

## Brief Report

# The Effects of Positive Normative Feedback on Learning a Throwing Task among Children with Autism Spectrum Disorder

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### ABSTRACT

**Background:** Autism spectrum disorder (ASD) is a severe developmental disorder which leads to physical disability. Positive normative feedback can promote motor learning. **Objectives:** The aim of this study was to evaluate the effects of positive normative feedback on learning a throwing task among children with ASD. **Methods:** This quasi-experimental study was carried out on twenty children with ASD who aged 6–10 years. Children were assigned to a positive normative feedback and a control group. In the positive normative feedback group, children were trained to throw beanbags to a target point on the ground with their nondominant arms. The acquisition phase included six ten-trial sets. Children in both groups received veridical feedback after each trial. However, children in the positive normative feedback group also received bogus feedback (scores, which were 20% greater than their actual scores) about their performance in each set. A retention test was performed 24 h after the acquisition phase. The independent sample *t*-test and the repeated measures analysis of variance were used to analyze the data. **Results:** There was no significant difference between the groups regarding the performance mean score at baseline. Moreover, despite increases in the performance mean scores over time in both groups, between-group differences in the acquisition and the retention phases were not statistically significant ( $P > 0.05$ ). **Conclusion:** Positive normative feedback does not have significant motivational effects on motor learning among children with ASD.

**KEYWORDS:** Autism, Feedback, Motor skills

## INTRODUCTION

Autism spectrum disorder (ASD) is a severe developmental disorder characterized by language and social communication impairments.<sup>[1,2]</sup> Moreover, while doing activities, children with ASD look clumsy and indicate stereotyped or repetitive motor movements, poor motor coordination, and impaired facial expression, postures, and gestures.<sup>[1-3]</sup>

One of the modalities for promoting motor learning is augmented feedback. As verbal information, feedbacks help correct mistakes and develop motor skills. Recent studies revealed the motivational role of feedback in improving motor learning.<sup>[4-5]</sup> Positive normative feedback includes a series of bogus feedbacks that are beyond individuals' actual practice.<sup>[6]</sup> A study showed the effectiveness of positive normative feedback in promoting motor learning, intrinsic motivation, and muscle

efficacy.<sup>[7]</sup> The present study sought to evaluate the effects of positive normative feedback on children with ASD.

## Objectives

The aim of this study was to evaluate the effects of positive normative feedback on learning a throwing task among children with ASD.

## METHODS

### Study design and participants

This quasi-experimental study was conducted in June 2014 on children with ASD who referred to the Behara Education and Rehabilitation Center for

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Autistic Disorders, Tehran, Iran. In total, twenty eligible children were recruited and assigned to a positive normative feedback ( $n = 10$ ) and a control ( $n = 10$ ) group. Eligibility criteria were an age of 6–10 years and no history of visual problems, memory impairments, cardiovascular diseases, or vestibular dysfunctions. Children were excluded if they developed medical problems and thus were unable to continue the study or if their parents were unwilling to stay in the study.

### Instruments

Children were asked to throw 100-g beanbags with their nondominant arms to a target point placed 3 m away from them on the ground. The target was surrounded by nine concentric circles with the radii of 20–100 cm. These circles were used to assess throwing accuracy. Accordingly, if a beanbag landed on the center of the target point, the score was 100, while if it landed in the 20–100 cm circles, the scores were 90–10, respectively. Finally, beanbags landed out of the 100 cm circle were scored 0.<sup>[4]</sup>

### Intervention

Children were informed about the goal of the task and were trained to throw beanbags overhead with the nondominant arms while standing behind a line 3 m from the target point. Initially, each child performed ten trials. The mean score of these ten trials was considered as pretest or baseline reading. Then, in the acquisition phase, each child performed six ten-trial sets of the task in one session. After each trial, all children in both groups were provided with their actual performance scores (veridical feedback). However, in addition to their actual performance scores for the trials, children in the normative response group were provided with a better mean score for each set which were 20% greater than their actual set mean scores. After 24 h, the retention test was performed.

### Ethical considerations

This study was approved by Guilan University of Medical Sciences, Rasht, Iran (with the code of 100.1581) and the Clinical Research Department of Kashan University Of Medical Sciences, Kashan, Iran (with the code of N.122). At the beginning of the study, participants' parents were ensured about confidential data management and their written informed consents were gained.

### Data analysis

The data were analyzed using the SPSS software version 13.0 (SPSS Inc., Chicago, IL, USA). The results of the Kolmogorov–Smirnov test revealed the normality of the performance scores. Thus, the independent-sample  $t$ -test was used for between-group comparisons both at baseline

and at the retention phase. Moreover, the repeated measures analysis of variance (RM ANOVA) was conducted for between-group comparison respecting the performance mean score across the six sets in the acquisition phase.  $P < 0.05$  were considered statistically significant.

## RESULTS

The two groups did not significantly differ from each other respecting demographic characteristics [Table 1]. The result of independent samples  $t$ -test on the pretest showed no significant differences between the two groups ( $t = 1.703$ ,  $P = 0.106$ ). RM ANOVA was done to compare the variations of mean scores in the six trials in the acquisition phase. The Mauchly's test showed that sphericity was assumed ( $P = 0.94$ ). The main effect of six trial set was significant ( $F = 31.37$ ,  $df = 5$ ,  $P < 0.001$ ) while the main effect of group ( $F = 1.46$ ,  $df = 5$ , and  $P = 0.210$ ) was not statistically significant. Tests of between-subjects effects showed that the interaction of group and set was not significant ( $F = 1.08$ ,  $P = 0.312$ ) [Table 2].

The result of independent samples  $t$ -test showed no significant difference between the two groups either in the acquisition phase [Table 2] or in retention phase ( $t = 1.036$ ,  $P = 0.314$ ).

## DISCUSSION

Despite some improvements in performance mean scores in both groups, between-group differences in the acquisition and the retention phases were not statistically significant. These findings imply that positive normative feedback had no significant motivational effects on motor learning among children with ASD. Conversely, previous studies showed the positive effects of normative feedback on performance.<sup>[6-8]</sup> Providing performers with scores greater than their actual performance scores can significantly improve their muscle efficacy and interest in doing a given task.<sup>[4,5,7]</sup> However, children with ASD have problems in processing visual, auditory, tactile, or olfactory data, show hypo- or hypersensitivity to environmental stimuli, and suffer from different neurological impairments<sup>[9]</sup> and cerebellar dysfunction.<sup>[2,10]</sup> Such problems, impairments, and dysfunction can disrupt emotional and motivational processes in their brains.<sup>[2,10]</sup>

**Table 1: Participants' demographic characteristics**

Characteristics	Groups		P ( <i>t</i> -test)
	Normative feedback	Control	
Age (year)	8.40 ± 0.96	8.50 ± 0.84	0.075
Height (Cm)	122.3 ± 17.60	120.6 ± 19.50	0.176
Weight (Kg)	37.4 ± 4.15	40.5 ± 4.25	0.279
Body mass index (Kg/m <sup>2</sup> )	20.6 ± 6.30	21.53 ± 5.13	0.149

**Table 2: Results of repeated measures analysis for the comparisons of the mean scores at six trials in the acquisition phase**

Total mean score	Acquisition phase <sup>a</sup>						P
	Set 1	Set 2	Set 3	Set 4	Set 5	Set 6	
Normative feedback group	61.40 ± 6.99	72.40 ± 9.78	74.00 ± 10.06	77.60 ± 7.04	80.50 ± 9.5	82.10 ± 9.65	<0.001 <sup>c</sup> 0.210 <sup>d</sup>
Control group	70.50 ± 13.41	74.30 ± 12.65	79.50 ± 12.25	81.90 ± 12.08	82.00 ± 10.86	85.60 ± 7.47	
P <sup>b</sup>	0.073	0.711	0.287	0.344	0.746	0.377	

<sup>a</sup>Data were presented as mean ± SD, <sup>b</sup>t-test, <sup>c</sup>The effect of set, <sup>d</sup>The effect of group. SD: Standard deviation

Our intervention consisted of a six ten-trial sets of doing a throwing task. Findings showed insignificant differences between the study groups regarding the performance mean scores. This exercise program might have been inadequate for learning a new skill and also for enhancing motivation and self-efficacy. It is noteworthy that unlike the mean scores of the sets of the acquisition phase, the performance means scores in the positive normative feedback group in the acquisition and the retention tests were slightly greater than the control group. This finding supports the idea that implementing positive normative feedback intervention for longer periods of time may produce significant results.

## CONCLUSION

Based on the findings of this study, positive normative feedback is not a learning variable, i.e., its application cannot produce significant motor learning outcomes for children with ADS. Of course, further studies with larger samples and longer periods of positive normative feedback are still needed for having conclusive results.

Among the study limitations were our inability to control the intervening effects of factors such as time, personal differences, daily activities, and lifestyle on performance scores. Future studies are recommended to determine the optimum number of trials and positive normative feedbacks for learning new motor skills by children with ASD.

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## Conflicts of interest

The authors declare that this study was conducted in the absence of any commercial and financial dependence on other parties which could result in conflict of interests.

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