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The Effects of Blocked and Random Practice on Speech Motor Learning in Individuals with Dysarthria Associated with Multiple Sclerosis and Healthy Controls

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ABSTRACT

Background: Dysarthria is a neurological motor speech disorder resulting from impairments in the neuromuscular control of speech. The underlying pathophysiological disturbances affecting speech control and execution arise from one or more sensorimotor abnormalities. Few studies have simultaneously compared the effects of different practice schedules on speech motor learning in both healthy individuals and patients with dysarthria. Therefore, this study investigated the effects of blocked and random practice on speech motor learning in individuals with multiple sclerosis (MS) and dysarthria compared with healthy controls.

Methods: The participants included 34 individuals with multiple sclerosis and dysarthria and 34 healthy controls. Participants were randomly assigned to one of two practice conditions: blocked practice or random practice. They were instructed to produce the target phrase three times at their normal speaking rate.

Results: No significant differences were observed between blocked and random practice in the patient group during the pre-practice, practice, or retention sessions. In contrast, among the healthy controls, significant differences were observed between the blocked and random practice groups during the pre-practice and retention sessions ($p \leq 0.001$). In contrast, no significant difference was found during the practice session. Specifically, healthy participants who received blocked practice performed better than those who received random practice during the pre-practice and retention sessions.

Conclusion: The findings suggest that the appropriate selection and application of blocked and random practice schedules at different stages of motor learning may enhance the acquisition and retention of speech motor skills.

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Introduction

Speech is a complex and dynamic motor activity that enables individuals to express emotions, thoughts, and responses to environmental stimuli [1]. It is produced through the integration of motor, linguistic, acoustic, physiological, and cognitive processes. Speech can be impaired by various disorders of the central nervous system, including Parkinson's disease, Amyotrophic Lateral Sclerosis, and Multiple Sclerosis (MS) [2]. Multiple sclerosis can lead to speech disorders by causing demyelinating lesions in brain regions responsible for controlling the muscles and structures involved in speech production. According to recent estimates, approximately 44%–50% of individuals with multiple sclerosis experience speech disorders, such as dysarthria, following disease onset [3, 4]. Individuals with MS may present with different types of dysarthria, including spastic dysarthria, ataxic dysarthria, and mixed dysarthria [5].

Over the past decade, researchers have made considerable efforts to facilitate the relearning of motor skills in individuals with various neurological disorders. These studies have demonstrated that the principles of motor learning provide significant benefits for teaching motor skills in healthy individuals and may also enhance rehabilitation outcomes in people with neurological impairments. However, the application of motor learning principles to speech rehabilitation, particularly in individuals with neurological disorders, remains unclear [6, 7]. In addition, Barbarulo et al. (2018) demonstrated that an integrated cognitive and motor training program had positive effects in individuals with Multiple Sclerosis [8]. Motor learning is defined as a set of processes associated with practice or experience that leads to relatively permanent changes in an individual's capability to perform motor skills [9].

Motor learning principles can be categorized into six main components: practice duration, practice distribution, practice schedule, attentional focus, generalization of practice, and task complexity [10]. Among these, the practice schedule refers to the order in which tasks or stimuli are presented during training and is typically classified into two types: blocked practice and random practice. In random practice, different target movements are presented in an unpredictable order, preventing learners from anticipating the next task. In contrast, blocked practice involves repeated practice of the same target movement until a predetermined level of performance is achieved before progressing to the next target movement. Consequently, learners can anticipate the training tasks during blocked practice [11].

Several studies have investigated the effects of different practice schedules on motor speech learning, although their findings have been inconsistent. Knock (2000) examined the effects of blocked and random practice schedules in a small group of individuals with apraxia of speech. The findings indicated that random practice was more effective than blocked practice in facilitating speech motor learning in these individuals [12]. In contrast, Maas et al. (2012) reported that both blocked and random practice conditions had positive effects on speech performance in children with childhood apraxia of speech [13]. Similarly, Adams examined the effects of these practice schedules in healthy individuals and found results consistent with previous studies, demonstrating that random practice produced superior retention compared with blocked practice [14]. In another study, Wang investigated the effects of four different practice schedules in healthy individuals. The results showed that a mixed practice schedule, combining blocked and random practice, was more effective for motor learning than either practice schedule alone [15].

Based on the available evidence, the findings regarding the effects of blocked and random practice schedules remain inconsistent and inconclusive. Moreover, most studies in this area have focused on a specific motor speech disorder, namely apraxia of speech, with limited attention given to other neurological speech disorders.

Given the increasing prevalence of Multiple Sclerosis (MS) worldwide [16] and the absence of a definitive cure, current treatment strategies primarily focus on symptom management and slowing disease progression [17]. Dysarthria is one of the common manifestations of MS, with a reported prevalence of approximately 44.9%[4]202020 .Therefore, identifying effective therapeutic approaches to improve speech function in individuals with MS-related dysarthria is of considerable clinical importance. Despite growing interest in motor learning–based interventions, evidence regarding the effects of different practice schedules in individuals with MS remains limited. Consequently, there is a need to establish a clearer evidence base for selecting the most appropriate practice schedule to optimize speech motor learning, enhance generalization, and promote long-term retention of treatment gains. Accordingly, the present study compared the effects of blocked and random practice schedules on speech motor learning in individuals with multiple sclerosis and dysarthria and healthy controls to improve our understanding of the practice conditions that best facilitate speech motor learning in individuals with dysarthria

Methods

The present study was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (Ethics Code: IR.AJUMS.REC.1395.51). Written informed consent was obtained from all participants before their enrollment in the study.

Participants

Thirty-four individuals with Multiple Sclerosis (MS) and dysarthria were recruited through the Khuzestan MS Association. Participants were between 22 and 57 years of age and were randomly assigned to one of two practice conditions: blocked practice (n = 17) or random practice (n = 17). In addition, 34 age-matched healthy individuals were recruited as controls and were similarly randomized to either the blocked practice group (n = 17) or the random practice group (n = 17).

Inclusion Criteria
Patient Group
All participants had received a definitive diagnosis of Multiple Sclerosis (MS) from a neurologist and had been living with the disease for at least five years since diagnosis. In addition, all participants had a score of 22 or higher on the Mini-Mental State Examination (MMSE), indicating adequate cognitive function for participation in the study [۱۸].

All participants also underwent a speech-language assessment to confirm the presence of dysarthria [8, 11]. A speech-language pathologist established the diagnosis of dysarthria according to the clinical guidelines described by Joseph R. Duffy [1]. Based on these guidelines, the diagnosis was made using both an oral motor examination and a perceptual evaluation of speech performance.

During the oral motor examination, the face, lips, jaw, tongue, and palate were evaluated for strength, speed, range of motion, muscle tone, and coordination. The perceptual speech evaluation included sustained phonation of the vowel **/a/**, alternating and sequential motion rate tasks (repetition of the syllables /ka/, /ta/, /pa/, /ta-pa/, and /ka-ta-pa/), number counting, and continuous speech samples obtained through self-introduction, job description, reading a standardized passage, and storytelling [1].

Exclusion Criteria
Participants were excluded if they:
- Experienced an acute relapse of MS during the study period.
- Had uncorrected visual or hearing impairments.
- Had cognitive impairment that interfered with participation in the study.
- Were bilingual.
- Had coexisting speech or language disorders other than dysarthria or were receiving speech-language therapy during the study period.

Healthy Control Group
Healthy individuals with no history of Multiple Sclerosis or other neurological disorders were recruited as the control group. They were matched to the patient group by age and sex. After obtaining a detailed medical history, a speech-language pathologist evaluated each participant's speech and voice using a perceptual speech assessment to confirm the absence of speech or voice disorders. Only individuals who met all inclusion and exclusion criteria were enrolled in the study.

Exclusion Criteria
Healthy individuals were excluded if they:
- Had uncorrected visual or hearing impairments.
- Had cognitive impairment that could interfere with participation in the study.
- Were bilingual.
- Had any speech or language disorder or were receiving speech-language therapy during the study period.

Treatment Procedures
The Persian phrase"Bahrebardari az Park-e Sabz-e Varzeshkaran" was selected as the target stimulus because its validity and reliability have previously been established for Persian-speaking individuals with speech disorders [19]**.**

Determination of the Baseline Speech Rate
To determine the Duration Index of the Phrase (DIP), all participants with Multiple Sclerosis and dysarthria were instructed to produce the target phrase" Bahrebardari az Park-e Sabz-e Varzeshkaran " three times at their normal speaking rate. The mean duration of the three productions was calculated for each participant. The average of these individual values was then used to establish the reference speech rate for the patient group.

Similarly, each of the 34 healthy participants produced the target phrase three times at their normal speaking rate. The mean duration of their productions was calculated and used to establish the reference speech rate for the healthy control group.

Both the patient and healthy control groups completed three experimental sessions: two acquisition sessions (a pre-practice session and a practice session) followed by one retention session.

Acquisition Sessions
Pre-practice Session
The pre-practice session was designed to prepare participants for the subsequent practice session [10]. Its primary purpose was to ensure that participants understood the task requirements and were able to perform the target phrase correctly before formal practice began [11].

During this session, participants received approximately 10 minutes of instruction on producing the target phrase"Bahrebardari az Park-e Sabz-e Varzeshkaran". The phrase was displayed on a 15 × 20 cm card while participants simultaneously listened to prerecorded auditory models presented via computer. Each participant produced the target phrase three times by following the auditory model.

The auditory models consisted of productions at the habitual speaking rate and at two slower speaking rates (2,400 ms and 3,500 ms).

In the random practice group, the target phrase was presented six times (three productions at the habitual speaking rate and three productions at the slower speaking rates of 2,400 ms and 3,500 ms) in a random sequence without a predetermined order. After each presentation, participants were instructed to repeat the phrase at the model speaking rate.

In the blocked practice group, the target phrase was also presented six times (three productions at the habitual speaking rate and three productions at the slower speaking rates of 2,400 ms and 3,500 ms). However, unlike the random practice group, the presentations followed a fixed sequence, with all productions at one speaking rate completed before proceeding to the next. After each presentation, participants repeated the phrase at the model speaking rate.

All speech samples were recorded in a sound-treated room using a Sony Stereo IC Recorder (ICD-UX543F). To provide feedback on speech duration, the recorded productions were analyzed in Microsoft Excel, and a visual representation of the phrase duration was generated for each participant. In addition, verbal feedback regarding speech duration (e.g., *"too long," "too short,"* or *"appropriate duration"*) was provided. Participants also received verbal feedback on the accuracy of their phrase production relative to the prerecorded auditory model.

Practice Session

The practice session lasted approximately 20 minutes and was conducted one day after the pre-practice session.

In the random practice group, the target phrase was presented 10 times (five productions at the habitual speaking rate and five productions at the slower speaking rates of 2,400 ms and 3,500 ms) in a random sequence. Participants listened to each prerecorded model through the computer and then repeated the phrase at the model speaking rate.

In the blocked practice group, the target phrase was also presented 10 times (five productions at the habitual speaking rate and five productions at the slower speaking rates of 2,400 ms and 3,500 ms). However, the stimuli were presented in a fixed sequence, with all productions at one speaking rate completed before proceeding to the next. Participants listened to each prerecorded model and repeated the phrase at the corresponding model speaking rate.

Visual and verbal feedback were provided using the same procedures as in the pre-practice session.

All speech samples were recorded in a sound-treated room using a Sony Stereo IC Recorder (ICD-UX543F).

Retention Session

The retention session was conducted **one week after the acquisition session** for both the blocked and random practice groups. During the one-week interval, participants were not assigned any practice tasks and were not informed that the target phrase"Bahrebardari az Park-e Sabz-e Varzeshkaran" would be reassessed.

The same target phrase was used during the retention session; however, no visual or verbal feedback was provided. Each retention session lasted approximately 10–15 minutes. Participants produced the target phrase 16 times, organized into two mini-blocks of eight consecutive repetitions.

Data Analysis

The data were analyzed using IBM SPSS Statistics version 22.0 (IBM Corp., Armonk, NY, USA). Data normality was assessed using the Kolmogorov–Smirnov test. The Mann–Whitney U test was used to compare the two groups with respect to age because the age distribution was non-normal. Differences between the groups in terms of sex and educational level were evaluated using the chi-square test.

Statistical Analysis

Descriptive statistics, including the mean, standard deviation (SD), speech duration measurements, and the mean differences between the blocked and random practice groups in both the healthy and patient populations, were calculated.

To evaluate changes in speech performance across the pre-practice, practice, and retention sessions, Generalized Estimating Equations (GEE) were used to analyze repeated measurements and compare response variables between the blocked and random practice groups in participants with Multiple Sclerosis and in the healthy control group.

Results

A total of 34 individuals with Multiple Sclerosis and dysarthria and 34 healthy controls participated in this study. Participants ranged in age from 22 to 57 years. The mean age of the MS group was 64.35± 22.10, whereas the mean age of the healthy control group was 35.67±22.10. The Mann–Whitney U test indicated no significant difference in age between the two groups ($p > 0.05$). Similarly, the chi-square test revealed no significant difference in sex distribution between the MS and healthy control groups ($p > 0.05$).

The Generalized Estimating Equations (GEE) analysis showed no significant differences in the mean target utterance duration between the pre-practice and practice sessions or between the practice and retention sessions among participants with Multiple Sclerosis who received random practice ($p > 0.05$). However, a significant difference was observed between the pre-practice and retention sessions ($p \leq 0.05$).

Similarly, among the healthy control participants who received random practice, there were no significant differences in the mean target utterance duration between the pre-practice and practice sessions or between the practice and retention sessions ($p > 0.05$). However, a significant difference was found between the pre-practice and retention sessions ($p \leq 0.05$) (Tables 1A and 1B).

The GEE analysis showed no significant differences in the mean target utterance duration between the pre-practice and practice sessions or between the practice and retention sessions among participants with Multiple Sclerosis who received blocked practice ($p > 0.05$). However, a significant difference was observed between the pre-practice and retention sessions ($p \leq 0.05$).

In contrast, among the healthy control participants who received blocked practice, significant differences were observed in the mean target utterance duration between the pre-practice and practice sessions, the pre-practice and retention sessions, and the practice and retention sessions ($p \leq 0.05$) (Tables 2A and 2B).

The GEE analysis showed no significant differences between the blocked and random practice groups among participants with Multiple Sclerosis during the pre-practice, practice, and retention sessions ($p > 0.001$) (Table 3).

In contrast, the GEE analysis showed that, among the healthy control participants, there were significant differences between the blocked and random practice groups during the pre-practice and retention sessions ($p \leq 0.001$). However, no significant difference was observed between the two practice groups during the practice session (Table 4).

Table 1A: Mean (± SD) target utterance duration during the pre-practice, practice, and retention sessions in participants with multiple sclerosis receiving random(MSRR) practice

Group	**Random**	**Pre-Practice (mean: 4.98 / SD:0.08)**	**Practice (mean: 5.02 / SD: 0.05)**	**Retention (mean: 5.14 / SD:0.08)**
Dysarthria	Pre-Practice (mean: 4.98 / SD:0.08)		P-Value: 0.59	Value:0.08 P-
	Practice (mean: 5.02 / SD: 0.05)	P-Value: 0.59		Value:0.02 P-
	Retention (mean: 5.14 / SD:0.08)	Value:0.08 P-	Value:0.02 P-	

Table 1B: Mean (± SD) target utterance duration during the pre-practice, practice, and retention sessions in healthy controls receiving random practice

Group	**Random**	**Pre-Practice (mean: 5.44 / SD:0.09)**	**Practice (mean: 5.28 / SD: 0.03)**	**Retention (mean: 5.53 / SD:0.09)**
Normal	Pre-Practice (mean: 5.44 /SD:0.09)		P–value :0.09	P–value :0.31
	Practice (mean: 5.28 /SD:0.03)	P- value :0.09		P–value :0.02
	Retention (mean: 5.53 /SD:0.09)	P–value :0.31	P–value :0.02	

Table 2A: Mean (± SD) target utterance duration during the pre-practice, practice, and retention sessions in participants with multiple sclerosis(MS) receiving blocked practice

Group	Block	Pre-Practice (mean: 5.05 /SD:0.12)	Practice (mean: 5.27 /SD:0.05)	Retention (mean: 5.43 /SD:0.12)
Dysarthria	Pre-Practice (mean: 5.05 /SD:0.12)		P–value :0.06	P–value :0.03
	Practice (mean: 5.27 /SD:0.05)	P–value :0.06		P–value :0.23
	Retention (mean: 5.43 /SD:0.12)	P–value :0.03	P–value :0.23	

Table 2B: Mean (± SD) target utterance duration during the pre-practice, practice, and retention sessions in healthy controls receiving blocked practice

Group	Block	Pre- Practice (mean: 5.77 /SD: 0.11)	Practice (mean: 5.30 /SD:0.02)	Retention (mean: 6.01 /SD:0.13)
Normal	Pre-Practice (mean: 5.77 /SD:0.11)		P–value :0.000	P–value :0.04
	Practice (mean: 5.30 /SD:0.02)	P–value :0.000		P–value :0.000
	Retention (mean: 6.01 /SD:0.13)	P–value :0.04	P–value :0.000	

Table 3: Comparison of target utterance duration between the blocked and random practice groups among participants with multiple sclerosis(MS) during the pre-practice, practice, and retention sessions

	Session	**Random Mean±S.D**	**Block Mean±S.D**	**P-value**
Dysarthria	Pre- practice	4.98± 0.089	5.05±0.12	0.09
	Practice	5.02±0.05	5.27±0.05	0.86
	Retention	5.14±0.08	5.43±0.12	0.55

Table 4: Comparison of target utterance duration between the blocked and random practice groups in healthy controls during the pre-practice, practice, and retention sessions

	session	**Random Mean±S.D**	**Block Mean±S.D**	**P-value**
Normal	Pre-practice	5.44± 0.09	5.77±0.11	0.05
	Practice	5.28±0.038	5.30±0.02	0.19
	Retention	5.53±0.098	6.01±0.13	0.02

Discussion

This study investigated the effects of blocked and random practice on speech motor learning in individuals with Multiple Sclerosis–related dysarthria and healthy controls. A total of 34 participants with MS-related dysarthria and 34 healthy controls, aged 22–57 years, were enrolled. Participants in each population were randomly assigned to either the blocked-practice group or the random-practice group

(17 participants per group). All participants completed the pre-practice, practice, and retention sessions.

The results showed that among participants who received random practice, there were no significant differences in the mean target utterance duration between the pre-practice and practice sessions, or between the practice and retention sessions, in either the MS or healthy control group ($p > 0.05$). However, a significant difference was observed between the pre-practice and retention sessions ($p \leq 0.05$).

In the MS group, the mean target utterance duration increased from 4.98 s during the pre-practice session to 5.02 s during the practice session and 5.14 s during the retention session. Although the increases from the pre-practice to the practice session and from the practice to the retention session were small, only the overall change between the pre-practice and retention sessions was statistically significant ($p \leq 0.05$).

In the healthy control group, the mean target utterance duration decreased slightly from 5.44 s during the pre-practice session to 5.28 s during the practice session. Then it increased to 5.53 s during the retention session. The changes between the pre-practice and practice sessions and between the practice and retention sessions were not statistically significant. However, the difference between the pre-practice and retention sessions was statistically significant ($p \leq 0.05$).

The results of the blocked practice condition differed between the participants with Multiple Sclerosis and the healthy controls. In the MS group, the mean target utterance duration increased from 5.05 s during the pre-practice session to 5.27 s during the practice session; however, this increase was not statistically significant ($p > 0.05$). In contrast, the mean target utterance duration in the healthy control group decreased from 5.77 s during the pre-practice session to 5.30 s during the practice session, a statistically significant change ($p \leq 0.05$).

The comparison between the pre-practice and retention sessions also showed different patterns between the two groups. In the MS group, the mean target utterance duration increased from 5.05 s during the pre-practice session to 5.43 s during the retention session; however, this increase did not reach statistical significance ($p > 0.05$). In contrast, the healthy control group demonstrated a significant increase in mean target utterance duration from 5.77 s during the pre-practice session to 6.01 s during the retention session ($p \leq 0.05$).

The increase in the mean target utterance duration from the pre-practice to the practice session is consistent with the first stage of the Fitts and Posner model of motor learning. According to the three-stage model proposed by Fitts and Posner (1967), motor learning progresses through three distinct stages that describe the acquisition and refinement of motor skills over time. During the cognitive stage, learners focus on understanding the nature of the task and developing strategies to perform it correctly. Successful performance at this stage requires a high level of cognitive engagement, including attention, problem-solving, and error correction. As learners experiment with different strategies, they gradually identify the most effective approach, leading to improved performance and skill acquisition [20].

Similarly, during the initial stage of speech motor learning, individuals perform the target task with a high degree of concentration and conscious control. Consequently, the observed increase in the mean target utterance duration from the pre-practice to the practice session may reflect participants' increased attention to accuracy and deliberate execution of the speech task rather than automatic performance.

The slight increase in the mean target utterance duration from the practice to the retention session in the participants with Multiple Sclerosis is consistent with the second stage of the Fitts and Posner model of motor learning. During this associative stage, learners refine the strategies developed during the cognitive stage and gradually eliminate unnecessary errors. As performance becomes more consistent, improvements occur more gradually than during the initial stage of learning. Because learners are primarily focused on refining an already established strategy rather than identifying an effective one, the cognitive demands are reduced compared with those of the cognitive stage [20].

According to the Fitts and Posner model, the final stage is the autonomous stage, during which the acquired motor skill becomes increasingly automatic and requires considerably less conscious attention and cognitive effort. At this stage, performance is more efficient, stable, and resistant to interference.

The pattern of changes in the mean target utterance duration across the pre-practice, practice, and retention sessions among healthy controls receiving blocked and random practice is consistent with the principles of the U-shaped hypothesis. According to this hypothesis, healthy individuals initially produce the target utterance at their habitual speech rate during the pre-practice session. As learning begins and speech motor and sensorimotor processes are engaged during the practice session, performance may temporarily decline due to the increased cognitive and motor demands of acquiring a new skill. However, with repeated practice, motor learning, and the gradual automation of sensorimotor processes, performance improves, increasing the mean target utterance duration during the retention session.

Other findings of this study showed no significant differences between the blocked and random practice groups among participants with Multiple Sclerosis during the pre-practice, practice, and retention sessions ($p > 0.05$). Therefore, it can be concluded that neither blocked nor random practice was superior to the other in promoting speech motor learning in this patient population. These findings are consistent with those reported by Kipa et al. (2016) and Edwin Maas et al. (2012) [13, 21]. Edwin Maas et al. investigated the effects of blocked and random practice in children with apraxia of speech and concluded that the advantages of random practice reported in the general motor learning literature are not readily generalizable to children with apraxia of speech, as both practice conditions were found to be effective [13].

In contrast, the findings of the present study are inconsistent with those of Teresa R. Knock et al. (2000) and Lin et al. (2007). Teresa R. Knock et al. examined the effects of stimulus presentation schedules on speech motor learning in individuals with apraxia of speech and reported that random practice facilitated retention more effectively than blocked practice [12]. Similarly, in studies of motor learning in patients with Parkinson's disease, Lin et al. concluded that blocked practice produced superior outcomes in motor performance [22].

The results of examining the effects of practice type (blocked or random) in the healthy control group across the pre-practice, practice, and retention sessions revealed significant differences between the two practice schedules during the pre-practice and retention sessions ($p \leq 0.001$). In contrast, no significant difference was observed during the practice session. These findings indicate that blocked practice resulted in better performance than random practice during the pre-practice and retention sessions. In contrast, the two practice schedules produced comparable performance during the practice session.

These findings are inconsistent with those reported by Scott Adams (2000), who investigated the effects of different practice schedules and feedback conditions on speech motor learning in healthy individuals. Adams reported that participants who received random practice performed better during the retention session than those who received blocked practice [14].

Several theoretical explanations have been proposed to account for the different effects of blocked and random practice. According to the elaboration hypothesis, random practice promotes more elaborate, distinctive, and comparative processing of different movement parameters. Consequently, learners are better able to discriminate between different target outputs, such as utterances produced at 2500 ms and 3500 ms, during the retention session. The reconstruction hypothesis suggests that, during random practice, learners must repeatedly reconstruct and retrieve the appropriate motor program for each trial, thereby strengthening motor memory and enhancing long-term retention. In contrast, learners receiving blocked practice can temporarily retain the motor program in working memory and reuse it in subsequent trials, reducing the need for repeated reconstruction. As a result, random practice is thought to promote more robust motor learning and better retention than blocked practice. In other words, random practice imposes greater cognitive processing demands, leading to deeper information processing and superior long-term retention and transfer of motor skills. In contrast, blocked practice involves relatively less cognitive effort and may therefore result in poorer retention and skill transfer [15].

Given the limited representation of older adults in the study population, future research should extend investigations beyond young adults to include older adults, as findings obtained from younger adults may not necessarily reflect motor learning patterns in older populations. Furthermore, the present study included participants with mild to moderate dysarthria and did not examine individuals with severe dysarthria. Therefore, future studies are recommended to investigate patients with more severe forms of dysarthria. Given the greater degree of neurological involvement in these individuals, their responses to blocked and random practice may differ from those observed in patients with milder forms of dysarthria.

Conclusions

This study compared blocked and random practice schedules across the pre-practice, practice, and retention phases of speech motor learning in individuals with Multiple Sclerosis–related dysarthria and healthy controls. The findings suggest that the appropriate and optimized application of blocked and random practice at different stages of motor learning may enhance the acquisition and retention of speech motor skills.

Author Contributions

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Conflict of Interest: The authors declare that they have no conflicts of interest.

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