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Feedback After Good Versus Poor Trials Affects Intrinsic Motivation

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Participation in sports can play many educational roles in students' personal development. It provides opportunities for enjoyment, learning new motor skills, interactions with others, as well as leading a healthy life style (Hassandra, Goudas, & Chroni, 2003). However, studies have reported that interest and participation in physical education gradually declines with age (Papaioannou, 1997). Therefore, it is important to examine factors that affect students' motivation for participation in sports and physical education.

Students may engage in physical activity for a variety of reasons, including a combination of intrinsic and extrinsic motives (Weiss & Ferrer Caja, 2002). However, extrinsic motivators alone are often not sufficient. Individuals may stop playing when sponsors pull out or the prize money stops. Yet, intrinsic motivation will keep them interested in sports when extrinsic rewards are no longer available. Intrinsically motivated individuals experience lower levels of performance-related anxiety, and exert greater levels of effort and persistence relative to those with a more extrinsic motivational orientation (Scanlan & Lewthwaite, 1986; Vallerand & Losier, 1999; Weiss & Ferrer Caja, 2002). Given the benefits of engaging in activities for more intrinsic reasons, identifying factors related to the facilitation and development of intrinsically motivated behavior is an important research goal.

A factor that may affect intrinsic motivation is physical educators' behavior. A few studies have examined the influence of various instructional behaviors on students' motivational orientation (e.g., Koka & Hein, 2003; Schunk, 1982). Much of this research took place under the umbrella of cognitive evaluation theory (CET). CET was formulated to explain the effect of external events such as rewards, feedback from significant others, or other external events on intrinsic motivation. CET focuses primarily on the fundamental needs for competence and autonomy or self-determination and implies that individuals are intrinsically motivated to pursue an activity when they feel competent and self-determined with regard to that activity. Consequently, the theory would argue that a physical educator's actions that affect the student's perceptions of competence or autonomy can ultimately impact the athlete's intrinsic motivation (Ryan & Deci, 2000, 2002).

Feltz (1992) suggested that participants determine their ability to perform a task through their cognitive appraisal of available information. A possible source of information is the feedback teachers provide (e.g., Schunk, 1991). Many researchers have demonstrated that feedback is an important source of competence information (Allen & Howe, 1998; Amorose & Horn, 2000). Specifically, these authors argued that positive information-based feedback given in response to students' performance resulted in increased perception of competence. When students perceive they have demonstrated ability, their feelings of accomplishment are enhanced (Lee, 1997). From a cognitive mediational perspective, learners' interpretation of their ability is important, not the ability itself. It is the learners' interpretation of their ability that has been linked to concrete achievements (Deci & Ryan, 1985; Weiss, 1987).

By providing learners with feedback about their strengths and weaknesses, physical educators may modify

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learners' interpretation of their ability and situational intrinsic motivation. For example, Weinberg and Jackson (1979) gave participants false success or failure feedback for their balancing ability by telling them that they had either exceeded the 82nd percentile, or they had fallen below the 18th percentile, respectively. Success feedback enhanced interest and enjoyment, and failure feedback had the opposite effect. Similarly, when studying the relationships between athletes' perception of different types of feedback and the level of intrinsic motivation, Amorose and Horn (2000) used the coaching feedback questionnaire (CFQ). The CFQ was developed as a questionnaire version of the coaching behavior assessment system (Smith, Smoll, & Hunt, 1977). Intrinsic motivation was assessed using the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989). The results showed that athletes with higher levels of intrinsic motivation perceived that their coaches provided high frequencies of positive and information-based feedback and low frequencies of punishment-oriented and ignoring behaviors.

While research on instructional behaviors and students' motivation has provided us with valuable information, there is a significant limitation. None of the studies in this area have provided an adequate test to examine the effects of feedback on students' intrinsic motivation. Several studies have focused on false feedback patterns (e.g., Vallerand & Reid, 1984). In other studies, students were asked to judge physical educator feedback (e.g., Nicaise, Bois, Fairclough, Amorose, & Cogérino, 2007). However, it has been suggested that there is not always congruence between teacher feedback and how students perceive and interpret the information (Roberts, 2001).

We followed up on these issues in the present study by examining whether the type of feedback learners receive about their performance can affect their intrinsic motivation. Specifically, we asked whether intrinsic motivation could be enhanced by providing feedback after relatively good as opposed to poor trials. Recent studies have found that motor learning was enhanced when feedback was provided after "good" rather than "poor" trials (Chiviacowsky & Wulf, 2007; Chiviacowsky, Wulf, Wally, & Borges, 2009). The authors speculated that this difference in learning was due to motivational factors. However, effects on motivation were not assessed in their studies. The present study was designed to determine whether feedback highlighting good as opposed to poor trials—even without the learner's knowledge—can have a positive influence on learners' motivation (which, in turn, may explain the learning benefits). Participants in the present study practiced a golf-putting task, and different groups received feedback after the three best or three poorest trials in each block of six trials, respectively (similar to Chiviacowsky & Wulf, 2007; Chiviacowsky et al., 2009). At the end of practice, they filled out a questionnaire assessing their intrinsic motivation (i.e., interest/enjoyment, perceived competence, and effort/importance). We hypothesized that feedback after good trials, relative to poor trials, would be positively related to intrinsic motivation.

Method

Participants

Participants were 46 female students (M age = 20.5 years, SD = 1.7) attending a large university in Tehran, Iran. All participants provided informed consent. They had no prior experience with the experimental task and were not aware of our specific study purpose. The Advising Committee of Science and Research at the University in Tehran reviewed and accepted this study.

Apparatus and Task

The task required participants to putt a golf ball to a circular target with a radius of 5 cm, placed on the floor 4 m from the participant. Fourteen concentric circles with radii of 10, 15, 20, 25...75 cm were drawn around the target. The circles were labeled with capital letters. Specifically, the inner circle was labeled A, the next circle B, etc., and the last was labeled O. These served as zones to assess the accuracy of the strokes. If the ball came to rest on the target (A), 150 points were awarded. If it ended up in one of the other zones, or outside the circles, 140 (B), 130 (C)...10 (O), or 0 points, respectively, were recorded.

Measures

We used the Intrinsic Motivation Inventory (IMI; McAuley et al., 1989) to assess participants' subjective experience related to the target activity. It is a multidimensional measurement device that has been used in several experiments related to intrinsic motivation and self-regulation (e.g., Plant & Ryan, 1985; Ryan, 1982; Ryan, Connell, & Plant, 1990; Ryan, Mims, & Koestner, 1983). The instrument assesses participants' interest/enjoyment, perceived competence, effort/importance, value/usefulness, felt pressure and tension, and perceived choice while performing a given activity, thus yielding six subscale scores. A nine-item questionnaire consisting of the interest/enjoyment, perceived competence, and effort/importance subscales of the IMI was adapted for use in this study. Three items from each subscale reflected students' general level of interest/enjoyment, perceived competence, and effort/importance. Specifically, we used the following items:

Interest/enjoyment

1. Golf putting was fun to do.
2. While I was putting, I was thinking about how much I enjoyed it.
3. I thought golf putting was a boring activity. (R)

Perceived competence

4. After putting for awhile, I felt pretty competent.

5. I am satisfied with my golf putting performance.
6. Golf putting was an activity that I couldn't do very well. (R)

Effort/importance

7. I didn't try very hard to do well at golf putting. (R)
8. It was important to me to do well at golf putting.
9. I tried very hard while putting.

These items were then translated into Farsi, using standard procedures. Responses on the 7-point Likert-type scale ranged from 1 = strongly disagree to 7 = strongly agree. Negatively worded items were rescaled before data analysis. Internal consistency of each subscale was calculated using Cronbach's α statistic. They were high: interest/enjoyment (0.9), perceived competence (0.8), and effort/importance (0.8). The three subscales were summed to yield a composite measure of intrinsic motivation.

Procedure

Participants were randomly assigned to two groups, with 23 participants in the "KR on good trials" and 23 in the "KR on poor trials" group. After each block of six trials, participants in the KR on good trials group received knowledge of results (KR) on their three best (i.e., most accurate) putts in that block, whereas those in the "KR on poor trials" group received KR on their three poorest putts (Chiviacowsky & Wulf, 2007; Chiviacowsky et al., 2009). Participants in both groups were informed that, at the end of each block of six trials, they would receive KR on three of those trials. However, they did not know for which trials they would receive KR. KR was written on a board and presented to them for a period of 15 s. It consisted of the trial number and respective score. Although circles had been marked with English letters (e.g., A, B, C), participants received quantitative feedback. For example, if a participant in the KR on good trials group had hit circles H, E, B, D, G, and C in a six-trial block, she would have received the following feedback: Trial 3: 140 points, Trial 4: 120 points, Trial 6: 130 points. (If that participant had been in the KR on poor trials group, she would have received feedback on the three poorest trials: Trial 1: 80 points, Trial 2: 110 points, Trial 5: 90 points.)

Participants were aware that scores ranged between 150 and 0. A plus or minus sign included with each score indicated whether the participant overshot or undershot the target, respectively. Based on a pilot study, we hypothesized that participants would not notice on which trials they received feedback when the circles were marked with English letters. We used a manipulation check to test this assumption. After they performed 60 putts and completed the IMI, we asked participants when they thought they received feedback, on the best or the poorest trials, or on both good and poor trials. In addition, we asked, "If you had a choice, would you practice some more, or end the experiment?"

Data Analysis

Four independent *t* tests were used to investigate the effects of feedback on good and poor trials on participants' overall intrinsic motivation as well as the three subscales of the IMI (interest/enjoyment, perceived competence, and effort/importance).

Results

A manipulation check confirmed the assumption that participants were generally not aware they had received feedback on selected trials. In response to the question of whether they had received feedback on good or poor trials, or both, 91% of participants reported they had received feedback on both good and poor trials. Only 4 participants guessed correctly (i.e., that they received feedback after poor trials). Thus, it appeared that participants were generally not aware of the feedback manipulation.

Table 1 shows the means and standard deviations for all dependent variables. The KR on poor trials group tended to have lower scores than the KR on good trials group on all dependent measures. While group differences failed to reach significance for effort/importance $T(44) = .91$, $p > .05$, $\eta_p^2 = .019$, and interest/enjoyment, $T(44) = .79$, $p > .05$, $\eta_p^2 = .014$, the two groups differed significantly in terms of perceived competence, $T(44) = 2.72$, $p \leq .01$ (significant after Bonferroni adjustment for multiple comparisons), $\eta_p^2 = .14$. Importantly, the KR on good trials group showed overall higher intrinsic motivation than the KR on poor trials group, $T(44) = 2.20$, $p \leq .01$ (significant after Bonferroni adjustment), $\eta_p^2 = .10$.

Discussion

The present study examined whether giving feedback after relatively good compared to poor trials would enhance learners' motivation. The findings demonstrated that individuals' intrinsic motivation was, indeed, higher when feedback was provided after good trials. In particular, perceived competence was greater in the KR on good trials group than in the KR on poor trials group. These results are in line with previous studies (Allen & Howe, 1998; Amorose & Weiss, 1998; Hollembeak & Amorose,

Table 1. Means and standard deviations for variables

Groups	Knowledge of results			
Variables	Good trials		Poor trials	
	M	*SD*	*M*	*SD*
Interest/enjoyment	18.08	3.35	17.35	2.93
Perceived competence	12.95	3.81	10.17	3.07
Effort/importance	10.86	1.91	10.43	1.24
Intrinsic motivation	41.91	7.12	37.96	4.85

2005; Koka & Hein, 2003; Nicaise et al., 2007; Schunk, 1982; Whitehead & Corbin, 1991) that have demonstrated associations between the type of feedback, perceptions of competence, and intrinsic motivation. The result of these studies are consistent with cognitive evaluation theory, which predicts that positive (e.g., praise, encouragement) and informational (e.g., technical instruction) feedback should lead to increases in perceptions of competence, which in turn increases individuals' levels of intrinsic motivation. Furthermore, positive feedback has been shown to encourage participants to raise their goals and expectancies for future performance (Singer & McCaughan, 1978), while negative feedback provides negative competence information and, therefore, decreases intrinsic motivation. Interestingly, the present results suggest that positive and negative feedback can affect performers' motivation at an unconscious level. The questionnaire results indicated that most participants were not aware they had received feedback on selected (good or poor) trials. Yet, their perceived competence—and their intrinsic motivation overall—was impacted nevertheless.

The present findings also provide an important link between the type of feedback and motivation, on the one hand, and learning, on the other. Recent studies by Chiviacowsky and colleagues (Chiviacowsky & Wulf, 2007; Chiviacowsky et al., 2009), who used a design similar to that used in the present study, found learning advantages when feedback was presented after trials with high accuracy scores (KR after good trials), compared to trials with low accuracy scores (KR after poor trials). The present results support the contention that differential motivational effects of feedback served as a mediator for the observed differences in learning in those and other studies (e.g., Chiviacowsky & Wulf, 2002).

We hypothesized that the KR on good trials group would also show increased interest/enjoyment and perhaps effort/importance. However, in perceived competence, those two subscales of intrinsic motivation did not yield significant group differences. Interestingly, 96% of participants reported that if they had a choice they would continue to practice. This suggests that interest/enjoyment is not necessarily related to perceived competence. Consistently, Inoue (2007) demonstrated that students who expressed high levels of confidence did not necessarily choose difficult tasks if their individual interest was low. In contrast, the students with high levels of interest chose more difficult tasks and successfully solved the problems, regardless of their confidence in their ability. Therefore, interest may be seen as a less ego-oriented and more task-oriented construct than perceived competence.

The present results also have important practical implications. A central question for practitioners, such as physical educators or coaches, is how to maintain or enhance students' intrinsic motivation. Our findings suggest that it is important to provide students with success experiences by giving them feedback that emphasizes good performance rather than poor performance. If learners feel good about themselves and their capabilities, they will be more motivated to continue practicing a given task. Moreover, there is accumulating evidence that increased motivation can have a more direct, positive effect on motor learning. Instructions or feedback that reduces the performer's self-related concerns appear to facilitate the learning process and to promote greater automaticity in movement control (Wulf & Lewthwaite, 2009).

In conclusion, the present findings demonstrate that feedback after relatively good as opposed to poor trials result in greater intrinsic motivation, in particular greater perceived competence. The present study focused specifically on the link between feedback and dimensions of intrinsic motivation; however, it did not examine effects on motor performance or learning. Future studies should incorporate measures of motivation as well as learning to examine more directly the relationship between feedback, motivation, and learning. In addition, future research could include control conditions to determine whether positive feedback enhances motivation or whether negative feedback reduces motivation, relative to a "neutral" feedback condition. Based on recent evidence (Lewthwaite & Wulf, 2009), positive feedback would be expected to have a beneficial effect. The present results highlight the need to revise theoretical accounts of feedback (e.g., Salmoni, Schmidt, & Walter, 1984) by incorporating motivational, in addition to informational, factors. Similarly, from an applied perspective, our findings suggest that practitioners should view feedback not only as information learners use to correct errors. Feedback also affects learners' motivation, which, in turn, appears to influence learning.

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