The Effect of Overt and Covert Motivational Self-Talk on Physiological Factor and Motor Performance During a Push-Up Exercise in Children

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Abstract

Background: One of the well-known cognitive strategies and techniques being used in a widespread manner by athletes both during the learning stages of a skill and within competitions is self-talk.

Objectives: In this research, we seek to examine the effects of overt and covert motivational self-talk on the physiological factor and the motor performance during a push-up exercise among children. Push-ups are one of the common tasks in schools with the universal standard used to measure the rate of endurance in the upper muscles of the trunk. The number of the correctly performed push-ups, regardless of the time, was each student's score and validity and reliability for this test (93).

Methods: The sample in the study consisted of 60 male students (aged 10.25 ± 0.57) studying in Bonab, Iran, during the 2017 - 2018 academic year who voluntarily participated in the study and were randomly divided into three groups of 20 (overt MST, covert MST and C group). At first, a pre-test including the push-up task and heart rate was performed. Then, the groups performed the push-ups task according to the specific conditions defined for each group as a post-test. The paired-samples *t*-test was used to examine the progress of the groups in comparison to the pre-test and the one-way ANOVA procedure, which was applied to compare the groups in their pre-test and post-test phases.

Results: The one-way analysis of variance showed that the groups did not have a significant difference in pre-test (push-ups test: P = 0.751, heart rate: P = 0.909). However, in the post-test, including the push-ups and heart rate, both the overt motivational self-talk (19.65 ± 8.95 and 118.60 ± 12.13, respectively) and the covert motivational self-talk (19.50 ± 5.03 and 119.09 ± 11.88) had a significant difference compared to the control group (13.10 ± 5.47 and 101.49 ± 9.15) (P = 0.010, P = 0.012 in push-ups task and P = 0.0001, P = 0.0001 in heart rate).

Conclusions: The results of the current study showed that there was no significant difference between the overt and the covert groups. Therefore, it is recommended for sports teachers and coaches to use MST in their preferred mode during training their sports skills.

Keywords: Overt Motivational Self-Talk, Covert Motivational Self-Talk, Learning, Children, Push-Ups, Heart Rate

1. Background

Many scientists and researchers are trying to discover effective and new factors associated with motor learning (1). Along with expanding sport and promoting sports competitions, methods for acquiring motor skills have become more important and significant advances have been made. Training is essential for motor and exercise skills; perhaps it can be said that proper training conditions save money, human resources, and time (1). Today, with the development of skilled athletes, their distinctive features are becoming less and less every day and the role of psychological factors to achieve the outcome of the game is more important and more prominent (2, 3). One of these psycho-logical factors is self-talk, which is used by athletes when practicing sports skills and racing (2, 4). To achieve the goals of motor skills, use of self-talk techniques that control and organize the mental state of athletes have been suggested (5). Self-talk is a conversation that athletes use in an overt or covert manner during acquiring or exercising, and thus, they think about their performance and strengthen it (4). Over the past few years, many studies have been conducted supporting the effects of self-talk strategies on the facilitation of learning and improvement of performance (4). One of the theories with regard to self-talk is Bandura's "self-efficacy theory" (4, 6). Bandura believes that self-talk is effective on the performance of athletes since it increases their self-confidence. He ar-

gues that self-efficacy is equal with feelings of competency, adequacy, and capability to cope with various issues and believes that people with higher degrees of self-efficacy shows more intense efforts in performing their tasks compared to the ones having low levels of self-efficacy (6). Another theory of self-referencing is Nideffer's attention theory. Nideffer states in his theory that self-talk increases the focus of athletes' attention on their performing motor tasks (4). In previous studies, self-talk was examined from a variety of aspects, including positive or negative modes, motivational or instructional modes, and overt or covert modes (4). In these studies, positive self-talk has been shown to have an advantage over negative self-talk in the performance of motor skills and the reduction of anxiety (4, 7). Other aspects of self-talk are educational or motivational (4). Several studies have compared these two aspects of self-talk (4). The results of these studies indicate that instructional self-talk is effective in learning and performing the skills that require care and coordination of organs and eyes (4, 8-10) and motivational self-talk for simple skills that require physical strength and endurance (4, 11-13). Self-talk can also be done in both overt and covert forms (4). Overt self-talk is a kind of self-talk in which one's voice is intense and others, like the examiner and the coach, can hear the person's voice; however, in the covert self-talk, the individual repeats the words in inaudible manner and in his/her mind (4).

Few studies have compared the overt and covert self-talk's impact on sports tasks. For example, Bahari et al. in a study, examined the effect of overt and covert motivational self-talk on the performance of the forced production task in the university students (14). The results showed that both types of self-talk improved the production of forced tasks compared to the control group and between the over and cover motivational self-talk there was no significant difference. Jabbari et al. in their research, showed that the overt motivational self-talk group has significantly ameliorated the outcomes of the dart throw than the covert motivational self-talk group in the university students (15).

Another factor influencing athletes' performance is the level of arousal (3, 16). Most research has emphasized the role of arousal in performing sports (17). Arousal affects the nervous structures involved in the performance and learning (17). One of the ways to measure the level of arousal is heart rate (3, 18). People often experience an increase in arousal by increasing the physiological factors, such as heart rate or adrenal level, or psychological factors such as a feeling of pressure or discomfort (3, 18). Therefore, considering the importance of the level of arousal in the performance of athletes, this study investigates the effect of self-talk on heart rate, which is one way to measure the level of arousal (3, 18). Therefore, the study of this

physiological factor in motivational self-talk can also be discussed.

Considering that one of the significant aims of motor behavior and sports psychologists is the training of skilled people from an early age in the shortest time and with the most desirable training methods and providing training methods that lead to the most learning in the skill training and also enable athletes to achieve peak performance during the competition (1). Therefore, due to the lack of research, comparing the effects of different ways of mentioning motivational self-talk (overt and covert) words and the effect of motivational self-talk on heart rate (physiological factor) in 10-year-old children, as well as in the present study, we compared the effect of overt and covert motivational self-talk on heart beat and jump performance in children.

2. Methods

2.1. Participants

A total of 60 male and right-handed students with the average age of 10.25 ± 0.57 who lacked any previous training and experience in throwing exercises with their non-dominant arm and studying in the school year of 2017 - 2018 in Bonab (Iran) participated voluntarily in the current study. Participants attended two fourth grade and two fifth grade physical education classes from three elementary schools (n = 22, 21, 22). Students participated in the study voluntary. Five students refused to participate. The sample size was adequate based on the study of Kolovelonis et al. and Boroujeni and Shahbazi the statistical power of 0.8 and effect size of 0.62, which is reported by Myers for cognitive solutions on the motor performance (Quoted by Boroujeni, 2011) in the level of 95% of confidence, using the following formula sample size in each group estimated as 19 individuals. For further certainty, 20 subjects were considered for the present study. It should be noted that the participants were relatively at the same level in terms of the number of push up tasks and physical fitness. Therefore, the participants were divided into three groups (overt motivational self-talk (overt MST) (n = 20), covert motivational self-talk (covert MST) (n = 20), and the control (C) group (n = 20)) according to the assigned numbers of the registration room with simple random sampling. All of them were informed of the research objectives and a consent form was signed by their parents.

2.2. Apparatus and Task

2.2.1. Push-Ups Test

Participants stood lying on their hands and then tried to bring their chests closer to the ground as far as their

chests touch the ground (the neck and waist are straight and right) and then they pushed to come back to starting position (the neck and waist are straight and right). This task was used to measure participants' strength and endurance. The number of correct movements was recorded as the subjects' points. The validity and reliability of this test have been confirmed in previous studies (0.93) (10).

2.2.2. Heart Rate Meter

The pulse oximeter, model NK-250B and produced by MAXY Company, was implemented to measure heart rate. The method of using this device is to place the probe on the index finger and then wait 5 to 10 seconds. Then the information is transferred to the device and then the heart rate is shown. Apparatus and method for monitoring respiration is done with a pulse oximeter. Monitoring respiration is based on plethysmography heart rate signal.

2.2.3. Self-Talk Manipulation Check

The self-talk manipulation check was used to obtain information about the participants' self-talk. This scale includes three questions: "Have you used self-talk during exercise and throwing?", "If so, what kind of self-talk have you used?", and "How many times have you used self-talk while practicing and throwing?"

2.3. Methods

At first, the authorization for this research was obtained from the Office of Education in Bonab, Iran, and approved by the University of Tehran. In addition, consent forms were obtained from students' parents. Subjects were randomly divided into three groups: overt MST, covert MST and C group. At first, the examiner showed the student how to perform and correctly execute the assignment. After the subjects warmed up for 5 minutes, a pretest for push-ups task and heart rate was performed. Then, the groups performed the push-ups task according to the conditions specified for each group as a post-test. In the overt MST group, students should repeat the self-talk word "strongly" loudly and audibly when they were ready to come back to starting position and in the covert MST group, students were asked to repeat the self-talk word "quietly" in their minds and inaudible by the examiner when they were ready to push and come back to starting position. The control group also made efforts without any instructions and self-talk. Upon completion of the task, the subjects' heart rate and the number of correct movements were recorded. The study was conducted in a school gym.

2.4. Data Analysis

For the purpose of statistical data analysis, mean and standard deviation were used as measures of descriptive statistics. Before the analysis of the data, Shapiro-Wilk test was applied to determine the normality of the distribution, while Levene's test was used to compare the equality of variances. After these two assumptions were confirmed, the paired-samples t-test was used to examine the progress of the groups in relation to the pre-test, while one-way ANOVA was used to compare the groups in the pre-test and post-test phases. All the analyses were conducted through the application of IBM SPSS 16.

3. Results

The groups did not have a meaningful difference in terms of demographic data (age, weight and height) and none of the participants left the research until the end (Table 1). Descriptive statistics are shown in Table 2. Results of Shapiro-Wilk tests showed that the data have a normal distribution.
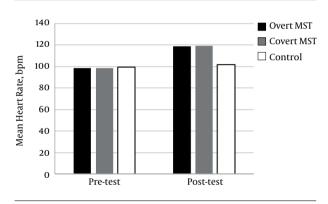
The groups did not have any significant difference in the push-ups test (P = 0.751) and in the heart rate test (P = 0.909). The results of one-way ANOVA showed that there is a meaningful difference among the points of the groups in the post-test of push-ups task ($F_{2, 59} = 6.189$, P = 0.004). To determine the location of differences, the results of Bonferroni post hoc test showed that there was a meaningful difference among the overt MST and covert MST groups with the control group (P = 0.010, P = 0.012). In addition, there was no meaningful difference among the points of overt MST and covert MST groups (P > 0.99). In the mean scores of heart rate, one-way ANOVA showed that there was a meaningful difference among the heart rate of the groups ($F_{2, 59} = 16.181$, P < 0.001). The results of Bonferroni test showed that there is a meaningful difference between the overt MST and covert MST groups on one hand and the control group on the other (P < 0.001). There was also no meaningful difference in the amount of heart rate between the overt MST and covert MST groups (P > 0.99).
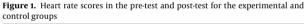
In order to investigate the intra-group differences in the push-ups test, the results of paired-samples t-test showed that there was a meaningful difference between the pre-test (14.95 ± 9.19) and post-test (19.65 ± 8.95) points in the overt MST group (P < 0.001) and the pre-test (14.15 ± 4.80) and post-test (19.50 ± 5.03) points in the covert MST group (P < 0.001). However, there was no meaningful difference between pre-test (13.30 ± 5.87) and post-test (13.10 ± 5.47) points in the control group (P = 0.464). In addition, in order to show intra-group differences in heart rate test, the results of paired t-test indicated that there was a meaningful difference between the pre-test (98.35 ± 11.34) and

Table 1. Mean ± SD of Demographic Variables

Factors	Groups			P Value
	Overt MST	**Covert MST**	**Control**	
Age	10.15 ± 0.48	10.25 ± 0.44	10.35 ± 0.74	0.550
Height	133.75 ± 7.35	137.00 ± 7.82	135.85 ± 7.67	0.398
Weight	30.75 ± 4.54	31.05 ± 5.42	30.35 ± 4.20	0.897

Table 2. Mean ± SD for the Three Groups in the Pre-Test and Post-Test Stages

	Push-Ups Test			Heart Rate		
	Pre-Test	**Post-Test**	**P Value**	**Pre Test**	**Post Test**	**P Value**
Overt MST	14.95 ± 9.19	19.65 ± 8.95	< 0.001	98.35 ± 11.34	118.60 ± 12.13	< 0.001
Covert MST	14.15 ± 4.80	19.50 ± 5.03	< 0.001	98.25 ± 9.95	119.09 ± 11.88	< 0.001
Control	13.30 ± 5.87	13.10 ± 5.47	0.464	99.50 ± 8.58	101.49 ± 9.15	0.132

Figure 1. Heart rate scores in the pre-test and post-test for the experimental and control groups

Figure 2. Push-up scores in the pre-test and post-test for the experimental and control groups

post-test (118.60 ± 12.13) points in the overt MST group (P < 0.001) and the pre-test (98.25 ± 9.95) and post-test (119.09 ± 11.88) points in the covert MST group (P < 0.001). There was no meaningful difference between the pre-test (99.50 ± 8.58) and post-test (101.49 ± 9.15) points in the control group in the heart rate test (P = 0.132). There was no meaningful difference between the pre-test and post-test points in the control group in the heart rate test. At the end, the results of self-talk manipulation check determined that 97% of the subjects used self-talk in the hidden motivational self-talk group.

4. Discussion

The results of this study showed that both self-talk modes (overt and covert) increase the performance of students during a push-up exercise in 10-year-old boys. Generally, both overt and covert MST modes ameliorated mo-
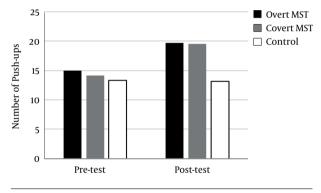
tor performance. This finding is consistent with the results of the studies by Theodorakis et al., Hatzigeorgiadis et al., Boroujeni and Shahbazi, Tahmasebi Boroujeni and Ghaheri, Kolovelonis et al., Zourbanos et al., Chang et al., and Edwards et al., that reported improvements in performance as a result of motivational self-talk (8-10, 13, 19-22). The results of this research can be explained by Bandura's theory where he regards self-efficacy as a reason for the excellent learning and performance of individuals (6). Bandura believes that any factor that increases self-efficacy increases the learning and performance of individuals. One of these factors is verbal encouragement, which has a special relationship with self-talk. MST acts like encouraging words. Therefore, MST increases self-efficacy and subsequently, increases the performance of motor tasks (6). In addition, the reason for this improvement can be attributed to the fact that self-efficacy helps improve performance by increasing energy and effort, relaxing and

Table 3. Results of ANOVA and Pair Wise Comparisons in Post-Test Stage

Groups (I)	Groups (J)	Mean Difference (I - J)	SE	P Value
		Push up Test		
Overt MST	Covert MST	0.15	2.13	> 0.99
	Control	6.55	2.13	0.010
Covert MST	Control	6.40	2.13	0.012
		Heart Rate		
Overt MST	Covert MST	0.45	3.60	> 0.99
	Control	17.10	3.60	< 0.001
Covert MST	Control	17.55	3.60	< 0.001

controlling the level of arousal, reducing anxiety, and self-efficacy, and increasing self-confidence (4, 19, 21, 23). In addition, Nideffer argues that the use of self-talk, especially important remarks, helps to accurately shift the focus between different dimensions of attention and the most appropriate focus on particular sports tasks (4, 24). However, the results of this part of the study were not consistent with previous studies (8, 25). Different types of tasks in the research by Theodorakis et al. (8) (sit-ups test, soccer, and badminton services) can be a reason for the inconsistency of the results in these two studies. In the research by Goudes et al. (25) the nature of the task, age of the subjects, and the fact that the subjects were physical education students can be the reason for the inconsistency of the results of this research with the results of the present study.

With regard to heart rate, the present study showed that both groups of overt and covert motivational self-talk had a significant difference with the control group in the post-test. The results of this part of the research support the research results that have linked the effect of motivational self-talk to increasing energy and effort, relaxing and controlling the level of arousal, and creating a positive mood (5, 8, 22, 26). The results of this part of the study can be explained by Bandura's self-efficacy theory. In this theory, verbal persuasion is a source of increased self-efficacy and increased effort. Thus, motivational self-talk increases the motivation of individuals. Therefore, the increase in arousal causes more heart rate in the overt and covert self-talk groups.

One of the important results of this research was the equality of the overt motivational self-talk group with the covert motivational self-talk group in push-ups test and heart rate. In the present research, there were no meaningful differences among the push-ups task points and the heart rate of the overt self-talk and covert self-talk groups. The results of this part of the research are in line with the results of Bahari et al. (14). The results of this part of the research on the equality of the overt MST group with the covert MST group can be explained based on the results obtained from the heart rate of the subjects. According to the results of heart rate measurement of subjects, it was observed that the overt MST group had the same average heart rate with the covert MST group. On the other hand, due to the fact that, in the gross tasks, greater arousal improves motor performance (3, 17), the equal arousal and heart rate can be a reason for the equality of the overt MST group with the covert MST group. The results of this part of the research are incompatible with the results of Jabbari et al. where it has been shown that the overt MST group caused a significant increase in dart throwing points than the covert MST group in university students (15). The most important reason for the inconsistency of the results of that research with the results of the current study are the age of the subjects.

4.1. Conclusion

In general, the results of this study showed that overt and covert motivational self-talk improves the performance of push-ups tasks and increases arousal and heart rate. Therefore, it is recommended for athletes, teachers, and coaches of endurance and coaching skills to use a psychological motivational self-talk strategy to enhance the performance of 10 year old children in exercise and athletics competitions. In addition, to increase arousal and heart rate, they can also use overt motivational self-talk or covert motivational self-talk. Also, since this study was conducted on male children, it is suggested that another research be carried out on 10-year-old girls and another study also examine the other dimension of self-talk (instructional self-talk) and the effect of this type of self-talk on heart rate.

school managers, and teachers who helped us in the process of conducting the current study.

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