Manipulating Feedback During Physical Education Climates: Immediate Effects on Motivation and Skill Performance

Drost, D. K., (corresponding author),
ddrost@uwf.edu, University of West Florida,
Wirth, Christopher K., cwirth@uwf.edu, University of West Florida
Leonard, Lesley, lleonard@ccga.edu, College of Coastal Georgia
Ruckman, Matthew, mruckman@uwf.edu, University of West Florida

Abstract

The purpose of this study was to investigate the effects of TARGET- and feedback-manipulated climates in a short unit of study of a familiar task. Participants were fourth- and fifth-grade students (n = 170) from intact classes in two southeast United States elementary schools. Classes were assigned to learn a familiar skill during a one week unit in a mastery or performance climate. Climate groups were assigned to receive either positive and general or informational feedback. The data collected on the participants included pre- and post-task skill and motivational measures. While climate and positive feedback had no effect on competence or skill change, informational feedback resulted in a decreased perceived competence and improved skill performance. At the conclusion of the intervention, participants in a mastery climate with positive feedback were significantly more motivated than those in a performance climate with informational feedback. When determining the appropriate climate and feedback for students, physical education teachers must consider whether lesson and unit objectives are to focus on motivation or skill performance. Information has the potential to positively affect actual measured competence while at the same time negatively affect perceptions of competence.

Keywords: Physical Education, Motivation, Climate, Feedback

According to America's Society of Health and Physical Educators (SHAPE), physical educator teachers should seek to cultivate within children and adolescents the skills, knowledge, and confidence for pursuing healthy, lifelong physically active endeavors (SHAPE, 2014). Development and mastery of motor skill competencies is recommended as a standard in America for physical education curriculum and content (SHAPE, 2015) and contributor to physical, cognitive, and social development in children and adolescents (Payne & Isaacs, 1995). Motor skills include both locomotor skills (e.g., walking, skipping, and galloping) and object control skills (e.g., kicking, catching, and tossing). Additionally, motor skill competency has been suggested as an important determinant for adequate participation levels in physical activities for children, adolescents, and adults (Clark & Metcalfe, 2002; Gallahue & Ozmun, 2006; Stodden et al., 2008).

Evidence from recent studies has exposed positive associations between motor skill competency and both perceived sport competence (Barnett, Morgan, van Beurden, & Beard, 2008) and cardiorespiratory fitness levels (Barnett, van Beurden, Morgan, Brooks, & Beard, 2009; Okely, Booth, & Patterson, 2001; Stodden, True, Langendorfer, & Gao, 2013) in children and adolescents. Considering the potential health impact of motor skill competency proficiency and the goals of school physical education, further investigations of motor skill development in school physical education is warranted. Specifically, the impact of climates and teaching methods may provide insight to understand effective ways for teaching children and adolescents' motor skills. Thus, the purpose of this study was to examine the influence of physical education climates and teaching behaviors on children and adolescent's motor skill achievement and motivation during consecutive physical education class periods.

Physical Education Climate

The Achievement Goal Theory (AGT) provides a motivational framework for understanding the impact of learning climates in educational and physical activity domains (Ames, 1992; Nicholls, 1989). According to AGT, teachers and coaches create psychological atmospheres, or motivational climates, during lessons, practices, and training sessions that can affect individuals' perceptions of competence in an activity (Ames, 1992; Nicholls, 1989). That is to say, motivation may have more to do with perceptions rather than some physical measure of success. Accomplishment can be based on an individual's perception of whether or not a goal or performance level has been reached (Van Yperen, Blaga, & Postmes, 2015). Disparate motivational climates may also impact the way individuals feel about pursuing future goals.

In physical domains, motivational climates have been described as either being supportive of effort and improvement (mastery climate) or focused on outperforming others and standardized comparisons (performance climate). The TARGET climate intervention was developed by Ames (1992) to foster a mastery climate. It is supportive of greater perception of a mastery climate in physical education (Christodoulidis, Papaioannou, & Digelidis, 2001; Digelidis. Papaioannou, Laparidis, & Christodoulidis, 2003; Morgan & Carpenter, 2002). Specifically, TARGET climate (Ames, 1992) is defined by six structures: (a) Task - tasks are designed to include variety and individual challenge and focus on personal or group goals, (b) Authority - students make decisions about the learning process, task design, and management of their progress, (c) Recognition - the task focus is on improvement and effort, (d) Grouping - students choose to work alone or in groups, (e) Evaluation - teacher allow students to self-assess and offer personal and individual feedback, and (f) Time - a majority of the task time is spent focused on practicing and learning the task. Climates which violate these structures are hypothesized to be performance climates (Ames, 1992).

Few research studies have focused on the effect of actual motivational climates in physical education. Studies which employed actual climates as experimental treatment conditions have largely targeted a mastery-oriented climate as the treatment due to the overwhelmingly positive effects on various psychological constructs. In many of these studies, researchers used either normal physical education climates or performance-oriented climates (which were often stated to be the same) as control conditions for a mastery-oriented climate intervention (e.g., Barkoukis, Tsorbatzoudis, & Grouios, 2008; Christodoulidis et al., 2001; Weigand & Burton, 2002). Results from research on the effects of participating in a mastery climate have been largely supportive of psychological and performance outcomes. Research in physical education has revealed that mastery climates are positively related to effort (Christodoulidis et al., 2001), enjoyment (Barkoukis et al., 2008; Christodoulidis et al., 2001; Weigand & Burton, 2002), perceived competence (Barkoukis et al., 2008; Valentini & Rudisill, 2004; Weigand & Burton, 2002), future behavior intentions (Christodoulidis et al., 2001), motor skill achievement (Martin, Rudisill, & Hastie, 2009; Valentini & Rudisill, 2004), and physical activity (Bowler, 2009).

Likewise, few studies have attempted to explore the motor skill achievement effects of mastery- and performance-involved physical education climates. Valentini and Rudisill (2004) found physically delayed kindergarten children experience greater locomotor skill improvement in a mastery climate using TARGET structures compared to those who participated in a climate designed to oppose TARGET. Martin, Rudisill, and Hastie (2009) not only discovered the same improvement difference in a similar study of kindergarten children, they also indicated a significant difference in object control skills, favoring participation in a mastery climate in all types of motor skill development. These studies targeted general physical education tasks as opposed to tasks focused on a specific sport or motor skill. Theeboom, De Knop, and Weiss (1995) studied the effects of mastery- versus performance-involved climates during a summer program, similar to a physical education setting. During this study, children learned and performed tasks in a short unit of study related to one sport. They reported that a mastery climate could indeed enhance post-intervention motor skill performance in sport (Theeboom, De Knop, & Weiss, 1995).

Popular among climate research is children's perceptions of the motivational climate in which they are participating. A mastery climate can be perceived when individuals think the social agents (e.g., teacher, coach) reward effort, emphasize tasks that support improvement, and accept mistakes (Nicholls, 1989). A performance climate can be perceived when individuals think that social agents present competitive tasks, reward high skill or behavior, and punish mistakes (Nicholls, 1989). In regard to the climate differences and psychological effects, perceived competence gains seem to be greater when children participate in a mastery climate (Valentini & Rudisill, 2004). However, outcomes such as effort, enjoyment, and behavior intention improvements do not seem to have been affected by differences in the type of motivational climate. Considering the limit of motivational climate comparative studies, there is very little evidence to support differences between mastery- and performance-involved climates.

Teacher Feedback

During the implementation of a motivational climate, teachers attempt to support learning by interacting with students individually and in groups, through both verbal and nonverbal communication. Feedback, and other related teacher behaviors, motivates students in learning and achievement settings (Deci & Ryan, 2002), including physical education (Fredenburg et al., 2001; Mouratidis et al., 2008). Cognitive Evaluation Theory (CET) represents a framework for understanding how environmental and social factors (e.g., teachers) facilitate individuals' intrinsic motivation (Deci & Ryan, 1985, 2000). This connection is mediated by the satisfaction of individuals' psychological needs (Deci & Ryan, 1985, 2000). A critical outcome of teacher administered task feedback, as explained by CET, is individual's perceptions of competence in the task (Ryan & Deci, 2000). The CET model is similar to the AGT model in that feedback, as opposed to the motivational climate of the task, impacts individual's perceived task competence. Studies have shown that the type of feedback delivered to individuals leads to different perceptions of competence (Horn, 2002; Smoll & Smith, 2002; Weiss, Amorose, & Wilko, 2009).

Overall, feedback in physical education is regarded as an effective teaching behavior and can effect changes in motivation (Fredenburg et al., 2001; Mouratidis et al., 2008) and performance (Fredenburg et al, 2001; Pellett & Harrison, 1995; Silverman, Tyson, & Krampitz, 1992). The question is not whether feedback makes a difference, rather what type of feedback makes a greater difference. Positive general feedback, focusing on motivational statements as opposed to information, has been found to enhance perceived competence in assorted contexts outside of physical education (Ryan & Deci, 2002; Smoll & Smith, 2002; Weiss et al., 2009). However, neither positive general feedback (Drost, 2012; Fredenburg et al., 2001; Viciana, Cervello, & Ramirez-Lechuga, 2007) nor informational feedback (Fredenburg et al., 2001; Mouritidis et al, 2008) during physical education tasks has been found supportive of heightened perceptions of competence. Also in physical education contexts, positive general feedback has not played a significant role in motor skill performance enhancement (Fredenburg et al, 2001; Silverman et al, 1992). Inconsistent outcomes also exist for the delivery of informational feedback. Informational feedback appears to have both positive effects (Fredenburg et al, 2001; Pellett & Harrison, 1995; Silverman et al, 1992) and limited and no relationship on motor skill performance (Masser, 1987; Mouratidis et al., 2008; Rikard, 1992).

Considering the potential discrepancies related to feedback, further exploration of motivational and performance effects of feedback in physical education is warranted. As prescribed by Braithwaite et al. (2010) and based upon their review of substantial correlation research and AGT (Ames, 1992, Epstein, 1989), we developed an experimental study to promote a mastery climate in physical education to enhance participant motivation. Also, in accordance to additional suggestions for future research found in feedback literature (Martin, Rudisill, & Hastie, 2009; Valentini & Rudisill, 2004), we were interested in the impact of a mastery climate on perceived competence and motor skill performance over time. Furthermore, Drost (2012) outlines the need to examine feedback, student performance, and motivation during a familiar task. Using AGT and CET as theoretical frameworks, the researchers developed research questions to determine how different climates and feedback influence students in physical education. The aim of this study was to investigate the effects of TARGET- and feedback-manipulated climates in a short unit of study of a familiar task with regard to change in pre- and post-task measures of perceived competence and motor skill performance.

Additionally, the potential differences in the effect of manipulated climates on post-task measures of perceived competence, effort/importance, interest/enjoyment, pressure/tension, and motor skill performance were analyzed.

Method

Participants

Participants in this study were 213 fourth- and fifth grade students who were recruited from two elementary schools. Due to absences or school conflicts during one of three separate data collection days, the actual participants who completed all elements of this study were 170 students (77 boys and 93 girls, M_{age} = 10.55, SD_{age} = .754) who attended 10 fifth-grade and two fourth-grade classes at two elementary schools (School A, *n* = 99; School B, *n* = 71) located in a medium-sized city in a southeast American state. The schools were selected for two reasons: (a) physical education periods consisted of students combined from two intact homeroom classes, (b) physical education periods were taught in a team teaching format by two teachers, and (c) the teachers and administrators at the schools were supportive of research. Students participated voluntarily through informed consent and child assent. Students who chose not to participate had physical education at another unobtrusive area of the school to avoid distraction during the experiment. The physical education teachers at each school followed the district curriculum focusing on motor skill development and utilized small units of study between one and five class meetings per skill theme. The present study simulated a unit considered normal for class structure, content, and time.

Procedures

Permission to conduct the study was obtained from the researchers' Institutional Review Board. Informed consent forms were completed by parents and collected prior to data collection. The initial data collection conducted one week prior to the experiment included completion of child assent forms and the pre-task questionnaire. The researchers conducted the experiment with each group during two consecutive physical education classes. Participants remained in group consisting of their normal physical education classmates. Groups were randomly assigned to two motivational climates and then climate groups were randomly assigned to one of two feedback groups. On day one, all groups were administered the task presentation and then practiced the tossing skill in a carefully controlled activity which allowed the researchers to measure pre-task performance assessment through video analysis. Following the practice session, groups participated in the predetermined experimental condition for the remainder of day one and part of day two. Day two ended with the same practice activity, used as a post-task performance assessment, followed by the post-task questionnaire.

Measures

Motor skill competency. Participants' motor skill competency was measured using a product evaluation of tossing skill before (pre-task performance assessment) and after (post-task performance assessment) the climate and feedback treatment conditions. For all treatment conditions, participants were video recorded while practicing tossing immediately after the introduction of the tossing learning cues. The practice task was carefully controlled so the participants were not aware the task was an assessment. Participants tossed 10 beanbags and were encouraged to land the object into a large hula hoop target at a distance of 25 feet. Each attempt was scored by the researchers on a 3-point scale (0 = missed target, 1 = struck target, 2 = landed on target) using video analysis.

Pre- and post-task perceived competence. A 6-item perceived competence subscale of the Intrinsic Motivation Inventory (IMI; McAuley, Duncan, & Tamman, 1989) was used to measure participants' pre- and post-task perceived competence in performing the tossing skill. For both the pre- and post-task scale, the item was modified for a tossing skill (e.g., "I am pretty skilled at tossing"). The tense of each item was also altered to account for perceptions of competence prior to the tossing unit (e.g., "I will be pretty skilled at tossing"). Participants responded to six items on a modified Likert-type scale ranging from 1 (not at all true) to 7 (very true).

Interest/enjoyment. The IMI subscale of interest/enjoyment, considered the self-report measure of intrinsic motivation, included seven items and was used in this study to measure post-task intrinsic motivation. The scale was modified for motivation toward perceptions of the tossing task (e.g., "I enjoyed doing the tossing activities very much"). Participants responded to each item on a modified Likert-type scale ranging from 1 (not at all true) to 7 (very true). Since the items pertain to specific tossing activities, no pre-task measurement was conducted.

Pressure/tension. Perceptions of feeling pressure and tension may negatively predict optimal motivation. The 6-item subscale of the IMI consisted of items measuring anxiety, nervousness, or relaxation during activity and therefore no pre-task measurement was made. Each item was modified to measure perceptions based on the tossing task (e.g., "I was very relaxed in doing the tossing activities"). Participants responded to each item on a modified Likert-type scale ranging from 1 (not at all true) to 7 (very true).

Effort/importance. Effort is also a subscale of the IMI and is often included as a scale when pertinent to research questions related to motivation. The subscale consisted of five items and participants responded on a modified Likert-type scale ranging from 1 (not at all true) to 7 (very true). Items were modified to focus on tossing activities (e.g., "I put a lot of effort into these activities") and measured post-task effort/importance only.

The Learning Task

Tossing was selected as the motor skill competency focus because the physical education teachers at each school contributed heavy emphasis to tossing and related motor skills within their respective curricula. The tossing skill was hence considered familiar which was confirmed in a pre-task questionnaire when the study participants were prompted to rate themselves on a modified Likert-type scale from 1 ("Never Heard of It") to 9 ("Pro"). As expected, the tossing skill was very familiar among the sample and participants considered themselves experienced and skillful (*M* = 7.17, *SD* = 1.49). The tossing skill was presented to all participants in the form of four learning cues (square up, step, swing, and extend) using the whole-part-whole presentation strategy: (a) groups were shown the skill in an actual authentic demonstration, (b) the cues were broken down and demonstrated individually, and

(c) the skill was demonstrated in the full form.

Two graduate students were recruited and trained to present the task at the onset of the tossing unit. Seven training sessions included practice following the presentation script, strict adherence to the climate routines, correct administration of feedback, and detailed understanding of the experimental procedures. Each task presenter was responsible for overseeing either the intervention climate (mastery climate) or control climate (performance climate) condition. Each condition received one of two types of feedback treatment, either positive general feedback designed to be motivational (e.g. "good job) or informational and specific feedback that was congruent with learning cues (e.g., "follow through toward the target").

Experimental Conditions

The mastery climate intervention was aligned with TARGET structures (Ames, 1992). Lesson plans were designed so that students focused on improvement, had control of their own practice tasks, participated as individuals or in small groups, were not evaluated by the teacher, and had flexible times to participate in self-structured practice tasks. Recognition, in the form of feedback, was manipulated as a part of the study intervention and therefore was the only inconsistent TARGET structure. The mastery climate included open space and a multitude of tossing and target implements of varying size, weight, and shape. Participants were informed that they must work to improve their tossing skills, could organize their own practice methods, and must keep practice group sizes less than five.

The control climate was designed to be an extremely performance-oriented climate and the lessons were planned with structures opposing TARGET. Therefore, the lessons included competitive game tasks, full teacher control, public declarations of success, a progression that separated high- and low-skilled participants, and timed start-stop activities. Participants in this condition played multiple tossing games, tossing beanbags in groups of two alternately to targets from a 20-foot distance in an attempt to score points and win individual contests. The games were timed, winners announced, and successive games organized based on previous game results. During planning, the teachers at the study site revealed this type of activity was normal for their curriculum, which validated this climate as a normal physical education climate.

Further manipulation of the experimental conditions was conducted by restricting the TARGET recognition structure (feedback). This restriction was designed to determine the potential impact of an individual TARGET structure on student motivation and performance. Each climate either received positive general feedback or informational feedback. Feedback was personal but not private so that all comments could be heard by all participants nearby, similar to how teachers deliver feedback in large classes. The administration of feedback to participants was specifically practiced so that feedback was heard and potentially beneficial to all students via a cross-over effect. An additional member of the research team administered feedback with the assigned task presenter since the combined classes were typically taught by two school physical education teachers at the same time.

Data Analyses

Reliability of the subscales was analyzed by observing the internal consistency levels and the reliability of the climate was established using percentage agreement. Next, we conducted three doubly multivariate repeated measures analysis of variance (ANOVA) tests to determine the effects of motivational climate and feedback conditions (within-subjects variable) on individual's perceived competence and performance (between-subjects variable). Each test explored the different experimental conditions. The first doubly multivariate ANOVA observed climate differences, the second feedback differences, and the third considered a combined climate and feedback condition. The manipulation of feedback within of each climate conditions resulted in the combined climate and feedback condition, or a four-group experimental condition, consisting of (a) mastery climate with positive general feedback, (b) mastery climate with informational feedback, (c) control climate with positive general feedback, and (d) control climate with informational feedback. Finally, a multivariate ANOVA was conducted to determine the effect of the four-group experimental condition on individual's perceived competence, interest/enjoyment, pressure/tension, effort/importance, and motor skill performance as dependent variables.

Results

Reliability and Validity

Internal consistency of the psychological scales was tested, via Cronbach's alpha levels, as evidence that the items within each scale measured the intended latent construct. The pre-and post-task perceived competence scales were found to have acceptable internal consistency (α = .74 and α = .76, respectively), while the interest/enjoyment scale had good internal consistency (α = .87). Lower alpha levels were found for pressure/tension (α = .45) and effort/importance (α = .66). The pressure/tension scale was excluded from further analyses while the effort/importance scale was retained. Alpha levels greater than .6 have been considered appropriate for internal consistency (Hair, Anderson, Tatham, & Black, 1998), especially when the sample size is over 100 (Stevens, 2002) and when items are measured using a modified Likert-type scale (Garson, 2008).

The reliability of the task presentation and feedback was established by video analysis to ensure each group received the same presentation of the tossing skill. The task presentation scripts from the videos were compared to the actual scripts. It was determined that there was a high percentage of accuracy to the actual script (98%). Likewise, the reliability of the feedback delivered during each of the two feedback conditions was determined by establishing a percentage that showed how closely the actual feedback delivered aligned with the feedback condition. Among all groups, feedback was accurately presented to participants (99%).

Motivational Climate

A multivariate ANOVA was conducted to test the effects of the type of motivational climate (between-subjects variable) on perceived competence and motor skill performance (within-subjects variables) over two time periods, before and after the intervention. Preliminary data screening did not violate the assumption of multivariate normality, linearity of association between quantitative outcome variables, or the homogeneity of variance/covariance matrices across conditions. The motivational climate by time period interaction was not statistically significant. However, there was a statistically significant within subjects effect for time, [$F_{(2, 167)} = 4.073$, $p < .05$, partial $\eta^2 = .047$]. There was also a statistically significant between subjects effect with regards to the motivational climate, [$F_{(2, 167)} = 3.940$, $p < .05$, partial $\eta^2 = .045$].

To follow up on the significant effects, two mixed ANOVAs, one for each dependent variable, were calculated and dependent-groups t tests were conducted. For perceived competence, univariate mixed ANOVA results indicated that there was not a statistically significant interaction effect. There was also not a significant within subjects effect ($p = .060$), nor a significant between subjects effect ($p = .068$). Though the post-task perceived competence mean was lower than the pre-task perceived competence mean for both motivational climates, results of dependent-groups t tests indicated that there were no statistically significant mean differences (see Table 1) in perceived competence considering climates.

For motor skill performance, univariate mixed ANOVA results indicated that there was not a statistically significant interaction effect, but there was a significant within subjects effect, [$F_{(1, 168)} = 5.119$, $p < .05$, partial $\eta^2 = .030$]. There was not a significant between subjects effect. Dependent-groups t tests also indicated no statistical mean difference (see Table 1) in motor skill performance though both climate groups showed marked tossing skill performance improvement, specifically in the mastery climate.

Table 1
Pre- and Post-task Descriptive Statistics

Outcome Variable	Between Subjects	Within Subjects Factor - Time	Mean	Standard Deviation	Standard Error	99% Confidence Interval Lower Bound	99% Confidence Interval Upper Bound
Perceived Competence	MC	1	5.378	0.978	.124	5.134	5.623
		2	5.239	1.320	.146	4.951	5.528
	PC	1	5.697	1.085	.105	5.490	5.904
		2	5.548	1.162	.124	5.214	5.702
	PF	1	5.509	1.151	.108	5.296	5.722
		2	5.437	1.129	.126	5.187	5.686
	IF	1	5.633	0.911	.121	5.393	5.873
		2	5.278	1.352	.142	4.997	5.559
	MCxPF	1	5.114	1.205	.196	4.727	5.502
		2	5.310	1.240	.234	4.848	5.771
	MCxIF	1	5.550	0.764	.158	5.238	5.863
		2	5.194	1.382	.189	4.821	5.566
	PCxPF	1	5.674	1.095	.127	5.424	5.925
		2	5.490	1.085	.151	5.192	5.788
	PCxIF	1	5.745	1.080	.184	5.382	6.107
		2	5.391	1.324	.219	4.959	5.822
Skill Performance	MC	1	5.873	2.893	.355	5.173	6.574
		2	6.563	3.224	.413	5.748	7.379
	PC	1	5.313	3.056	.300	4.720	5.906
		2	5.808	3.655	.350	5.117	6.499
	PF	1	5.716	3.027	.307	5.109	6.323
		2	5.758	3.572	.357	5.054	6.462
	IF	1	5.333	2.956	.346	4.650	6.016
		2	6.587	3.353	.402	5.794	7.379
	MCxPF	1	6.250	2.927	.566	5.133	7.367
		2	6.536	3.766	.657	5.238	7.833
	MCxIF	1	5.628	2.879	.457	4.726	6.529
		2	6.581	2.864	.530	5.534	7.628
	PCxPF	1	5.493	3.062	.366	4.770	6.215
		2	5.433	3.465	.425	4.594	6.272
	PCxIF	1	4.938	3.058	.529	3.893	5.982
		2	6.594	3.966	.615	5.380	7.808

Note: MC = Mastery Climate. PC = Performance Climate, PF = Positive General Feedback; IF = Informational Feedback.

Feedback

A second doubly multivariate ANOVA was conducted to observe the effects of the type of feedback (between-subjects variable) on perceived competence and motor skill performance (within-subjects variables) over two time periods, before and after the intervention. Preliminary data screening did not violate the assumption of multivariate normality, linearity of association between quantitative outcome variables, or the homogeneity of variance/covariance matrices across conditions. The feedback intervention by time period interaction was statistically significant, [$F_{(2, 167)} = 3.669$, $p < .05$, partial $\eta^2 = .042$]. There was also a statistically significant within subjects effect for time, [$F_{(2, 167)} = 5.294$, $p < .05$, partial $\eta^2 = .060$]. However, there was not a statistically significant between subjects effect with regards to feedback type.

Follow-up mixed ANOVAs were calculated and dependent-groups t tests were conducted for each dependent variable. For perceived competence, univariate mixed ANOVA results indicated that there was not a statistically significant interaction effect. There was a significant within-subjects time effect [$F_{(1, 168)} = 4.687$, $p < .05$, partial $\eta^2 = .027$], but not a significant between-subjects feedback effect. Though the post-task perceived competence mean was lower than the pre-task perceived competence mean for both feedback intervention groups, results of dependent-groups *t* tests (Table 1) indicated that there was only a significant difference in perceived competence change in the informational feedback group ($p < .05$). In this group, participants' scores were significantly lower after the task.

For motor skill performance, univariate mixed ANOVA results indicated that there was a statistically significant interaction effect [$F_{(1, 168)} = 5.596$, $p < .05$, partial $\eta^2 = .032$], and a significant within subjects effect [$F_{(1, 168)} = 6.401$, $p < .05$, partial $\eta^2 = .037$]. There was not a significant between subjects effect. Simple effects across the two time periods were examined. The group receiving informational feedback significantly increased motor skill performance scores from pre- to post-task assessment ($p < .05$) while there were no mean differences (Table 1) in motor skill performance in the general positive feedback group.

Climate and Feedback

A third and final doubly multivariate ANOVA was performed to observe the effects of the combined climate and feedback condition (between-subjects variable) on perceived competence and motor skill performance (within-subjects variables) over two time periods, before and after the intervention. The combined condition consisted of (a) mastery climate with positive general feedback, (b) mastery climate with informational feedback, (c) control climate with positive general feedback, and (d) control climate with informational feedback. Preliminary data screening did not violate the assumption of multivariate normality, linearity of association between quantitative outcome variables, or the homogeneity of variance/covariance matrices across conditions. The climate by feedback intervention by time period interaction was not statistically significant. There was a statistically significant within subjects effect for time [$F_{(2, 167)} = 4.659$, $p < .05$, partial $\eta^2 = .053$]. There was not a statistically significant between subjects effect with regards to climate by feedback intervention.

Two follow-up mixed ANOVAs, one for each dependent variable, were calculated and dependent-groups t tests were conducted. For perceived competence, univariate mixed ANOVA results indicated that there was not a statistically significant interaction effect, within subjects effect, or between subjects effect. The post-task perceived competence mean was lower than the pre-task measure in both groups that received informational feedback. Only one group, the mastery climate and general positive feedback group, increased mean perceived competence. No changes were found to be significantly different (Table 1).

For motor skill performance, univariate mixed ANOVA results indicated that there was not a statistically significant interaction effect. There was a significant within subjects effect with time [$F_{(1, 168)} = 6.920$, $p < .05$, partial $\eta^2 = .040$], but not a significant between subjects effect. An illustration of the interaction is provided in the figure below. Simple effects across the two time periods were examined. There was a statistically significant difference in pre- to post-task motor skill performance in the performance climate with informational feedback ($p < .05$). Both climates, when accompanied by informational feedback group, increased mean motor skill performance while only little or no mean motor skill performance differences (Table 1) in any group receiving general positive feedback group.

Post-task Impact on Motivation and Performance

Finally, a multivariate ANOVA was conducted to determine the effect of the four-group, climate-feedback on post-task perceived competence, interest/enjoyment, pressure/tension, effort/importance, and motor skill performance. Preliminary data screening did not violate the assumption of multivariate normality or of the assumption of linearity of association between quantitative outcome variables nor the homogeneity of variance/covariance matrices across conditions. Results showed a main treatment effect for motivational climate and feedback on the [Wilks' Lambda = .777; $F_{(12, 432)} = 3.606$, $p < .05$; partial $\eta^2 = .081$]. Univariate analysis of variance showed a significant effect of motivational climate and feedback differences on interest/enjoyment ($F = 8.327$, $p < .05$).

All possible pairwise comparisons were made using the Tukey's HSD. Based on this test, it was found that the group receiving informational feedback in a performance-oriented climate (M = 4.375) had significantly lower interest/enjoyment scores than all other groups. In addition, the group receiving positive general feedback in a mastery-oriented climate (*M* = 6.026) had significantly higher interest/enjoyment scores than the group receiving positive general feedback in a performance-oriented climate (*M* = 5.362).

Discussion

The purpose of this study focused on the impact of motivational climates and different types of feedback on students' perceived competence and motor skill achievement. The study also observed whether the combined climate and feedback condition affected students' post-task motivation, motivational constructs, and motor skills differently. Based on theory and past literature, the researchers anticipated a strong connection between perceived competence improvement and both mastery climate (Barkoukis, et al., 2008; Christodoulidis et al., 2001; Valentini & Rudisill, 2004; Weigand & Burton, 2002) and positive general feedback (Deci &

Ryan, 1985, 2000). Overall, results did not show support for these previously reported implications. However, in line with previous research (Fredenburg et al., 2003), informational feedback was found to make a difference in motor skill performance. Ultimately, the consideration of both climate and feedback simultaneously may provide a better understanding of differences in students' perceived competence and motor skill development.

Participating in mastery-oriented climates has been found to be supportive of perceived competence and motivation (e.g., Barkoukis, et al., 2008; Christodoulidis et al., 2001; Valentini & Rudisill, 2004; Weigand & Burton, 2002). The current study results show, contrary to the literature, no perceived competence benefits when practicing in a mastery climate, in comparison to performance climates. When observing mean differences, participants motor skill performance improved while perceived competence diminished, though neither was significant. One potential explanation for diminishing perceived competence may be the nature of the task. Viciana et al. (2007) and Drost (2012) report participation in climates, during which new content is introduced, resulted in development of new competence. In the current study, the task consisted of familiar, as opposed to new, content. Students brought an abundance of potential experiences and feelings to the unit which could have affected their post-task feelings of competence. Additionally, though TARGET (Ames, 1992) establishes a blueprint for a mastery climate, teachers can formulate mastery climates which are very different, while adhering to TARGET structures. In this study, the mastery-involved lesson followed a constructivist format which allowed students to make their own choices about practice, gave lots of options to choose from, and lacked organizational structure. The students' inexperience with constructivist learning climates may have attenuated the expected perceived competence improvements that were expected.

Theory posits that students receiving positive general feedback, or motivational feedback, should have greater perceptions of competence benefits in comparison to those who receive informational feedback (Deci & Ryan, 1985, 2000). However, literature on the effects of feedback in physical education has not been successful in supporting those theoretical implications (Drost, 2012; Fredenburg et al., 2001; Viciana et al., 2007). The results of this study partially support both theory and previous literature. Though no significant perceived competence change was found between motivational and informational feedback, negative psychological implications were found to be evident for students who received informational feedback. Conversely, positive general feedback had little impact on competence perceptions.

Students in this study received greater support for their competence perceptions from what teachers say, in the form of feedback, rather than what students actually did and how they performed. For those students who received only motivation-supporting feedback, in the form of positive general feedback, neither perceived competence nor motor skill performance changes were observed. However, when students receive large amounts of information about their motor skill performances from a teacher, they can improve motor skills while simultaneously perceiving themselves to be less competent. In support of our findings, Koka and Hein (2006) found that feedback interpreted by students as controlling may have a negative impact on motivation. Though the feedback in this study was strictly informational and planned as non-controlling, students may have misunderstood the intent of the feedback and perceived the information as commanding or possibly even negative, as opposed to the intended helpful nature. For example, when a student was told to "Follow through straight toward the target," the intent of the feedback may have been to support a cue or part of the motor skill. The student, however, may have interpreted the feedback as correcting something that was being performed incorrectly.

When reviewing the feedback and climate together, the negative effects of informational feedback in a performance climate had the most detrimental impact on motivation (represented by the interest/enjoyment subscale on the post-task questionnaire) while motivational feedback in a mastery climate had the greatest potential to support motivation. These results seem to indicate that teachers who desire enhanced student motivation should avoid information as it has the potential to negatively influence how they perceive their own competence. Alternately, teachers attempting to positively impact student performance should distribute large amounts of information.

The pedagogical decisions physical education teachers make during planning and teaching play an important role in children's potential for being physically active as adults. The expected climate effects on learning and motivation were not observed in the current study. Instead, physical education teachers in America appear to impact students to a greater degree through the delivery of feedback. The researchers found, as in Fredenberg et al. (2003), that information has the potential for improving children's motor skills. Fredenberg and associates (2003) also reported that success was recognized by students and resulted in improved perceptions of their own competence. Perceived competence was not affected by the performance improvements in this study. Participants in Fredenberg's study (2003) knew they had improved due to the nature of the task but in this study, participants were not given scores and due to the type of assessment, they would have had very little knowledge of whether they had improved their tossing skill or not. Regardless of geographic location, this study provides evidence that physical education teachers must pay close attention to the objectives of their lessons, specifically whether or not the focus is on motor skill achievement or motivation to persist in the skill.

The results of the climate impact on perceived competence may have been limited by the manipulation of the TARGET structure. An inconsistent mastery climate, because of manipulated feedback, could have been the reason current results deviated from literature supporting stronger relationships between mastery climates and motivation. The recognition structure within TARGET outlines a utilization of private and individual feedback that is both motivational and informational. Because there was no attempt to discreetly deliver feedback, the mastery climate could have been compromised, resulting in weak motivational outcomes. Since TARGET requires structures, these results may offer a deeper look at the recognition structure and call for future research on the individual effects of all TARGET structures. Other potential limitations include, for one, addressing a motor skill that was familiar. The familiarity of a motor skill likely brings other unknown and unmeasured, and possibly confounding, variables into students' psychology. Also, because the researchers chose to avoid a limitation by using one school for one climate, they created another limitation. It is possible that students at each school possessed different pre-task feelings and motor skills. Although the pre-task questionnaire did not reveal these particular differences, other differences could have existed.

Research attempting to understand the varied effects of feedback must continue. Many studies have discovered confounding results and researchers must work in the future to identify what type of feedback is best used during a host of differing conditions and contexts. Future studies should include both positive and informational feedback during lessons. Other studies have adopted this but not to the point of complete understanding. We must focus on how frequently each type of feedback should be administered, during what types of lessons, to which types of students, and for what purpose - motivation or performance.

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