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The Effect of Teacher's Instructional Language Types on Intrinsic Motivation, Self- Efficacy, and Performance Accuracy in A Darts Throwing Skill

Fatemeh Ghanaatian Jahromi *, **Saeed Arsham, Rasoul Yaali**
Department of Physical Education and Sport Sciences, Kharazmi University, Tehran, Iran

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***Corresponding author:**
Fatemeh Ghanaatian Jahromi. Department of Physical Education and Sport Sciences, Kharazmi University, Tehran, Iran

Phone: +989171910719
Fax: +982188830857

Email:
ghanaatian_310@yahoo.com

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Abstract

Introduction: Features of the environment where practice takes place may influence performance, learning as well as the quality of experienced motivation. This study was performed with the aim of investigating the effect of teacher's instructional language on students' intrinsic motivation, self-efficacy, and performance accuracy while they were involved in performing a darts throwing skill.

Methods: Forty-eight female students were randomly divided into three instructional language groups (autonomy supportive, controlling, neutral). All three groups watched the same silent clip about darts throwing. They performed 21 throws (as pre-test) and subsequently, each group watched a specific clip prepared for them. Instructions in the second clip provided learners with different degrees of choice or control in performing the task in spite of similar technical information. Then, each group performed 51 throws as their post-test. On the second day, all groups performed 21 throws without any instruction as retention test. All participants completed the Intrinsic Motivation Inventory by McAuley et al. (1991) before the pre-test and after the post- and retention tests. To test the research results, the statistical procedure ANOVA with repeated measures test with Bonferroni post-hoc test were used ($P \leq 0.05$).

Results: The results revealed that the instructional language used in the autonomy-supportive group facilitated learning significantly through its effect on intrinsic motivation and self-efficacy ($P \leq 0.05$). In addition, on the acquisition and retention tests, the autonomy supportive group showed a significant better accuracy in throwing darts towards targets relative to the other two groups ($P \leq 0.05$).

Conclusions: Giving choice to learners is a useful way in acquiring motor skills. Teachers must try to provide situations which promote learners' sense of competence (self-efficacy) which in turn, improves learning. These situations can include information which is effective on the learners' perception of their abilities. Giving autonomy to learners during practice and changing the instructional language to improve intrinsic motivation are different ways for creating such situations.

Keywords: Instructional Language, Intrinsic Motivation, Self-efficacy, Performance Accuracy

Introduction

One of the factors affecting motor learning as well as the way of performing a particular skill is the type of instructional language used by the teacher. Because motivation is defined as an inclusive term encompassing all the factors which affect the energizing and directing of behaviors as well as enforcing it (1), many factors– from social and environmental to internal processes and thoughts- can initiate or change the direction and intensity of a performed behavior. It has been observed in many cases that individuals take part undecidedly in motor activities to challenge themselves in a previously learnt behavior or to learn a new skill (2). This tendency to

participate in different activities is called intrinsic motivation. In other words, intrinsic motivation refers to an innate tendency for innovations and challenges, which improves the individual's capacities for exploration and learning (3). A well-known theory in the area of motor learning studies is self- determination theory which provides information about motivated self-controlled behaviors. According to part of this theory of motivation, there are three basic psychological needs of autonomy, competence, and relatedness. Autonomy refers to an individuals' need for active control or participation in determining activities. Competence refers to an effective interaction with the environment by following optimal challenges and overcoming them. Finally, relatedness is the need for being considered. It seems that if while-learning conditions provide learners with choice, this will result in the satisfaction of their needs of autonomy and competence (4), which will affect motivation and behavior too. However, researchers in the area of self-controlled motor learning have not explicitly measured this issue yet (2). In spite of the importance of motivation in facilitating motor learning (5), one of the neglected gaps in the area of motor learning is that increasing motivation has more hypothesized as a factor underlying learning benefits rather than being assessed or measured. Studies show that if learners are provided with control over aspects of their practice conditions, learning of motor skills increases. According to Lemos *et al.* (2017), self-efficacy, which means anticipating positive experiences in the future, can results in a balance in thoughts, attention, motivation and psycho-motor activities in the direction of the performer's goals (6), which, in turn, creates efficient neural connections and ultimately, better learning. Other studies have also paid attention to this issue and revealed that an improvement in self-efficacy has happened as a result of providing learners with choice (1, 7, 8). In many studies, in order to measure motivation in a practice environment, the instructional language has been manipulated based on the way that the task is presented and the technique by which participants are monitored (9). Instructional language type refers to the particular language used by the teacher to stimulate and involve learners in leaning activities. Accordingly, instructional language can be imagined on a continuum, one extreme of which is the controlling style, the other extreme is autonomy-supportive style and the middle point is neutral style (10). In controlling style, teachers enforce athletes to think, feel and perform according to the prescribed methods. In contrast, the autonomy-supportive style refers to identifying, instructing and creating sources of intrinsic motivation to reinforce the athletes' will power (9). In the present study, a darts throwing task is used. In such tasks, planning must be done before performance and in a quick way. This feature, i.e. quick decision making, seems to prevent self-control processes (1). Previous studies have provided reasons for the effect of autonomy need satisfaction on the improvement of learning. Many of these studies refer to a deeper processing of information as a result of self-control (11, 12). In contrast, other studies have revealed that information processing is not the main cause of this effect (1, 13). According to Wulf' and Lewthwaite's Optimal Theory, the learner's autonomy basically influences their motivational state. These researchers maintain that the action-goal coupling can lead to the creation of effective neural connections which facilitate learning and consequently, are effective on memory consolidation by making dopamine available (14). Besides, research has shown that having choice is correlated with an increase in the activity of those areas of the brain which play a direct role in reward processing and start their activities even before the performance of a perceived choice (15). As a result, internal rewards, particularly intrinsic motivation, can initiate dopamine reactions and promote memory consolidation processes (16). Accordingly, it seems necessary to

conduct research which, besides applying learning measures, utilizes affective measures such as intrinsic motivation (such as interest, enjoyment) to study their effects on facilitating motor learning. According to previous literature, having choice or agency may probably increase expectations for gaining positive achievements such as self-efficacy (14, 16), even when these choices are not directly related to the anticipation of evidence for performance achievements. As a result, there is a need for more expansive research to predict the effect of autonomy support as a result of manipulating self-efficacy. Taking into account the findings of previous studies and in order to probe more deeply into the effect of instructional language type on motor skills learning, the present study aims at exploring two variables self-efficacy and intrinsic motivation, which have been referred to in previous research as effective factors on learning (1). Therefore, the present study tries to find out whether intrinsic motivation increases as a result of giving choice to individuals and whether this created motivation has any effect on self-efficacy (perceived competence) and accordingly on learning a darts throwing skill and the accuracy of its performance.

Methods

The design of this study is semi-experimental with one independent variable (instructional language type) with three levels and three dependent variables of intrinsic motivation, self-efficacy, and performance accuracy (measured in three phases). Around 300 female undergraduate students (18- 23 year old), who were studying at the Farhangian University in Shiraz in the academic year 2017-2018, comprised the statistical population of this study. A non-probabilistic, available sampling method was used to choose the sample. As in experimental research the minimum sample size is 15 (17) and based on previous research (18, 1), Forty-eight subjects selected. Participants were divided into three groups using a random assignment procedure and received three instructional language types (autonomy-supportive, controlling, and neutral). It should be noted that participation in this research was voluntary; however all students agreed to take part in the study. A self-report questionnaire was used to collect demographic information as well as information about the entrance criteria into the experiment which included having no previous experience in darts throwing sport, being right-handedness, having no trauma, eyesight problems, and addiction to alcohol, cigarettes or drugs, and no previous hormone medication. In this study, we used McAuley *et al.*'s (1999) intrinsic motivation inventory to investigate different aspects of intrinsic motivation. This questionnaire includes 45 items and 6 subscales of interest/enjoyment, perceived competence (self-efficacy), attempt/importance, tension/pressure, perceived choice, and value/usefulness while doing an activity (19). It should be noted that in the present study, only two subscales of interest/enjoyment and perceived competence were used. McAuley *et al.* (1991) refer to the subscale of interest/enjoyment as the index of intrinsic motivation (19). Also, in previous research, perceived competence is regarded the same as self-efficacy (2). Students who had the experiment's criteria were asked to complete a written consensus to cooperate two days with the researcher and to be ready for the experiment at 8 a.m. at the darts throwing room. As was mentioned, 48 students were randomly divided into three groups of instructional language (autonomy supportive, controlling, and neutral). On the first day, each participant watched an instructional clip about darts throwing individually. As the participants had no previous experience in darts throwing, this first clip was silent in order just to make participants familiar with the ways of holding the missiles and throwing them. All groups watched the same clip. Then, they performed 7 rounds (21 throws) as their pre-test. Features of the throws were registered

using centimeter unit. In the next phase (practice phase), three instructional clips with three different instructional language styles were displayed for each group. The instructional language in the autonomy supportive group was inviting and expressive. For example, expressions such as "I suggest", "I ask", "and "you can" were used in teaching darts throwing. In contrast, the controlling instructional language was authoritative using expressions such as "you must", "you should", and "If you don't do …., then …. ." In the neutral language group, sentences which indicated either control or autonomy were avoided (9). Then the participants performed 51 throws (17 rounds) as their post-test and the features of each throw were registered. All participants completed the intrinsic motivation inventory by McAuley *et al.* (1991) before pre-test and after post- and retention tests to measure the subscales of intrinsic motivation and self-efficacy (perceived competence) related to the instructional language type. On the second day, all participants attended the darts throwing room at 8 a.m. to take the retention test. The retention test included 21 throws (7 rounds) without watching any instructional clip. Having finished the test, the participants completed the two subscales of the intrinsic motivation questionnaire one more time. The coordinates of the spot where the missiles were hit relative to the dartboard center (x and y coordinates for each throwing) were recorded manually and then were placed in the following formulas to compute the accuracy of each throwing. The radial error was calculated from the following formula,

$$\textbf{Radial Error} = (x^2 + y^2)^{1/2}$$

Where, x and y are the coordinates of each throwing based on the position of the targeted spot of the missile on the dartboard. The two-dimensional variable error was calculated by this formula,

$$\textbf{Variable error} = \left\{\left(\frac{1}{K}\right)\sum_{i=1}^{k}[(x_i - x_c)^2 + (y_i - y_c)^2]\right\}^{1/2}$$

Here, K is the number of throws, i is one specific throwing, x_c and y_c are the averages from x and y, respectively (20). According to the international standards of darts throwing, the points are counted based on the areas where the missiles are hit; however, in the present study, redial error (deviation from the center) and two-dimensional variable error (the homogeneity of the throws) were used as the two criteria to compute the participants' accuracy of performance and learning scores. In this research, we used descriptive statistics (mean and standard deviation) to describe data and Kolmogorov-Smirnov test to check the normality of the data. The independent variable included the three types of instructional language (neutral language, controlling language, autonomy supportive language) and the dependent variables were accuracy in darts throwing performance (which is measured by radial and two-dimensional variable errors), intrinsic motivation, and self-efficacy. To test the research hypotheses, the statistical procedure ANOVA with repeated measures [3 (three groups) × 3 (three steps of pre-test, post-test, and retention)] was used. The post-hoc bonferroni test was used after all analysis procedures. The analysis of data was conducted using SPSS (version 22) and the significance level for all variables was set at $P \leq 0.05$.

Results

This study was conducted with the aim of examining the effects of instructional language type on the intrinsic motivation, self-efficacy, and accuracy performance in darts throwing skill. Table 1 presents the mean and standard deviations of the research variables for the 48 participants divided into three groups (each group 16). Table 2 presents the results of the Pillai's trace test to determine whether the presumptions of ANOVA with repeated measures are observed for the variable intrinsic motivation. As the Pillai's trace test coefficient (0.37) was significant, we were

able to continue the analysis. It should be noted that the results of Mauchly- Sphericity test were not significant (F=0.96, P<0.05). Therefore, the assumption of the equality of within-subjects' variances is observed. Table 3 presents the results of the ANOVA analysis. As Table 3 depicts, for within-subject main effect of intrinsic motivation, the between-group factor is significant (F=11.88, P= 0.001). Moreover, the within-subject interactive effect of motivation by group (F= 7.18, P= 0.001) is significant. In addition, regarding the between-subjects results, the main effect of group is not significant. Table 4 presents the results of the Pillai's trace test to determine whether the presumptions of ANOVA with repeated measures are observed for the variable self- efficacy. As the Pillai's trace test coefficient (0.21) was significant, we conducted the ANOVA analysis. It should be noted that the results of Mauchly-Sphericity test were not significant (F=0.96, P<0.05). Therefore, the assumption of the equality of within-subjects' variances is observed. Table 5 presents the results of the ANOVA analysis. As Table 5 illustrates, for the within-subject main effect of self-efficacy, between-group factor is significant (F=16.38, P= 0.001). Furthermore, the within-subject interactive effect of self-efficacy by group is significant too (F= 3.09, P= 0.001). However, regarding the between-subjects results, the main effect of group is not significant. Table 6 presents the results of the Pillai's trace test to determine whether the presumptions of ANOVA with repeated measures are observed for the variable accuracy of performance. As the Pillai's trace test coefficient (0.75) was significant, we continued the ANOVA analysis. The results of Mauchly- Sphericity test were not significant (F=0.32, P>0.05). Therefore, the assumption of the equality of within-subjects' variances is observed. Table 7 depicts the results of the ANOVA analysis. Based on Table 7, for the within-subject main effect of accuracy of performance, between-group factor is significant (F=10.88, P= 0.001). Moreover, the within-subject interactive effect of accuracy of performance by group is significant too (F= 3.56, P= 0.001). In addition, regarding the between-subject results, the main effect of group is significant (F= 4.09, P=0.02). In order to examine which groups (autonomy supportive, controlling, neutral) showed a significant difference, we used the post-hoc Bonferroni correction test. The results are depicted in Table 8. The results of Table 8 reveal that the autonomy supportive group had a significant difference with the controlling group, (P= 0.03). Based on the means of the groups, the group which received instruction with an autonomy supportive language had a better accuracy in their performance and as a result, showed better learning.

Discussion

The results of the present research showed that the autonomy supportive group was significantly better than the controlling group regarding the accuracy of throwing toward the targets. Therefore, learning a new motor skill (the modified darts throwing skill) improved in the conditions that the instructions are supportive of the autonomy and self-determination of the learners compared with the instructions provided for the controlling and neutral groups. In addition, the facilitated learning in the autonomy supportive group was associated with an increase in intrinsic motivation and self-efficacy. As present study explored the effect of three types of instructional languages on the three dependent variables of intrinsic motivation, self-efficacy, and performance accuracy (in darts throwing skill), the discussion is arranged based on the abovementioned dependent variables. Regarding the improvement of learning in a new skill in the autonomy supportive group in this study as compared to some other studies, it can be stated that providing learners with choice has improved learning.

Table 1. The mean and standard deviations of research variables in the three phases according to group

Step	Variable	Radial error	Two-dimensional variable error	Self-efficacy	Intrinsic Motivation
	group*	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
	1	18.03± 3.12	17.67 ±1.78	23.37±5.96	36.62 ±7.06
Pre-test	2	18.07 ±4.43	17.25 ±1.85	23 ±3.42	36.06 ±8.48
	3	17.41 ±3.10	17.22 ±1.96	24.06 ±7.83	36.06 ±5.37
	1	13.38 ±2.38	14.42 ±1.79	28.94 ±7.49	43.62 ±4.59
Post-test	2	16.85 ±3.60	16.31±1.85	24.37 ±5.33	37.06 ±7.71
	3	15.91 ±2.57	17.05 ±2.54	25.75 ±7.78	36.81 ±6
	1	12.95 ±3.12	14.02 ±2.27	28.44 ±6.54	43.25 ±4.67
Retention	2	16.97 ±4.44	16.87 ±2.80	25.68 ±4.47	36.81 ±7.21
	3	14.60 ±3.68	16.06 ±2.97	25.44 ±8.17	37.87 ±5.70

Group 1: autonomy supportive; Group 2: controlling; Group 3: neutral

Table 2. The results of Pillai's Trace Test to determine the presumptions of ANOVA with repeated measures for the variable Intrinsic Motivation

Sources	Value	F	P
Intrinsic Motivation	0.37	5.13	0.001

Table 3. The results of ANOVA with repeated measures for the variable intrinsic motivation

Effects	Change resources	Sum of squares	Freedom degree	Mean of squares	F	P	Etta squared
Within-subject	Motivation	233.43	2	116.71	11.88	0.001	0.21
Between-subject	Motivation* group	282.19	4	70.55	7.18	0.001	0.24
	Group	582.76	2	291.38	2.78	0.07	0.11

Table 4. The results of Pillai's Trace test to determine the presumptions of ANOVA with repeated measures for the variable self- efficacy

Sources	Value	F	P
Self-efficacy	0.21	2.60	0.04

Table 5. The results of ANOVA with repeated measures for the variable self- efficacy

Effects	Change resources	Sum of squares	Freedom degree	Mean of squares	F	P	Etta squared
Within-subject	self-efficacy	280.72	2	140.36	16.38	0.001	0.27
Between-subject	self-efficacy* group	105.90	4	26.48	3.09	0.001	0.12
	Group	167.35	2	83.67	0.76	0.47	0.03

Table 6. The results of Pillai's Trace Test to determine the presumptions of ANOVA with repeated measures for the variable Accuracy of Performance

Sources	Value	F	P
Accuracy of performance	0.75	17.11	P< 0.05

Table 7. The results ANOVA with repeated measures for the variable Accuracy of Performance

Effects	Change resources	Sum of squares	Freedom degree	Mean of squares	F	P	Etta squared
Within-subject	accuracy of performance	272.21	5	64.81	10.88	0.001	0.20
Between -subject	accuracy of performance* group	178.30	10	21.22	3.56	0.001	0.14
	Group	211.25	2	105.62	4.09	0.02	0.15

Table 8. The results of bonferroni post-hoc test to determine the significant differences among groups

Groups		Mean differences	P
Autonomy Supportive	controlling	-1.98*	0.03
	neutral	-1.60	0.10
Controlling	autonomy Supportive	1.98*	0.03
	Neutral	0.38	0.99
Neutral	autonomy Supportive	1.60	0.10
	controlling	-.38	0.99

For example, the results of Hooyman *et al.*'s (2014) research are also in line with the present research. In their study, they showed that learning the bowling cricket skill improved in the conditions where the instructions were supportive of autonomy compared with the conditions where they were controlling (1). Also Reeve and Tseng (2011) reported that participants in the autonomy supportive and neutral groups (compared with the controlling instructional language group) showed a significantly higher degree of emotional involvement (such as enjoyment, amusement, curiosity, interest) and this probably led to a better learning in these groups (18). Overall, it can be stated that according to Deci and Ryan's Self-Determination Theory (1985), the autonomy supportive instructional language has probably satisfied the learners basic psychological need of autonomy and facilitated learning in this group (compared to the other two groups (21). In the same line of research, other studies have shown if learners are provided with control over aspects of their practice conditions, the learning of motor skills improves. For example, the results of Wulf *et al.*'s (2017) research indicated that choices related to the task were as effective as unrelated ones in learning motor skills (22). Regarding the other variable of the study, i.e. intrinsic motivation, as Table 3 depicts, teaching a new skill (darts throwing) has increased intrinsic motivation in the three groups; however, the mean of the scores in the autonomy supportive group is higher in the acquisition and retention phases compared with the other groups. Therefore, the results of the present study show that the instructional language of a task (taking into account whether the instructions are supportive of autonomy or not) not only has various motivational results, but is also effective on motor learning too. Accordingly, Wulf *et al.* (2017) maintain that learning in both autonomy supportive and controlling conditions is motivational by itself (22). Therefore, the effects of having choice on motor learning may be inherently motivational (and not informational). Furthermore, the results of Abe *et al.* (2011) showed that monetary rewards for good performance lead to more efficient learning in contrast to punishment for weak performance (for example having to pay money) or controlling conditions. These researchers have maintained that dopamine, which is related to the positive motivation (for example positive affects), is necessary for the neuroplasticity changes including memory consolidation (16). Thus, the results of the previous studies as well as the findings of the present study confirm that autonomy and control over the practice

environment improve intrinsic motivation in individuals. Based on the findings of the above studies, it seems that regarding the motivation variable it can be stated that when the individuals' psychological needs of autonomy and competence are supported, these needs become actively interwoven with the learning activities and internalize the values related to that learning environment (4), which in turn, can influence motivation and behavior and strengthen the mental context and psychological needs of the learners and lead to long-term change in the desired behavior (2). When one of these needs is satisfied, the quality of motivation improves and if all three are satisfied, motivation reaches the optimal level. Therefore, the practice environment during learning (for example giving choice to learners) can influence learning by facilitating or prohibiting the internalization of motivation. As a result, the abovementioned points can be an explanation for the results of this study showing that the autonomy supportive instructional language may have influenced the intrinsic motivation by relatively satisfying the basic psychological needs in this group compared with the other two groups. In addition, based on the previous literature, another reason can be proposed for the improvement of individuals' performance under ideal motivational conditions (e.g. autonomy supportive conditions). According to this alternative explanation, these conditions can facilitate the creation of the brain's functional connections. Functional connections are the neural connections related to a particular task, which are observed among separate districts of the brain in skillful performers (24). A switch from the default mode network toward neural networks, which are necessary for successful performance, is facilitated through salience network (14). Based on this fact, non-optimal motivational conditions (e.g. lack of autonomy) may limit this switching toward related functional networks or limit the goal-action coupling. Regarding the next variable of this study, i.e. self-efficacy, based on Table 1, the means of self-efficacy scores (perceived competence) in acquisition and retention phases were higher in the autonomy supportive group compared with the other two groups. Regarding the other variable of the study, as Table 1 demonstrates, the means of self-efficacy (perceived competence) scores in the acquisition and retention phases were relatively higher in the autonomy supportive group than in the other two groups. The study by Lemos *et al.* (2017) shows that learners' self-efficacy increases as a result of providing them with choice (6). Reeve and Tseng (2011) have reported a higher perceived competence ranking in the autonomy supportive group compared with the controlling group in a puzzle solving task (18). Therefore, it can be concluded that self-efficacy resulted from giving learners a sense of autonomy can have a positive influence on the participants' learning (8). Overall, the findings of the present study regarding the three abovementioned variables (learning, intrinsic motivation, and self-efficacy) are in line with previous literature. However, the noticeable point in the results of the present study (according to Table 5) is that for the within-subject main effect of self-efficacy, the between-group factor was meaningful. In addition, the interactive within-subject effect of self-efficacy by group was significant too. However, the results of the between-subject factors were not significant for group. To explain this observation, two main reasons can be proposed. First, individuals' self-efficacy is not just affected by the instructions in the test session. Rather, learners can differ from each other regarding the self-efficacy resources such as successful or unsuccessful experiences of the past, trial of a task, modeling others' success or failure, encouragement and reinforcement received from surrounding people, and their emotional and physiological conditions (25). Consequently, all these factors can affect a person's self-efficacy. The second important point is that previous studies have provided many explanations for the effect of

supporting the learners' needs of autonomy on the improvement of learning, some of which are related to the deeper processing of information (11, 12). Other studies maintain that the learner's autonomy influences their motivational state (14) and probably leads to effective neural connections which facilitate performance and learning (6). The results of the present study confirm the second explanation for this reason that comparing the mean scores of the intrinsic motivation in the three groups shows that motivation is higher in the autonomy supportive group. It can be concluded that inducing a sense of autonomy has been effective on the participants' motivational state in the autonomy supportive group and as a result, on their self-efficacy and ultimate learning compared to the other two groups. However, this cannot be concluded confidently. Future research is required to undertake manipulations in the instructional language by using different teaching methodologies and task evaluations in order to gain more significant results confirming the findings of this study. In addition, as mentioned earlier, participants were shown three types of instructional language via a clip. Accordingly, one of the limitations of this study is the participants' different perceptions of the teacher's instructional language type in the clip, which can make a difference in the stabilization of autonomy or control in the learners. In contrast, in a real instructional context, the teachers' use of facial expressions and hand movements or their giving feedback to the learners during instruction may influence the degree of the induced motivation or even create a greater sense of autonomy or control in the learners.

Conclusions

Giving choice to learners during teaching, even when the choices are not very significant or when the degree of learners' skill and insight is unknown, is a useful way in acquiring motor skills. Teachers and coaches must try to provide situations which promote learners' sense of competence (self-efficacy) which in turn, improves learning. These situations can include information which is effective on the learner's perception of their abilities. Providing positive feedback about performance, giving autonomy to learners during practice and changing the instructional language to improve intrinsic motivation are different ways for creating such situations.

Ethical issues

Participation in this research was voluntary, so participants could withdraw from the study at any time. Besides, they completed a written consensus to cooperate for two days of the research. The study was evaluated in the Committee for Ethics in Sports Sciences regarding observing ethical rules and protecting human participants and was approved with the following code: IR. SSRI.REC.1397

Authors' contributions

All authors equally contributed to the writing and revision of this manuscript**.**

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