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Temporal Relations Among Multidimensional Perceptions of Competence and Trichotomous
Achievement Goals in Physical Education

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1 **Abstract**

2 **Objectives:** The purpose of the present study was two-fold: (1) To empirically establish
3 whether young people differentiate their perceived competence in physical education (PE) in
4 terms of the self, mastery of tasks, and others, and (2) To examine longitudinal relations
5 between these three ways of defining perceived competence and trichotomous achievement
6 goals.

7 **Methods:** At the start of the study, students ($n = 227$ males, $n = 205$ females; M age = 13.18,
8 $SD = 0.87$ years) completed measures of mastery-approach, performance-approach and
9 performance-avoidance goals, along with other-, self- and mastery-referent forms of perceived
10 competence. The same measures were subsequently recorded three, six and nine months later.

11 **Results:** Analyses supported longitudinal factorial invariance for each goal and each type of
12 perceived competence. Partial support was found for the positive influence of other-referent
13 perceived competence on approach and avoidance performance goal adoption over time.

14 **Conclusion:** Young people can construe their competence in PE in various ways. Relative to
15 one's classmates, increases in other-referenced perceptions of competence can subsequently
16 lead to increased adoption of both performance goals.

17

18 **Keywords:** approach-avoidance achievement goals, perceived competence, physical education

19

1 Temporal Relations Among Multidimensional Perceptions of Competence and Trichotomous
2 Achievement Goals in Physical Education

3 Recent theorizing has proposed that competence should serve as the conceptual
4 centerpiece of research into achievement motivation. Assigning competence a core role will,
5 according to Elliot and Dweck (2005), help to bring clarity and parsimony to the achievement
6 motivation literature because competence can be defined and operationalized in precise ways.
7 A number of different theories of achievement motivation have incorporated the competence
8 concept, including achievement motive and attribution frameworks. One perspective that has
9 received a great deal of empirical attention during the past twenty-five years, in both education
10 and physical domains, is achievement goal theory (Dweck, 1986; Elliot, 1997, 1999; Nicholls,
11 1984, 1989). Recently, Elliot and co-workers have sought to clarify the conceptualization of
12 competence within the achievement goal framework, as well as to propose the nature of the
13 relationships between competence and goals (see Elliot, 1999, 2005; Elliot & Church, 1997;
14 Elliot & Harackiewicz, 1996). However, limited empirical attention has focused on the
15 interrelationships between goals and competence in the physical domain using this
16 contemporary perspective. Moreover, the extant body of literature has largely failed to take into
17 account the more precise ways in which competence may be defined when testing associations
18 with goals. In particular, from a developmental perspective, we know little about the
19 transactional nature of relations and whether bidirectional relationships exist (Sameroff, 2009).
20 The present study tested the direction and magnitude of relations between young people's
21 perceived competence and goal striving in school physical education (PE) over time. In line
22 with contemporary theory (Elliot, 2005), relations were examined between goals and more
23 nuanced definitions of competence.

24 **Perceptions of Competence and Trichotomous Achievement Goals**

1 The work of Elliot and associates adopts a motivational analysis of competence and
2 therefore examines how competence energizes and directs individuals' behavior in settings
3 where competence is salient. Competence is viewed as a basic fundamental psychological need
4 that activates behavior (Elliot, McGregor, & Thrash, 2002). However, as a consequence of
5 experience and socialization, individuals develop the need not just to develop or demonstrate
6 competence but to avoid developing or displaying incompetence. Importantly, Elliot and his
7 colleagues (Elliot, 1999, 2005; Elliot & McGregor, 2001; Elliot et al., 2002) distinguish three
8 standards of competence that individuals may use in evaluating performance: "absolute (the
9 requirements of the task itself), intrapersonal (one's own past attainment or maximum potential
10 attainment), and normative (the performance of others). That is, competence may be evaluated,
11 and therefore defined, according to whether one has acquired understanding or mastered a task,
12 improved one's performance or fully developed one's knowledge or skills, or performed better
13 than others" (Elliot & McGregor, 2001, p.501). Achievement goal research in the domain of
14 sport and physical activity has ignored these separate standards by which competence can be
15 defined, although researchers have occasionally incorporated these distinct facets within
16 measures of goal attainment. That is, attainment can be judged in terms of whether individuals
17 perceive task mastery, self-improvement or superiority over others (Amiot, Gaudreau, &
18 Blanchard, 2004; Soucy Chartier, Goudreau, & Fecteau, 2011). Assessment of individuals'
19 level of perceived competence per se has combined self-referent and norm-referent items
20 within the same measure or has focussed exclusively on normative items. Moreover, commonly
21 used items and response scales have been vague with respect to the definition of competence
22 (e.g., "How good are you at?"; "Not at all good – Very good"). Consequently, relationships
23 between specific types of competence perceptions and goals remain poorly understood.

24 In the trichotomous achievement goal framework, three achievement goals are posited
25 to channel the general need to develop competence/avoid incompetence into striving for

1 desirable outcomes or striving to avoid aversive events and possibilities (Elliot, 1999). Hence,
2 goals represent the aims of individuals' behavior and these approach- and avoidance-oriented
3 aims emerge, in part, from perceptions of competence (Elliot & Church, 1997; Elliot & Thrash,
4 2001). A mastery-approach (MAp) goal focuses on developing self- and mastery-referent
5 competence, a performance-approach (PAP) goal focuses on demonstrating norm-referent
6 competence, and a performance-avoidance (PAv) goal focuses on avoiding demonstrating
7 normative incompetence. Examples in the physical domain include: trying to improve one's
8 100 metre freestyle time (MAp); trying to beat an opponent in badminton (PAP); and striving to
9 avoid finishing last in a football tournament (PAv).

10 **Relations Between Perceived Competence and Achievement Goals**

11 Competence perceptions are conceptualized by Elliot and colleagues to directly
12 determine adoption of goals. Approach goals are theorized to emerge from higher perceptions
13 of competence, whereas lower perceptions of one's competence are posited to bring about the
14 adoption of avoidance goals (Elliot, 1999; Elliot & Church, 1997). In PE, individuals with high
15 perceived competence are likely to have received positive feedback and praise for their efforts
16 and achievements from their teachers and peers, and thus may be more likely to seek further
17 improvement and normative success. On the other hand, those individuals for whom criticism
18 and embarrassment have led to low perceptions of competence are more likely to seek to avoid
19 further negative outcomes and comparisons in PE classes. Although support for proposed
20 relationships has been found in the educational domain (e.g., Elliot & Church, 1997), research
21 in the physical domain has yielded mixed findings (e.g., Morris & Kavussanu, 2008; Stevenson
22 & Lochbaum, 2008; Warburton & Spray, 2008). Perceived competence has been positively
23 associated with PAv goals as well as PAP goals, suggesting that individuals who report
24 confidence in their abilities nevertheless strive to avoid normative failure because, in so doing,
25 they are more likely to increase their chance of success (see Covington, 1992).

1 In terms of the physical domain, achievement goal researchers have also posited paths
2 from performance goals to perceived competence (e.g., Goudas, Biddle, & Fox, 1994),
3 suggesting a direction of influence from goals to perceived competence. This direction of
4 influence stands in contrast to the framework proposed by Elliot and co-workers which clearly
5 views perceived competence to determine goals. Nevertheless, it is plausible that the aim of
6 individuals' behavior affects how they feel about their competence. For example, pursuing
7 MAp goals, with their emphasis on absorption in the task and high effort, may result in
8 enhanced self-referent competence. Consequently, researchers should seek to clarify whether
9 competence underpins goals, whether goals underpin competence, or whether bidirectional
10 effects occur. In order to achieve this aim, studies need to incorporate at least two measurement
11 waves.

12 To date, however, studies of competence perceptions and goals in the physical domain
13 have overwhelmingly adopted a cross-sectional design (for a review, see Biddle, Wang,
14 Kavussanu, & Spray, 2003). We know little, for example, about the stability or continuity of
15 competence perceptions and goals over time in different physical contexts and whether change
16 in one construct impacts on change in another construct. That is, the transactional nature of the
17 relationships between goals and competence has not received attention. For example, does
18 change in one's perceived normative competence predict change in the adoption of PAp goals
19 at a subsequent time point or vice-versa? Is full cross-prediction in evidence, whereby residual
20 change in perceived competence and goals predicts subsequent residual change in goals and
21 perceived competence respectively? Depending on the time interval of interest, PE students can
22 encounter several compulsory activities with different classmates and teachers across occasions
23 of measurement. The PE context, therefore, represents a unique physical setting in which to
24 examine motivational phenomena among young people over time.

25 **The Present Study**

1 The present investigation sought to examine temporal relations between perceived
2 competence and trichotomous achievement goals within the context of school PE. In line with
3 Elliot's (1999, 2005) multidimensional conceptualization of competence, our first aim, utilizing
4 confirmatory factor analytic procedures, was to determine students' competence perceptions
5 from three standards: self-referent (intrapersonal), mastery-referent (absolute), and other-
6 referent (normative). Given acceptable factorial invariance of the different types of perceived
7 competence over time, our second aim was to assess the relationships between the three types
8 of perceived competence and the three goals across four waves of measurement.

9 We anticipated that temporal patterns of stability and change would differ across types
10 of perceived competence and goals. When students change curriculum activity, the new activity
11 represents an opportunity to develop self- and mastery-referent competence to a lesser or
12 greater extent. In addition, it is possible that the perceived normative ability of class members
13 changes due to factors such as previous experience and rate of learning, leading to variability in
14 normative competence scores across activities. Similarly, different activities may promote the
15 adoption of particular goals (e.g., overtly competitive team games versus typically more
16 individualistic activities such as gymnastics and health and fitness). Given that, within Elliot's
17 framework, competence perceptions represent one antecedent among an array of potential
18 antecedents that differentially relate to achievement goal adoption, we expected relations
19 between perceived competence and goals to be moderate in magnitude (Elliot, 1999, 2005). In
20 accordance with theory and research, we also hypothesized that perceptions of competence
21 would be positively associated with approach goals (Elliot, 1999, 2005; Elliot & Church,
22 1997).

1 **Method**

2 **Participants**

3 At the first measurement wave, 432 students (male $n = 227$, female $n = 205$) from PE
4 classes in Years 7, 8 and 9 of a state comprehensive high school in East England, United
5 Kingdom, took part in the research. Participants were aged between 11 and 15 years ($M =$
6 13.18 , $SD = 0.87$ years) at wave 1. The socio-economic circumstances of the students that
7 attended the school were below the national average. Less than 5% of students came from
8 minority ethnic backgrounds or spoke English as an additional language (Office for Standards
9 in Education, 2007, p. 3). A team of two female and two male teachers taught compulsory PE
10 classes, each typically comprising 30 students.

11 **Procedures**

12 Ethical approval for the research procedures, which complied with the guidelines of the
13 British Psychological Society, was obtained from the relevant institutional body. Permission for
14 conducting the research was sought from the head teacher and head of physical education at the
15 school. Parental consent was obtained through distribution of letters prior to data collection.
16 Following an introduction to the purpose of the research, informed assent was given by
17 participants through the completion of a willingness to participate form. All parents provided
18 consent and no student refused to take part or asked for their data to be subsequently
19 withdrawn. All procedures took place prior to a normal curriculum PE lesson. Participants were
20 given an explanation of how to complete each section of the questionnaire and were provided
21 with the opportunity to ask any questions. All participants were assured that the information
22 collected would remain confidential and would have no effect on their PE report. Each
23 participant responded anonymously to the questionnaire which took approximately 20 minutes
24 to complete. However, knowledge of each participant's class/teacher, date of birth and gender

1 allowed for matching of responses at later measurement waves. The questionnaires were
2 counterbalanced prior to distribution. The first wave of data collection took place in April and
3 all procedures were repeated in July of the same school year and again in October and January
4 of the following academic year.

5 **Measures**

6 Each participant completed a questionnaire that collected the following information.

7 *Personal details.* Three items relating to form group, date of birth, and gender comprised this
8 section of the questionnaire.

9 *Goal adoption.* Goal adoption was assessed using three sub-scales from the Achievement Goal
10 Questionnaire for Sport (AGQ-S, Conroy, Elliot, & Hofer, 2003). The individual item stem of
11 ‘In PE/Sport what are your main concerns?’ preceded the items. The nine items were answered
12 on a seven-point Likert scale that ranged from not at all true of me (1) to very much like me
13 (7). Three items assessed each type of goal. Sample items included, ‘It is important for me to
14 perform as well as I possibly can’ (MAp), ‘It is important to me to do well compared to others’
15 (PAp), ‘I just want to avoid performing worse than others’ (PAv). The fourth sub-scale of
16 mastery-avoidance (MAv) was not utilized in the present study owing to the conceptual and
17 empirical limitations of the AGQ-S items (for a full discussion, see Elliot & Murayama, 2008).
18 Support for the factor structure of the AGQ-S and the reliability and validity of the MAp, PAp
19 and PAv goals has been established (Conroy, Elliot, et al., 2003).

20 *Perceived competence.* This was assessed using six items answered on a five-point Likert scale
21 that ranged from strongly disagree (1) to strongly agree (5). Two items assessed perceived
22 competence (PC) relating to mastery of the task (PC Mastery) (‘I am often able to successfully
23 complete the activities I am set in PE’, ‘The activities that my teacher sets in PE I can usually
24 do well’). Two items assessed PC relating to the self (PC Self) (‘I can perform tasks and skills

1 in PE better than I used to', 'I am better at activities in PE than I used to be') and two items
2 assessed PC relating to others (PC Other) ('I am better at PE than others in my class', 'I am one
3 of the best at PE in my class').

4 **Data Analysis**

5 All analyses were carried out using EQS 6.1 software (Bentler & Wu, 2002). Logistic
6 regression analyses revealed that the pattern of missing data was not significantly associated
7 with participants' perceived competence or achievement goal scores at the start of the study.¹
8 All analyses employed full information maximum likelihood estimation techniques. Given that
9 the normalized estimate of Mardia's coefficient of multivariate kurtosis was high (lowest value
10 for achievement goals was 29.91 and for PC 12.37), the robust maximum likelihood estimation
11 procedure was used.

12 ***Preliminary analyses: Factorial validity and longitudinal factorial invariance.*** In order to
13 assess the factorial validity of the new measure of perceived competence, a series of nested
14 models testing alternative structures was analysed across time. These analyses assessed whether
15 the a priori factor structure was evident at each wave of measurement. Specifically, four
16 alternative models were examined; a unidimensional (one factor), dichotomous (two factors:
17 self/mastery and other), trichotomous (three factors: self, mastery, and other), and hierarchical
18 model (four factors: a second-order PC factor underpinned by self, mastery, and other first-
19 order factors). In addition, the factor structure of goals, as assessed by the AGQ-S, was
20 examined across time.

21 Following confirmatory factor analysis (CFA), the longitudinal factorial invariance
22 (LFI) of achievement goals and types of PC was assessed using six separate models, one for
23 each achievement goal (MAp, Pap, and PAv), and one for each type of PC (other, self, and
24 mastery). In line with research conducted in the physical domain, the LFI of the individual
25 models was assessed using a series of nested models with progressively more constrained

1 model parameters (see Conroy, Elliot, et al., 2003; Conroy, Kaye, & Coatsworth, 2006;
2 Conroy, Metzler, & Hofer, 2003).

3 ***Main analyses: Temporal relations between perceived competence and achievement goals.*** A
4 series of structural equation models was examined to test the temporal relations between the
5 three types of PC and each of the three achievement goals. The procedures for these analyses
6 were informed by developmental theory and empirical research in the physical domain (Conroy
7 & Elliot, 2004; Sameroff, 2009). Specifically, we tested separate models for each achievement
8 goal to reduce the complexity of the results and because the scales may be used independently
9 of each other in research settings (Conroy, Elliot et al., 2003). Corresponding item
10 uniquenesses across waves of measurement and the latent factors at wave one were allowed to
11 covary. Factor loadings and item uniquenesses were constrained to be invariant over time,
12 however, the covariance of the within-time factor disturbances was freely estimated at waves
13 two, three and four. Four nested models were specified (see Figure 1). 1) The no cross
14 prediction (stability) model established paths only between each latent variable and the
15 subsequent corresponding latent variable (i.e., all cross-lagged paths were fixed to zero); 2) In
16 addition to the paths of the no cross prediction model, the second model added directional paths
17 from PC to achievement goals (e.g., self-referent PC at time 2 to MAp goals at time 3). This
18 model was labelled the PC-Goals model; 3) In addition to the paths of the no cross prediction
19 model, the third model, referred to as the Goals-PC model, added directional paths from
20 achievement goals to PC (e.g., PAp goals at time 3 to other-referent PC at time 4); 4) In the
21 final model, paths were established between each latent variable and the subsequent
22 corresponding latent variable and from early PC or goals to subsequent goals and PC
23 respectively (i.e., all cross-lagged paths were freely estimated). This model was referred to as
24 the full cross prediction model and served as the baseline model for model comparisons as it
25 estimated the most non-zero paths. In the testing of the temporal relations between PC and

1 achievement goals, if the PC-Goals or Goals-PC models were revealed to be plausible
2 alternatives based on comparison of model fit with the full cross prediction model, they were
3 then examined against the no cross prediction model. This final model comparison examined
4 whether any additional constraints (i.e., fixing the cross-lagged paths to zero) could be imposed
5 on the model without significant loss of fit (cf. Conroy & Elliot, 2004).

6 INSERT FIGURE 1 HERE

7 *Evaluation of model fit.* In all analyses, model fit was evaluated using comparisons of absolute
8 (chi-square, consistent version of Akaike's information criterion [CAIC], root mean square
9 error of approximation, [RMSEA], standardized root mean square residual, [SRMR]) and
10 relative (non-normed fit index, [NNFI], comparative fit index [CFI]) fit indices. In line with Hu
11 and Bentler's (1999) recommendations, values of ≥ 0.90 and ≥ 0.95 for the NNFI and CFI were
12 taken as representing an acceptable and good fit to the data respectively. Values of ≤ 0.6 and \leq
13 0.8 were taken as indicating good model fit for the RMSEA and SRMR respectively. Scaled
14 chi-square difference tests were also used in conjunction with these fit indices to assess which
15 of the nested models showed better fit to the data (Satorra & Bentler, 2001).

16 Results

17 Descriptive statistics and internal consistency estimates for each of the three achievement goals
18 and types of PC are presented in Table 1. Factor correlations between all study variables across
19 all measurement waves are shown in Table 2. Each scale exhibited acceptable internal
20 consistency in that Cronbach's alpha exceeded the 0.70 criterion at each wave of measurement.
21 Correlations among the three types of perceived competence were less than unity (range = .40
22 to .82), supporting the notion of distinct but related definitions of competence. Correlations
23 among the three achievement goals ranged from .55 to .95. In particular, both performance
24 goals were strongly and positively correlated at each time point.

25 INSERT TABLES 1 AND 2 HERE

1 **Preliminary Analyses: Factorial Validity and Longitudinal Invariance**

2 **Perceived competence.** The CFA results for the PC questionnaire indicated that the
3 hypothesized factor structure, three separate but correlated factors, exhibited a good fit to the
4 data across all measurement occasions [$SB\chi^2(186) = 197.56, p > .05$; NNFI = .994; CFI = .996;
5 SRMR = .031; RMSEA (90% CI) = .015 (.000-.031)]. Relative and absolute fit indices were
6 superior to alternative factor structures. The dichotomous model of PC revealed acceptable
7 goodness of fit, but scaled chi-square difference test showed this model to be inferior to the
8 trichotomous model. The one PC factor model and the hierarchical model showed poor fit. In
9 the three factor model, all factor loadings exceeded .68 and each item loaded significantly on
10 its hypothesized latent variable at all measurement occasions.

11 The LFI analyses to assess the structural stability and invariance of responses to the three sub-
12 scales of the PC questionnaire showed that according to the absolute fit criteria, PC Mastery
13 achieved weak factorial invariance whereas PC Other and PC Self achieved strong factorial
14 invariance. However, each PC factor achieved strict factorial invariance with respect to relative
15 fit indices. In summary, the CFA analyses revealed that all further analyses should utilize the
16 three factor model of PC (i.e., PC Other, PC Self and PC Mastery) while the LFI analyses
17 revealed that the three types of PC exhibited acceptable longitudinal factorial invariance
18 (Meredith & Horn, 2001).²

19 **Achievement goals.** Given the higher inter-factor correlations among the two performance
20 goals over time, the fit indices of a series of nested models were examined. The CFA results
21 revealed that the a priori factor structure of the trichotomous achievement goal framework, that
22 is three separate but correlated goals, exhibited a good fit to the data across measurement waves
23 [$SB\chi^2(528) = 689.88, p < .001$; NNFI = .956; CFI = .963; SRMR = .050; RMSEA (90% CI) =
24 .034 (.026-.040)]. Relative and absolute fit indices were superior to alternative factor structures
25 (e.g., PAp and PAv items comprising one factor along with a separate MAp factor;

1 trichotomous model with the correlation between performance goals constrained to 1). In the
2 trichotomous model, all factor loadings exceeded .61 and each item loaded significantly on its
3 hypothesized latent variable at each wave of measurement.

4 The LFI analyses to assess the structural stability and invariance of responses to the
5 three achievement goal sub-scales showed that according to the absolute fit criteria, the MAp
6 and PAv factors achieved weak factorial invariance and the PAp factor achieved strong
7 factorial invariance. However, due to the influence of sample size on these indices, it is also
8 necessary to assess the factorial invariance of the models in terms of the relative fit criteria
9 (Marsh, Balla, & McDonald, 1988). Each achievement goal model achieved strict factorial
10 invariance with respect to relative fit indices. In summary, these analyses revealed that the three
11 achievement goals exhibited acceptable longitudinal factorial invariance (Meredith & Horn,
12 2001).³

13 **Main Analyses: Temporal Relations between Perceived Competence and Achievement** 14 **Goals**

15 The temporal relations among the three types of PC and the three achievement goals
16 were examined using a series of structural equation models. Tables 3-5 show the absolute and
17 relative fit indices and the nested model comparisons for each type of PC with each of the three
18 achievement goals.

19 ***PC and MAp goals.*** Table 3 shows that models for PC Mastery and PC Self exhibited
20 acceptable to good fit to the data, whereas the models for PC Other and MAp goals generally
21 did not show as good fit indices (notably model CAIC, NNFI and RMSEA). The nested model
22 comparisons showed that model fit did not significantly decrease when paths which originate in
23 early PC (Self or Mastery) or MAp goals and predict subsequent MAp goals or PC (Self or
24 Mastery) respectively were constrained to zero. There was also no significant decrease in
25 model fit when comparing the PC-Goals and Goals-PC models with the no cross prediction

1 model. It was therefore concluded that the no cross prediction model (i.e., non-significant
2 prospective paths) was more parsimonious and was the best model for PC Self/Mastery and
3 MAp goals.

4 INSERT TABLE 3 HERE

5 ***PC and PAp goals.*** Table 4 shows that each model exhibited a good fit to the data for each type
6 of PC with PAp goals. The nested model comparisons for PC Other with PAp goals showed
7 that model fit decreased significantly with the removal of paths which originate in early PC
8 Other and predict subsequent PAp goals, but not with the removal of paths which originate in
9 early PAp goals and predict subsequent PC Other. It was therefore concluded that for PC Other
10 and PAp goals, the best model was the PC-Goals model, whereby paths originating in early PC
11 Other predict subsequent PAp goals. The standardized parameter estimates for PC Other and
12 PAp goals are presented in Figure 2 and show that individuals with positive change scores in
13 PC Other at Time 2 increased adoption of PAp goals at Time 3.

14 For PC Self and PC Mastery and PAp goals, the nested model comparisons showed that
15 model fit did not significantly decrease when paths which originate in early PC (Self and
16 Mastery) or PAp goals and predict subsequent PAp goals or PC (Self and Mastery) respectively
17 were constrained to zero. There was also no significant decrease in model fit when comparing
18 the PC-Goals and Goals-PC models with the no cross prediction model. It was therefore
19 concluded that the no cross prediction model (i.e., non-significant prospective paths) was more
20 parsimonious and was the best model.

21 INSERT TABLE 4 AND FIGURE 2 HERE

22 ***PC and PAv goals.*** Each model exhibited a good fit to the data for each type of PC with PAv
23 goals (see Table 5). The nested model comparisons for PC Other with PAv goals showed that
24 model fit decreased significantly with the removal of paths which originate in early PC Other
25 and predict subsequent PAv goals, but not with the removal of paths which originate in early

1 PAv goals and predict subsequent PC Other. It was therefore concluded that for PC Other with
2 PAv goals, the best model was the PC-Goals model, whereby paths originating in early PC
3 Other predict subsequent PAv goals. The standardized parameter estimates for PC Other and
4 PAv goals are presented in Figure 3 and show that individuals with positive change scores in
5 PC Other at Time 2 increased adoption of PAv goals at Time 3.

6 Finally, for PC Self and PC Mastery and PAv goals, the nested model comparisons
7 showed that model fit did not significantly decrease when paths which originate in early PC
8 (Self and Mastery) or PAv goals and predict subsequent PAv goals or PC (Self and Mastery)
9 respectively were constrained to zero. There was also no significant difference in model fit
10 when comparing the PC-Goals and Goals-PC models with the no cross prediction model. It was
11 therefore concluded that the no cross prediction model (i.e., non-significant prospective paths)
12 was more parsimonious and was the best model.

13 INSERT TABLE 5 AND FIGURE 3 HERE

14 In sum, these results indicated differential temporal patterns among types of perceived
15 competence and the three achievement goals of the trichotomous goal framework. Findings for
16 PAp and PAv goals were similar in that PC Other was shown to be a moderately strong
17 predictor of both goals, whereas the no cross prediction model was the best fitting for both PC
18 Mastery and PC Self and the three goals.

19 Discussion

20 The present study sought to examine temporal relations between different types of
21 perceived competence and approach-avoidance achievement goals within the context of school
22 PE. More specifically, we first set out to establish support for the factorial validity of three
23 types of perceived competence: self-improvement in PE activities, capacity to fulfil/master
24 tasks set by the teacher, and normative comparisons of ability with classmates. Our second aim
25 was to assess the magnitude and direction of relationships among these different competence

1 perceptions and the achievement goals across four time points spanning a period of nine
2 months.

3 The present research provides initial insight into young people's capacity to distinguish
4 different types of perceived competence in the PE context, providing support for recent
5 theorizing (Elliot, 1999, 2005; Elliot & Dweck, 2005). Each definition of competence exhibited
6 acceptable internal consistency and strict factorial invariance across measurement occasions.
7 Previous research in the physical domain has typically examined perceived competence as a
8 unidimensional factor. In the current study, the three-factor model demonstrated superior fit
9 indices when compared with alternative models. We suggest that identifying more nuanced
10 perceptions of competence will further knowledge of the motivational consequences for
11 individuals holding high or low perceptions. With regard to the present investigation, we
12 examined the effects of changes in students' specific competence perceptions on changes in
13 goal adoption in PE (Elliot, 1999, 2005). However, in line with research and theory (e.g.,
14 Goudas et al., 1994; Sameroff, 2009), we tested alternative patterns of temporal relations.

15 Continuity was demonstrated for the three types of perceived competence and the three
16 achievement goals across all occasions of measurement. These continuities reflect rank-order or
17 relative stability in the corresponding constructs. However, PE represents a unique setting in
18 which young people pursue a range of different physical activities over time. Consequently, we
19 expected to see inter-individual differences in competence perceptions and goals as students
20 encountered new activities in differing environments.

21 There was some support for the theoretical proposition (Elliot, 1997, 1999; Elliot &
22 Church, 1997; Elliot & Harackiewicz, 1996) that perceived competence influences the adoption
23 of goals. The PC-goals model was shown to be the better fitting model for PC Other with PAp
24 goals and for PC Other with PAv goals. Students who increased their rank-order position in
25 terms of perceptions of normative competence also increased their relative position in terms of

1 both types of performance goals between the second and third measurement waves. However,
2 this relationship was not found between the third and fourth waves, which could be a result of
3 the change of PE activities during this time frame. In future, studies need to consider more
4 explicitly the influence of changing PE activities on the self-perceptions and goals of young
5 people. It was also apparent that, across waves two and three, students who reported greater
6 increases in perceptions of norm-referenced competence relative to their classmates also
7 reported greater adoption of goals focussed on avoiding being incompetent compared to others.
8 This relationship is counter to the theoretical propositions of Elliot and co-workers, and may be
9 explained by the high correlation between the performance goals at all time points.
10 Consequently, the finding of a positive relationship between normative perceived competence
11 and PAV goals should be viewed with caution, however, it is consistent with emerging evidence
12 in education and PE contexts (Jagacinski, Kumar, Boe, Lam, & Miller, 2010; Wang, Biddle, &
13 Elliot, 2007; Warburton & Spray, 2008). The positive influence of normative perceived
14 competence on PAV goals may also be a consequence of the perception of classroom and PE
15 settings as particularly performance- or ego-involving (i.e., characterized by evaluation of
16 ability and greater recognition and attention given to the normatively more able; Ames, 1992).
17 Thus, further work is warranted on the influence of the context on the relationship between
18 normative perceived competence and the adoption of PAV goals (Jagacinski et al., 2010).

19 The present study found little support for higher perceptions of competence predicting
20 increased adoption of MAp goals. When examining MAp goals, the no cross-prediction model
21 was the preferred model for both PC Self and PC Mastery. Other antecedents may moderate the
22 relationship of perceived competence with MAp goals. One candidate is likely to be implicit
23 theories of athletic ability (Biddle, Wang, Chatzisarantis, & Spray, 2003; Dweck, 1999).
24 Researchers should examine the proposition that high perceived competence in conjunction

1 with a view of PE ability as acquirable and increasable is more likely to facilitate the adoption
2 of MAp goals than high perceived competence combined with a fixed, entity view of ability.

3 **Limitations, Future Directions, and Conclusions**

4 The current study provides an initial attempt to examine the dynamic relationships
5 among constructs drawn from contemporary achievement goal theory, using a transactional
6 perspective to identify the influence of ‘change on change’ (Sameroff, 2009). We identified
7 specific time periods when increased perceptions of normative competence predicted increased
8 adoption of PAp and PAv goals. Such findings are important because they clarify the direction
9 of influence whereby the predictor variable clearly precedes the criterion variable. However,
10 noting that relative increases in perceived competence reported at one moment in time lead to
11 relative increases in reported goal adoption three months later takes no account of the numerous
12 ‘transactions’ between perceived competence and goals that occur during the period of time
13 i.e., perceived competence may change *between* waves two and three and thus exert a within-
14 time influence on goal adoption (and vice-versa) (see Gershoff, Aber, & Clements, 2009). In
15 the present study, moderate to strong correlations were found between types of perceived
16 competence and goals at all measurement waves, indicating significant contemporaneous
17 relationships among the constructs. Fixing these within-time parameters to zero resulted in
18 considerably worse model fit in all cases. Developmental research in sport and exercise
19 psychology should utilize continuous or nonrecursive models to identify the magnitude and
20 direction of influence of these within-time relationships.

21 Moreover, researchers conducting longitudinal studies need to consider the time interval
22 between measurement waves, as longer intervals have been shown to be linked with smaller
23 effect sizes (Gershoff et al., 2009). In the current investigation, conducting four measurement
24 waves across nine months was deemed not to place too heavy a burden on school staff and
25 participants, whilst permitting examination of temporal relations across two academic years.

1 Studies which assess relations between competence and goals within the same PE activity using
2 much shorter time intervals (e.g., 3-4 weeks) may produce larger effect sizes and, in addition,
3 reveal prospective relationships between perceptions of competence and MAp goals (cf.
4 Conroy, Coatsworth, & Fifer, 2005; Conroy & Elliot, 2004).

5 Further work should aim to expand and validate the multidimensional measure of
6 perceived competence, including studies of face validity of existing and new items. Ensuring
7 that each type of competence perception has at least three indicators may offset
8 underidentification problems commonly associated with continuous-time structural equation
9 models (Gershoff et al., 2009). An expanded measure will assist researchers in testing the full
10 model incorporating all types of perceived competence and all achievement goals, as well as
11 testing model invariance across gender. It remains to be established whether the temporal
12 relations between normative competence perceptions and performance goals found in the
13 present study remain significant when the influence of other types of competence and goals is
14 controlled.

15 The differentiation of types of perceived competence has implications for theory and
16 research in achievement motivation beyond the realm of the current investigation. For example,
17 adopting a self-determination theory perspective (Ryan & Deci, 2002), how might the
18 informational function of rewards and other external events relate to the satisfaction of
19 competence from mastery, self and normative perspectives? Similarly, physical self-concept
20 researchers may examine the differentiated view of competence to determine relative
21 contribution to individuals' overall physical self-worth.

22 In summary, the present research provides empirical support for multidimensional
23 definitions of competence, as advocated in the theorizing of Elliot (1999, 2005). The
24 prospective influence of competence perceptions on achievement goals was documented, albeit
25 restricted to normative perceived competence and performance goals. These findings indicate

1 that adopting a more nuanced conceptualization of perceived competence in PE is insightful
2 and we encourage researchers in physical activity to consider a multidimensional perspective in
3 answering their research questions involving the competence construct.

4

1 Notes

2 ¹ Data were missing mainly due to wave non-response i.e., students were absent from
3 school when questionnaires were administered.

4 ² Details of the CFA and LFI results for each type of perceived competence can be
5 obtained from the first author.

6 ³ Details of the CFA and LFI results for the achievement goals can be obtained from the
7 first author.

8

9

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24

1 Table 1
 2 *Descriptive Statistics and Internal Consistency Estimates at Each Wave of Measurement*

Variable	Wave 1			Wave 2			Wave 3			Wave 4		
	M	SD	α	M	SD	α	M	SD	α	M	SD	α
MAp	5.02	1.39	.80	4.87	1.29	.74	4.82	1.31	.76	4.52	1.33	.76
PAP	4.18	1.59	.82	4.11	1.51	.84	4.13	1.46	.85	4.09	1.38	.83
PAv	4.67	1.47	.72	4.36	1.50	.78	4.23	1.43	.78	4.14	1.36	.79
PC Other	2.69	1.15	.82	2.82	1.14	.78	2.82	1.09	.78	2.79	1.05	.70
PC Mastery	3.65	0.93	.79	3.63	0.86	.72	3.67	0.91	.80	3.48	0.91	.76
PC Self	3.93	1.03	.82	3.91	0.95	.75	3.90	0.93	.76	3.72	0.97	.80

3
 4 *Note.* MAp = mastery-approach; PAP = performance-approach; PAv = performance-avoidance; PC = perceived competence
 5 * $p < .05$

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1 Table 2

2 *Factor Correlations at Each Wave of Measurement*

3

	MAp				PAP				PAv				PC Other				PC Mastery			
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
MAp	-	-	-	-																
PAP	.63*	.61*	.60*	.60*	-	-	-	-												
PAv	.64*	.61*	.55*	.55*	.88*	.91*	.93*	.95*	-	-	-	-								
PC Other	.57*	.45*	.56*	.65*	.62*	.65*	.70*	.72*	.43*	.49*	.53*	.60*	-	-	-	-				
PC Mastery	.67*	.78*	.69*	.70*	.51*	.50*	.54*	.54*	.40*	.45*	.40*	.44*	.77*	.69*	.75*	.80*	-	-	-	-
PC Self	.64*	.66*	.63*	.62*	.41*	.33*	.31*	.37*	.39*	.32*	.30*	.32*	.55*	.40*	.50*	.55*	.73*	.82*	.77*	.79*

4

5 *Note.* MAp = mastery-approach; PAP = performance-approach; PAv = performance-avoidance; PC = perceived competence; W = wave

6 * $p < .05$

7

8

1 Table 3

2 *Temporal Relations Between Multidimensional Perceptions of Competence and Mastery-Approach Goals*

Model	Satorra-Bentler χ^2	df	Model CAIC	NNFI	CFI	SRMR	RMSEA	RMSEA (90% CI)
PC Other and MAp goals								
Independence	2547.79	205						
Full cross-prediction	331.02**	148	-646.64	.892	.922	.075	.068	.058-.077
Goals - PC	337.42**	151	-660.06	.892	.920	.081	.067	.058-.077
PC - Goals	331.90**	151	-665.58	.895	.923	.074	.066	.057-.076
No cross-prediction	338.01**	154	-679.28	.895	.921	.080	.066	.057-.076
Model comparisons								
	$\Delta SB\chi^2$	Δdf						
Full cross-prediction vs. Goals - PC	6.37	3						
Full cross-prediction vs. PC - Goals	2.13	3						
Goals - PC vs. No cross-prediction	1.93	3						
PC - Goals vs. No cross-prediction	6.07	3						
PC Mastery and MAp goals								
Independence	2120.35	205						
Full cross-prediction	229.00**	148	-748.66	.941	.958	.072	.045	.033-.056
Goals - PC	232.34**	151	-765.13	.942	.958	.073	.045	.033-.055
PC - Goals	232.11**	151	-765.37	.943	.958	.073	.045	.033-.055
No cross-prediction	235.15**	154	-782.14	.944	.958	.075	.044	.032-.055
Model comparisons								
	$\Delta SB\chi^2$	Δdf						
Full cross-prediction vs. Goals - PC	3.32	3						
Full cross-prediction vs. PC - Goals	2.84	3						
Goals - PC vs. No cross-prediction	2.49	3						
PC - Goals vs. No cross-prediction	3.02	3						
PC Self and MAp goals								
Independence	2060.31	205						
Full cross-prediction	226.51**	148	-751.15	.941	.958	.073	.044	.032-.055
Goals - PC	228.65**	151	-768.93	.943	.958	.071	.044	.032-.055
PC - Goals	231.28**	151	-766.20	.941	.957	.074	.044	.032-.055
No cross-prediction	233.09**	154	-784.21	.943	.957	.072	.044	.032-.054
Model comparisons								
	$\Delta SB\chi^2$	Δdf						
Full cross-prediction vs. Goals - PC	1.97	3						
Full cross-prediction vs. PC - Goals	4.75	3						
Goals - PC vs. No cross-prediction	4.46	3						
PC - Goals vs. No cross-prediction	1.76	3						

3 *Note.* MAp = mastery-approach; PC = perceived competence

4 ** $p < .01$

5

1 Table 4

2 *Temporal Relations Between Multidimensional Perceptions of Competence and Performance-Approach Goals*

Model	Satorra-Bentler χ^2	df	Model CAIC	NNFI	CFI	SRMR	RMSEA	RMSEA (90% CI)
PC Other and PAp goals								
Independence	3123.68	205						
Full cross-prediction	185.54*	148	-792.12	.982	.987	.050	.031	.013-.044
Goals - PC	205.80**	151	-791.68	.975	.981	.086	.037	.023-.048
PC - Goals	187.48*	151	-810.00	.983	.988	.055	.030	.012-.043
No cross-prediction	206.78**	154	-810.52	.976	.982	.088	.036	.021-.047
Model comparisons	$\Delta SB\chi^2$	Δdf						
Full cross-prediction vs. Goals - PC	26.63*	3						
Full cross-prediction vs. PC - Goals	1.46	3						
PC - Goals vs. No cross-prediction	24.62*	3						
PC Mastery and PAp goals								
Independence	2581.28	205						
Full cross-prediction	176.05	148	-801.61	.984	.988	.055	.026	.000-.040
Goals - PC	181.94*	151	-815.53	.982	.987	.065	.027	.005-.041
PC - Goals	176.92	151	-820.56	.985	.989	.058	.025	.000-.039
No cross-prediction	183.84*	154	-833.45	.983	.987	.071	.027	.000-.040
Model comparisons	$\Delta SB\chi^2$	Δdf						
Full cross-prediction vs. Goals - PC	5.78	3						
Full cross-prediction vs. PC - Goals	0.80	3						
Goals - PC vs. No cross-prediction	1.76	3						
PC - Goals vs. No cross-prediction	6.92	3						
PC Self and PAp goals								
Independence	2553.15	205						
Full cross-prediction	211.15**	148	-766.28	.963	.973	.061	.040	.027-.051
Goals - PC	214.35**	151	-783.12	.963	.973	.062	.039	.026-.051
PC - Goals	213.86**	151	-786.62	.964	.973	.063	.039	.026-.051
No cross-prediction	216.81**	154	-800.49	.964	.973	.064	.039	.026-.050
Model comparisons	$\Delta SB\chi^2$	Δdf						
Full cross-prediction vs. Goals - PC	2.79	3						
Full cross-prediction vs. PC - Goals	2.18	3						
Goals - PC vs. No cross-prediction	2.02	3						
PC - Goals vs. No cross-prediction	2.57	3						

3 *Note.* PAp = performance-approach; PC = perceived competence

4 * $p < .05$ ** $p < .01$

5

1 Table 5

2 *Temporal Relations Between Multidimensional Perceptions of Competence and Performance-Avoidance Goals*

Model	Satorra-Bentler χ^2	df	Model CAIC	NNFI	CFI	SRMR	RMSEA	RMSEA (90% CI)
PC Other and PAv goals								
Independence	2541.24	205						
Full cross-prediction	237.18**	148	-740.48	.947	.962	.053	.047	.036-.058
Goals - PC	249.21**	151	-748.27	.943	.958	.073	.049	.038-.059
PC - Goals	241.49**	151	-755.98	.947	.961	.052	.047	.036-.058
No cross-prediction	253.00**	154	-764.29	.944	.958	.071	.049	.038-.059
Model comparisons	$\Delta SB\chi^2$	Δdf						
Full cross-prediction vs. Goals - PC	12.92*	3						
Full cross-prediction vs. PC - Goals	4.17	3						
PC - Goals vs. No cross-prediction	12.57*	3						
PC Mastery and PAv goals								
Independence	2059.50	205						
Full cross-prediction	189.89*	148	-787.77	.969	.977	.058	.032	.016-.045
Goals - PC	193.54*	151	-803.93	.969	.977	.061	.032	.016-.045
PC - Goals	191.81*	151	-805.67	.970	.978	.056	.032	.015-.044
No cross-prediction	195.14*	154	-822.15	.970	.978	.059	.031	.015-.044
Model comparisons	$\Delta SB\chi^2$	Δdf						
Full cross-prediction vs. Goals - PC	3.62	3						
Full cross-prediction vs. PC - Goals	1.80	3						
Goals - PC vs. No cross-prediction	1.50	3						
PC - Goals vs. No cross-prediction	3.27	3						
PC Self and PAv goals								
Independence	2029.73	205						
Full cross-prediction	200.99**	148	-776.67	.960	.971	.056	.036	.022-.048
Goals - PC	204.04**	151	-793.43	.961	.971	.057	.036	.022-.048
PC - Goals	205.61**	151	-791.87	.959	.970	.061	.037	.023-.048
No cross-prediction	208.53**	154	-808.77	.960	.970	.061	.036	.022-.048
Model comparisons	$\Delta SB\chi^2$	Δdf						
Full cross-prediction vs. Goals - PC	2.84	3						
Full cross-prediction vs. PC - Goals	4.67	3						
Goals - PC vs. No cross-prediction	4.53	3						
PC - Goals vs. No cross-prediction	2.68	3						

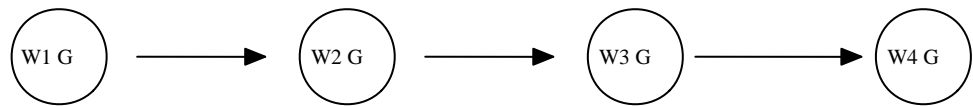
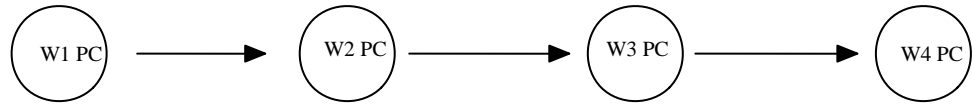
3 *Note.* PAv = performance-avoidance; PC = perceived competence

4 * $p < .05$ ** $p < .01$

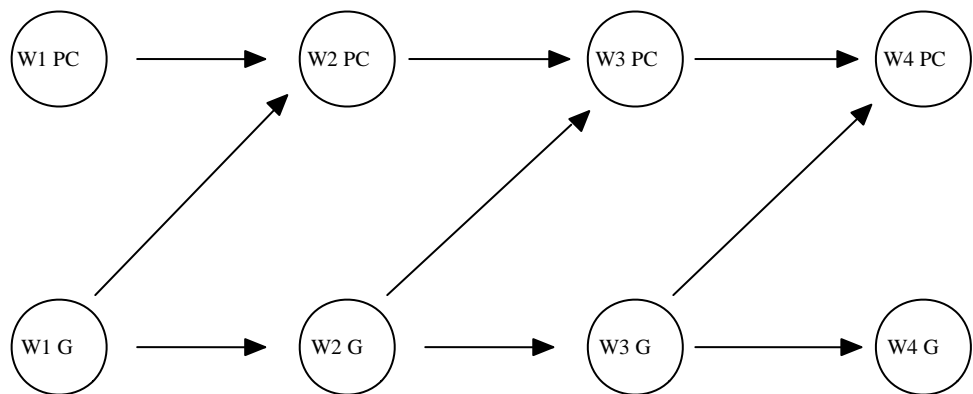
Figure 1

Prospective relations between perceived competence and achievement goals tested in the present study.

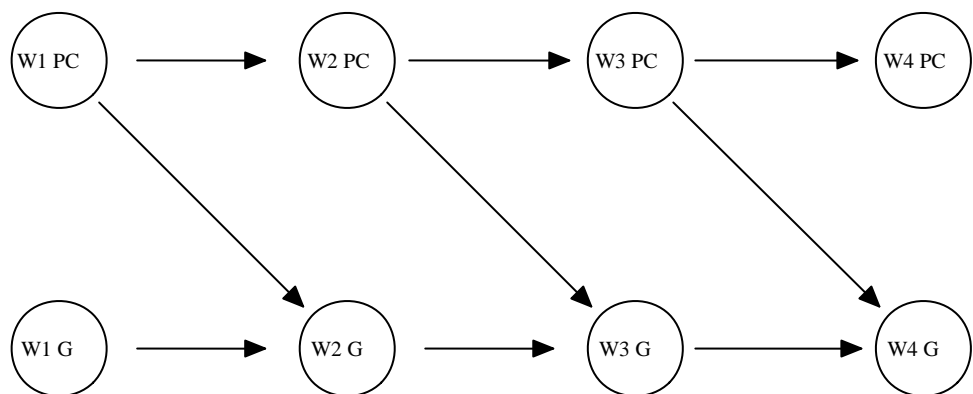
a) No cross-prediction model



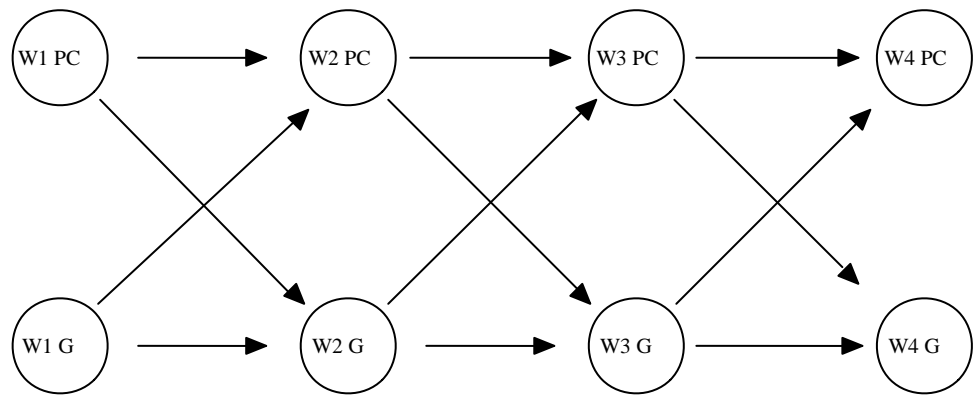
b) Goals – PC model



c) PC – goals model



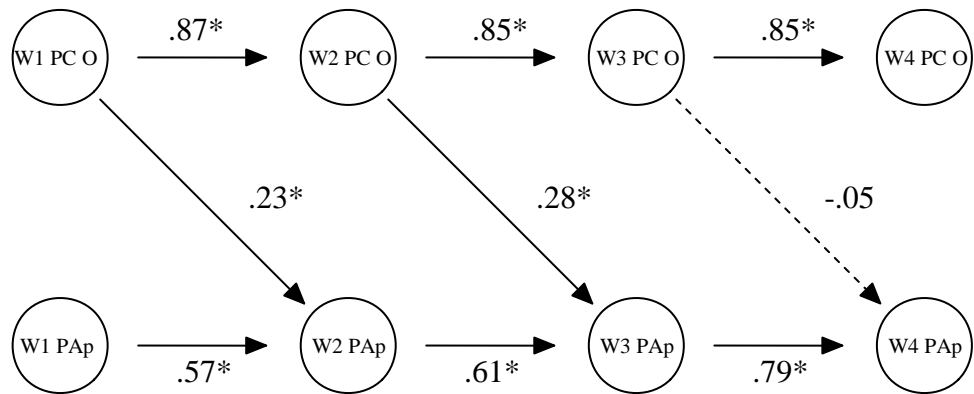
d) Full cross-prediction model



Note. Measurement model parameters and within time correlated factors (wave [W] 1) and disturbances (waves 2, 3 and 4) are omitted for the sake of clarity. PC = type of perceived competence; G = type of achievement goal.

Figure 2

Prospective relations between PC Other (PC O) and performance-approach (PAp) goals.

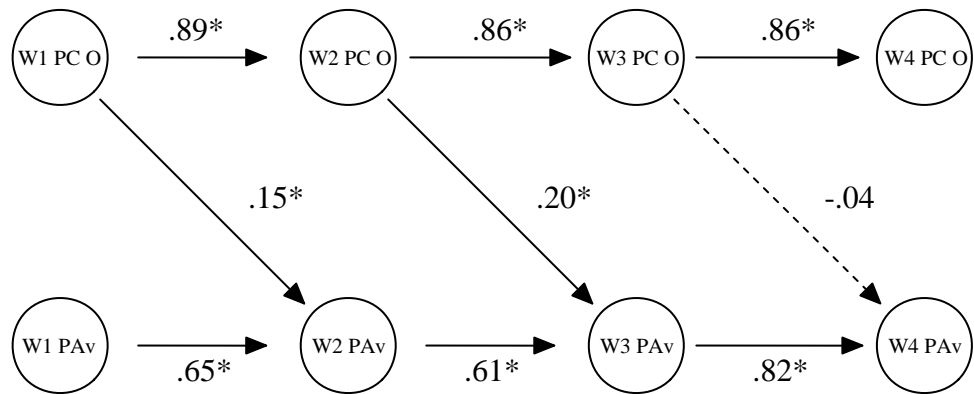


Note. Measurement model parameters and within time correlated factors (wave [W] 1) and disturbances (waves 2, 3 and 4) are omitted for the sake of clarity.

* $p < .05$

Figure 3

Prospective relations between PC Other (PC O) and performance-avoidance (PAv) goals.



Note. Measurement model parameters and within time correlated factors (wave [W] 1) and disturbances (waves 2, 3 and 4) are omitted for the sake of clarity.

* $p < .05$