substantial main effect for practice phases, Wilk Lambda =.88,  $F(5, 53) = 1.44$ ,  $p < .225$ , partial eta squared = .120, with all groups showing an inconsistency in overhand throwing accuracy test scores across six phases of practice. The main effect comparing the three types of intervention was not significant,  $F(2, 57) = .286$ ,  $p = .752$ , partial eta squared=.010, suggesting no difference in the effectiveness of the three groups of feedback frequencies (100%, 65% and bandwidth feedback frequencies). This

result has accepted the null hypothesis of the present study.

#### ***Retention Test***

There was a statistically significant difference at  $p < .004$ . Despite reaching statistical significant, the actual difference in mean scores between the groups was quite small. The effect size calculated by eta square was 0.04. Post hoc comparisons using the Turkey HSD test indicated that the mean score for group 1 ( $M = 503.50$ ,  $SD = 126.502$ ) was significantly different from group 3 ( $M = 390.00$ ,  $SD = 57.583$ ). Group 2 ( $M = 435.500$ ,  $SD = 113.020$ ) did not differ significantly from either group 1 or 3.

#### ***Relationship between Motivation and Feedback Frequencies during Practice Phases***

There was a medium, negative correlations between two variable  $r = -.388$ ,  $n = 60$ ,  $p < 0.91$  with high level of 100% feedback frequencies associated with lower level intrinsic motivation. For 65% feedback frequencies, there was a medium, negative correlations between 2 variable  $r = -.232$ ,  $n = 20$ ,  $p < 0.24$  with high level of 65% feedback frequencies associated with lower level intrinsic motivation. While for bandwidth feedback frequencies, there was a large, negative correlations between 2 variable  $r = -.507$ ,  $n = 20$ ,  $p < .023$  with high level of 65% feedback frequencies associated with lower level intrinsic motivation. All the result not accepted the null hypothesis of the study.

**Table 1:** Three groups of feedback frequencies (100%, 65% and Bandwidth) scores during 6 phases of training

Variables		100% feedback frequencies			65% feedback frequencies			Bandwidth		
		n	Mean	SD	n	Mean	SD	n	Mean	SD
<b>Practices</b>	Practice 1	20	108.50	86.953	20	113.00	81.633	20	187.00	115.854
	Practice 2	20	140.50	93.554	20	143.00	89.840	20	151.00	113.272
	Practice 3	20	177.00	110.506	20	179.00	107.650	20	151.50	74.711
	Practice 4	20	161.00	123.327	20	169.00	114.657	20	158.00	111.808
	Practice 5	20	176.50	104.190	20	179.00	101.302	20	173.50	89.811
	Practice 6	20	167.00	139.060	20	176.50	131.520	20	204.00	154.593

**Table 2:** Three groups of feedback frequencies (100%, 65% and Bandwidth) scores during 24 hours retention test

Variables		100% feedback frequencies			65% feedback frequencies			Bandwidth		
		n	Mean	SD	n	Mean	SD	n	Mean	SD
<b>Retention test</b>		20	503.50	126.50	20	435.50	113.01	20	390.00	57.58

## Discussion

The result during practice phases has shown that there was no significant interrelation between or within three groups (100%, 65% and bandwidth feedback frequencies). This result was supported the null hypothesis in the present study. However, during practice phases 65% feedback frequencies and bandwidth feedback frequencies groups has shown highest score (mean) between practices compared to 100% feedback frequencies groups. During practice phases 100% group did not having an accurate throw during practice because there may had a difficulty in processing the information or the feedback that had been given was reaching into higher level so it might have impaired their skill of performance. This result has violated the theory of close loop by Adam (1971) and Schmidt stated that the

main rule of providing KR are “more is always better” in order to develop a new skill of movement. On the other hand, the finding from Sabzi et al., (2012) has shown that reduce and bandwidth of feedback frequencies had benefit the practice phases depend on their ability of the learner to process the additional cognitive demand. Reduced post respond feedback enhances the information – processing demands and greater dependence on intrinsic feedback mechanism during no feedback trials (Goh, Katak and Sullivan, 2012). Individuals who received high level of feedback frequency more likely to experience overload, thus resulting in reduced task effort and ultimately less learning and performance improvement (Lam et al., 2011).

In 24- hour’s retention test, there was a significant difference between three

groups. The 100% feedback group has a greater result in the overhand throwing accuracy test. While another groups not perform well on the overhand accuracy test even though they scored high (score mean) during practice session. This result has violated the null hypothesis of the study. Children who received reduced the feedback frequency beyond at the critical point through the acquisition phase was detrimental to motor performance and learning of these children. These situations happen because when the feedback is withdrawn, the learners need to attend to and interpret the intrinsic feedback that leads to stronger internal representation of the skill (Sullivan et al., 2008). Children acquired more practice trial with feedback in order to form a more accurate and stable internal representation of motor skill (Sullivan et al., 2008). Sullivan et al., (2008) that had investigated the effect of different frequencies on skill acquisition has stated that children who received 100% feedback during the acquisition phases were more accurate and consistent on delayed retention test than the children who received reduced feedback frequencies.

During the 24-hour retention time the participant may synthesizes the information that had been received both intrinsically and extrinsically to formulate a new movement plan. The participant encourages active processing for movement modification but they can also check for understanding (Coker, 2004). The enough feedback and performance information may give the advantages to the participant in 100% feedback frequencies group to perform well during retention test.

The bandwidth frequencies group had shown the negative medium relationship compared to 100% and 65% feedback frequencies groups. This result was against the finding by Amorose and Horn (2000) has stated that athletes with higher level of intrinsic motivation perceived that their coaches provided high frequencies of positives feedback. Children are less effective in attending and interpret intrinsic feedback have a greater difficulty with detection and estimation of movement errors (Sullivan et al., 2008). Motivation generally enhances the feeling of the competence of the children. If we refer to the mean of accuracy throw of bandwidth feedback frequencies group during practice was high compared to other groups, and it similar to finding from Chiviadowsky & Wulf (2007) enhance learning a motor skill. The result had accumulating the evidence that motivation not really playing a role of feedback in enhancing the motor learning. Motivational consequences of feedback directly impact the learning motor skill.

### **Conclusion**

In conclusion, our result indicated that the children may require more practice trials with feedback in order to form more accurate in performing a skill. This is another evident had shown children at age 10 to 11 years old may need 100% of feedback in order to mastering a motor skill. Based on the result, we can assume that feedback frequencies not enhance the motivation of the participants in learning motor skill. As we know these two components are important factors in order to make the process of learning become more efficient. The amount of feedback and

practice phases must be consistent with the level of difficulty of the skill and the proper cues of feedback.

### Recommendation

Based on the findings of the present study, future aspects of research should be focusing on other group of age for example the effect of feedback frequencies on children, teenager and adult. Many of past study only investigated the effect of motivation on learning skill acquisition, there is no research that conduct to determine the level of motivation of the participants in acquisition of motor skill. Other than that, future research also can be done on the feedback that based on the knowledge of result not the amount of feedback frequencies.

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