Learning and Instruction 22 (2012) 222–230

Contents lists available at SciVerse ScienceDirect

Learning and Instruction

journal homepage: www.elsevier.com/locate/learninstruc

Personal best goals and academic and social functioning: A longitudinal perspective

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ARTICLE INFO

Article history:
Received 4 April 2011
Received in revised form
8 November 2011
Accepted 14 November 2011

Keywords:
Personal best (PB)
Goals
Academic functioning
Social functioning

ABSTRACT

Personal best goals (PB goals) articulate a target performance standard that matches or exceeds one's previous best. This study examined the role of PB goals in academic and social functioning. Alongside academic and social outcome measures, PB goal items were administered to 249 high-school students at the beginning and end of their school year. Longitudinal structural equation modeling suggested, at Time 1, PB goals significantly predicted students' deep learning, academic flow, academic buoyancy, positive teacher relationship, and favorable attitudes toward peer cooperation. Further, at Time 2, the effects of PB goals on deep learning, academic flow, and positive teacher relationship remained significant after controlling for prior variance of corresponding Time-1 factors, suggesting sustained benefits of PB goals in students' academic and social development. These findings hold substantive, applied, and methodological implications for researchers and practitioners seeking to examine and harness PB goals in educational settings.

1. Introduction

School is a setting where students are often inadvertently involved in a zero-sum reward game (Covington, 1992; Martin, 2010). On the one side, competition that takes place in this setting tends to reward only a relative minority of students. On the other side, however, the system potentially dampens motivation and confidence of the relative majority of students particularly those who put a great deal of effort into their studies but still do not perform as well as the most capable minority. As a result of such a competitive game, students see teachers as judges of their success and peers as potential barriers to their accomplishment (Covington, 1992). Consequently, students are likely to perceive schooling as an experience associated with fear, frustration, and anxiety (Martin, 2010).

Focusing on personal best (PB) goals as target goals that exceed or match an individual's previous best performance has been suggested as one way of optimizing students' academic potential (Martin, 2006, 2011a). PB goals enable a greater focus on self-paced progress and have potential effects of reducing negative consequences of social comparisons as PB-oriented students use their previous best performance – and not that of others – as a benchmark of their attainments. Indeed, as reviewed below, prior investigations (Martin, 2006; Martin & Liem, 2010) have demonstrated the yields of PB goals on key educational outcomes in student academic trajectories.

The present study extends these existing studies by examining the role of PB goals in academic and social functioning. These extensions take three forms. First, the study examined the extent to which PB goals relate to deep learning, academic flow, academic buoyancy, teacher relationships, and peer cooperation – key academic and social functioning at school that have not been previously investigated in relation to PB goals. Second, the study tested the hypothesized relationships between PB goals and the academic and social factors at two time points (with an approximately 1-year interval) and in the one longitudinal analytic model (see Fig. 1). Thus, relative to more typical cross-sectional work, the analysis provided a more stringent test of the role of PB goals after accounting for prior variance in outcome factors (Martin, 2011b). Third, the study also sought to examine PB goals after controlling for students' age, language background, and academic ability as covariates in the model. Taken together, the study is expected to yield a fuller understanding of PB goals in the educational setting, particularly of its academic and social consequences – the juxtaposition of which have not yet been explored.

1.1. PB goals: theoretical perspectives

Students are said to accomplish PB goals when the performance and effort they attain and expend are higher than, or is as good as,

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doi:10.1016/j.learninstruc.2011.11.003

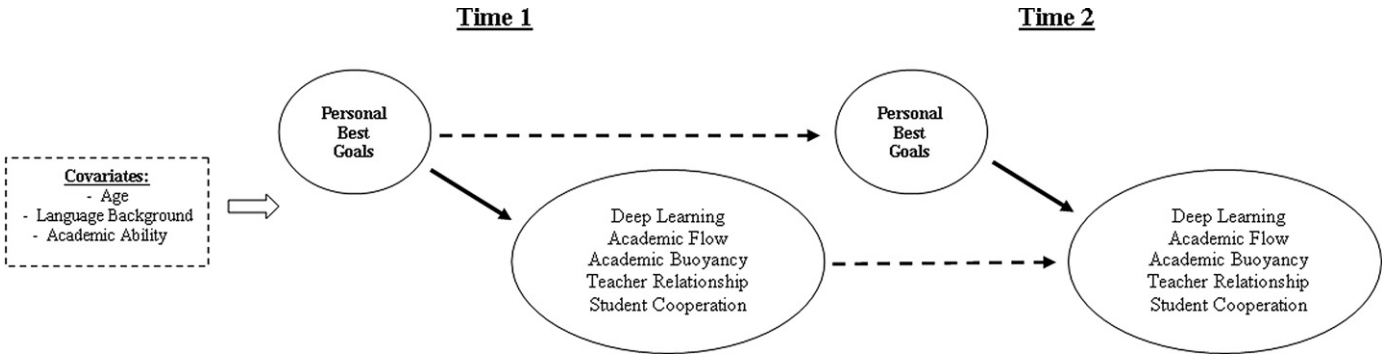

Fig. 1. Hypothesized longitudinal model of PB goals and socio-academic outcomes. Note: arrows with dashed line represent auto-regressive paths (temporal stability paths) between time-1 and Time-2 corresponding variables.

their previous best performance and effort (Martin, 2006, 2011a). Key theoretical underpinnings aligned with and inspiring the PB concept include goal content (Austin & Vancouver, 1996), achievement goal (Elliot, 2006), and goal-setting (Locke & Latham, 2002) perspectives. From a goal content viewpoint, "meeting a challenging standard of achievement, or improvement" is one of the main task-based goals that individuals pursue in their daily lives (Austin & Vancouver, 1996, p. 357) – and this is well aligned with the focus of PB goals on self-improvement and attaining specific and optimally challenging outcomes.

From achievement goal perspectives (e.g., Elliot, 2006), individuals may aim to attain competence in a particular task and this attainment can be evaluated relative to some absolute criteria (task-based referents), their own capacity (self-based referents), or others' performances (other-based referents). Whilst task-based and self-based evaluative standards have been integrated as a key defining concept of *mastery goals*, other-based, normative evaluative referents have been used to define *performance goals* (see Elliot, 2006). Recently, Elliot, Murayama, and Pekrun (2011) proposed a 3 × 2 achievement goal framework, in which task-based and self-based referents of the mastery goals are distinguished and separated. Furthermore, they also integrated the approach and avoidance valences.[1] Of particular relevance to PB goals is the concept of *self-approach goals* focusing on the attainment of competence exceeding one's previous performance (e.g., to perform better on the exams than I have done in the past on these types of exams). Similar to self-approach goals, PB goals are approach-based goals, represent concrete target outcomes guiding behaviors, and are evaluated against intrapersonal standards based on one's previous best performance and/or future potential attainment. However, whilst self-approach goals seem to center on pursuing *product* outcomes (e.g., exam results), PB goals represent target attainments associated with not only the *products* (e.g., school grades) but also the *processes* (e.g., spending longer time on homework than before) of students' engagement in their schoolwork (Martin, 2011a).

Martin (2006, 2011a) also maintained that PB goals are closely linked to goal-setting capacity (Locke & Latham, 2002). The goal-setting literature has documented that specific and optimally challenging goals yield higher levels of performance as these goals enhance the clarity of what is to be achieved (Locke & Latham, 2002). As PB goals reflect specific target outcomes slightly higher than one's previous best performance, it is important that one has the skills to set specific goals with a difficulty level optimally discrepant from one's ability. Further, emphasizing PB goals is aligned with a self-determination perspective (Ryan & Deci, 2000) as the process of pursuing PB goals potentially evokes and strengthens students' intrinsic motivation through the senses of competence and autonomy students gain when pursuing a challenging but attainable target performance set based on their own decision. Additionally, as the optimally challenging nature of PB goals makes success more accessible to students, the accumulated success experience associated with pursuing PB goals over time may also gradually enhance students' self-efficacy (Bandura, 1997).

1.2. The yields of PB goals: the underlying mechanism

The role of PB goals as a precursor of academic and social functioning can be explained by different theoretical models of goal orientation. Of particular relevance here is motivated action theory (DeShon & Gillespie, 2005) positing that achievement goals individuals hold provide a mental framework orienting them to a certain pattern of construing, evaluating, and responding to achievement situations that facilitate goal attainment. The theory maintains that, to accomplish their goals, individuals need to engage in a variety of action plan goals as practical strategies that can be subsumed under such categories as seeking feedback, allocating resources, or exploring problems. Based on this theorizing, we posit that in pursuing PB goals, students engage in various strategies and develop capacities facilitating the attainment of their goals.

1.3. Prior studies on PB goals

To the extent that PB goals are associated with intrinsic motivation and self-efficacy, there are reasons to believe that pursuing PB goals facilitates and promotes desirable academic processes and outcomes (Martin, 2006, 2011a). In support of this, Martin (2006) demonstrated the positive links between PB goals and educational aspiration, school enjoyment, classroom participation, and persistence. In another study, Martin and Liem (2010) adopted a cross-lagged panel analytic framework to juxtapose the salience of prior PB goals in predicting subsequent engagement and achievement (e.g., homework completion, performance in literacy and numeracy tests) with the salience of prior engagement and achievement factors in predicting subsequent PB goals. Their findings showed that, in all instances, PB goals were a significant

[1] The 3 × 2 achievement goal model (Elliot et al., 2011) postulates six types of goals that students may pursue in relation to their school performance (e.g., test results), including (1) *self-approach goals*, orienting students to perform better than their past attainment; (2) *self-avoidance goals*, orienting students to avoid performing worse than their prior performance; (3) *task-approach goals*, orienting students to do well on a task; (4) *task-avoidance goals*, orienting students to avoid doing a task inadequately; (5) *other-approach goals*, orienting students to perform better than others; and (6) *other-avoidance goals*, orienting students to avoid performing worse than others.

predictor of each subsequent engagement and achievement factor (even after controlling for prior variance of each corresponding engagement/achievement factor).

Although the Martin and Liem (2010) study has shed important light on the longitudinal consequences of PB goals, their study centered only on academic consequences, which were individually tested using a cross-lagged relational analysis, and did not control for relevant covariates (e.g., socio-demographic background). Building upon this study, the present investigation seeks to examine the role of PB goals in other key academic factors that have not yet been studied in relation to PB goals, including the adoption of deep learning, the experience of flow in learning, and the extent to which students are buoyant in their academic life. Further, with a view to better understanding its interpersonal consequences, the study also examines how pursuing PB goals (inherently personalized and self-referenced) relates to students' perceived relationships with their teachers and the extent to which they are willing to cooperate with peers.

1.4. PB goals and academic functioning

Academic functioning refers to multifaceted processes undergone by students as they adapt and negotiate academic demands. Three key dimensions of academic functioning examined in this study are deep learning, academic buoyancy, and academic flow.

1.4.1. Deep learning

Deep learning is an adaptive form of cognitive processing that promotes greater understanding and better academic performance (Fredricks, Blumenfeld, & Paris, 2004). Achievement goal research (e.g., Elliot & McGregor, 2001) has demonstrated that mastery-oriented students typically reported preferences for deep learning. Some other studies (e.g., Liem, Lau, & Nie, 2008) have also exhibited the adoption of deep learning by performance-oriented students. These findings suggest that the use of deep learning assists mastery-oriented students to gain knowledge and provides performance-oriented students better chances in getting high marks – two aims associated with PB goals. In view of this, the pursuit of PB goals is likely to relate to the adoption of deep learning (Hypothesis 1).

1.4.2. Academic flow

Academic flow refers to a subjective optimal experience when students are totally absorbed in a task at hand particularly due to task-related enjoyment and satisfaction (Martin & Jackson, 2008). According to Csikszentmihalyi (1990), the flow experience likely occurs when one engages in a task with a difficulty level optimally challenging to one's possessed ability. Indeed, an optimally challenging task is the essence of PB goals focusing on target attainments with a level of difficulty slightly exceeding the level of skills one possesses. Hence, there are reasons to believe that students oriented to reach PB goals are likely to experience academic flow (Hypothesis 2).

1.4.3. Academic buoyancy

In their everyday academic lives, students are faced with academic setbacks including receiving bad marks or facing difficult tasks. In part, it is students' academic buoyancy – or the capacity to deal with stresses typical of everyday academic life – that determines the extent to which they can successfully overcome these academic challenges (Martin & Marsh, 2009). Martin & Liem, 2010 showed that persistence is a significant predictor of academic buoyancy beyond the effects of prior academic buoyancy and other key motivational factors (e.g., self-efficacy, planning). From a PB perspective, heightened persistence has been found to be a consequence when students are PB-oriented (Martin & Liem, 2010). Given the empirical links between PB goals and persistence and between persistence and academic buoyancy, it is reasonable to predict that pursuing PB goals may relate to academic buoyancy (Hypothesis 3).

1.5. PB goals and social functioning

Students' social functioning at school relates to their academic performance, motivation and engagement, and well-being. Work by Qin, Johnson, and Johnson (1995), for example, suggested that students' cooperation with peers was associated with heightened uses of higher-order thinking and better achievement. Studies have also indicated that students perceiving that their teachers cared for their well-being exerted more effort in studies (Wentzel, 1997). Notwithstanding the importance of these relationships in student academic life, they have not yet been examined in relation to PB goals.

1.5.1. Student cooperation

Pursuing PB goals may give rise to students' positive attitudes toward peer cooperation. Consistent with motivated action theory (DeShon & Gillespie, 2005), the goals individuals hold (e.g., mastery goals) orient the way they see others and construe meanings of their social interactions. Studies have shown that, given their focus on knowledge development, mastery-oriented students perceive others as valuable informants that can help develop their understanding, whereas performance-oriented students see others as competitors (Hijzen, Boekaerts, & Vedder, 2007; Roussel, Elliot, & Feltman, 2011; Tossman, Kaplan, & Assor, 2008). As PB-oriented students focus their efforts on self-improvement and outperforming their past attainments – hence, the type of competition they engage in is inherently self-referenced – they may see others as resources to attain their target goals rather than as competitors. Thus, pursuing PB goals may relate to students' attitudes toward cooperation with their peers (Hypothesis 4).

1.5.2. Teacher relationships

In a competitive environment where students are assessed normatively, academic success is typically determined by teacher-assigned grades (Covington, 1992). Given the importance of grades and yet their 'scarce' nature (i.e., teachers disproportionately reward the best performing students), teachers often use grades to manage classroom behaviors (Covington, 1992). Consequently, students may perceive teachers as the ultimate authority who determines their academic success – a perception likely giving rise to students' fear of teachers (Covington & Teel, 1996). In emphasizing PB goals, however, students feel more in control of their own learning and they may not see teachers as the sole gatekeeper of their academic success. Instead, PB-oriented students may see teachers as a source of knowledge crucial for their self-improvement. Hence, the extent to which students are oriented toward pursuing PB goals may relate to positive teacher relationships (Hypothesis 5).

1.6. Relevant covariates

In estimating the effects of PB goals on the socio-academic factors of interest, it is important to control for students' age, language background, and academic ability (see Fig. 1) as these factors have been found to be significantly associated with the socio-academic factors examined in this study. For example, studies have demonstrated that age negatively predicted academic buoyancy (Martin, Colmar, Davey, & Marsh, 2010) and teacher-student

relationships (Bracken & Crain, 1994), but it was a positive predictor of deep learning (Sadler-Smith, 1996) and flow experience (Sahoo & Sahu, 2009). Studies have also shown the role of language or ethnicity background in deep learning, resilience, the quality of teacher–student relationship, and peer cooperation (den Brok & Levy, 2005; Leung, Ginns, & Kember, 2008; Liem, Martin, Nair, Bernardo, & Prasetya, 2009). Another factor to control is academic ability as, through its impact on self-efficacy and sense of control in learning, academic ability has been associated with deep learning, academic flow, academic buoyancy, the quality of student-teacher relationships, and peer cooperation (Bandura, 1997; Liem et al., 2008; Wentzel, 1997). Taken together, these findings highlight the need to control for the effects of age, language background, and academic ability when examining the effects of PB goals on the socio-academic factors of interest.

1.7. Aims and hypotheses

This study aimed to examine the role of PB goals on key academic and social factors at two time points across one school year. As shown in Fig. 1, the study hypothesizes that pursuing PB goals would have positive effects on deep learning (Hypothesis 1), academic flow (Hypothesis 2), academic buoyancy (Hypothesis 3), positive teacher relationships (Hypothesis 4), and peer cooperation (Hypothesis 5). To this end, the study utilizes longitudinal latent modeling which provides an ideal opportunity to: (a) assess the stability of hypothesized links between PB goals and outcome measures over time; (b) examine the predictive power of Time-2 PB goals on Time-2 outcomes after controlling for Time-1 variance of the corresponding outcomes; and (c) assess cross-time paths between parallel constructs (test-retest paths). The extent to which effects of PB goals on socio-academic outcomes remain significant at Time 2, after accounting for prior variance of the corresponding socio-academic factors and controlling for demographic and ability factors, is an exploratory issue that we sought to ascertain in this study.

2. Method

2.1. Participants

The sample comprised 254 students from an independent (non-government) girls' high school in an urban area of New South Wales, Australia. They completed the survey at the 1st term (Time 1) and the 4th term (Time 2) of the school year. Approximately 28% students were in Year 7, 31% were in Year 8, and 41% were in Year 9. Their mean age was 13.81 years ($SD = .92$) at Time 1 and 14.47 years ($SD = .98$) at Time 2. Of the sample, 66% were of English-speaking background and 34% were of non-English-speaking background. The school was a higher performing school and of higher socio-economic status than the national average. Notwithstanding this, it subscribes to the same state-based curriculum and its students are assessed through common state-based exams. The broader research program under which the present study resides was administered across all of Years 7–9. Thus, participation was near-100 percent. Preliminary analysis indicated that five cases had a substantial number of missing values across Time 1 and Time 2. Given that these cases accounted for less than 5% of the dataset (i.e., 2%), a listwise deletion method was performed (see Kline, 2011), resulting in the final sample of 249 cases.

2.2. Procedure

The survey was administered in a normally scheduled class by a designated classroom teacher. The teacher first explained the rating scale to students and then presented a sample item. The achievement test was administered following the completion of the survey. Once all surveys were collated, the cover sheet (containing the name of the participants) was discarded and all completed surveys were assigned a unique identification number that could be used to identify responses for matching Time-1 and Time-2 data in longitudinal analyses. This unique identifier was also used to assure anonymity and confidentiality for all students.

2.3. Measures

Measures probing demographic information (i.e., age, language background), key variables of interest (i.e., PB goals, deep learning, flow, buoyancy, teacher relationships, student cooperation), and achievement were used. The six psychometric scales described below were rated by students from 1 (*strongly disagree*) to 7 (*strongly agree*).

2.3.1. Personal best goals

To measure academic personal best goals, the four PB items in Martin and Liem's (2010) study were used. These items are as follows: "When I do my schoolwork I try to do it better than I've done before"; "When I do my schoolwork I try to do the best that I've ever done"; "When I do my schoolwork, I try to improve on how I've done before"; "When I do my schoolwork I try to get a better result than I've got before".

2.3.2. Deep learning

To measure deep learning, the four-item Elaboration Scale in the Students' Approaches to Learning (SAL) instrument (Marsh, Hau, Artelt, Baumert, & Peschar, 2006) was used. An example of the items is "When I study, I try to relate new material to things I have learned in other subjects".

2.3.3. Academic flow

To measure the extent to which students undergo a subjective optimal experience during studying (i.e., academic flow), the ten-item Core Academic Flow Scale (Martin & Jackson, 2008) was used. An example of the items is "When I do my schoolwork, I am totally focused on what I am doing".

2.3.4. Academic buoyancy

To measure the extent to which students are buoyant when they are faced with setbacks in everyday academic life, the four-item Academic Buoyancy Scale (Martin & Marsh, 2009) was used. An example of the items is "I am good at dealing with setbacks at school – e.g., bad mark, negative feedback on my work".

2.3.5. Teacher relationship

To measure the extent to which students perceive that they have good relationships with their teachers, the four-item Teacher–Student Relationship Scale of the Self-Description Questionnaire II-Short (SDQ II-S; Marsh, 1990) was selected. An example of the items is "In general, I get along with my teachers".

2.3.6. Student cooperation

The extent to which students like to work with other students was measured by the five-item Cooperative Learning Scale drawn from the SAL instrument (Marsh et al., 2006). An example of the items is "I like to work with other students".

2.3.7. Achievement test

Test performance on the 40-item Wide Range Achievement Test-3 (WRAT-3; Wilkinson, 1993) was used as an indicator of

general academic ability or proficiency. The scores, reflecting the number of correct responses, were standardized within grade levels.

2.4. Statistical analysis

2.4.1. Confirmatory factor analysis (CFA) and structural equation modeling (SEM)

The main analyses involved the application of CFA and SEM performed using M*plus* 6.0 (Muthén & Muthén, 1998-2010). Maximum likelihood with robustness to non-normality and non-independence of observations (MLR) was used to estimate our models. Following recommendations on establishing model fit (Marsh, Hau, & Wen, 2004), the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), the χ^2 test statistic, and an evaluation of parameter estimates were used in the present research to assess model fit. The RMSEA index is less affected by sample size than the χ^2 test statistic and values at or less than .08 and .05 are taken to reflect acceptable and excellent fit respectively (Yuan, 2005). The CFI values at or greater than .90 and .95 are typically taken to reflect acceptable and excellent fit to the data respectively (McDonald & Marsh, 1990). The CFI contains no penalty for a lack of parsimony so that improved fit due to the introduction of additional parameters may reflect capitalization on chance, whereas the RMSEA contain penalties for a lack of parsimony (Yuan, 2005).

2.4.2. Composite-score latent modeling

Modeling longitudinal data using SEM can lead to a lack of stability of parameter estimation and model fit statistics when the ratio of the sample size relative to the parameters to be estimated is large. To address this problem, we performed composite score-based SEM (see Holmes-Smith & Rowe, 1994 for details). This technique reduces the number of parameters because, instead of being predicted by its constituent observed variables, each latent variable is represented by a weighted composite score derived from a confirmatory, one-factor, congeneric model (performed with syntax provided by Raykov, 2009). Proportional factor score regression weights (κ) generated from a congeneric model solution are used to modify the weight of each item before a composite score is calculated. Factor score regression weights are particularly important because they take into account individual item measurement error and their unique (unequal) contributions to the composite score. Moreover, the number of parameters in composite score-based SEM can be further reduced as the factor loading (λ) and measurement error variance (θ) of latent variables in the model are fixed with the values calculated using the weighted composite-score reliability (ρ or r_m – maximized reliability) of the factor under consideration. That is, the factor loading can be calculated by calculating the square-root of ρ and the measurement error variance can be calculated by subtracting ρ from 1.

3. Results

3.1. Descriptive statistics and psychometric properties

Descriptive statistics, distributional properties, Cronbach's alpha, and the summary of factor loadings for the scales used, at Time 1 and Time 2, are presented in Table 1. As indicated by skewness and kurtosis, the distributional properties across scales approximated normal distributions. All the multi-item subscales evinced suitable levels of reliability using conventional benchmarks. Item-level CFA was first performed with Time-1 and Time-2 datasets to test the robustness of the factor structure of the scales used. Given the small-sample size ($N = 249$) relative to the estimated measurement model in each time point (6 latent factors with 31 indicators), the Swain adjustment for small-sample-size-and-large-model conditions (Herzog & Boomsma, 2009) – available through the R statistical program – was used to obtain small-sample robust estimators of noncentrality-based and incremental model fit. The analysis showed a good fit of the model to both Time-1 data, χ^2=(411, $N = 249$) = 818.25, $p < .001$, CFI = .91, RMSEA = .06, and Time-2 data, χ^2=(411, $N = 249$) = 895.02, $p < .001$, CFI = .91, RMSEA = .07. All factor loadings were significant ($p < .001$) and the ranges and means of the loadings were acceptable. Taken together, the psychometric properties of the factors under study are sound and provide a robust measurement basis upon which to conduct statistical analyses aimed at addressing the substantive questions central to the study.

3.2. Preliminary correlations

Table 2 shows that most correlations between PB goals and academic and social outcomes are as predicted. At Time 1 and Time 2, PB goals were positively correlated with deep learning, academic flow, and teacher relationship. Whilst PB goals were significantly related to academic buoyancy and student cooperation at Time 1, these associations were not significant at Time 2. Table 2 also shows intraclass and cross-intraclass correlations between Time-1 and Time-2 factors that account for the dependent nature of the repeated measures (Griffin & Gonzalez, 1995). Intraclass correlations were relatively high, ranging between $r = .49$ (teacher relationship) and $r = .78$ (test performance), suggesting test-retest or temporal stability of the measures. Taken together, these results provide support to testing hypothesized relationships in one integrative model taking into account shared variances among variables.

Additionally, relative to English-speaking students, non-English-speaking students were higher in Time-1 and Time-2 test performance but lower in Time-1 and Time-2 academic buoyancy, Time-1 academic flow, and Time-1 positive teacher relationships. Older students had better Time-1 test performance but less favorable attitudes toward peer cooperation at both time points. Students with better Time-1 and Time-2 test performance endorsed higher Time-2 PB goals.

Table 1
Descriptive statistics, Cronbach's alphas, and CFA factor loadings for the scales in the study.

Scale	Time 1						Time 2					
	Mean	*SD*	Kurtosis	Skewness	Cronbach's α	CFA Loadings Range (Mean)	Mean	*SD*	Kurtosis	Skewness	Cronbach's α	CFA Loadings Range (Mean)
Personal Best Goals	5.44	.99	−.78	−.26	.86	.74–.86 (.80)	5.28	1.08	.59	−.59	.90	.79–.85 (.82)
Deep Learning	4.85	1.07	−.15	−.39	.79	.60–.85 (.72)	4.90	1.13	.71	−.56	.86	.73–.83 (.78)
Academic Flow	4.52	.98	−.19	−.26	.91	.48–.82 (.72)	4.32	1.01	1.06	−.57	.93	.56–.87 (.77)
Academic Buoyancy	4.42	1.23	−.38	−.40	.81	.58–.77 (.68)	4.56	1.25	.32	−.59	.84	.64–.81 (.72)
Teacher Relationship	5.04	1.04	−.19	−.45	.82	.62–.81 (.73)	4.98	1.20	.77	−.78	.87	.69–.90 (.80)
Student Cooperation	5.21	1.01	1.46	−.89	.81	.42–.91 (.64)	5.25	.96	.95	−.58	.79	.34–.86 (.63)
Test Performance	66.09	11.53	−.27	.36	–	–	68.68	13.56	−.75	.10	–	–

Note: Test performance is a single achievement score.

Table 2
Correlations among demographics, ability, and factors in the study.

		Covariates				Time-1						Time-2					
		Age	LB	TP_{T1}	TP_{T2}	PB	DL	AF	AB	TR	SC	PB	DL	AF	AB	TR	SC
Covariates	Age	1.00															
	Language Background (LB)	−.13*	1.00														
	T1 Test Performance (TP_{T1})	.13*	.28***	1.00													
	T2 Test Performance (TP_{T2})	.11	.31***	.78***	1.00												
Time-1	Personal Best Goals (PB)	−.07	.03	.07	.22*	1.00											
	Deep Learning (DL)	−.07	−.05	.02	.03	.61***	1.00										
	Academic Flow (AF)	−.09	−.16*	−.04	−.02	.65***	.66***	.100									
	Academic Buoyancy (AB)	−.03	−.16*	−.10	−.08	.17**	.28***	.34***	1.00								
	Teacher Relationship (TR)	−.04	−.19**	−.06	.03	.51***	.37***	.59***	.32***	1.00							
	Student Cooperation (SC)	−.14*	−.06	−.01	.02	.14*	.26***	.16*	.24***	.17**	1.00						
Time-2	Personal Best Goals (PB)	−.11	.12	.11*	.14*	.62***	.44***	.47***	.08	.36***	.15**	1.00					
	Deep Learning (DL)	.03	.11	.03	.10	.44***	.51***	.38***	.08	.20***	.09*	.56***	1.00				
	Academic Flow (AF)	−.02	−.01	−.02	−.02	.47***	.38***	.55***	.16***	.36***	.11*	.67***	.60***	1.00			
	Academic Buoyancy (AB)	.11	−.15*	−.08	−.05	.08	.08	.16***	.51***	.15**	.18***	.10	.16*	.23***	1.00		
	Teacher Relationship (TR)	.03	−.01	.03	.08	.36***	.20***	.36***	.15**	.49***	.22***	.45***	.37***	.51***	.17*	1.00	
	Student Cooperation (SC)	−.14*	−.01	.02	−.01	.15**	.09*	.11*	.18***	.22***	.58***	.10	.17**	.06	.17*	.19**	1.00

Notes: *$p < .05$, **$p < .01$, ***$p < .001$; Language background (1 = English speaking, 2 = non-English speaking); Shaded coefficients are intraclass correlations.

3.3. Composite-score latent modeling

Composite-score modeling of the hypothesized longitudinal model showed an excellent fit to the data, $\chi^2=(45, N=249)=96.29$, $p < .001$, CFI = .96, RMSEA = .07. The result shows that, at Time 1, PB goals positively predicted deep learning ($\beta = .72$), academic flow ($\beta = .74$), academic buoyancy ($\beta = .26$), teacher relationship ($\beta = .61$), and student cooperation ($\beta = .16$). The amount of explained variance in Time-1 outcomes ranged between 6% (student cooperation) and 58% (academic flow). At Time 2, even after controlling for the shared variance between Time-1 factors and their Time-2 corresponding factors, PB goals still predicted deep learning ($\beta = .45$), academic flow ($\beta = .59$), and teacher relationship ($\beta = .32$). At Time 2, however, PB goals did not significantly predict academic buoyancy ($\beta = .05$) and student cooperation ($\beta = .05$). The amount of explained variance in Time-2 outcomes ranged between 33% (academic buoyancy) and 59% (academic flow). Taken together, these findings demonstrated the relative temporal stability of the role of PB goals in socio-academic functioning.

For covariates, at Time 1, compared with English-speaking students, non-English-speaking students reported lower academic flow ($\beta = -.18$), lower academic buoyancy ($\beta = -.20$), and less positive relationships with teachers ($\beta = -.21$). Age negatively predicted students' inclination to work with peers ($\beta = -.16$) at Time 1, but it positively predicted academic buoyancy ($\beta = .15$) and deep learning ($\beta = .12$) at Time 2. Table 3 presents all the standardized β coefficients in the longitudinal model and Fig. 2 shows only the significant effects in the model.

In summary, the longitudinal latent modeling indicated that, partialing out the effects of age, language background, and academic ability, students' PB goals had positive effects on their adoption of deep learning, experience of academic flow, buoyancy in academic life, positive relationships with teachers, and favorable attitudes toward peer cooperation. Further, the model showed that the PB goals' effects on deep learning, academic flow, and positive teacher relationships remained significant at Time 2 even after accounting for prior variance of the corresponding socio-academic factors and effects of the covariates.

4. Discussion

The present study examined the role of PB goals in academic functioning (students' deep learning, academic flow, academic buoyancy) and interpersonal processes (perceived relationships with teachers, attitudes toward peer cooperation) at two time points (across one school year). Composite-score latent modeling confirmed the salience of PB goals in students' academic and social functioning. At Time 1, over and above the effects of covariates, PB goals significantly predicted students' adoption of deep learning (Hypothesis 1), experience of academic flow (Hypothesis 2), buoyancy in academic life (Hypothesis 3), positive relationships with teachers (Hypothesis 4), and favorable attitudes toward peer cooperation (Hypothesis 5). The analysis also exhibited sustained benefits of PB goals on students' deep learning, academic flow, and positive teacher relationships as the PB goals' effects on these outcomes remained significant at Time 2 even after accounting for prior variance of the corresponding academic and social factors and effects of the covariates. These significant paths within Time 2 are particularly illuminating because Time-1 variance in Time-2 factors has been explained and so remaining Time-2 effects can be deemed robust. Of further note, auto-regressive paths indicated that all Time-1 factors significantly predicted their corresponding Time-2 factors. Taken together, the present longitudinal study has provided evidence that PB goals are a significant predictor of students' academic capital and key interpersonal relationships in the school context.

4.1. Substantive implications

Goal theorists (e.g., DeShon & Gillespie, 2005) have contended that the different goals that individuals hold provide mental frameworks regulating different sets of cognitive, affective, and behavioral choices and consequences associated with efforts to attain the goals. Similarly, goal-setting theorizing (Locke & Latham, 2002) has suggested that the goals people are committed to attain function as a motivational catalyst that directs their attention and effort toward goal-relevant information and activities and heightens their persistence. The present study has demonstrated that students' pursuit of PB goals has a wide array of consequences not only on academic capacities but also on social functioning that may promote attainment of their PB goals. For example, students seeking to attain PB goals (e.g., a slightly higher mark than their previous best) appear inclined to adopt deep learning to help them attain their target performance. It is also the pursuit of optimally challenging tasks characterizing PB goals that affords students with a required condition to experience 'flow' in their task engagement. Similarly, positive teacher-student relationships can also be enhanced by orienting students toward pursuing their PB goals

Table 3
Standardized beta coefficients for the final longitudinal model of personal bests and academic and social outcomes.

		Covariates				Time-1						Time-2					
		Age	LB	TP_{T1}	TP_{T2}	PB	DL	AF	AB	TR	SC	PB	DL	AF	AB	TR	SC
Covariates	Age																
	Language Background (LB)																
	T1 Test Performance (TP_{T1})																
	T2 Test Performance (TP_{T2})			.81***													
Time-1	Personal Best Goals (PB)	−.09	−.01	.09													
	Deep Learning (DL)	−.03	−.08	−.01		.72***											
	Academic Flow (AF)	−.05	−.18**	−.04		.74***											
	Academic Buoyancy (AB)	−.08	−.20***	−.05		.26***											
	Teacher Relationship (TR)	−.02	−.21***	−.05		.61***											
	Student Cooperation (SC)	−.16*	−.09	.03		.16*											
Time-2	Personal Best Goals (PB)	−.06	.07	.06	.03	.64***											
	Deep Learning (DL)	.12*	.09	−.07	.07		.33***					.45***					
	Academic Flow (AF)	.09	.02	−.03	−.08			.31***				.59***					
	Academic Buoyancy (AB)	.15*	−.03	−.09	.07				.55***			.05					
	Teacher Relationship (TR)	.07	.02	.09	.01					.39***		.32***					
	Student Cooperation (SC)	−.04	.02	.01	−.03						.62***	.05					

Notes: *$p < .05$, **$p < .01$, ***$p < .001$; Language background (1 = English speaking, 2 = non-English speaking); Shaded coefficients denote auto-regressive paths.

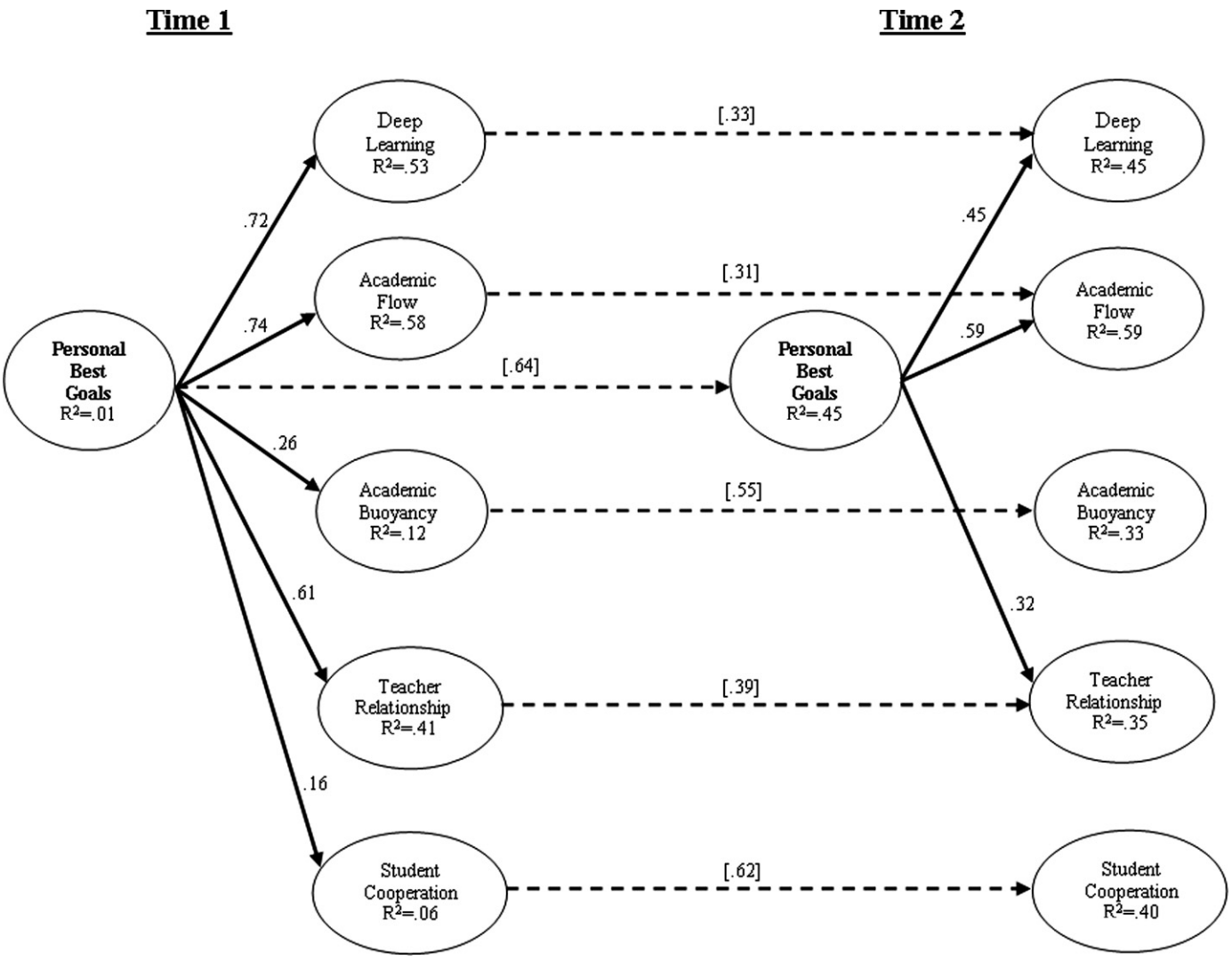

Fig. 2. Final longtudinal model of PB goals and socio-academic outcomes. Notes: All parameters are significant at $p < .05$; dotted line represents auto-regressive paths; for clarity purposes covariates are not shown in this figure.

because teachers are not seen as the ultimate gatekeeper of their academic success (Covington, 1992).

It is noteworthy, however, that the role of PB goals in relation to academic buoyancy was relatively weak at Time 1 ($\beta = .26$) and non-significant at Time 2 ($\beta = .05$). As demonstrated in prior research, one consequence of being PB-oriented is heightened persistence (Martin & Liem, 2010). Persistence, alongside self-efficacy, planning, anxiety (as a negative predictor), and uncertain control (also as a negative predictor), have also been found as key motivational predictors of academic buoyancy (Martin et al., 2010). Hence, the extent to which students' pursuit of PB goals interface with academic buoyancy may be mediated by their persistence and/or other proximal predictors of academic buoyancy. Future studies need to test this meditational hypothesis.

Similarly, although the effect of PB goals on students' attitudes toward peer cooperation was significant at Time 1 ($\beta = .16$), this effect was relatively weak compared with other PB goals effects in the model and was non-significant at Time 2 ($\beta = .05$) after controlling for covariates and shared variance with the Time-1 corresponding factor. Speculative explanations to this finding might relate to characteristics of our sample and its educational setting. Slavin (1990), for example, found that most of the cooperative learning situations experienced by students under norm-referenced and individual-oriented assessments – typically characterizing most Western education settings like in the present study – were initiated by teachers and successful when based on group rewards. Moreover, Johnson and Engelhard (1992) have shown that girls reported higher preferences for cooperative learning than boys. Hence, there are reasons to believe that the extent to which pursuing PB goals relates to favorable attitudes toward peer cooperation might be mediated/moderated by students' gender, the emphasis on group activities in the curriculum, and the nature of assessment used to evaluate performance. Future studies should consider these factors in assessing the effect of PB goals on peer cooperation.

4.2. Applied implications

Our findings provide an empirical basis for educational practice targeting students' goal-setting skills (Locke & Latham, 2002). In his meta-analyses, Hattie (2009) found that the sizes of goal effects on performance varied according to the levels of difficulty and specificity of the goals set by students. The effect was relatively low at $d = .49$ when the target goals are too difficult and ambiguous to attain (e.g., when 50% of materials relevant to goal attainment are unknown) compared to $d = 1.19$ when the target goals are optimally challenging and more specific (e.g., when there is an optimal gap between the known and unknown goals-relevant materials). This is not surprising because optimally challenging and specific goals provide a clear benchmark which students can use to monitor and evaluate the progress of their goal attainment (Locke & Latham, 2002). Goal-setting theorizing has also pointed to the salience of people's commitment, self-efficacy, and perceived importance of the goals as positive moderators in the goal-performance relationships (Locke & Latham, 2002). Hence, to harness the PB goals concept in academic setting, educational interventions should coach students how to set PB goals, help them recognize their personal capacities to achieve such goals, and make explicit why such goals are worth attaining.

The concept of PB orientation also relates to a promising way of assessing student performance (Martin, 2011a). Research and theorizing have pointed out that the extent to which students are engaged in social comparisons of ability is, in part, reinforced by assessment practices with norm-referenced assessments typically associated with intensified social comparisons (Covington, 1992). Whilst it is probably unrealistic to eliminate norm-referenced assessments, implementing classroom assessments focusing on students' PB goals, alongside the norm-referenced assessment, may reduce students' tendency to compare their performance with that of others. To the extent that this is the case, teachers can introduce the concept of PB goals to students and ask each student to complete a PB assessment sheet for each school subject in which a student records his/her previous best performance, a 'next' performance goal (i.e., whether the goal is to maintain or to improve one's PB), and steps or ways to reach their PB goals. The co-implementation of PB-oriented and norm-referenced assessments provides chances of experiencing academic success to all students rather than only the most able students in the class. Hence, implementing PB-oriented assessments seems consistent with student-centered principles in education as it recognizes individual students' unique potential and aims at optimizing the realization of this unique potential.

4.3. Methodological implications

The study also affirms the importance of some key methodological dimensions. First, it highlights the instrumentality of longitudinal approaches to substantive issues in motivation and learning research by estimating unique effects of hypothesized factors (e.g., PB goals) on outcome measures (e.g., deep learning) after controlling for auto-regressive paths of the outcome measures (Martin, 2011b). Second, the study provides evidence for the efficiency of weighted composite-score latent modeling (Holmes-Smith & Rowe, 1994) as a robust modeling technique that can be used when the sample is small and the estimated parameters are many. Whilst researchers dealing with such a situation would typically rely on a path analysis technique that does not purge constructs of measurement error and disregards individual items' contributions to their factor's composite score, the weighted composite-score modeling is methodologically more robust and consistent with the essence of latent modeling as it takes into account item unreliability and unique (unequal) contributions to the composite score of the target factor. Hence, compared with the traditional path analysis, this technique generates more accurate parameter estimates vital in understanding the effects of key predictors on outcomes.

4.4. Limitations and future directions

There are a number of potential limitations important to consider when interpreting findings which provide directions for future research. First, although the study involved a longitudinal dataset that is inherently difficult to collect, the sample was relatively small ($N = 249$) and comprised female students only. Future studies should extend generalizability of the present findings to a more representative high-school student population by drawing a larger sample encompassing both female and male students across a full span of high-school years.

Second, whilst the study adopted a longitudinal design which, to a certain extent, allows an inference about causality suggesting that factors measured at Time 1 are possible 'causes' of the changes in factors measured at Time 2 (Martin, 2011b), the correlational nature of the data does not fully allow conclusions of causal relations between PB goals and the socio-academic outcomes of interest. Future studies should employ (quasi-)experimental designs to ascertain the extent to which PB-related interventions bring about changes in academic and non-academic outcomes.

Third, the present study has administered the PB scale to measure the extent to which students pursue target goals that are higher than, or comparable with, their previous best performance. As described earlier, there are apparent conceptual similarities between PB and self-approach goals (Elliot et al., 2011). However, PB goals are conceptually broader than self-approach goals as the

former represents *product* and *process* dimensions of target goals whereas the latter seems to focus on the *product* dimension. Hence, future research needs to measure product- and process-related PB goals and test their discriminant and convergent validity in relation to self-approach goals.

Fourth, PBs-related research has predominantly been conducted in a culturally Western educational setting emphasizing individualism (Liem et al., 2009). There is a need for future studies to examine the effects of PB goals – that are characteristically personalized, self-set, and self-evaluated – among students in other cultural and educational contexts that operates on the basis of collectivist values and emphasizes the importance of togetherness, conformity, and deference to authority (e.g., teachers, parents). This too, then, is an area for future research.

5. Conclusion

The present study examined the role of PB goals in students' socio-academic functioning across the course of a school year. After controlling for age, language background, and academic ability, longitudinal modeling showed that, at Time 1, PB goals predicted deep learning, academic flow, buoyancy in academic life, perceived positive teacher relationships, and favorable attitudes toward peer cooperation. The role of PB goals in students' deep learning, academic flow, and perceived teacher relationships remained significant at Time 2 after controlling for prior variance of the corresponding socio-academic factors and covariates. Taken together, the present investigation has provided potential substantive, applied, and methodological implications for researchers and practitioners seeking to harness PB goals in students' academic lives.

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