Scandinavian Journal of Educational Research

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/csje20

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Version of record first published: 21 Nov 2011.

To cite this article: Andre Koka (2013): The Relationships Between Perceived Teaching Behaviors and Motivation in Physical Education: A One-Year Longitudinal Study, Scandinavian Journal of Educational Research, 57:1, 33-53

To link to this article: http://dx.doi.org/10.1080/00313831.2011.621213

Scandinavian Journal of Educational Research, 2013
Vol. 57, No. 1, 33–53, http://dx.doi.org/10.1080/00313831.2011.621213

The Relationships Between Perceived Teaching Behaviors and Motivation in Physical Education: A One-Year Longitudinal Study

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This study aimed to examine the direction of relationships between specific dimensions of perceived teaching behaviors and motivation in physical education over time among 330 secondary school students. Cross-lagged path-analytic models revealed that autonomous motivation was reciprocally related over time with perceived decision-making style, and positive feedback and that prior situation consideration, social support, and teaching behavior were related to a higher level of subsequent autonomous motivation and a lower level of controlled motivation; however, prior autonomous motivation was related to a higher level of subsequent positive nonverbal feedback. Results suggest that differences in the direction of relationships between various dimensions of perceived teaching behaviors and students' motivation in physical education are due to differences in the nature of the teacher-student interaction behind each teaching behavior.

Keywords: cross-lagged panel design, intrinsic and extrinsic motivation, path analysis, self-determination theory, significant other, students

Considerable amount of research has focused on the factors in physical education (PE) that promote students' motivation to engage in physical activity (Hagger & Chatzisarantis, 2007, 2008; Reeve & Jang, 2006). Most of this research has explored the role of teachers' interpersonal behaviors in PE (see Hagger & Chatzisarantis, 2007; Hein & Koka, 2007; Standage, Gillison, & Treasure, 2007 for a review). Specifically, research reveals that students who feel their teachers exhibit more autonomy-supportive behaviors versus controlling behaviors have higher levels of intrinsic motivation and self-determination in PE (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005; Ntoumanis, 2001, 2005; Ommundsen & Kvalø, 2007; Standage, Duda, & Ntoumanis, 2003, 2005, 2006). In exploring the literature available on the relationship between students' motivation and perceived teaching behaviors, I did not find any studies that could verify how these variables are interrelated. Most of the motivational studies conducted in PE are cross-sectional and have hypothesized that students' motivation is influenced by their perceptions of teachers' behavior (Koka & Hein, 2003, 2005; Pihu, Hein, Koka, & Hagger, 2008). There are, however, other cross-sectional studies suggesting the reverse process in that a high level of students' motivation may affect the way teachers act (e.g. Pelletier, Séguin-Lévesque, & Legault, 2002; Pelletier & Vallerand, 1996; Skinner & Belmont, 1993). Specifically, the latter studies suggest that students who are more motivated and show higher behavioral engagement in PE may perceive their teachers to engage in more frequent autonomy-supportive behaviors than students who are less motivated. Studies

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conducted so far point toward a reciprocal relation between students' motivation and perceived teaching behaviors in PE, although none of them actually tested this relation.

The present study thus aimed to understand the mechanism by which various dimensions of perceived teaching behaviors, such as democratic behavior, autocratic behavior, teaching and instruction, situation consideration, social support, as well as verbal and nonverbal feedback, and students' motivation, namely autonomous and controlled motivation in PE, are interrelated, using longitudinal data. In the subsequent sections, I will focus on (1) defining the autonomous and controlled motivation, as well as various dimensions of abovementioned teaching behaviors; (2) illustrating the function these behaviors have in forming students' motivation in PE; and (3) elaborating on the possible reciprocal relationships among variables.

Autonomous and Controlled Motivation in PE

The self-determination theory (SDT), introduced by Deci and Ryan (1985, 2000), has demonstrated to be a useful motivational framework for understanding the quality of an individual's motivation in a given context and the environmental factors that affect motivation in that context. SDT distinguishes between two broad types of motivation: autonomous and controlled motivation. Autonomous motivation refers to engaging in an activity purely for the enjoyment and satisfaction inherent in the activity itself (i.e. intrinsic motivation) or because the individual judges the activity to be important (i.e. identified regulation). For example, students who are autonomously motivated take part in PE because they enjoy the fun derived from it (e.g. "I really enjoy what we do in PE lessons"), reflecting intrinsic motivation, or because they realize that taking part in PE is important for developing their sport skills (e.g. "Participating in PE is important because I am able to improve my sport skills there"), reflecting identified regulation according to SDT (Deci & Ryan, 1985, 2000). On the contrary, controlled motivation refers to engaging in an activity in order to avoid negativity and gain positive feelings of sense of self (i.e. introjected regulation) or because it is a "must" (i.e. external regulation). For example, students who are controlled participate in PE in order to gain social recognition or to avoid internal pressures (e.g. "Not taking part in PE makes me feel bad about myself"), reflecting introjected regulation, or to avoid confrontation with the teacher (e.g. "I take part in PE just because I'll get into trouble if I do not"), reflecting external regulation according to SDT (Deci & Ryan, 1985, 2000).

SDT assumes that the quality of motivation people will experience while pursuing behaviors across various contexts is dependent on the extent to which the basic psychological needs for competence (i.e. a desire of being effective in his or her environment), autonomy (i.e. a desire of being the origin of his or her behavior), and relatedness (i.e. a desire of being socially connected to others) are satisfied (Deci & Ryan, 1985, 2000). That is, fulfilling students' basic psychological needs in PE is proposed as central to promotion of autonomous types of motivation (i.e. intrinsic motivation and identified regulation), whereas failing to satisfy students' basic psychological needs in PE should result in controlled types of motivational regulation (i.e. introjected and external regulation; Deci & Ryan, 1985, 2000).

The Role of Perceived Teaching Behaviors on Students' Motivation in PE

Considerable research supports the idea that perceived teachers' autonomy-supportive behavior is important in fostering autonomous motivation in PE (Hagger et al., 2003, 2005; Ntoumanis, 2001, 2005; Ommundsen & Kvalø, 2007; Standage et al., 2003, 2005,

2006). The use of general operationalization of teachers' autonomy-supportive behavior in these studies limited, however, the determination of the differentiated effects of specific dimensions of teacher's instructional behaviors on students' motivation in PE. In line with previous research conducted in a coaching setting (Allen & Howe, 1998; Chelladurai & Saleh, 1980; Hollembeak & Amorose, 2005; Zhang, Jensen, & Mann, 1997), Koka and Hagger (2010) have specified the association between specific dimensions of teaching behaviors, such as decision-making style (i.e. democratic versus autocratic style), teaching and instruction, situation consideration, social support, both verbal and nonverbal feedback, and self-determined motivation in PE. A democratic decision-making style refers to a behavior of the teacher which allows students to participate in decisions about strategies for games played during lessons. On the contrary, an autocratic teacher displays a very rigid decision-making style and demands obedience from students. Teaching and instruction refers to teacher's behaviors that are oriented towards trying to improve the students' performance by providing relevant technical instructions on skills. Providing positive general feedback includes praise and encouragement for students' good performance and effort. Situation consideration reflects the extent to which the teacher takes into account students' abilities when delegating roles such as assigning them to the right game position. The teacher who exhibits interest and concern for the welfare of the students is considered to be socially supportive. The nonverbal feedback refers to the teacher's use of gestures, such as clapping hands, smiling, or patting on a shoulder as a response to students' good performance and effort (i.e. positive nonverbal feedback) and gestures such as rolling of the eyes, shaking head, or displaying an angry face as a response to students' poor performance or errors (i.e. negative nonverbal feedback).

Using SDT as a theoretical framework, Koka and Hagger (2010) tested the process by which perceptions of described teaching behaviors influence students' self-determined motivation in PE. According to SDT, it was hypothesized that various dimensions of perceived teaching behaviors influence students' self-determined motivation through the satisfaction of one or more of the psychological needs for competence, autonomy, and relatedness. Koka and Hagger (2010) found that perceived satisfaction of the needs for competence and relatedness, but not for autonomy, predicted students' self-determined motivation in PE. As for the influence of various dimensions of perceived teaching behaviors, while positive general feedback influenced perceived satisfaction of all three needs, democratic behavior influenced perceptions of autonomy. Only positive general feedback, however, predicted students' self-determined motivation in PE via the satisfaction of needs for competence and relatedness. Unexpectedly, results revealed that perceived autocratic behavior, teaching and instruction, situation consideration, and negative nonverbal feedback had significant and direct relationships with students' self-determined motivation in PE, unmediated by the psychological need satisfaction variables, with situation consideration and teaching and instruction revealing positive and autocratic behavior and negative nonverbal feedback revealing negative relationships. Koka and Hagger (2010) explained this deviation from the tenets of SDT by suggesting that these teaching behaviors failed to provide students with the substantial competence information or facilitate their feelings of autonomy and relatedness in PE. However, in line with similar studies conducted in the coaching setting (Amorose & Horn, 2000), these results demonstrated that when students perceived their teachers to exhibit increased teaching and instruction and situation-consideration behaviors and less frequent autocratic behavior and negative nonverbal feedback, they were more self-determined in their motivation towards PE.

Perceived Teaching Behaviors and Motivation in PE: The Rationale of Why Both Variables are Likely to be Associated in a Reciprocal Way

The research described above supports the perspective that a teacher's behavior predicts students' motivational orientation in PE. As mentioned earlier, however, there is research suggesting that students' motivational orientation may influence the teacher's interaction with students (e.g. Pelletier et al., 2002; Pelletier & Vallerand, 1996; Skinner & Belmont, 1993). These studies are based on the assumptions of the behavioral confirmation process, introduced by Snyder (1984), suggesting that a supervisor's beliefs about a subordinate's motivational orientation (e.g. intrinsic versus extrinsic) could elicit the supervisor's behavior (e.g. autonomy-supportive versus controlling), which, in turn, causes the subordinate's behavior that will confirm the supervisor's initial beliefs. Pelletier et al. (2002), for example, found that when the teacher perceived their students to be intrinsically motivated and self-determined, the teacher was in turn more self-determined and autonomy-supportive with his/her students. Bearing this in mind, one may argue that when a student enjoys the content of PE and considers the lessons to be essential to improving his or her sport skills (i.e. autonomous motivation), this subsequently influences his or her behavior (e.g. actively taking part in PE, asking questions, and having a say about practice sessions). The student's own behavior, in turn, induces the behavior from the teacher (e.g. including the student into the decision-making process by asking for the student's opinion and providing positive feedback) that will likely lead to higher perceptions of the teacher's corresponding behavior.

Present Study

A review of the literature concerning the relationships between perceived teaching behaviors and students' motivation in PE suggests that no study has examined simultaneously the impact of (1) various dimensions of perceived teaching behaviors on students' motivation; (2) students' motivation on various dimensions of perceived teaching behaviors; and (3) potential reciprocal relationships between various dimensions of perceived teaching behaviors and students' motivation. Longitudinal study design has the potential to understand the mechanisms in operation by demonstrating the direction of the relationships between these constructs.

The present study thus aimed to examine the direction of relationships between various dimensions of perceived teaching behaviors and students' different types of motivation described above in PE. Using cross-lag panel path-analytic models involving two waves of data, it was investigated how various dimensions of perceived teaching behaviors, such as democratic behavior, autocratic behavior, teaching and instruction, situation consideration, social support, both verbal and nonverbal feedback, and students' autonomous and controlled motivation in PE influence each other over a one-year period (see Figure 1). Specifically, the following research questions were addressed. First, do one's perceptions of various dimensions of teaching behaviors predict how one regulates his or her behavior in PE (i.e. motivational orientation)? Second, does the way in which a person regulates his or her behaviors in PE explain the perceptions of various dimensions of teaching behaviors? Third, is the relationship between these variables reciprocal, or is there no effect between variables at all, leaving only stability effects?

The present study contributes to the extant literature by examining the mechanism by which abovementioned dimensions of perceived teaching behaviors and students'

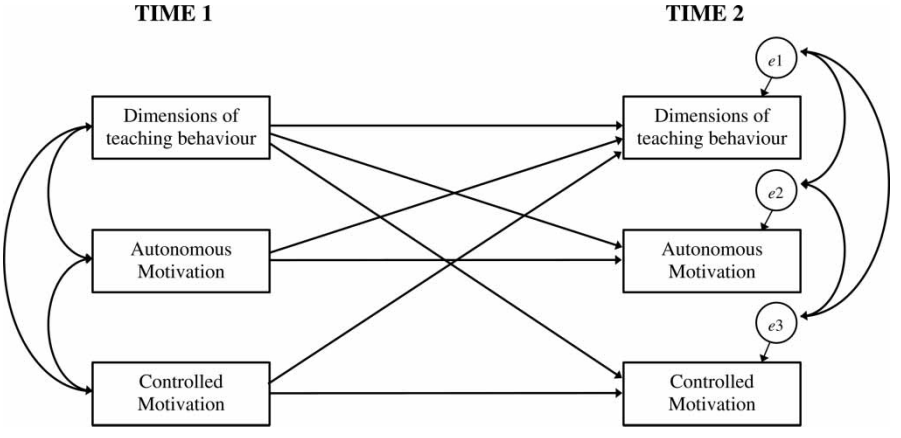

Figure 1. The hypothesized model to be tested (e = error term).

autonomous and controlled motivation in PE are interrelated, using longitudinal data. Understanding the mechanism by which these variables are related is important for the refinement of intervention programs. If the unidirectional relationship with the flow from perceived teaching behaviors to students' motivation will be evident, intervention programs focusing on teacher training should be most effective (i.e. fostering positive relationships between teacher and students). On the other hand, if the unidirectional relationship with the flow from students' motivation to perceived teaching behaviors is evident, programs focusing on students should be most effective (i.e. fostering students' enjoyment, perceived effort, and perceived competence in PE). If the bidirectional relationships between perceived teaching behaviors and students' motivation are supported, programs that combine teacher and student intervention should produce the most pronounced effects.

Method

Participants and Procedures

The participants for this study were 330 secondary school students (194 girls and 136 boys; M age = 13.74 years, SD = .73) from a town of 100,000 inhabitants located in southeast Estonia. The present study included two data collections over the course of 12 months, with 498 students taking part in the first data collection (at Time 1, students were in 7th and 8th grades). Students' responses to the questionnaires administered at Time 2 were matched with responses to the questionnaires administered at Time 1 using dates of births and gender as matching indices. An attrition rate of 33.7 % at Time 2 was primarily due to two reasons. The first and probably the main reason for relatively high attrition rate was that it's quite common in Estonia to change schools when entering the last grade (i.e. 9th grade) of secondary school in order to study further in a better high school. The second reason was caused by student absence on the day of data collection.

Participation in the study was voluntary, and institutional, parental, and student permission was obtained prior to the study. The questionnaires at both Time 1 and Time 2 data collection were administered to students at schools during the regular school day in their "home" rooms. Students were assured that their answers would remain confidential.

The Ethical Committee of the University of Tartu, Estonia approved all the study procedures and protocol.

Measures

Perceived teaching behaviors

The 15-item Leadership Scale for Physical Education (LSPE; Koka & Hagger, 2010), an adapted version of the Revised Leadership Scale for Sport (RLSS; Zhang et al., 1997), was used to assess students' perceptions of various teaching behaviors in PE with dimensions of democratic behavior, autocratic behavior, teaching and instruction, situation consideration, and social support. Each subscale of teaching behavior included three items, preceded by the stem, "My PE teacher. . .," and responses were made on 5-point scales ranging from (1) "never" to (5) "always." Example items are: ". . .asks for the opinion of the students on strategies for specific games" (democratic behavior), ". . .refuses to compromise on a point with students" (autocratic behavior), ". . .makes complex things easier to understand and learn" (teaching and instruction), ". . .sets goals that are compatible with students' ability" (situation consideration), and ". . .stays interested in the personal well-being of the students in the lessons" (social support). In the present study, the proposed five-factor structure of the scale was supported via confirmatory factor analysis (CFA). The goodness of fit test parameters were: $\chi^2(80) = 139.68$, $p = .001$, χ^2/df ratio $= 1.76$, CFI $= .97$, NNFI $= .96$, RMSEA $= .039$, 90% confidence interval (CI_{90}) for RMSEA range $= .028$ to .049.

The 9-item Perceptions of the Teacher's Feedback questionnaire (PTF; Koka & Hein, 2005) was used to assess students' perceptions regarding the type of feedback their PE teachers provided them in response to their performances with dimensions of positive general feedback, positive nonverbal feedback, and negative nonverbal feedback. Example items are: "The teacher praises me" (positive general feedback; three items), "In response to a good performance the teacher claps his/her hands" (positive nonverbal feedback, three items), and "In response to a poor performance the teacher rolls his/her eyes" (negative nonverbal feedback; three items). According to Koka and Hein (2005), the PTF included only positive types of verbal feedback and not the opposite, negative types of verbal feedback, because the latter items were not supported by CFA. Students were asked to indicate their agreement or disagreement with each statement on a 5-point scale ranging from (1) "strongly disagree" to (5) "strongly agree." The CFA supported the proposed three-factor structure of the scale. The goodness of fit test parameters were: $\chi^2(24) = 49.81, p = .002$, χ^2/df ratio $=$ 2.08, CFI $= .95$, NNFI $= .93$, RMSEA $= .047$, CI_{90} for RMSEA range $= .028$ to .065.

Motivational regulations

An adapted version of the Behavioral Regulations in Exercise Questionnaire (BREQ; Mullan, Markland, & Ingledew, 1997) was used to assess students' motivation towards PE. The BREQ has been appropriately adapted to Estonian PE by Koka and Hagger (2010). Students were asked to respond to the question, "Why do you participate in PE?" followed by different reasons: intrinsic motivation (four items, e.g. "because PE is fun"), identified regulation (four items, e.g. "because I value the benefits of PE"), introjected regulation (three items, e.g. "because I feel ashamed when I miss a PE class"), and external regulation (four items, e.g. "because other people say I should"). Responses were measured on 5-point

scales ranging from (1) "strongly disagree" to (5) "strongly agree." The CFA for the BREQ approached the criteria for satisfactory fit proposed by Hu and Bentler (1999): $\chi^2(70) = 225.80$, $p = .001$, χ^2/df ratio = 3.23, CFI = .91, NNFI = .88, RMSEA = .074, CI_{90} for RMSEA range = .057 to .077.

Researchers have argued that it is more important to distinguish between autonomous and controlled motivation than between intrinsic and extrinsic types of motivation (Guay, Marsh, Sénecal, & Dowson, 2008; Shahar, Henrich, Blatt, Ryan, & Little, 2003). Accordingly, I adhered to this perspective by summing the subscale average scores of intrinsic motivation and identified regulation to form the autonomous motivation and introjected regulation and external regulation to form the controlled motivation. Guay et al. (2008) have argued that using these broader categories of motivation, instead of referring to each type of regulation, enables to test more parsimonious models while still taking into consideration the distinction between the autonomous and controlled types of regulations introduced by SDT.

Data Analyses

Prior to analyses, the data set was checked for accuracy of data entry, missing values, and assumptions regarding normality. The preliminary analyses included the following: First, using dummy-coding (stay vs. dropout), the independent samples t-test was conducted on the mean scores of all the study variables to test for possible differences among those students who completed the questionnaires at two time points and those who only completed the questionnaires at Time 1. Second, the paired samples t-test was conducted to examine whether there were changes in mean scores over a one-year period. Also, Pearson product correlation coefficients were used to examine relationships between various dimensions of perceived teaching behaviors and autonomous motivation, and controlled motivation.

The main analyses included path analyses to test the direction of relationships between various dimensions of perceived teaching behaviors and students' different types of motivation using LISREL 8.51 software (Jöreskog & Sörbom, 1996). Specifically, eight separate path analyses were conducted involving each dimension of perceived teaching behavior and students' autonomous and controlled motivation. To conduct a single path analysis involving all eight perceived teaching behaviors in the model was considered to be impossible because of the problems with multicollinearity.[1] In every path analysis, four models were compared in

[1]The confirmatory factor analysis (CFA) with eight dimensions of perceived teaching behaviors demonstrated that correlations, although strong and significant (correlation coefficients ranging from .32 to .95), among the LSPE and PTF constructs were all significantly different from the unity, supporting discriminant validity of the constructs. According to Bagozzi & Kimmel (1995), the discriminant validity of the constructs was supported when the difference between unity and the value of the correlation exceeded 1.96 multiplied by the standard error of the correlation. The CFA for eight-factor model exhibited good fit to the data: $\chi^2(224) = 361.81$, $p = .001$, χ^2/df ratio = 1.62, CFI = .95, NNFI = .93, RMSEA = .035, 90% confidence interval (CI_{90}) for RMSEA range = .028 to .042. The eight-factor first-order CFA model was then compared with a second-order CFA model. This model was an extension of the first-order CFA model and specified two second-order latent factors. The first second-order latent factor accounted for the covariances between perceived teaching behaviors such as democratic behavior, teaching and instruction, situation consideration, social support, positive general verbal feedback, and positive nonverbal feedback as, according to Reeve and Jang (2006), specific components of autonomy-supportive teaching behaviors. The second second-order

order to investigate the relationships among dimension of perceived teaching behavior and two types of motivation. The first model estimated all stability effects (i.e. horizontal effects—the regression of the variable on itself over time) and cross-lag paths (i.e. how one variable at one point in time accounts for another variable at a second or later time) among the dimension of perceived teaching behavior and autonomous and controlled motivation, except the cross-lag paths leading prior autonomous motivation to subsequent controlled motivation and vice versa (see Figure 1). The cross-lag paths between autonomous motivation and controlled motivation were not tested because there is no theoretical rationale to postulate unidirectional or reciprocal relation between these variables. In the second and third model, the relative importance of the cross-lag paths linking the perceived teaching behavior to autonomous motivation and controlled motivation, respectively, was tested using the method advocated by previous researchers (e.g. Guay et al., 2008; Julien, Senécal, & Guay, 2009). Specifically, in model two, cross-lag paths among dimension of perceived teaching behavior and autonomous motivation were set to 0, while in model three, cross-lag paths among dimension of perceived teaching behavior and controlled motivation were set to 0. When the omission of cross-lag paths in either model led to a decrease in fit indices in terms of differences in chi-square values, as compared to a more general model (i.e. model one), then it can be argued that these cross-lag paths are potentially significant and need to be considered in the interpretation of the results. In model four, the importance of all cross-lag paths were estimated by setting all cross-lag paths to 0, leaving only stability or horizontal effects. Thus, the importance of the set of cross-lag paths was based on the results of models 1–4.

To assess the model fit, the Comparative Fit Index (CFI), the Non-Normed Fit Index (NNFI), and Root Mean Square Error of Approximation (RMSEA) were used. The values close to or greater than .95 for CFI and NNFI and values equal to .08 or less for RMSEA is indicative of an acceptable fit (Hu & Bentler, 1999). The difference in chi-square (χ^2) between two models was applied to determine whether the models were statistically different or not.

Results

Preliminary Analyses

The data screening revealed that 4.2 % of the data at Time 1 and 0.3 % of the data at Time 2 were missing. The Little's (1988) missing completely at random (MCAR) test indicated that the data were indeed missing completely at random at both Time 1 ($\chi^2 = 148.29$, df = 139, p = .28) and Time 2 ($\chi^2 = 13.98$, df = 11, p = .23). Since there were less than 5 % of missing data at both time points, the Expectation Maximization (EM) algorithm was implemented to impute the missing data, using missing value analysis in LISREL.

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latent factor accounted for the covariances between perceived teaching behaviors, such as autocratic behavior and negative nonverbal feedback as specific components of controlling teaching behaviors (Reeve & Jang, 2006). This second-order CFA merely approached the criteria for satisfactory fit proposed by Hu and Bentler (1999): $\chi^2(243) = 498.53$, $p = .001$, χ^2/df ratio = 2,05, CFI = .90, NNFI = .88, RMSEA = .056, CI_{90} for RMSEA range = .045 to .060. Based on these results, it was deemed to be justified to test the direction of relationships between each dimension of perceived teaching behavior and students' different types of motivation separately.

Using dummy-coding (stay vs. dropout), the independent samples t-test revealed no significant differences in mean scores of any of the study variables between students who took part in both data collection and those who did not, suggesting that attrition did not affect the results reported in this study. The paired samples t-test indicated that mean scores of most of the study variables remained stable over a period of one year. However, both perceptions of autocratic behavior and controlled motivation decreased significantly between Time 1 and Time 2 (see Table 1).

An inspection of the correlations, presented in Table 2, revealed that all eight perceived teaching behaviors were significantly and positively associated with autonomous motivation for the different measurement times, with the exceptions of autocratic behavior and negative nonverbal feedback that had significant and negative association with autonomous motivation. It is worth noting that the relationships between most of the perceived teaching behaviors and controlled motivation were not significant; however, perceived autocratic behavior and nonverbal types of feedback had significant and positive relationships with controlled motivation.

Main Analyses

The direction of relationships between different dimensions of perceived teaching behaviors and autonomous and controlled motivation were tested with various nested path-analytic models. Multivariate skewness (43.56, $p < .001$) and kurtosis (478.13, $p < .001$) estimates were significant, indicating that variables were highly abnormal. Since the variables were not normally distributed, the data was analyzed using the robust maximum likelihood estimation method, an analysis that adjusts the chi-square statistics and the standard errors under conditions of non-normality to prevent Type I error (Satorra & Bentler, 1988). Results of these path-analytic models are presented in Table 3.

First, results based on democratic behavior, autocratic behavior, situation consideration, positive general feedback, and positive nonverbal feedback provided support for the importance of cross-lag paths involving autonomous motivation but not those involving controlled

Table 1
Descriptive Statistics and Internal Reliability of the Study Variables (N = 330)

	Time 1			Time 2		
Variable	*M*	*SD*	α	*M*	*SD*	α
Democratic behavior	2.92	1.01	.78	3.01	.96	.79
Autocratic behavior	2.32	.80	.60	2.19*	.80	.69
Teaching and instruction	3.41	.81	.66	3.44	.78	.67
Situation consideration	3.40	.94	.77	3.39	.91	.80
Social support	3.45	.99	.79	3.47	.96	.81
Positive general feedback	3.18	.98	.77	3.27	.90	.75
Positive nonverbal feedback	2.60	.96	.65	2.65	.93	.67
Negative nonverbal feedback	2.24	1.01	.72	2.21	.96	.71
Autonomous motivation	3.41	.92	.87	3.45	.91	.88
Controlled motivation	2.29	.82	.77	2.15*	.84	.80

Note. All variables were measured on a 5-point scale. * $p < .01$.

Table 2
Correlations Among the Study Variables

Subscale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Democratic behavior T1	-																			
2. Autocratic behavior T1	-.54	-																		
3. Teaching and instruction T1	.59	-.48	-																	
4. Situation consideration T1	.66	-.54	.64	-																
5. Social support T1	.76	-.63	.68	.77	-															
6. Positive general feedback T1	.54	-.29	.42	.54	.56	-														
7. Positive nonverbal feedback T1	.45	-.19	.26	.36	.41	.54	-													
8. Negative nonverbal feedback T1	-.38	.45	-.26	-.40	-.45	-.17	-.02	-												
9. Autonomous motivation T1	.56	-.46	.54	.49	.61	.53	.42	-.27	-											
10. Controlled motivation T1	.07	.12	.01	-.13	-.02	.02	.13	.24	.23	-										
11. Democratic behavior T2	.45	-.35	.38	.37	.42	.34	.28	-.10	.41	-.02	-									
12. Autocratic behavior T2	-.40	.47	-.40	-.38	-.46	-.22	-.20	.25	-.28	.03	-.53	-								
13. Teaching and instruction T2	.37	-.33	.46	.36	.41	.26	.28	-.10	.31	-.01	.63	-.49	-							
14. Situation consideration T2	.37	-.34	.38	.42	.42	.30	.23	-.14	.27	-.07	.64	-.55	.68	-						
15. Social support T2	.47	-.48	.44	.46	.53	.36	.30	-.19	.36	-.09	.72	-.62	.70	.72	-					
16. Positive general feedback T2	.36	-.30	.36	.38	.41	.52	.39	-.13	.43	-.03	.51	-.40	.52	.51	.58	-				
17. Positive nonverbal feedback T2	.28	-.17	.27	.26	.25	.40	.47	.06	.33	.04	.43	-.22	.37	.35	.42	.65	-			
18. Negative nonverbal feedback T2	-.25	.37	-.17	-.21	-.30	-.11	.01	.46	-.17	.07	-.20	.47	-.19	-.23	-.35	-.26	.03	-		
19. Autonomous motivation T2	.40	-.36	.36	.35	.40	.38	.28	-.17	.56	.05	.54	-.41	.48	.44	.54	.60	.46	-.24	-	
20. Controlled motivation T2	.04	.12	-.09	-.06	-.09	.10	.10	.13	.17	.38	.07	.21	.01	-.03	-.05	.07	.25	.28	.22	-

Note. Bivariate correlations of .11 and above are significant at the $p < .05$; bivariate correlations of .14 and above are significant at the $p < .01$ level. T1 = first data collection (Time 1); T2 = second data collection (Time 2).

Table 3
Results of the Multiple Path-analytic Models

Models Tested	χ^2	df	CFI	NNFI	RMSEA	χ^2 diff./df diff.
Models with Democratic Behavior						
Model 1	4.93	2	.99	.95	.067	-
Model 2	32.00	4	.93	.75	.147	27.07** / 2
Model 3	6.68	4	.99	.98	.045	1.75 / 2
Model 4	32.68	6	.94	.84	.117	27.75** / 4
Models with Autocratic Behavior						
Model 1	7.70	2	.99	.90	.093	-
Model 2	19.45	4	.96	.86	.109	11.75** / 2
Model 3	11.12	4	.98	.95	.074	3.42 / 2
Model 4	25.84	6	.95	.88	.101	18.14** / 4
Models with Teaching and Instruction						
Model 1	11.52	2	.98	.84	.121	-
Model 2	17.21	4	.97	.88	.101	5.69 / 2
Model 3	16.24	4	.97	.90	.097	4.72 / 2
Model 4	23.85	6	.96	.89	.096	12.33** / 4
Model 5	13.06	4	.98	.92	.083	1.54 / 2
Models with Situation Consideration						
Model 1	5.03	2	.99	.94	.068	-
Model 2	11.87	4	.98	.92	.078	6.84* / 2
Model 3	5.38	4	1.00	.99	.032	0.34 / 2
Model 4	14.76	6	.97	.91	.080	9.73* / 4
Model 5	6.68	5	1.00	.99	.032	1.65 / 3
Models with Social Support						
Model 1	13.60	2	.98	.84	.133	-
Model 2	19.11	4	.97	.88	.108	5.51 / 2
Model 3	20.68	4	.97	.88	.113	7.08* / 2
Model 4	26.46	6	.96	.89	.102	12.86** / 4
Model 5	16.39	4	.97	.91	.097	2.79 / 2
Models with Positive General Feedback						
Model 1	2.76	2	1.00	.99	.034	-
Model 2	27.04	4	.95	.81	.133	24.28** / 2
Model 3	7.10	4	.99	.98	.049	4.34 /2
Model 4	28.91	6	.95	.88	.108	26.15** / 4
Models with Positive Nonverbal Feedback						
Model 1	4.54	2	.99	.95	.062	-
Model 2	15.54	4	.97	.89	.094	11.00** / 2
Model 3	5.48	4	1.00	.99	.034	0.93 / 2
Model 4	16.04	6	.97	.93	.072	11.50* / 4
Model 5	6.60	5	1.00	.99	.031	1.12 / 3
Models with Negative Nonverbal Feedback						
Model 1	5.90	2	.99	.92	.077	-
Model 2	8.23	4	.99	.95	.057	2.34 / 2

(*Continued*.)

Table 3. (*Continued*.)

Models Tested	χ^2	df	CFI	NNFI	RMSEA	χ^2 diff./df diff.
Model 3	7.00	4	.99	.97	.048	1.11 / 2
Model 4	10.22	6	.99	.97	.046	4.32 / 4

Note. * $p < .05$;** $p < .01$.

motivation. Specifically, results indicated that when cross-lag paths involving autonomous motivation were not estimated (i.e. were set to 0), this resulted in a significant increase in the chi-square value, whereas significant change in chi-square value was not followed when cross-lag paths involving controlled motivation were not estimated. Further, results based on democratic behavior, autocratic behavior, and positive general feedback revealed that there were significant reciprocal relationships between autonomous motivation and these three dimensions of perceived teaching behaviors. Moreover, results indicated that the positive influence of prior autonomous motivation on subsequent perceived democratic behavior and subsequent positive general feedback was stronger than the positive influence of prior perceived democratic behavior and prior positive general feedback on subsequent autonomous motivation. As for perceived autocratic behavior, the opposite trend was evident. That is, the negative influence of prior perceived autocratic behavior on subsequent autonomous motivation was stronger than the negative influence of prior autonomous motivation on subsequent perceived autocratic behavior. Standardized solutions of these models are presented in Figures 2, 3, and 4. Results based on situation consideration and positive nonverbal feedback revealed that not all cross-lag paths involving autonomous motivation were significant. Specifically, the path from prior perceived nonverbal positive feedback to subsequent autonomous motivation and path from prior autonomous motivation to subsequent perceived situation consideration was not significant. The non-significant perceived nonverbal positive feedback → autonomous motivation is consistent with previous study (Koka & Hein, 2005), as nonverbal feedback did not contribute to students' motivational

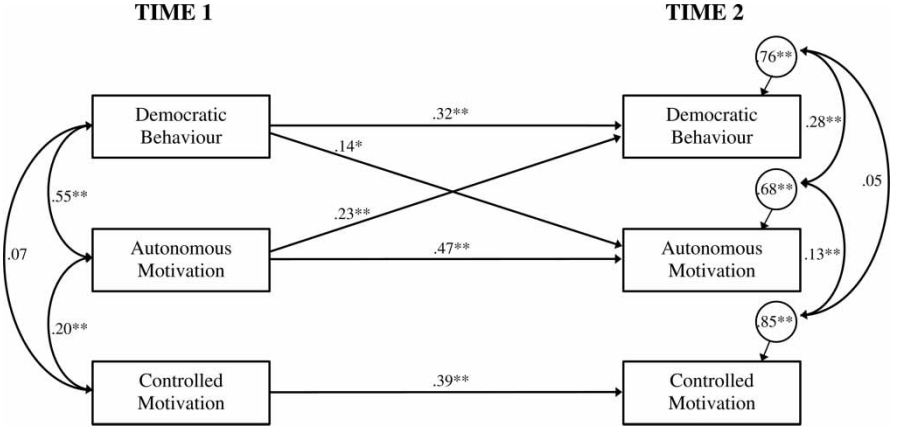

Figure 2. Results based on perceived democratic behavior ($^{*}p < .05$, $^{**}p < .01$).

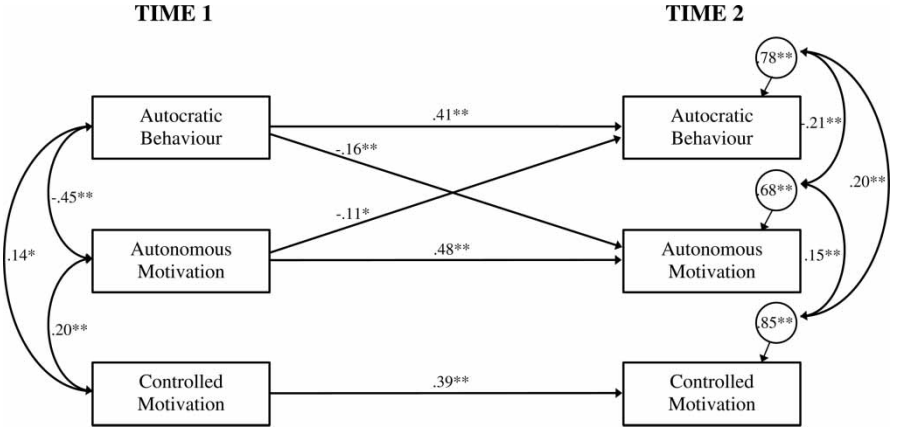

Figure 3. Results based on perceived autocratic behavior (*$p < .05$, **$p < .01$).

differences in PE, mainly due to teachers probably providing little nonverbal positive feedback. As for the non-significant autonomous motivation → perceived situation consideration, it is possible that a student may enjoy playing football only in PE and will be satisfied with the teacher's situational consideration behavior in that particular lesson, but will not be happy with the same kind of teacher behavior in a lesson where volleyball, for instance, is played. This contradiction may likely be a cause of non-significant path from autonomous motivation to perceived situation consideration. As a result, the fifth model was tested in which non-significant cross-lag paths involving autonomous motivation were excluded (see Model 5 for both situation consideration and positive nonverbal feedback shown in Table 3). The Model 5 for both situation consideration and positive nonverbal feedback revealed a good fit to the data (see Table 3) in that the chi-square was not significantly different from the less restricted model (i.e. Model 1). On this basis, results of the Model 5 for both models based on situation consideration and positive nonverbal feedback were selected as the best model tested. The standardized solutions for these models based on situation consideration and positive nonverbal feedback are presented in Figures 5 and 6, respectively. Specifically, results indicated that prior perceived situation consideration predicted subsequent autonomous motivation, whereas prior autonomous motivation predicted subsequent perception of teacher's nonverbal feedback and not vice versa.

Second, results based on teaching and instruction indicated no significant differences in chi-square values when cross-lag paths involving autonomous motivation in Model 2 and controlled motivation in Model 3 were set to 0 (see Table 3). However, when cross-lag paths involving autonomous motivation were omitted (i.e. in Model 2), the significant negative effect of prior teaching and instruction on subsequent controlled motivation emerged. Similarly, when cross-lag paths involving controlled motivation were omitted (i.e. in Model 3), the significant positive effect of prior teaching and instruction on subsequent autonomous motivation emerged. Moreover, results of Model 4 indicated that when all cross-lag paths were excluded, this resulted in significant increase in the chi-square value compared with Model 1. Therefore, the fifth model was tested in which paths leading prior teaching and instruction to subsequent autonomous and controlled motivation were evaluated. The Model 5 for teaching and instruction exhibited the best fit that approached

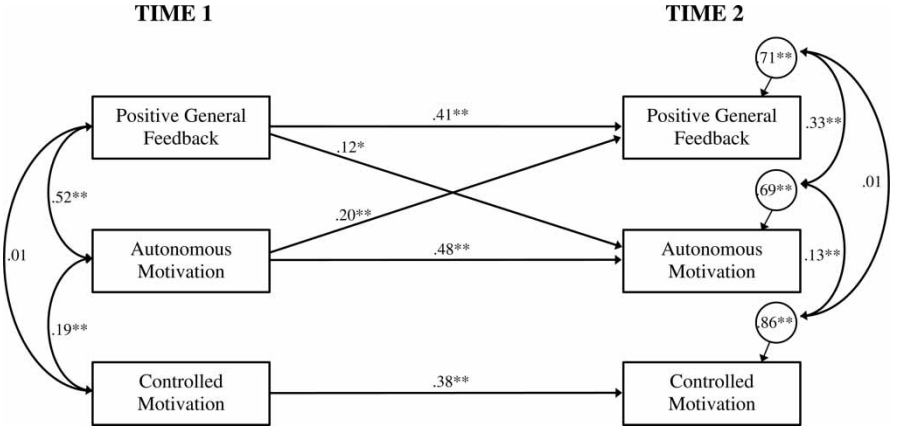

Figure 4. Results based on perceived positive general feedback (*$p < .05$, **$p < .01$).

the criteria of satisfactory fit (see Table 3), and the chi-square value was not significantly different from Model 1. The standardized solution for this model based on teaching and instruction is presented in Figure 7.

Third, results based on social support provided support for the importance of cross-lag paths involving controlled motivation but not those involving autonomous motivation. That is, results indicated that when cross-lag paths involving controlled motivation were set to 0, this resulted in a significant increase in the chi-square value, whereas it was not the case when cross-lag paths involving autonomous motivation were set to 0. Results, thus, revealed the significant negative influence of prior social support on subsequent controlled motivation. However, similar to the results based on teaching and instruction, when cross-lag paths involving controlled motivation were omitted, the significant positive influence of prior social support on subsequent autonomous motivation emerged. Thus, the fifth model was tested in which path leading prior social support to subsequent autonomous

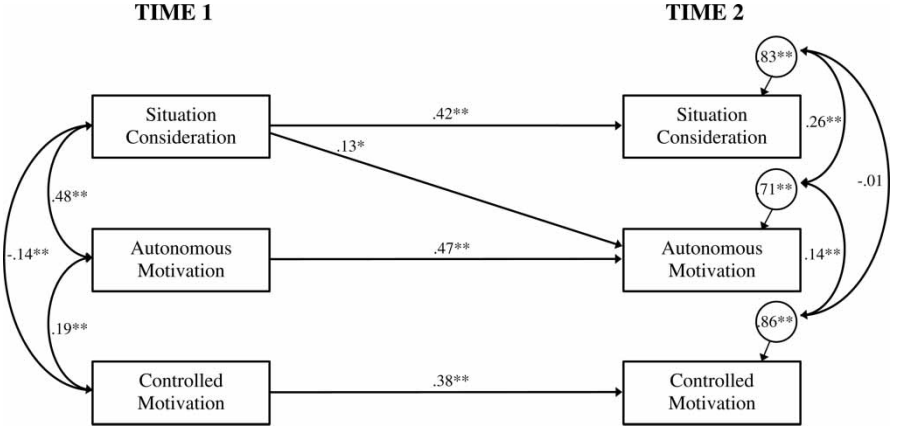

Figure 5. Results based on perceived situation consideration (*$p < .05$, **$p < .01$).

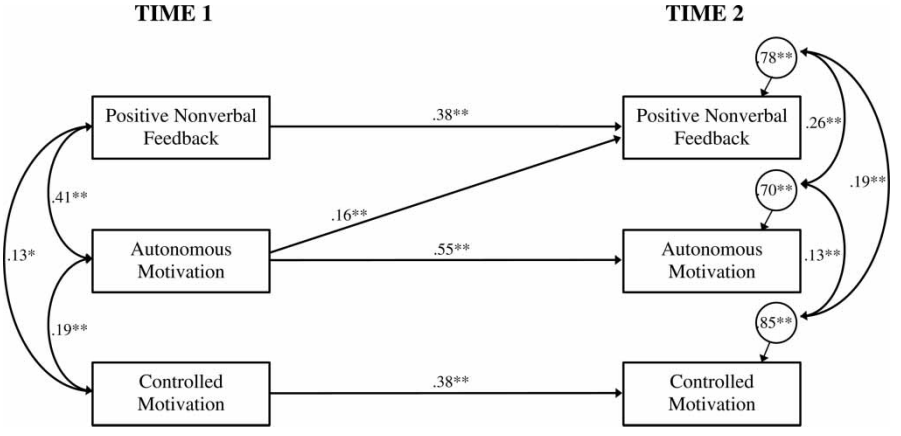

Figure 6. Results based on perceived positive nonverbal feedback (*$p < .05$, **$p < .01$).

motivation was evaluated along with path leading prior social support to subsequent controlled motivation. The Model 5, although approaching the criteria of good fit, exhibited the best fit with the chi-square value not being significantly different from Model 1. The standardized solution for this model based on social support is presented in Figure 8.

Fourth, results based on negative nonverbal feedback provided evidence that none of the cross-lag paths were significant and, therefore, were not deemed as important to be considered in the interpretation of the results. That is, fit indices of the stability or horizontal effects model (i.e. Model 4, Table 3) did not change substantially in terms of differences in chi-squared values compared with a less constrained model (i.e. Model 1).

Summing up, the results of cross-lagged path-analytic models revealed that perceived teaching behaviors, such as democratic behavior, autocratic behavior, positive general feedback, and students' autonomous motivation were reciprocally related over time. Furthermore, results indicated that prior perceived social support and teaching and instruction were related to higher levels of subsequent autonomous motivation and lower levels of controlled

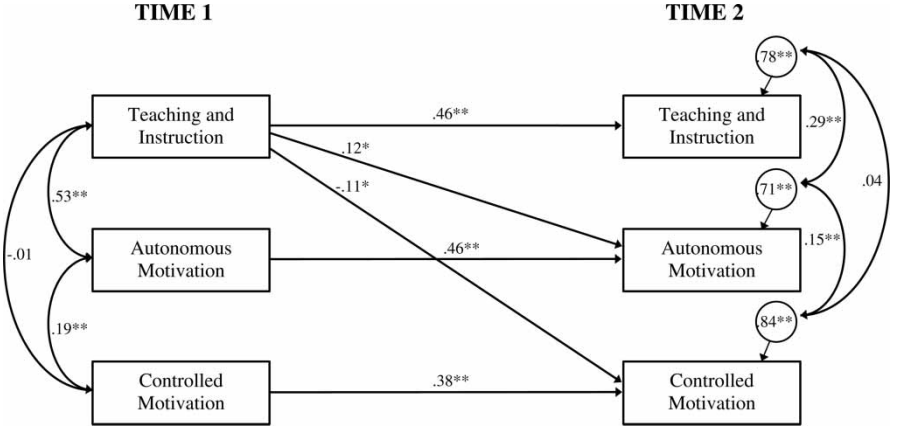

Figure 7. Results based on perceived teaching and instruction (*$p < .05$, **$p < .01$).

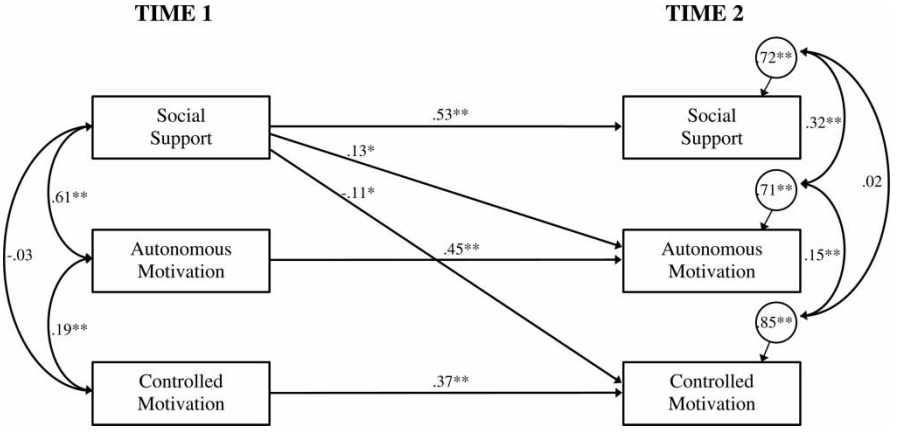

Figure 8. Results based on perceived social support (*$p < .05$, **$p < .01$).

motivation and not the reverse. Finally, results revealed that prior perceived situation consideration was related to higher levels of subsequent autonomous motivation, whereas prior autonomous motivation was related to higher levels of subsequent positive nonverbal feedback and not vice versa.

Discussion

The present study revealed that the direction of relationships between various dimensions of perceived teaching behaviors and students' autonomous and controlled motivation in PE is different. Results provided some support for both reciprocal and unidirectional relations. A possible explanation for discrepancies in the direction of relationships between various dimensions of perceived teaching behaviors and students' motivation might be the nature of the teacher-student interaction behind each teaching behavior.

Reciprocal Relationships Among Perceived Teaching Behaviors and Students' Motivation

Results indicated that students who perceived that their teachers included them in decision-making processes (i.e. adopting democratic behavior and avoiding an autocratic one) and provided them with positive general feedback, experienced a higher level of autonomous motivation in PE at Time 2. In addition, autonomously-motivated students perceived their teachers as exhibiting higher frequencies of democratic behavior and positive general feedback but lower frequencies of autocratic behavior at Time 2. These reciprocal relations are not surprising; as has been noted by Beutel (2010), there is a two-way interaction between teacher and student when the teacher includes that student into decision-making processes (i.e. asking students' opinions about lesson plans and allowing students to say what they think about it) and provides the student with positive feedback. The significant effect running from perceptions of those teaching behaviors to students' autonomous motivation corroborates one of the tenets of SDT (Deci & Ryan, 1985, 2000). That is, according to SDT, people are motivated to participate in activities when they feel a reasonable amount of choice and positive feedback about their

performance provided by significant others. The significant flow of influence running from students' autonomous motivation to perceptions of those teaching behaviors is consistent with results found in previous studies (Pelletier et al., 2002; Skinner & Belmont, 1993). That is, students who are highly motivated to engage in activities may feel that teachers respond to their performance with more positive behaviors. On the other hand, students with low levels of motivation may feel that teachers disregard them.

Unidirectional Relationships Among Perceived Teaching Behaviors and Students' Motivation

Results indicated that students who perceived that their teacher put emphasis on teaching and instructing, took into account students' abilities when planning activities and exercises (i.e. situation consideration), and exhibited interest and concern for the welfare of the students (i.e. social support) experienced a higher level of autonomous motivation in PE at Time 2 and not the reverse. These unidirectional relationships are not surprising; in the case of these teaching behaviors, the teacher uses mainly direct instructions and the flow of interaction runs from teacher to student rather than the reverse (Beutel, 2010). That is, the teacher is the one who says which game position should be played, what should be performed, and how. According to Beutel, the main goal of teacher-student interaction, in this case, is to teach a subject and achieve better results rather than to interact with students. The possible explanation for unidirectional relation among perceived social support and students' autonomous motivation could be that it is rather rare that there are close relationships between teachers and students at this age.

Results indicated that when students perceived more frequent teaching and instruction and social support from their teacher, they experienced a lower level of controlled motivation in PE at Time 2 and not the reverse. This suggests that PE teachers should continuously provide technical instructions to improve skill acquisition and to ask about the personal well-being of the students. These perceived teaching behaviors should result in a decrease in controlled types of motives of participation in PE.

Results also revealed that students who were autonomously motivated perceived their teachers as responding more frequently to students' good performance and effort with positive gestures (e.g. clapping hands, smiling, or patting on a shoulder) in PE at Time 2 and not vice versa. This is consistent with previous studies (Pelletier et al., 2002; Skinner & Belmont, 1993) that demonstrated how teachers tend to respond to students' performance with positive gestures that are motivated and have higher behavioral engagement. A possible reason for the non-significant effect of prior positive nonverbal feedback on subsequent autonomous motivation could be, as suggested by Koka and Hein (2005), that teachers obviously provide small amounts of nonverbal praise and encouragement.

Non-significant Relationships Among Perceived Teaching Behaviors and Students' Motivation

Results indicated no significant reciprocal or unidirectional relationship between perceived negative nonverbal feedback and students' autonomous and controlled motivation. Previous cross-sectional studies conducted in both competitive sport (Allen & Howe, 1998) and PE (Koka & Hein, 2005) contexts have shown that perceived negative nonverbal feedback did not significantly contribute to athletes/students' intrinsic motivation. Koka and

Hein explained this non-significant effect by suggesting that teachers do not often use negative nonverbal feedback as a response to poor performance, or students do not or do not want to notice it. However, in their cross-sectional study, Koka and Hagger (2010) found that perceived negative nonverbal feedback predicted students' self-determined motivation in PE. In their study, the self-determined motivation was viewed as self-determination index, and not autonomous and controlled motivation separately, using the method advocated by previous researchers (e.g. Hagger et al., 2005; Standage et al., 2006) to calculate the self-determination index. In the present study, correlational analyses revealed, however, that perceived negative nonverbal feedback was negatively associated with autonomous motivation and positively with controlled motivation at both Time 1 and Time 2 (see Table 2). Thus, PE teachers should avoid responding to students' poor performance by using gestures such as rolling of the eyes, shaking of the head, or displaying an angry face since, as has been suggested by Deci and Ryan (1985), all events that bear negative influence on individuals' perceptions of basic psychological needs for autonomy, competence, and relatedness will likely undermine their intrinsic motivation and self-determined motivation.

Limitations and Directions for Future Research

First, although results of the present study provided interesting and unique information about the direction of relationships between specific dimensions of perceived teaching behaviors and autonomous and controlled motivation in PE, the possibility still remains, as in any longitudinal studies attempting to establish relationships between variables, that there is a third variable that could explain the relations between the variables that are the focus of the model (Guay et al., 2008). Since it is not possible to incorporate all potential third variables into the model, one must be cautious while interpreting obtained relationships. Second, although it was emphasized to students that the questionnaire was designed to measure their general feelings about a teacher's behavior as well as reasons to participate in PE and not about one particular class, it is possible that the content of PE lessons may explain an important portion of variance in motivational orientations. That is, one student may only like to play basketball in PE, while another may only like to do gymnastics. Future studies, therefore, should include the effect of the PE class's content. Third, measures used in this study were all students' self-reports. Although caution should indeed be exercised when interpreting subjective ratings by students, researchers (e.g. Anderson & Walberg, 1974; Fraser, 1989; Scriven, 1988) have claimed that students' ratings about learning environments as well as teachers' behaviors are comparatively valid. It should also be noted that, in many cases, the cross-lag effects were rather small and this limits the degree to which the results can be generalized. Finally, the present study was conducted with secondary school students from one town in Estonia. The present sample, therefore, is not representative of the entire secondary school population in Estonia, also reducing the level to which results can be generalized.

Conclusions and Recommendations for Practice

In conclusion, a unique contribution of the present study is uncovering the mechanism by which various dimensions of perceived teaching behaviors and students' autonomous and controlled motivation in PE are interrelated. Results revealed that students' perceptions of teaching behaviors may be important in predicting their motivation, but also that students' motivation may influence the quality of interaction with teachers in PE.

From an applied perspective, given that adopting a teaching style that includes democratic decision-making, providing positive feedback and social support, and considering different situational factors while teaching students facilitates formation of subsequent autonomous motivational orientation, teachers should continuously focus on these teaching behaviors. Teachers should also bear in mind that students' motivational orientation may influence the way they interact with students. Results of the present study indicated that autonomously-motivated students perceived more frequent subsequent democratic behavior and positive general feedback but less frequent autocratic behavior from their teacher. This means that students who are already highly motivated in PE will become even more motivated. Those students, however, who initially had a lower level of motivation in PE, will probably experience a further decrease in their motivation. Therefore, in order to promote autonomous motivation among discouraged students, teachers should particularly involve them more in the decision-making process, provide them with positive general feedback and social support, and consider more closely their ability when assigning them to game positions.

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