Original Article

The effect of different feedback functions and error estimation on the retention of dart throw skill (An Emphasis on Sandwich Approach)

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ABSTRACT

Feedback is the most important variables during learning. The present study examined the importance of Feedback different types during observational learning. Participants received one of the following types of information: Feedback about a movement that reinforces a correct pattern (confirmatory), Feedback about a movement that diagnoses an error (corrective), Feedback about a movement that reinforces a correct pattern and diagnoses an error (combined), or not receive any feedback (control). This experiment consisted of 60 exercise attempts divided into 4 blocks of 15 attempts and after each block, the rest of the 60-second was given to the subjects. Twenty-four hours after training, the subjects were recruited and performed 10 attempts as retention. The scoring method (accuracy) used in this study was based on the standard scoring method in the throwing field.The results showed that among groups, the feedback group received the best result in the accuracy score between the groups. In other words, confirmatory feedback, when presented to the subjects along with the estimation of errors, had a significant effect on the accuracy of the throwing of the dart. After the confirmatory feedback group, the corrective feedback group had gained the best performance in the accuracy rating between the groups. Interestingly, the statistical results suggest that the combined group, after the confirmatory and corrective feedback groups, ranked third in the best performance of the dart throw accuracy score. According to the prediction of the researcher, the control group was the last group in terms of the score. It was concluded that in the learning and performance of a discrete motor skill, knowledge of performance feedback that confirms success is more effective than knowledge of performance feedback that corrects errors. Combining corrective and confirmatory feedback together in the sandwich approach used here does not appear to provide superior learning when compared to corrective feedback alone.

Keywords: confirmatory feedback, corrective feedback, combined feedback

Introduction

Obviously, what most coaches follow when teaching skills in different ways is the learning and implementation of those skills. Therefore, coaches who understand effective learning processes will undoubtedly be superior to athletes in teaching skills. Therefore, practicing and gaining experience, together with other factors such as learning and learner's conditions, create a new and sustainable motor behavior that can be said to create a new occurrence in the behavior of a person that distinguishes him from his past [1].

One of the augmented information given to the learner is the feedback that refers to any sensory information about the movement. This sensory news can be provided from either within the individual (inherent feedback) or the outside environment (enhanced feedback). Enhanced feedback, sometimes referred to as "augmented feedback", includes news that results from performance. This kind of feedback is augmented through an individual or instrument in the

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environment, and is provided to the inherent feedback of the assignment. [2].

Traditional feedback approaches (domains, summaries, etc.) have a special emphasis on feedback correction function, in other words, feedback provides primarily information for error correction. Another approach that gives a more focused look at the timing of feedback is the approach that allows the learner to control the timing of receiving feedback. Self-controlled is a relatively new line of feedback research in the literature of motor behavior. Important questions emerging from the self-control feedback literature relate to how the learner uses feedback and why the subject decides to request feedback. [3] reported that the majority of self-controlled participants had a request for feedback after good performance, which implicitly emphasizes the motivational function of feedback. This preference (motivational function) is opposed to the traditional approaches of feedback (based on the emphasis on corrective function). According to some researchers, the more common function for augmented feedback is the motivation of learners when practicing a task. According to [4], augmented feedback can make the task more interesting, enabling learners to be more alert and encouraging them to set higher performance targets. Lee and Carnahan (1990) stated that confirming the correct answer could encourage the learner to stabilize the pattern of motion, while corrective feedback encourages individuals to change the pattern. Additionally, feedback that repeatedly emphasizes errors may tend to reduce self-efficacy, while feedback that confirms successful performance may increase self-efficacy. [5]

One approach recently reviewed about feedback in research has been called Bottleneck or "sandwich" approach. In this approach, the combination of two types of confirmatory and corrective feedback is likely to be of benefit, derived from Gould and Weinberg (2011) in coaching literature and sports psychology. Confirmatory feedback in the new approach means feedback on a move that reinforces the correct pattern. Corrective feedback also means feedback about a move that recognizes an error. Augmented feedback is provided from an external source of information, and the learner shows how to compare the actual performance with the desired one. Transmitted information may focus on the result or the technique of movement. Information function is specifically related to identifying error correction attempts [5].

In this regard, [5] explored the corrective, confirmatory, and combined functions of feedback. The results indicated that corrective and combined groups received a higher score than the confirmatory group at all stages of the trial. There was also no difference in the pattern of movement in the combined and corrective groups.

One of the advantages of the recent approach is the simultaneous study of two functions (information and motivational), but according to [6] pointing to the inseparability of feedback from the category of error detection, this gap is felt in the study of the new approach. It should also be noted that there is dearth of research on error discovery besides studying feedback functions. Furthermore, [7] suggests that conditions for participants to estimate their performance and, in addition, receive different types of feedback are worthy of attention because this may increase the cognitive effort of the individual as well as his motivation for successful access to the goal [8]. Some researchers refer to error estimation as mental enhancement, and believe that estimating the error in the KR delayed interval leads to better inherent feedback to guide the movement in order to increase learning. Also, error estimation improves the skill evolution and the ability to detect the error [1,7] examined the effects of estimating the awareness of a good outcome against weakness during the acquisition of a spatial motion task. The data of retention and transference tests showed that the participants who received KR after their successful attempts, their estimates of performance error and learning were better than those who received KR after their weak tries. These cases show that feedback and error estimation play a complementary role in learning motor skills. Despite evidence of the combination of feedback and error estimation as an efficient method, there is some evidence contradictory to this one. In other words, some researchers believe that secondary information processing activities will degrade learning and motor activity. For example, [9] compared the effect of self-control feedback and error estimation on acquisition and maintenance of equilibrium tasks. Based on the results, in the retention period, the main effect of two variables of type of feedback and gender was significant. So that men's balance in retention test was significantly higher than women. However, the main effect of age range and error estimation was not significant. In addition, the effect of estimating pattern error (form) and the result of moving on learning motor skills is another challenging topic that has been neglected in research. The purpose of the model error estimation is to allow the subject to calculate the error in their moving pattern at the KR delay distance, and the estimation of the result error means that the person is moving in the delay distance.

Now, according to what was mentioned above, in the superiority of feedback functions (motivational and corrective function) in motor learning, what is raised is the question of whether there is a difference between the methods of providing feedback (confirmatory, corrective, and combination) on the retention of dart throw skills or not.

Accordingly, the researcher strived to examine the various functions of feedback (confirmatory, corrective, and combination) using a throwing task as a field motion skill. For a long time, feedback has been considered by researchers as one of the most important factors influencing learning. Bilodeau claims that feedback, like the practice itself, is one of the most important variables in the learning process, which can be justified in terms of practical and theoretical aspects.

In addition, many researches have focused on estimating the feedback of the awareness of the outcome, and few cases have focused on evaluating the feedback from the implementation awareness (with confirmatory and corrective functions) and the combined mode (sandwich approach). Primary research in the field of feedback has largely focused on error correction, but a review of the related literature shows that there is dearth of

research on error estimation taking into account the confirmatory and corrective roles of feedback, the implementation awareness and the result. Therefore, there is a need for research like the present study. So, based on response hypothesis, when an individual performs his or her own motion, if he actively engages in the information processing to identify his error, and, after looking for the estimation of the error, he is provided with enhanced feedback, he can better compare the action taken with the criterion and in case of discrepancy, he will correct it in the next attempt. Therefore, those who, after the move, are forced to estimate their motion error, will receive more KR, the more KR receives, as this comparative action assists in responding to the next answer plan. So in this research, we not only look at the various feedback functions, but also consider different error estimation methods.

In another discussion, how subjects use augmented feedback, or in other words, the nature of the activities that the subject performs in the delayed interval of feedback, is another issue that has recently been considered by researchers for motor behavior. So that based on the response hypothesis, the amount of conflict between an individual before receiving feedback and how to use it cannot be independent of each other, because when the subject does his/her effort, they actively engage information processing to discover their error and, if actively looking at this processing, or in other words, the subjective error estimation, is given to the subject of the feedback provided, enabling him to compare the effort with the criterion's effort, and from the information obtained through this hypothesis test will be used in future efforts. So, according to some researchers, those who perform their mental estimation of error after performing the move can do this comparative action according to the response hypothesis and make the subsequent action plans better. As a result, it is anticipated that higher levels of learning will occur as more augmented feedback is provided [6].

However, inconsistent with this view and in accordance with the guideline hypothesis, when participants receive a high KR frequency during acquisition, they fail to use additional memory processing or discovery of additional information resources that have the largest share in memory growth.

Given that fieldwork is more capable of generalizability (compared to laboratory tasks) to exercise skills, the necessity of doing research is doubled. On the other hand, as the movement behavior literature emphasizes the importance of feedback in learning motor skills, it is quintessential to recognize the variables that encourage the learner to use feedback.

The present study is also applied to trainers in the field of motor skills training, seeking effective, faster and more efficient ways to make learning and obtaining these skills faster in person and enhances the learner with less time to take an automatic step in learning motor skills.

Ultimately, because in learning motor skills, especially motor skills that have many components, learning speed, time, and money are a matter of concern for educators and motor behavior specialists, it is important to find independent variables that are effective in discovering the error, reducing cost, time and learning speed.

Methodology

Research type and method: The statistical population of the study consisted of students studying at Mashhad universities. The study sample included 60 students. The sample size was determined according to the G-POWER sample size software. After selecting the subjects, they were randomly divided into four groups based on feedback and error estimation (along with a control group). The subjects did not have any experience in performing the relevant task, and they did not have any information about the objectives of the study before engaging in and performing the task. In this research, different groups, based on the type of feedback, performed the dart throw task. Analysis of variance (ANOVA) was run to examine the learning outcome of movement in the retention phase.

Different methods of providing feedback: It is a method of feedback planning, in which the type of feedback is intended and includes three types of confirmation, correction and combination.

Data collection method:

* Research instrument and type of task

A laptop computer (Acer 5738 ZG), by which educational videos and instructions were taught.

2- One camcorder.

Throw board

Throw dart

Individual profile form

Scoreboard: The scoring method (accuracy) used in this study was based on the standard scoring method in the throwing field.

* The method of conducting research and collecting the required data

Before the task was performed in practice, the subjects in the test room were provided with information on how to do the job and its purpose. This data included the method of carrying out the task, its purpose and the content of feedback information. After seeing and hearing the initial information, they were taught how to do it several times, after which they themselves performed the task five times. After assuring the understanding of how to do the task, the subjects were prepared to do the main training efforts.

To perform the task, according to the specific objectives of the experiment, the subject stood behind the throw line and took the dart.

Bottom of Form

The subjects were informed of various error estimation methods. After completing the training efforts and before receiving feedback information, they returned to their starting position, they told their pattern of action according to the required method of estimating the error (motion pattern), after

each effort. Also, after completing the training in the acquisition phase, depending on the feedback (confirmatory, corrective and combined), information was presented appropriately to the group in which they were located. The subjects in the control group did not receive any feedback after completing the training efforts. This experiment consisted of 60 exercise attempts divided into 4 blocks of 15 attempts and after each block, the rest of the 60-second was given to the subjects.

Retention

Twenty-four hours after training, the subjects were recruited and performed 10 attempts as retention. No feedback was given to people at this stage.

Data analysis method:

* Statistical research method

Descriptive and inferential statistics were used to analyze the data. In the descriptive statistics section, the central indices and the distribution of variables related to experimental groups were calculated. Also, in the inferential statistics section, one-way ANOVA (within-group and between-group comparison) was used to examine the specific objectives of the experiment. Level of significance was considered for all statistical methods as $p \leq 0.05$ and SPSS software version 16 was used to perform statistical calculations.

Results

The results of the Kolmogorov-Smirnov test showed that the level of significance in all variables was greater than (0.05), which indicated that data distribution was normal ($p>0.05$). Also, the results of Leven test indicated that the equality of variances was established ($p>0.05$).

Accuracy in dart throw

Descriptive information about accuracy test in three stages of pre-test, post-test and retention for each of the four groups of confirmation feedback combined feedback, and control group are shown in Table 1.

Table 1. The means of Accuracy in dart throw in three stages of pre-test, post-test and retention.

	pre-test score	pre-test standard deviations	post-test score	post-test standard deviations	Retention score	Retention standard deviations
confirmation feedback	56.2	30.118	55.27	28.409	59.60	29.758
corrective feedback	42.71	27.348	48.36	35.402	36.50	24.235
control	53.21	34.575	53.36	38.586	47.36	24.181
combined feedback	47.77	20.925	48.38	31.296	50.38	40.172

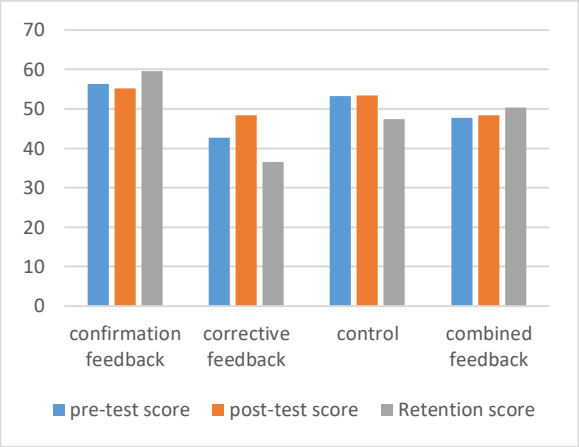

Figure 1. The means of Accuracy in dart throw in three stages of pre-test, post-test and retention

In examining the effect of different feedback functions and estimating error on the accuracy of Dart throw skill, the results of ANOVA test showed that there was a difference between the accuracy scores in the pre-test and post-test of all groups, and that the difference was significant. In other words, the subjects performed better in the post test than in the pretest.

Post hoc test results (LSD) showed that among groups, the feedback group received the best result in the accuracy score between the groups. In other words, confirmatory feedback, when presented to the subjects along with the estimation of errors, had a significant effect on the accuracy of the throwing of the dart. After the confirmatory feedback group, the corrective feedback group had gained the best performance in the accuracy rating between the groups. Interestingly, the statistical results suggest that the combined group, after the confirmatory and corrective feedback groups, ranked third in the best performance of the dart throw accuracy score. According to the prediction of the researcher, the control group was the last group in terms of the score.

Discussion and Conclusion

The purpose of this study was to compare the effect of different feedback functions and error estimation on Dart throw skill retention. In other words, the purpose of this study was to investigate the independent and integrated effects of confirmatory and corrective KP on the recognition and validation of Dart's motor skills learning. The results of this study are consistent with recent research, which demonstrates the benefits of receiving feedback after good efforts [10] and suggest that confirmatory KP feedback is of great benefit [7]. It was expected that a group that received both corrective and confirmatory KP (new approach) would get the highest scores throughout all stages of the test because the participants, in addition to receiving corrective information, were also likely to have an increase in their self-confidence due to the confirmation of their success [5]. Additionally, the correction group was supposed to achieve a higher score than the confirmatory team because KP should allow them to correct their mistakes. It was also assumed that if subjects evaluated their performance over

the acquisition period and that they were also provided with augmented feedback, they could better use inherent feedback, and as a result their learning skills would increase. In relation to the discovery of error, according to the schema theory, one should not be able to detect an error after performing slow motion, while such an ability is possible after a quick move. The reason for this is that the ability to detect an error is actually used to create a slow motion, thereafter, the ability to detect an error does not remain. Like Adams' theory, empirical evidence supports such predictions [1]

Also, [7] examined the effects of estimating the awareness of a good result against weakness during the acquisition of a spatial motion task. Retaining and transfer testing data showed that participants who received KR after their successful efforts, assessed better performance errors and learning better than those who received KR after their weak efforts. These cases show that feedback and error estimation play a complementary role in learning motor skills. Despite evidence of the combination of feedback and error estimation as an efficient method, there is some evidence that this is the opposite, in other words, some researchers believe that secondary information processing activities will destroy learning and motor activity. For example, [9] compared the effect of self-control feedback and error estimation on acquisition and retention of equilibrium tasks. Based on the results, in the retention period, the main effect of two variables of the type of feedback and gender was significant, so that the time to maintain men's balance in the test was significantly higher than that of women, while the main effect of the age range and error estimation was not significant. One of the main findings of this test was that the corrective feedback group got better results after the confirmatory feedback proportionate to combined feedback on the performance and learning of dart throwing skill. In other words, in examining the effect of different feedback functions and estimating errors on the accuracy of dart throw skill accuracy, the results of ANOVA test showed that there was a difference between the accuracy scores in the pre-test, post-test and the retention of all the groups. It should be noted that the results in this experiment are consistent with some of the theoretical views presented. One of the interpretations that can be made is related to the type of task. In this test, where Dart Throw skill task was used, the type of skill has led to unique results compared to other studies. According to the response hypothesis, how to engage a person before receiving augmented feedback, and how to use it cannot be independent of each other. Accordingly, when a subject performs his or her movement, he actively engages in processing to determine his error. If, after looking for the estimation activity, the subject is presented with enhanced feedback information, he is better able to compare the action taken with the criterion, and if he notices any difference, he will try to correct it in the next effort. Therefore, for those who are forced to estimate their error after performing the motion, if KR is presented, they will lead to more learning, because, according to response hypothesis, such comparison will help to plan the next response answer to the [6].

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