# Achievement goals, behavioural engagement, and mathematics achievement

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# Achievement Goals, Behavioural Engagement, and Mathematics Achievement: A Mediational Analysis

**Abstract**

Previous studies have shown that mastery-approach and performance-approach goals can be positively associated with adaptive educational outcomes. Few studies, however, have examined links with behavioural engagement. The aim of the present study was to examine whether behavioural engagement mediated relations between mastery-approach and performance-approach goals and subsequent achievement in mathematics. Data were collected from 1,057 students aged 9 to 11 years in a longitudinal design over the course of a single school year. Results showed that a mastery-approach, but not a performance-approach, goal predicted behavioural engagement. Behavioural engagement, in turn, predicted mathematics achievement. Furthermore, behavioural engagement mediated relations between mastery-approach and subsequent mathematics achievement. This study contributes to the evidence base for the adaptive role of mastery-approach which can be encouraged by students setting personal best goals, and teachers ensuring that feedback is task-focused, and that the classroom climate is mastery-focused.

*Keywords*: achievement goals, performance-approach, mastery-approach, behavioural engagement, achievement

## 1.0 Introduction

Achievement goals are thought to influence the direction of achievement behaviours such as behavioural engagement (Elliot, 2005; Elliot & Hulleman, 2017). Specifically, approach-orientated goals energise behavioural engagement that would ultimately manifest in improved achievement (Elliot & Church, 1997; Rawsthorne & Elliot, 1999). Mastery-approach goals have been linked to a variety of positive academic outcomes including interest, positive achievement emotions and achievement (e.g., Huang, 2011, 2012; Hulleman, Shrager, Bodman, & Harackiewicz, 2010). Findings for performance-approach have been equivocal; partly due to the ways that the construct has been differently operationalised (Hulleman et al., 2010; Senko & Dawson, 2017). In their meta-analysis of 243 studies, Hulleman et al (2010) showed that performance-approach goals correlated positively ($r$ = .14) with achievement when items emphasised performing well relative to others and negatively ($r$ = -.14) when items emphasised appearing competent to others.

Few studies, however, have examined how achievement goals might be related to behavioural engagement (e.g., Gonida, Voulala, & Kiosseoglou, 2007, 2009), or how behavioural engagement could mediate relations between achievement goals and subsequent educational achievement (Liem, Lau & Nie, 2008). In the present study we address this gap in the literature by examining how behavioural engagement mediates the relations between mastery-approach and performance-approach goals, and subsequent mathematics achievement in a sample of primary school students aged 9 to 11 years. Using a longitudinal design with five waves of data collection, we control for prior behavioural engagement and mathematics achievement.

### 1.1 Achievement Goals

Achievement goals are defined by Hulleman et al. (2010) as “a future-focused cognitive representation that guides behavior to a competence-related end state that the individual is either committed to approach or avoid" (p. 423). In the goal standards approach, achievement goals are differentiated relative to the standard or criterion used to judge competence (Elliot, 2005; Senko & Tropiano, 2017). These can be relative to others (e.g., correctly solving more mathematics problems than the class average or a particular classmate), relative to the absolute demands of a task (e.g., solving a mathematics problem correctly), or relative to one's own past achievements or future potential (e.g., beating one's previous number of mathematics problems solved correctly). In terms of valence, approach goals occur when a student is striving for success, whilst avoidance goals occur when a student is striving to avoid failure (Elliot & Church, 1997).

The 2x2 framework of achievement goals proposes that mastery and performance goals are differentiated along dimensions of approach and avoidance (Elliot & McGregor, 2001; Elliot & Murayama, 2008). In the present study, however, we focused solely on approach-orientated mastery and performance goals. Younger students are less likely to be able to adequately distinguish between approach and avoidance goals (Bong, 2001, 2009; Ross, Shannon, Salisbury-Glennon, & Guarino, 2002) potentially leading to reduced predictive power and statistical suppression. Mastery-approach goals are judged against self or task-determined standards of competence; to develop one's competence in order to successfully complete a task or improve on one's previous performance. Performance-approach goals are judged relative to others; to demonstrate one's competence is better than that of classmates. Although mastery-approach and performance-approach goals have distinct foci it is likely they will be positively related due to shared antecedents such as strong competence beliefs and a strong need for achievement (Elliot & McGregor, 2001; Hulleman et al., 2010).

Meta-analyses show that mastery-approach goals are positively related to interest and achievement (Huang, 2012; Hulleman et al., 2010), and positive achievement emotions such as enjoyment (Huang, 2011). Meta-analytic studies have also shed some light on the equivocal relations found between performance-approach and achievement. Performance-approach has not been consistently operationalised in the literature; some measures use normative items that focus on performance relative to classmates and others use items that focus on *appearing* competent to others. When measured using normative items, focusing on performance relative to others, performance-approach shows positive relations with achievement (Huang, 2012; Hulleman et al., 2010), self-regulation, competence beliefs, and use of deep and adaptive surface learning strategies (Senko & Dawson, 2017). Furthermore, performance-approach goals are positively related to positive achievement emotions and negatively related to negative achievement emotions (Huang, 2011).

### 1.2 Behavioural Engagement

Behavioural engagement refers to active participation in school, lessons and classroom activities (e.g., Appleton, Christenson, Kim, & Reschly, 2006; Fredricks, McColskey, Meli, Mordica, Montrosse, & Mooney, 2011). Indicators include on task-behaviour, effort, persisting on challenging tasks, paying attention in class, attendance, and homework completion. Behavioural engagement is one of a number of ways that characterise students making maximum use of learning opportunities (see Fredericks, Blumenfeld, & Paris, 2004; Jimerson, Campos, & Gried, 2003; Reschly & Christenson, 2012). Other forms of engagement include emotional and cognitive engagement. Emotional engagement refers to positive and negative reactions to school, lessons, and relationships with teachers and peers, and cognitive engagement to the level of personal investment and involvement in learning and learning tasks (Appleton et al., 2006; Fredricks et al., 2011; Martin, 2007; Voelkl, 2012). We focused solely on behavioural engagement in the present study as theory proposes that achievement goals are the reasons why individuals engage in achievement related situations (Elliot, 2005; Elliot & Hulleman, 2017; Pintrich, 2003), although this has received little empirical attention. In contrast, multiple studies have examined how achievement goals relate to emotions (Daniels, Stupinskys, Pekrun, Haynes, Perry & Newall, 2009; Pekrun, Cusack, Murayama, Elliot, & Thomas, 2014; Putwain, Larkin, & Sander, 2013) and learning strategies (e.g., Diseth, 2011; Liem et al., 2008; Michou, Mouratidis, Lens, & Vansteenkiste, 2013), which are often used as proxies for emotional and cognitive engagement, respectively."

Models of engagement propose that behavioural engagement is a necessary prerequisite for achievement (e.g., Finn & Zimmer, 2012; Reschly & Christenson, 2012; Voelkl, 2012). Without high levels of school attendance or active participation in lessons students will not have the opportunity to receive instruction, extend or deepen their learning, or receive feedback on their learning. Numerous studies have supported this link in diverse samples of primary and secondary school students using various indicators of behavioural engagement. In secondary school students, measures of persistence, participation, and involvement positively correlate with standardised measures of numeracy and literacy (Martin & Liem, 2010), standardised measures of science achievement (Lee, Hayes, Seitz, DiStefano, & O' Connor, 2016 ) and class grades (Froiland & Worrell, 2016; Wang & Holcombe, 2010). In elementary school students, measures of participation, involvement, and attentiveness, positively correlate with class grades (e.g., Patrick, Ryan, & Kaplan, 2007; Reyes, Brackett, Rivers, White, & Salovey, 2012) and standardised tests of reading and mathematics (Dotterer & Lowe, 2011). Furthermore, it has been shown that effortful engagement predicts achievement on standardised reading and mathematics tests over time in elementary school children after controlling for prior achievement (Hughes, Luo, Kwok, & Loyd, 2008).

### 1.3 Behavioural Engagement Mediates Relations between Achievement Goals and Achievement

In achievement goal theory (Elliot, 2005; Elliot et al., 2011; Hulleman et al., 2010; Pintrich, 2003) achievement goals are theorised as a the reasons for engaging in achievement-orientated behaviours (effort, persistence, paying attention, on-task behaviour, attendance, and homework completion; collectively referred to as behavioural engagement). Stronger mastery-approach and performance-approach goals would be expected to relate to greater behavioural engagement; they are both appetitive goals that relate to positive emotions and achievement (Huang, 2011; 2012; Hulleman et al., 2010). The focus of mastery-goals on the *development* of competence, however, would result in a stronger link with behavioural engagement (in classroom settings) than performance goals with a greater focus on the *demonstration* of competence. It would be anticipated that performance-approach goals might show a stronger link with greater effort and engagement in testing situations. Empirical evidence collected to date using cross-sectional designs in samples of secondary school students has partially supported this theorising. As anticipated, Mih, Mih, and Dragos (2015), showed relations between mastery-approach and behavioural engagement were stronger than for performance-approach. Gonida et al. (2007, 2009), however, showed positive relations between mastery-approach, but not performance-approach, goals and behavioural engagement.

Since studies have also shown behavioural engagement to be a direct antecedent of achievement (e.g., Lee et al., 2016; Patrick et al., 2007; Reyes et al., 2012), it is plausible that behavioural engagement mediates the relations between achievement goals and subsequent outcomes. A possible alternative, that behavioural engagement moderates relations between achievement goals and achievement outcomes would be unlikely as behavioural engagement is both theoretically and empirically speaking an outcome of motivational factors such as achievement goals. Remarkably, only one study to date has examined how behavioural engagement mediated the relations between achievement goals and achievement. Using a longitudinal design to control for prior achievement, Liem et al. (2008) showed that effort (an indicator of behavioural engagement) mediated relations between mastery-approach, but not performance-approach, goals and performance on a class test in a sample of secondary school students. Relatedly, using a cross-sectional design, Mih et al. (2015) showed that the indirect link from mastery-approach to academic functioning (low absenteeism, completing homework, and high educational aspirations), mediated by behavioural engagement, was stronger in secondary school students than for performance-approach.

In Liem et al.'s study (2008) achievement goals were measured concurrently with effort leaving a question over directionality. It is preferable for studies assessing mediation to have a temporal separation between mediator and outcome to eliminate uncertainty over directionality of relations and control for prior variance in the outcome variable (Kenny, Kashy, & Bolger, 1998). Furthermore, no studies have examined the direct link between achievement goals and engagement, or the mediating role of behavioural engagement, in samples of younger students where relations between achievement goals and outcomes would be potentially stronger (see Huang, 2011). We address these limitations in the present study using a robust longitudinal design to examine how mastery-approach and performance-approach goals predict mathematics achievement, mediated by behavioural engagement, in a sample of students aged 9-11 years, controlling for prior mathematics achievement and behavioural engagement. Our mediational model is shown in Figure 1.

[Figure 1 here]

### 1.4 Aim of the Present Study

The aim of the present study was to examine if behavioural engagement mediated relations between mastery-approach and performance-approach goals, and subsequent achievement in mathematics in a sample of primary school students aged 9-11 years. As motivation, engagement, and achievement are likely to vary from one subject to another

(Bong, 2001; Buehl & Alexander, 2005; Buehl, Alexander, & Murphy, 2002) it is important, according to the matching-specificity principle, that constructs and items are conceptualised in a domain-specific fashion (Swann, Chang-Schneider, & McClarty, 2007). Successful mathematics learning at school is linked to future earning potential of an individual (Rose & Betts, 2004) and a globally competitive science, technology, engineering, and mathematics, workforce (Bates & Phelan, 2002). Accordingly, mathematics learning in primary and secondary education has been the focus of international research efforts (e.g., Kärkkäinen & Vincent-Lancrin, 2013; Wai, Lubinski, Benbow, & Steiger, 2010). However research has yet to examine how mathematics achievement in primary school children relates to achievement goals and behavioural engagement. To address this gap in the literature we focused on mathematics in the present study.

Data were collected longitudinally in five waves over the course of a single school year. Mathematics achievement was measured in the first and final waves, behavioural engagement, at the second and fourth waves, and achievement goals at the third wave. Thus, we were able to examine how achievement goals predict subsequent behavioural engagement, after controlling for the autoregressive relation with prior behavioural engagement, and then how behavioural engagement predicts subsequent mathematics achievement (and the mediating role of behavioural engagement), after controlling for the autoregressive relation with prior mathematics achievement. Importantly, for the purposes of mediation, achievement goals, subsequent behavioural engagement, and subsequent mathematics achievement were all temporally separated.

The following hypotheses were examined:

*Hypothesis 1*: $T_3$ achievement goals will predict $T_4$ behavioural engagement. This will be stronger for mastery-approach than performance-approach.

*Hypothesis 2*: $T_4$ behavioural engagement will predict $T_5$ mathematics achievement.

*Hypothesis 3*: $T_4$ behavioural engagement will mediate relations between $T_3$ achievement goals and $T_5$ mathematics achievement. Indirect relations will be stronger for mastery-approach than performance-approach.

# 2.0 Method

## 2.1 Sample

Achievement data were available for all participants, thus sample size was primarily determined by responses to the three waves of self-report data collection ($T_2$, $T_3$ and $T_4$). At $T_2$ there were 1,057 participants from 25 English primary schools clustered in 65 classrooms. Participants were either in the penultimate (Year 5) or final (Year 6) year of primary school with a mean age of 10.1 years (*SD* =.94). Sample characteristics are shown in Table 1. Due participant attrition the sample size dropped to 959 participants at $T_3$ there were and 453 participants at $T_4$. The demographic characteristics of the sample, however, remained similar at each wave. Attrition was due to a combination of factors such as students being absent from school due to school trips organised near the end of term, illness, and students exercising their ethical right to non-participation. Missing data were unrelated to substantive study variables (*r*s = .01 - .05) or covariates (*r*s = <.01 - .03) and handled in subsequent analyses using full information maximum likelihood (Muthén & Muthén, 2012).

[Table 1 here]

## 2.2 Measures

**2.2.1 Behavioural engagement.** Behavioural engagement was measured using the five-item scale from the *Engagement vs. Dissatisfaction with Learning Questionnaire* (Skinner, Kindermann, & Furrer, 2009). All items were adapted to refer to mathematics lessons or activities (e.g., ‘I participate in the activities and tasks in my maths lessons’)[1]. Participants responded on a five-point scale (1=strongly disagree, 5= strongly agree) such

[1] In UK parlance, mathematics is referred to as maths.

that a higher score represents stronger engagement in mathematics lessons. The internal consistency, construct, and predictive validity, of this scale have been reported in previous research (e.g., Skinner & Chi, 2012; Skinner, Furrer, Marchand, & Kinderman, 2008). Psychometric data for the present study, reported in Table 1 below, were good.

**2.2.2 Achievement goals.** Mastery- and performance-approach goals were measured using nine items from the *3x2 Achievement Goals Measure* (Elliot, Murayama, & Pekrun, 2011). Items from the original scale were adapted to focus specifically on mathematics and the language simplified for use with primary school students. A mastery goal was measured using three items each from the self (e.g., 'My aim is to perform better in maths than I have done in the past') and task subscales (e.g., 'My aim is to get a lot of questions right in maths'). A performance goal was measured with three items (e.g., 'My aim is to perform better than other students in maths') from the 'other' subscale. A cognitive validity exercise (Karabenick et al., 2007), conducted with an independent sample of twelve students aged 9-12 years, confirmed that item wording could be understood and that subjective item interpretation was consistent with the definition of the goals. Participants responded on a five-point scale (1 = strongly disagree, 5 = strongly agree) such that a higher score represented a stronger endorsement of that goal. Preliminary confirmatory factor analyses showed that self and task were not empirically differentiable ($r$ = .85) and were combined into a single mastery goal for subsequent analyses. Psychometric data are reported in Table 1 below.

**2.2.3 Mathematics achievement.** Mathematics achievement was measured using teacher reported student progress benchmarked against National Curriculum levels (Department of Education, 2014)[2]. National Curriculum levels were criterion-referenced standards of attainment comprising eight levels (8 being the highest) subdivided into three

[2] From 2015 onwards this system was replaced to allow schools to have autonomy to choose their own measures of progress. These data were collected in the 2014-15 academic year, before these changes were introduced.

sub-levels (low, mid, and high). In our sample, the scores ranged from level 2 (low) to level 6 (high) resulting in a fifteen-point scale (the expected level of a student at the end of Year 6 is level 5). Although the reliability of teacher assessments in our study cannot be directly established, teacher judgements of National Curriculum Levels have been shown to correspond to those on standardized tests in 75% of cases (Reeves, Boyle, & Christie, 2001).

**2.3 Procedure**

The study utilised a longitudinal, multi-wave design, with data collected at five time points throughout one academic year by the students' regular teacher. Teachers received training and followed a script that explained to students the purpose of the study; that it was not a test, that is was acceptable to ask for help with reading, that participation was voluntary, how to withdraw from the study if they wished to, and that responses were anonymous. Mathematics achievement was collected at the beginning ($T_1$; September 2014) and end of the academic year ($T_5$; July 2015), behavioural engagement data were collected in December 2014 ($T_2$), and June 2015 ($T_4$), and achievement goals were measured in March 2015 ($T_3$).

Self-report data for all variables were collected from students during lesson time using personal digital assistants. These are small handheld electronic devices that allowed the teacher to provide students with instructional materials, such as mathematics problems, via a wireless connection (and in our case, the items for self-report). Responses were uploaded to a database with anonymised student identifiers that were used to link self-report data with achievement. The project was approved by a Faculty Ethics Committee and consent was provided by the school Head Teacher, class teacher and parents/ carers. Additional assent was provided by students at each wave of data collection. This study was part of a larger project that was registered with the Center for Open Science. In addition to the measures reported here, we also collected data for mathematics learning strategies at $T_2$ and enjoyment and boredom at $T_2$ and $T_4$.

## 2.4 Analytic Plan

Our analytic plan followed two steps. First, we used confirmatory factor analysis (CFI) to examine the properties of a measurement model consisting of $T_1$ and $T_5$ mathematics achievement, $T_2$ and $T_4$ behavioural engagement, and $T_3$ achievement goals, as latent variables. Gender and age were subsequently added to this CFA as manifest variables to generate bivariate correlations. Second a structural equation model (SEM) was used to test the paths specified in Figure 1 (also including gender and age) including the indirect relations from $T_3$ achievement goals to $T_5$ mathematics achievement mediated by $T_4$ behavioural engagement.[1]

# 3.0 Results

## 3.1 Descriptive Statistics

Descriptive statistics are shown in Table 2. $T_2$ behavioural engagement, $T_4$ behavioural engagement, and $T_3$ mastery-approach, showed negatively skewed leptokurtic distributions. The internal consistency coefficients for $T_2$ and $T_4$ behavioural engagement and $T_3$ achievement goals were good (Cronbach's $\alpha \geq .71$) and standardised factor loadings reported from the measurement model described below were satisfactory ($\lambda \geq .47$). The intraclass correlation coefficient statistic ($ICC_1$) represents the proportion of variance attributable to the classroom level. A relatively small proportion of variance in $T_2$ and $T_4$ behavioural engagement and $T_3$ mastery-approach was evident at the classroom level (approximately 7% and 4% respectively). A larger proportion of variance in $T_3$ performance-approach and $T_1$ and $T_5$ mathematics achievement (≥ 13% approximately) occurred at the classroom level. In subsequent latent variable modelling analyses, using the M*plus* software (Muthén & Muthén, 2017), standard errors were adjusted for the non-normal distribution of data using the maximum-likelihood estimator with robust standard errors (MLR) and the clustering of participants into classes using the type = complex command in conjunction with the cluster function (Muthén & Muthén, 2017).

[Table 2 here]

**3.2 Measurement Models and Latent Bivariate Correlations**

An initial measurement model was built using five indicators each for behavioural engagement at $T_2$ and $T_4$, six indicators for $T_3$ mastery-approach and three indicators for $T_3$ performance-approach. $T_1$ and $T_5$ mathematics achievement was modelled, at each time point, using a single item indicator that was fixed at $\lambda = 1$ ($\varepsilon = 0$). Residual variance for the corresponding behavioural engagement indicators at $T_2$ and $T_4$ were allowed to correlate. This CFA, and all subsequent analyses, were performed using M*plus* v.8 and evaluated using a variety of model fit criteria. These included the root mean square error of approximation (RMSEA), standardised root mean square residual (SRMR), comparative fit index (CFI), and the Tucker-Lewis index (TLI). According to Hu and Bentler (1999), good model fit is indicated by a RMSEA value of ≤ .06, a SRMR value of ≤ .08, and CFI/ TLI values of ≥ .95. The rigid application of such guidance, however, may not be appropriate when using data collected in naturalistic settings, such as a school (e.g., Heene, Hilbert, Draxler, Ziegler, & Bühner, 2011; Lance, Butts, & Michels, 2006).

By these criteria, the measurement model showed a good fit to the data, $\chi^2(169) = 299.81$, $p < .001$, RMSEA = .028, SRMR = .042, CFI = .969, and TLI = .962. To establish the measurement invariance of behavioural engagement at $T_2$ and $T_4$, we constrained factor loadings, $\chi^2(173) = 312.65$, $p < .001$, RMSEA = .028, SRMR = .062, CFI = .967, and TLI = .960, followed by intercepts, $\chi^2(178) = 325.86$, $p < .001$, RMSEA = .029, SRMR = .066, CFI = .965, and TLI = .959, and finally residual variance, $\chi^2(183) = 348.92$, $p < .001$, RMSEA = .030, SRMR = .079, CFI = .961, and TLI = .955 (see Merideth, 1993). At each step, declines in CFI/ TLI were not > .01, and RMSEA not >.015, showing an equivalent factor structure, loadings, intercepts, and residual variances, in behavioural engagement at $T_2$ and $T_4$ (Chen, 2007; Cheung & Rensvold, 2002; Vandenberg & Lance, 2002).

Gender and age were added to the measurement model as manifest variables and latent bivarate correlations reported from this model: $\chi^2(200) = 344.84$, $p < .001$, RMSEA = .027, SRMR = .039, CFI = .967, and TLI = .958. Latent bivariate correlations are shown in Table 3. $T_3$ mastery-approach and performance-approach goals were positively correlated with $T_2$ and $T_4$ behavioural engagement. $T_5$ mathematics achievement was positively correlated with $T_2$ and $T_4$ behavioural engagement and $T_3$ mastery-approach. Age was positively correlated with $T_1$ mathematics achievement.

[Table 3 here]

### 3.3 Structural Equation Modelling

A SEM was used to test the model set out in Figure 1 (including gender and age as covariates). This model showed a good fit to the data, $\chi^2(201) = 349.34$, $p < .001$, RMSEA = .027, SRMR = .040, CFI = .966, and TLI = .957, and so we proceeded to examine standardised path coefficients. As an approximate guide, Keith (2006) recommends that βs > .05 are considered as small, βs > .10 moderate, and βs > .25 large. Statistically significant paths are shown in Figure 2.

[Figure 1 here]

$T_1$ mathematics achievement predicted $T_2$ behavioural engagement ($\beta = .17$, $p < .001$). $T_2$ behavioural engagement predicted $T_3$ mastery-approach ($\beta = .54$, $p < .001$) and $T_3$ performance-approach ($\beta = .41$, $p < .001$). $T_3$ mastery-approach predicted $T_4$ behavioural engagement ($\beta = .38$, $p < .001$), over and above the variance accounted for by $T_2$ behavioural engagement ($\beta = .31$, $p < .001$) and $T_1$ mathematics achievement ($\beta = .08$, $p = .39$). $T_3$ performance-approach was not a statistically significant predictor of $T_4$ behavioural engagement ($\beta = .03$, $p = .79$). $T_4$ behavioural engagement predicted $T_5$ mathematics achievement (β = .18, $p$ =.02), over and above the variance accounted for by $T_1$ mathematics achievement (β = .77, $p$ <.001) and $T_2$ behavioural engagement (β = .03, $p$ =.66). $T_3$ mastery-approach (β = .08, $p$ =.24) and $T_3$ performance-approach (β = -.10, $p$ =.32) were not direct predictors of $T_5$ mathematics achievement.

The indirect relationship from $T_3$ mastery-approach to $T_5$ mathematics achievement was mediated by $T_4$ behavioural engagement: β =.07, *SE* = .03, 95% CIs [.02, .12]. The indirect relationship from $T_3$ performance-approach to $T_5$ mathematics achievement was not statistically significant: β <.01, *SE* = .01, 95% CIs [-.02, .03]. Of the covariates included in the model, age was related to $T_1$ mathematics achievement (β = .36, $p$ <.001). All other relations were not statistically significant (*p*s >.05).

**4.0 Discussion**

The aim of the study was to examine whether behavioural engagement mediated the relations between two achievement goals (mastery-approach and performance-approach) and subsequent mathematics achievement. Data were collected from a sample of primary school students aged 9 to 11 years over the course of a single year using five waves of data collection. Results from a structural equation model show that $T_3$ mastery-approach, but not $T_3$ performance-approach, predicted $T_4$ behavioural engagement over and above the variance accounted for by $T_1$ mathematics achievement, and $T_2$ behavioural engagement, partially supporting *Hypothesis 1*. $T_4$ behavioural engagement predicted $T_5$ mathematics achievement over and above the variance accounted for by $T_1$ mathematics achievement, and $T_2$ behavioural engagement,supporting *Hypothesis 2*. An indirect relationship was shown between $T_3$ mastery-approach and $T_5$ mathematics achievement, mediated by $T_4$ behavioural engagement, but not between $T_3$ performance-approach and $T_5$ mathematics achievement, partially supporting *Hypothesis 3*. Findings provide evidence for the mediating role of $T_4$ behavioural engagement in the mastery-approach and achievement relation after controlling for autoregressive relations with prior behavioural engagement and mathematics achievement.

Achievement goals are conceptualised as cognitive representations that guide engagement in achievement-related settings (Elliot, 2005; Elliot & Hulluman, 2017). Accordingly, it might be expected that they predict adaptive forms of achievement behaviour, captured by behavioural engagement, such as on-task behaviour, effort, and attentiveness. Previous studies have shown that although mastery-approach and performance-approach goals correlate with behavioural engagement (Gonida et al., 2007, 2009; Liem et al., 2009), when the shared variance is controlled for, using regression analysis or SEM, only mastery-approach goals remain as a predictor (Mih et al., 2015, is an exception). Our study replicated the finding in a younger sample of students that, after the shared variance with performance-approach was accounted for, only mastery-approach was a significant predictor of behavioural engagement. It is likely that in classroom settings, where the focus in on developing competence, mastery-approach is more adaptive for engagement than a performance-approach. In other achievement situations, such as testing, it is possible that a performance-approach, with the greater emphasis on demonstrating competence, will be more adaptive

Many studies have shown that behavioural engagement predicts subsequent achievement in younger students (e.g., Dotterer & Lowe, 2011; Hughes et al., 2008; Patrick et al., 2007; Reyes et al., 2012). The present study was no exception and, although the size of the path coefficient was moderate, unlike the majority of previous studies, we controlled for prior achievement. Thus, we can be confident that the predictive power of engagement is not an artifact of prior achievement. That is, higher engagement can account for a statistically significant proportion of variance in subject achievement above and beyond the influence of prior achievement. Although the anticipated mediating role of behavioural engagement was small in the indirect relation from mastery-approach to achievement, the same point can be made; this was controlling for both prior engagement and achievement. This is typical for studies conducted in naturalistic settings using complex longitudinally collected data (Collie, Martin, Malmberg, Hall, & Ginns, 2015). Large indirect relations are usually only found in such datasets when autoregressive relations have not been accounted for (Martin, 2011). Thus, the beneficial role of mastery-approach extends not only to behavioural engagement, but also to subsequent achievement.

The main focus of our study was to examine whether behavioural engagement mediated the relations between goals and subsequent achievement. Like Liem et al. (2008), we found indirect relations between mastery-approach and subsequent achievement but not for performance-approach. Importantly, our study builds on Liem et al. (2008) in the following three ways. First, Liem et al. (2008) measured effort and achievement goals simultaneously, thus it not possible to rule out the possibility that achievement goals mediated relations between effort and subsequent achievement rather than effort mediating relations between achievement goals and subsequent achievement. In the present study the temporal separation between achievement goals and behavioural engagement resolves questions over directionality.

Second, Liem et al. (2008) did not control for autoregressive relations with prior achievement or effort. Thus, it is not possible to establish whether achievement goals offer incremental benefits in subsequent effort and achievement, over prior effort and achievement. By controlling for prior achievement and engagement in the present study we are able to show that a mastery goal is related to subsequent engagement and achievement, over and above the variance accounted for by prior achievement and engagement. Third, our study used a measure of behavioural engagement (see Skinner et al., 2009) that included a broader range of indicators of behavioural engagement (effort, participation, attention, and concentration) than Liem et al (2008) who only used a measure of effort. Thus, our study offers an examination of the principle that goals influence the direction of achievement behaviours using a construct, namely behavioral engagement, covering a broader range of behaviours than has been considered previously.

### 4.1 Limitations and Directions for Future Research

While a longitudinal design was used that allowed for a robust test of relations, it should be noted that we did not employ a fully cross-lagged design that would have measured achievement goals, behavioural engagement, and achievement at each wave. Cross-lagged designs offer an additional level of robustness by controlling for concurrent, as well as previous, relations with focal constructs. Within the limits of ethical and logistical constraints, future studies should strive for multi-wave cross-lagged panel designs where possible. Furthermore, although we limited data collection to approach-orientated goals for good reasons, this restricts the extent to which our findings comment on achievement goal theory more generally. One possibility would be to broaden the content of items used to measure goals, for instance, to include the reasons for adopting a goal (e.g., achievement motives, social values, and anticipated emotions). This approach is frowned upon by advocates of the goal standards approach for confounding the measurement of the goals with related constructs (see Elliot & Murayama, 2008; Sommet & Elliot, 2017). However, there may be a trade-off for the measurement of avoidance goals between the precision of goal measurement and making items more understandable to young children (i.e., a goal orientation approach). Future studies need to resolve this conundrum. Finally, we utilised a modelling technique that accounted for the clustering of data within classes. However, there may have been additional data at the class level resulting in biased parameter estimated (Luo & Kwok, 2009). Future studies with sufficiently large and balanced samples may wish to consider a three-level structure in their analyses.

### 4.2 Implications for Educational Practice

The findings of this study add to the body of literature (e.g., Huang, 2011, 2012; Hulleman et al., 2010; Senko & Dawson, 2017) suggesting that mastery-approach goals are adaptive for educational outcomes. There are various ways that a teacher could facilitate their students to develop mastery goals. To help students focus on developing their competence relative to their own past performance, students could be asked to set specific learning goals for their future (personal best goals) based on improving on their past performance (see Martin, 2015). To help students focus on developing competence relative to task demands, teachers can make sure that all feedback, especially summative feedback provided during task progress, is focused on task-specific demands and how task completion can be enhanced (see Pekrun et al., 2014). Finally, teachers can ensure that they build a classroom climate of mastery by not inadvertently comparing students' progress or achievement to those of others or encouraging potentially damaging normative comparisons by presenting individual grades to the whole class (see Daniels, Frenzel, Stupinsky, Stewart, & Perry, 2013).

### 4.3 Conclusion

The findings presented in this study provide further evidence for the adaptive role of mastery-approach goals based on a longitudinal design controlling for prior variance in mediating and outcome variables in a sample of students aged 9 to 11 years. Students who strongly adopted mastery-approach goals were more involved and attentive in their mathematics lessons, and subsequently showed greater mathematics achievement than their classmates who did not adopt mastery-approach goals so strongly. Mastery-approach goals can be encouraged by students setting personal best goals, and teachers ensuring that feedback is task-focused, and that the classroom climate is mastery-focused.

## Endnote

[1] Relations between $T_1$ achievement, $T_2$ engagement, and $T_3$ achievement goals, were not central to our hypotheses. They were included, however, to account for the likely relations that exist between these constructs and modelled as directional paths, rather than correlations, to reflect the temporal order in which they were collected. Although directional relations from $T_1$ achievement to $T_2$ engagement, and from $T_2$ engagement to $T_3$ achievement goals, runs counter to the proposed hypothesis that $T_4$ engagement mediates relations between $T_3$ goals and $T_5$ achievement it is theoretically plausible that over time goals, engagement, and achievement, are related in a reciprocal fashion (e.g., Finn & Zimmer, 2012; Skinner, 2016).

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Table 1

*Sample Characteristics at Each Wave of Data Collection*

| | Wave 2 | Wave 3 | Wave 4 |
|---|---|---|---|
| Total: | 1,057 | 959 | 453 |
| Gender: | | | |
| Male | 414 | 455 | 221 |
| Female | 543 | 504 | 232 |
| Year: | | | |
| Year 5 | 554 | 489 | 236 |
| Year 6 | 503 | 470 | 217 |
| Ethnic Heritage: | | | |
| Asian | 112 | 101 | 60 |
| Black | 40 | 33 | 15 |
| White | 819 | 760 | 359 |
| Other/ Mixed Heritage | 86 | 65 | 19 |

Table 2

*Descriptive Statistics for Behavioural Engagement ($T_2$ and $T_4$), Achievement Goals ($T_3$), and Mathematics Achievement ($T_1$ and $T_5$)*

| | Mean | SD | α | $ICC_1$ | Skewness | Kurtosis | Factor Loadings |
|---|---|---|---|---|---|---|---|
| $T_2$ Engagement | 4.52 | 0.60 | .83 | .07 | -2.11 | 6.97 | .55 – .83 |
| $T_4$ Engagement | 4.52 | 0.50 | .81 | .07 | -1.05 | 1.18 | .61 – .72 |
| $T_3$ Mastery-approach | 4.60 | 0.46 | .78 | .04 | -2.32 | 9.95 | .55 – .67 |
| $T_3$ Performance-approach | 4.01 | 0.86 | .71 | .13 | -0.88 | 0.42 | .47 – .73 |
| $T_1$ Mathematics achievement | 6.59 | 1.92 | — | .20 | 0.07 | -0.08 | — |
| $T_5$ Mathematics achievement | 7.43 | 1.90 | — | .21 | 0.15 | -0.18 | — |

Table 3

*Latent Bivariate Correlations between $T_1$ and $T_5$ Mathematics Achievement, $T_2$ and $T_4$ Engagement, $T_3$ Achievement Goals, and Gender and Age*

| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|---|
| 1. $T_2$ Engagement | — | .54*** | .53*** | .41*** | .12*** | .14* | -.07 | -.01 |
| 2. $T_4$ Engagement | | — | .57*** | .43*** | .13* | .24*** | -.07 | -.09 |
| 3. $T_3$ Mastery-approach | | | — | .70*** | .17*** | .18* | .01 | .01 |
| 4. $T_3$ Performance-approach | | | | — | -.01 | .03 | -.01 | -.09 |
| 5. $T_1$ Maths Achievement | | | | | — | .82*** | -.01 | .36*** |
| 6. $T_5$ Maths Achievement | | | | | | — | -.06 | .10 |
| 7. Gender | | | | | | | — | — |
| 8. Age | | | | | | | | — |

* $p$ <.05. ** $p$ <.01. *** $p$ <.001.

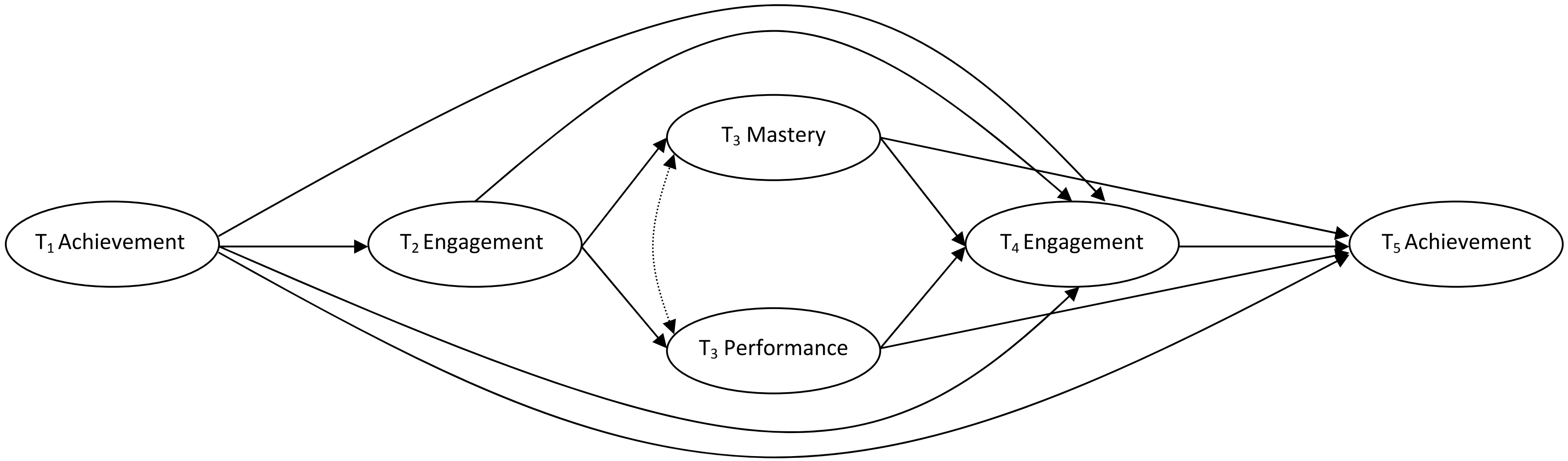


*Figure 1*. Model examining the hypothesised relations between mathematics achievement, engagement, and achievement goals. Structural paths are represented as solid black lines and covariances as dotted lines. Gender and age were included as covariates but for expediency have been omitted from this figure.

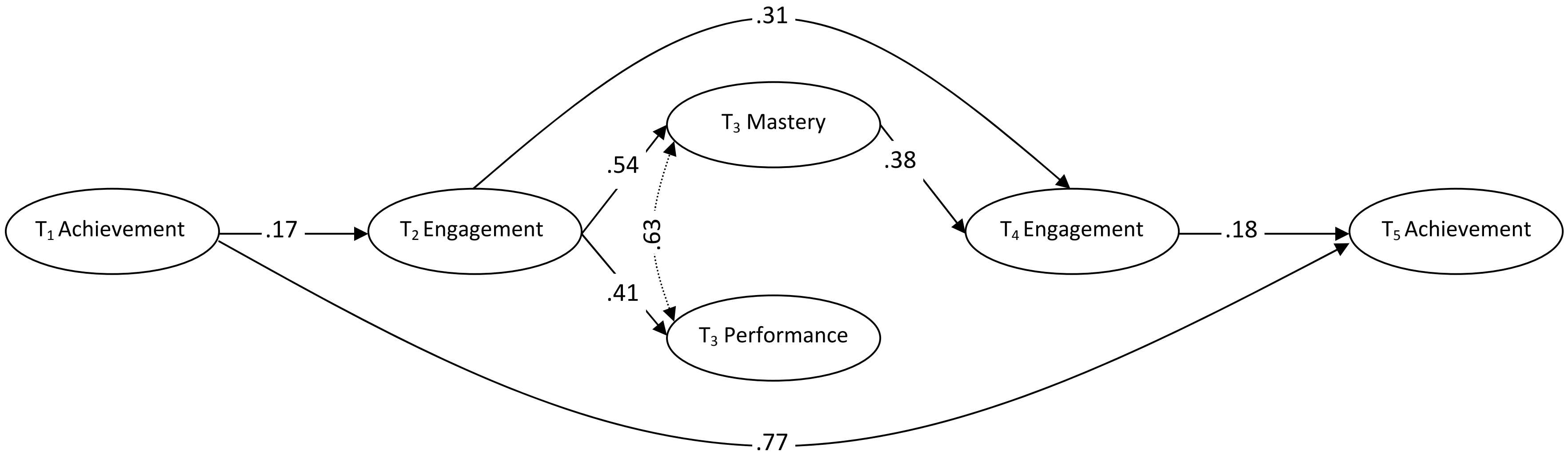


*Figure 2*. Statistically significant paths (solid black lines) and covariance (dotted line) from the SEM (coefficients are standardised).