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High School Students' Motivation to Learn mathematics: The Role of Multiple Goals

Abstract: Using a sample of 310 Year 10 Chinese students from Hong Kong, this survey study examined the effects of multiple goals in learning mathematics. Independent variables were mastery, performance-approach, performance-avoidance, and pro-social goals. Dependent variables included perceived classroom goal structures, teacher's support, learning motives and strategies, attitudes and grade aspiration. Based on regression and cluster analyses, this study found convergent evidence supporting the benefits of adopting additional adaptive goals alongside mastery goals. Regression analyses located significant interaction between pro-social goals and mastery goals in predicting higher levels of positive learning attitudes and lower levels of surface learning motives. Cluster analyses confirmed that students endorsing pro-social goals, performance-approach goals and mastery goals in their goal profiles had an adaptive pattern of perceptions, use of strategies, learning motives and grade aspiration in mathematics.

Keywords: Achievement goals; Chinese; mathematics; Motivation

Introduction

East Asian students' outstanding performance in mathematics, as shown repeatedly in the past rounds of international testing by The Trends in International mathematics and Science Study (TIMSS; Mullis, Martin, Foy, & Arora, 2012), begs the question of what motivates these students to learn, to aspire, and to achieve well. Research-based answers to this important question not only add to our understanding of Asian students' motivational patterns, but will also contribute to an empirical base for promoting sustained engagement in learning mathematics. The current study addressed this question by examining the motivational effects of achievement goals on learning mathematics among high school students in Hong Kong.

Achievement goals are students' perceived cognitive purposes that define *why* and *how* students engage in learning (Ames, 1992). Achievement goal studies in the past three decades have contrasted the effects of two major types of goals on learning and achievement, namely, mastery versus performance goals (Senko, Hullenman & Harackiewicz, 2011). Mastery goals focus students to learn for the sake of improvement and comprehension; whereas performance goals bring students' attention to achievement and relative ability. The question of which type of goals can optimize students' learning motivation has led to two contrasting perspectives, mastery-goal and multiple-goal perspectives. The mastery-goal perspective promotes the use of mastery goals *per se* to optimize students' motivation to learn and considers all form of performance goals detrimental (Midgley, Kaplan & Middleton, 2001). Based on the separation of performance goals into approaching and avoidance orientations, multiple-goal researchers (e.g. Barron & Harackiewicz, 2001) showed that detrimental effects of performance goals on learning were confined to those with an avoidance orientation such as avoiding showing a lack of ability whilst positive effects were found among performance goals with an approaching orientation such as seeking a better grade. The multiple-goal perspective promotes simultaneous endorsement of mastery and performance-approach goals. Subsequent studies (e.g. Barron & Harackiewicz, 2001; Pintrich, Conley & Kempler, 2003) have reported positive effects on learning derived from multiple goals. Nevertheless, most studies on multiple goals have focused on college students (Wolters, 2004) and few used samples of high school students. Little is known about the operation of multiple goals among students in cultural contexts beyond Euro-American societies (Pintrich et al., 2003). Multiple-goal studies that have included additional goals, other than those focusing on mastery and performance considerations, remain few (Senko et al., 2011). Against this backdrop, the current study examined Chinese high school students' multiple goals (mastery, performance-approach, performance-avoidance and pro-social goals) and their effects on the use of learning strategies, motives, attitudes, grade aspirations and perceptions of teacher support and classroom goal structures in the context of mathematics learning.

Multiple goals, learning strategies and attitudes

Increasingly, more studies (e.g. Barron & Harackiewicz, 2001; Lau & Lee, 2008) reported the benefits of simultaneous adoption of mastery and performance-approach goals on the use of regulatory and deep learning strategies, learning interest and positive attitudes attached to learning. However, the relationship between multiple goals and learning is far from conclusive. First, previous studies did not assess simultaneously the role of performance-avoidance goals, and therefore, have not been able to evaluate possible interactive effects of these maladaptive goals with adaptive goals such as mastery goals on learning, valuing and achievement. Second, the positive nature of multiple goals can be attributed to differences in academic context, task nature, and student characteristics. For example, Meece and Holt (1993) found empirical results supporting the mastery-goal perspective among primary students in an academic climate nurturing a mastery focus. In contrast, Barron and Harackiewicz (2001) formulated the multiple-goal perspective based on their research involving undergraduate students learning in an environment where both mastery and performance are expected. It is interesting to see if the enhanced positive effects of multiple goals on learning can also be observed among Chinese secondary students who learn mathematics in a competitive environment.

In the domain of mathematics, Hannula (2006) argued that students' learning motivation is complex. Many constructs, including students' needs, goals, and beliefs, have been used to research motivation. In addition, classroom influences and other situated factors such as feelings and emotions can complicate students' motivation to learn (c.f Goldin, 2014). In discussing the issue of complexity in motivation to learn mathematics, Hannula (2006) highlighted the importance of personal goals. Aligning with Hannula, Zhu and Leung (2011) distinguished two sources of motivation that focus students separately on enjoyment in and perceived values of learning mathematics. To a great extent, these two sources of motivation parallel the distinction between mastery and performance-approach goals.

In the context of motivating students to learn mathematics, there is, however, no published research that has examined the effects of simultaneous endorsement of mastery and performance-approach goals. There were, however, studies that found mastery goals correlated positively with effort expenditure in mathematics learning (e.g. Chouinard, Karsenti & Roy, 2007), valuing of mathematics, and students' self-efficacy beliefs and achievement levels in mathematics (e.g. Bong, 2001). In addition, Pantziara and Philippou (2015) found that mastery and performance-approach goals had positive independent effects on students' interest in learning mathematics. Bong's study of Korean students (2001) provided longitudinal evidence supporting that both types of goals were related to valuing of mathematics and students' self-efficacy in mathematics. Taken altogether, these mathematics-focused studies, alongside achievement goal research, have provided an empirical foundation supporting the hypothesis that combining both goals would be associated with adaptive patterns for learning mathematics, which, in this study, were characterised by use of deep strategies, deep motives, positive attitudes and aspirations for better results in learning mathematics. In particular, deep strategies and motives focus students on deep understanding in mathematics (Biggs, 1987), and their deployment is critical for students to "conjure, explain and make mathematical arguments" in what Schoenfeld (2014, p.407) dubbed as mathematically powerful classrooms.

Social goals have seldom been included in the research of multiple goals. It is unclear how social goals complement, conflict or compensate mastery and performance-approach goals (Dowson & McInerney 2001). There is, however, a general lack of unity in defining and classifying social goals. For example, social goals have been defined variously in terms of social outcome (e.g. Wentzel, 1989), demonstration of social competence (Ryan & Shim, 2006) and social purposes for achievement engagement (Urdan and Maehr, 1995). The current study aligned with Urdan and Maehr (1995) and considered social goals as students' social purposes for engaging in learning mathematics. Chan's study (2008) of Chinese gifted students found that prosocial goals promoting peer collaboration interacted significantly with mastery goals in predicting achievement levels. In line with Chan (2008), the current study focused on students' collaborative and helping behaviours as a form of prosocial goals for learning mathematics.

Performance-avoidance goals were another type of achievement goals that this multiple-goal study examined. There is little disagreement regarding the detrimental nature of performance-avoidance goals among achievement goal researchers (Senko et al., 2011). From the multiple-goal perspective, it is important to separate the main and interaction effects between performance-avoidance goals and other achievement goals, including those derived from pro-social goals. Adding performance-avoidance goals into the agenda of multiple-goal research can help clarify the effects of performance-approach goals. In addition, both performance-approach and avoidance goals should be important for the current sample of Chinese students who studied mathematics in an exam-oriented education system where competition for performance is always keen. The question is in what ways these maladaptive goals that focus students on avoiding showing incompetence or performing at the minimal level affect the operation of adaptive goals, and in this study, these include mastery, performance-approach and pro-social goals.

Multiple goals, goal structures and perceived support

Classroom goal structures are descriptions of the prevailing instructional practices, policies, and teacher behaviors (Wolter, 2004). Thus far, two types of classroom goal structures, namely mastery and performance goal structures have attracted much attention. Mastery goal structure refers to students' perceptions that their teacher focuses them on understanding and learning in classroom academic work. In contrast, performance-approach goal structure refers to students' perceptions that their teacher focuses students on outperforming others and getting high achievement in classroom academic work. Most studies found that students' achievement goals are associated with corresponding classroom goal structures (e.g. Midgley & Urdan, 2001). In other words, personal mastery goals are associated with perceived mastery goal structure while performance-approach goals are related to perceived performance goal structure. These bivariate associations can be interpreted in two viable ways. First, classroom goal structures predict students' personal goals (e.g. Friedel, Cortina, Turner, & Midgley, 2007). Based on this position, various goal researchers have developed classroom based intervention attempting to promote mastery goals by crafting a mastery oriented learning environment.

Equally viable is the theorisation that personal goals moderate students' perceived classroom goal structures. The current study adopts this alternative line of thinking. Classroom messages are rather mixed and it is often hard to pin down exactly what type of goals that teachers are trying to convey to their students (Urdan, 2004). It is through students' perceptions that the effects of classroom goal structure are filtered. Ames (1992) argued that students' thoughts, perceptions and interpretation mediate the effects of teacher behaviours. Tapola and Niemivirta (2008) provided empirical evidence directly supporting this alternative line of thinking and confirmed that students' perceived classroom goal structures are a function of personal achievement goals. In other words, classroom goal structures are students' perceptions or subjective construal of classroom norms and emphasis. This interpretation is in line with the work of Boekaerts (2001) that focus on students' subject interpretation of classroom learning events. It is also consistent with the theoristation that achievement goals are an interpretative framework guiding students' cognition, affect and behaviours for learning, and mediating the effects of teacher behaviours (Ames, 1992).

To date, few studies (e.g. Tapola & Niemivirta, 2008) have explored the effects of multiple goals on perceived goal structures. The current study adds to the multiple-goal literature by exploring how students' achievement goals interact with each other to moderate students' perceptions of classroom goal structures in learning mathematics. In addition to mastery and performance goal structures, this study examined students' perceived social goal structure. A social goal structure is defined as teachers' emphasis on social interaction and collaboration as the norm for a specific classroom, which is similar to the construction of cooperative classroom structure. Given that the mathematics teachers involved in this study claimed to have used mainly collaborative forms of pedagogy in their classrooms, it is interesting to see if students would perceive the dominance of such a form of social focus in their perceptions of classroom environment.

Related to students' perceived classroom structures is the level of support they receive from the teacher. Research (e.g. Wentzel, 1989) on interpersonal relationship in academic settings has found significant relationship between students' perceived support from teacher and their positive behaviour, motivation and attitudes. Using an undergraduate sample, Kaufman and Dodge (2009) found that students' mastery goals predicted relatedness with teacher while performance-approach goals and performance avoidance goals failed to establish any significant association with this important social variable. The current study examined students' perceived level of support from their teachers in terms of whether they considered their teachers friendly, caring and supportive. From the multiple goal perspective, the question is whether endorsing performance-approach or performance-avoidance goals alongside mastery goals would be associated with a lower level of perceived support.

Research hypothesis

Based on the discussion above, this study examined the hypotheses below:

H1: Adaptive goals for learning mathematics (including mastery goals, performance-approach goals and pro-social goals) would have positive independent effects on perceived classroom structures, deep motives, deep strategies, positive learning attitudes and grade aspiration. The reverse was expected in maladaptive goals, i.e. performance avoidance goals.

H2: The effects of adaptive goals would be enhanced by another adaptive goal in learning mathematics. In contrast, maladaptive goals would dampen the positive effects of adaptive goals.

H3: Personal goal profiles dominated by adaptive goals would be associated with positive perceptions, learning motives, strategies, attitudes and higher level of grade expectation for learning mathematics. In contrast, personal goal profiles dominated by maladaptive goals would be associated with a less desirable or negative pattern of perceptions, learning, attitudes and aspiration.

To examine these hypotheses, regression and cluster analyses were conducted. Regression analyses will provide an understanding of the main and interactive effects of multiple goals at the variable level. Cluster analyses will add to the variable-centred analyses by showing how a person-centred approach can reveal the effects of multiple goals at the individual level. Combining both types of analyses will provide a better understanding of the nature of multiple goals. Theoretically speaking, students are capable of endorsing a number of goals simultaneously (cf. Pintrich, 2000). Examining students' goal profiles (H3) will improve our understanding of different types of goal users and how they combine goals together in different ways.

Method

Participants

The participants were 310 secondary four (Year 10) students with mixed abilities in mathematics drawn from six secondary schools in Hong Kong. Secondary schools in Hong Kong were classified according to students' collective performance into three different achievement bands. Band 1 schools were mainly made up of high achievers while band 3 schools were populated mainly by low achieving students. The participants came from two band 1, one band 2, and one band 3 secondary schools. These students aged between 15 and 17 with a mean of 15.33 (SD=.55). In terms of gender mix, 43.2% were male and 53.8% female.

Procedure

Students completed two questionnaires in two separate sessions. The first questionnaire assessing achievement goals, self-assessed mathematics identities, and grade aspiration was administered in the beginning of the academic year. The second questionnaire assessing learning strategies, learning motives, perceived classroom structures, perceived teacher support and attitudes towards mathematics was completed three months later. The final sample was comprised of students who had completed both questionnaires. Students (N=11) who did not complete one of the questionnaires were removed from the final data set.

Major Constructs

The items assessing mastery, performance-approach and performance avoidance goals, perceived mastery structures and perceived performance structures were adapted from the Patterns of Adaptive Learning Scales (PALS, Midgley et al., 2000). Items assessing pro-social goals and perceived social structure were written specifically for this study after consulting Dowson and McInerney (2001) and PALS. Items assessing perceived teacher support were adapted from the Classroom Life Instrument (Johnson & Johnson, 1983). The focal concern during the adaptation process was to ensure that all the items referred to the learning of mathematics. Students rated each item on a 5-point Likert scale (strongly disagree=1; strongly agree=5). All these adapted items were listed in the supplementary materials. Below, sample items were described.

Achievement goals. The items measuring achievement goals were preceded by a stem, "*I study mathematics because ...*". This study predated the separation of mastery goals into approach and avoidance orientations. Consequently, it did not assess mastery-avoidance goals. The items assessing mastery goals correspond to those assessing mastery-approach goals. Mastery goals were measured by three items. The Cronbach alpha was 0.81. A sample item is "*I like to learn new things in mathematics*". Performance-approach goals were measured by three items. The Cronbach alpha was 0.82. A sample item is "*I want to do better than other students in my Maths class*". Performance-avoidance goals were measured by three items. The Cronbach alpha was 0.70. A sample item is "*I do not want others to think that I cannot do challenging mathematics*". Pro-social goals are social purposes for learning, and behaviourally, can be represented as helping friends to learn, working with friends in a group, and finding mathematical solutions with friends (cf. Dowson & McInerney, 2001). Three items measured pro-social goals. The Cronbach alpha was 0.68. A sample items is "*I want to help my friends to learn mathematics*".

Perceived classroom structures. All the items on classroom goal structures were preceded by a stem "*In this class, my maths teacher focuses us on…*". Perceived mastery structure assessed students' perceptions of teachers' predominant concern on promoting learning and understanding. Three items assessed this construct. A sample item is "*learning new ideas and important concepts in mathematics*". The Cronbach Alpha was .71. Perceived performance-approach structure assessed students' perceptions of teacher's concern on competence demonstration and relative performance among students. A sample item is "*getting higher marks in tests and examinations*". The Cronbach Alpha was .70. Perceived social structure assessed students' perceptions of teacher's focus on creating a collaborative learning environment. Two items assessed this construct. A sample item is "*helping each other to learn*". The Cronbach Alpha was .73.

Perceived teacher support. Perceived teacher support was assessed using 5 items. These items assessed students' perceptions of teachers' social support. The Cronbach Alpha was .90. A sample item is "*My maths teacher cares about my feelings*".

Learning strategies and motives. Items assessing students' learning strategies and motives were taken from mathematics Learning Process Questionnaire (MLPQ, Liu, 1997), which was based on the Learning Process Questionnaire (Biggs, 1987). Students rated on a 5-point Likert scale (1=very true of me, 5=very untrue of me) their motives and strategies in mathematics. Two set of motives and strategies were assessed. The deep motives assessed students' intention to develop a deep understanding of learning materials in mathematics. Five items assessed this construct. Sample items are "*I find that maths can become very interesting* *once you get into it*” and “*I feel really excited when I suddenly figure out how to solve a difficult problem in maths*”. The Cronbach Alpha was .70. The deep strategy construct assessed students’ use of learning strategies that lead to deep understanding and comprehension. Five items assessed this construct. Sample items are “*I try to relate what I have learnt in maths to other subjects and situations*” and “*In studying a new topic in maths, I often recall materials I have learnt and see if there is a relationship between them*”. The Cronbach Alpha was .73. The surface motive construct refers to students’ general lack of interest and intention to learning mathematics. The main concern is to get the task out of the way. Five items assessed this construct. Sample items are “*I think maths teachers shouldn’t expect us to work on topics outside the set curriculum*” and “*Although I take maths, I am not particularly interested in the subject*”. The Cronbach Alpha was .70. The surface strategy construct refers to rehearsal based strategies that focus students on reproducing an idea or a concept without thorough understanding. Rote learning and effort minimization are major surface strategies. Five items assessed this construct. Sample items are “*I find the only way to learn maths is to memorise the rules and formulas by heart*” and “*I find it better to learn just the rules and formulas in a maths topic than try to understand all about it*”. The Cronbach Alpha was .65.

Attitudes. Students’ attitudes towards mathematics were assessed using two constructs, positive and negative attitudes. These two constructs assessed students’ valuing of and interest in learning mathematics. Positive attitudes were assessed using 4 items. Sample items are “*It is important to learn mathematics*” and “*I find learning mathematics interesting*”. The Cronbach Alpha was .83. Negative attitudes were measured using 5 items. Sample items are “*I don’t value the chance of learning mathematics*” and “*I seldom find learning mathematics interesting*”. The Cronbach Alpha was .73.

Grade aspiration and past achievement levels. Students were asked to rate the grade they intended to achieve at the end of the academic year (A, B, C, D, E). The data from this item was coded into a 5-point Likert scale (A=5, E=1). Students' past achievement levels were measured based on students' end-of-year grades in mathematics in pervious academic year.

Self-assessed mathematics identity. Students' self-assessed mathematics identity was measured using one item. Students were required to indicate if they considered themselves high-achieving, average-achieving or low-achieving students in mathematics.

Results

Regression analyses

Tables 1 and 2 show descriptive statistics and correlation results. These tables were provided in the supplementary materials. A series of hierarchical regression analyses was conducted to examine the role of personal goals in predicting perceived classroom goals, perceived support, learning strategies, motives, attitudes and grade aspiration. Students' prior levels of achievement were entered in the first step, gender was dummy coded (0=males; 1=females), followed by students' personal goals, and finally, two-, three- and four-way interactions of personal goals. All independent variables were centred following Aiken and West (1991). The interactive terms were constructed using these centred variables. Preliminary regression analyses found that three- and four-way interaction were not significant and therefore they were removed from the analytical procedures. The final analyses contained 6 main effects (step 1 and 2) and 6 two-way interactive terms (step 3). Tables 3, 4, and 5 in the supplementary materials summarised the regression results. All the significant interaction effects were interpreted before examining the main effects. To avoid Type II error, significant interactive terms located in regression models in Step 3 that did not explained additional variance over the Step 2 regression models were not interpreted.

Predicting Perceived goal structures and perceived support. Regression results showed that achievement goals predicted perceived goals structures. There was, however, no significant main or interactive effect of goals on perceived support. After controlling for the effects of prior achievement levels and gender, students' achievement goals as a group in Step 2 showed significant effects on predicting perceived goal structures. In particular, mastery goals (β=.31, p<.001), performance-approach goals (β=.21, p<.001) and performance avoidance goals (β=-.15, p<.001) predicted perceived mastery structures. Students who held strong mastery goals, performance-approach goals but weak performance-avoidance goals would tend to think that their teachers focused them on learning and improving understanding in their mathematics lessons.

Performance-approach goals (β=.22, p<.001) was the only significant predictor for perceived performance structure. Similarly, pro-social goals (β=.42, p<.001) was the only significant predictor for perceived social structure. In other words, students who focused on getting better results and outperforming others tended to perceive that their teachers focused on performance and achievement as the main purpose for completing academic work in their mathematics class. Similarly, students who adopted pro-social goals tended to think that their mathematics teachers encouraged collaboration and mutual help in their classes. In line with previous studies (e.g. Friedel et al., 2007), the current findings showed a high level of congruence between personal goals and perceived classroom goal structures.

The results showed several significant interaction effects in Step 3. In predicting perceived performance structure, a significant regression model was located in Step 3 that explained an additional 5% of variance over the previous model. Mastery goals (β=-.73, p<.001), performance-approach goals (β=.23, p<.001) and the interactive term of mastery and performance avoidance goals (β=.81, p<.001) were significant predictors. These results indicate that an endorsement of mastery goals would be associated with a lower level of perceived performance structure. However, this relationship was qualified by a significant interaction with performance-avoidance goals which would dampen the negative predictive effect of mastery goals on perceived performance structure (See Figure 1 in the supplementary materials).

Predicting strategies and motives. After controlling for prior achievement levels and gender effect, mastery goals predicted positively the use of deep strategies (β=.30, p<.001), and negatively, surface strategies (β=-26, p<.001). Performance-avoidance goals predicted the use of surface strategies (β=.15, p<.001). Performance-approach goals and pro-social goals, however, did not predict these strategies. In terms of learning motives, mastery goals predicted positively deep motives (β=.32, p<.001), and negatively, surface motives (β=-.37). Performance-approach goals predicted positively deep motives (β=.25, p<.001). Performance-avoidance goals predicted positively surface motives (β=.15, p<.05).

In Step 3 of predicting surface motives, significant interaction effect was found between mastery goals and pro-social goals (β=-.22, p<.005). Strong mastery goals were associated with lower levels of surface motives and this relationship would be enhanced with the presence of pro-social goals. Nevertheless, when mastery goals are weak, the presence of pro-social goals will be associated with higher levels of surface motive (see Figure 2 in the supplementary materials).

In addition, significant interaction effect was also found between performance-approach goals and pro-social goals in Step 3 on predicting surface motives. The interaction result (see

Figure 3 in the supplementary materials) indicates that students using performance-approach goals alongside pro-social goals would have a lower level of surface motives (β=.29, $p<.005$). This interactive relationship is particularly pronounced when performance-approach goals are weak. The regression model of Step 3 explained an additional 4% variance over that was found in Step 2.

Predicting Attitudes and grade aspiration. After controlling for the effects of prior mathematics achievement and gender differences, mastery goals predicted positive attitudes (β=.47, $p<.001$) and grade aspiration (β=.17, $p<.001$). As expected, mastery goals predicted a low level of negative learning attitudes (β=-.21, $p<.001$). Performance-approach goals predicted positive attitudes (β=.17, $p<.001$) while performance-avoidance goals predicted negative attitudes (β=.17, $p<.001$). Pro-social goals adaptively predicted a low level of negative learning attitudes (β=-.27, $p<.001$). In addition, pro-social goals were also significant in predicting grade aspiration level (β=.12, $p<.001$), indicating that pro-social goals would be associated with a higher level of grade aspiration.

The enhancement effect of pro-social goals again was revealed in the prediction of positive attitudes in Step 3. A significant interactive term between mastery and pro-social goals (β=.18, $p<.001$) indicates that endorsing pro-social goals alongside mastery goals would lead to a higher level of positive attitudes (see Figure 4 in the supplementary materials). This relationship would be more pronounced when mastery goals are strong. This significant regression model explained an additional of 3% of variance over the previous model in Step 2.

Cluster analyses

Using a two-step cluster analytical procedure (Hair, Tatham, Anderson, & Black, 1998), hierarchical and non-hierarchical clustering repeatedly classified the participants into 4 clusters.

To further assess the stability of the 4-cluster solution, a discriminant function analysis was conducted. Three significant discriminant functions were found, indicating that using the four goals as predictors, 99% of the cases were correctly classified into four clusters. A MANOVA analysis confirmed that these four clusters differed in these four goals, Phillai's Trace=1.26, $F_{(12, 906)}$=54.59, p<.0001, η^2=.42.

Based on post-hoc tests and the goal configuration in each profile, these four clusters of mathematics students were labelled. Table 4 shows the descriptive statistics about these four clusters. These four clusters were not different from one another in gender composition, $\chi^2_{(3)}$=3.72, p=.29. However, a significant ANOVA found that they differed in their prior achievement level, $F_{(3, 278)}$=10.09, p<.0001. Cluster 2 and 3 had higher achievement levels than did Cluster 1 and 4. Students' prior achievement levels were controlled for in the subsequent multivariate analyses.

Table 4
Cluster Result - Four-Cluster solution

	Cluster 1 (N=65) Performance-anxious		Cluster 2 (N=103) All-goal		Cluster 3 (N=98) Motivated		Cluster 4 (N=41) Avoidant		F p<.001	Eta Square (η2)
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Mastery goals	2.52 [c]	.51	3.78 [a]	.54	3.51 [b]	.52	2.38 [c]	.80	102.64	.50
Performance-approach goals	3.51 [b]	.49	4.31 [a]	.43	3.42 [b]	.49	2.34 [c]	.64	164.33	.62
Performance-avoidance goals	3.65 [b]	.44	4.23 [a]	.48	2.85 [d]	.44	3.41 [c]	.86	220.99	.69
Pro-social goals	2.78 [d]	.56	3.51 [a]	.57	3.19 [b]	.50	3.08 [c]	.69	62.83	.38
Grade levels (previous year)	1.75 [b]	1.01	2.39 [a]	1.24	2.33 [a]	1.25	1.34 [b]	.80	10.09 (ANOVA)	--

Students in Cluster 1 were high in both performance-approach and performance-avoidance goals; this cluster was therefore labeled as the performance-anxious group. Compared to Cluster 2 and 3, more students in Cluster 1 identified themselves as low-achieving students in mathematics. Students in this group had relatively lower grades in mathematics in previous year than did those in cluster 2 and 3. Students in Cluster 2 had the highest scores in all the goals, indicating that students in this cluster were highly motivated. This cluster was labeled as the all-goal group. These students were high achievers and they had the highest average grade in mathematics in previous year. Most students in this cluster, however, identified themselves as average-achieving students, albeit of their high achievement. Students in Cluster 3 had relatively high scores in mastery, performance-approach and pro-social goals. Their scores on performance avoidance goals were relatively low. They were therefore labeled as the motivated group and they had relatively higher grades in mathematics in the previous year than did those in Clusters 1 and 4. Most students in this cluster, however, identified themselves as average students in mathematics. The goal profile of students in cluster 4 was dominated by performance-avoidance goal. In addition, they had average pro-social goals. Their mastery and performance-approach goals were rather weak compared to the other three clusters. This cluster was therefore labeled as the avoidant group. Compared to students in Cluster 2 and 3, they did relatively poorer in mathematics in the previous year. Most students in this cluster identified themselves as low-achieving students in mathematics.

MANOVA analyses confirmed that these four clusters were differed from each other in terms of perceived classroom goal structures and perceived support (Wilks Lambda=.83, $F_{(9, 640)}$=5.39, p<.0001, η^2=.06), learning strategies and motives, (Wilks Lambda=.85, $F_{(15, 707)}$=2.87, p<.0001, η^2=.05), and attitudes towards learning mathematics (Wilks Lambda=.83, $F_{(9, 640)}$=5.39, p<.0001, η^2=.06). Finally an ANOVA analysis also found that they differed in their levels of grade aspiration, $F_{(9, 637)}$=7.31, p<.0001. Table 5 shows the results of MANOVA analyses, after controlling for students' prior achievement levels in mathematics. Students in both all-goal and motivated groups had similar learning profiles for mathematics. There were only two counts of differences between these two types of motivated multiple-goal students. All-goal students had higher scores on perceived performance structure and deep learning motives than did those from the motivated group.

The most pronounced differences were found between all-goal and motivated students on one side and performance-anxious and avoidant students on the other. Students in the all-goal and motivated groups had higher scores than did students in the performance-anxious and avoidant groups on perceived goal structures, perceived support, deep motives and strategies, positive learning attitudes and grade aspiration for mathematics. In contrast, students in the performance-anxious and avoidant groups had higher scores on negative learning attitudes, surface motives and surface strategies than did those in the all-goal and motivated groups.

Table 5
MANOVA Results

Dependent variables	Cluster 1 (N=65) Performance-anxious		Cluster 2 (N=103) All-goal		Cluster 3 (N=98) Motivated		Cluster 4 (N=41) Avoidant		MANOVAs	η^2
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Perceived mastery structure	3.31[b]	.70	3.93[a]	.49	3.80[a]	.67	3.30[b]	.64	$F_{(3, 284)}$=12.84**	.12
Perceived performance structure	2.90[b]	.61	3.24[a]	.57	2.89[b]	.60	2.65[b]	.42	$F_{(3, 284)}$=9.71**	.09
Perceived social structure	2.58[b]	.85	2.97[a]	.75	2.98[a]	.75	2.65[b]	.42	$F_{(3, 284)}$=7.43**	.07
Perceived support	3.08[a]	.67	3.38[a]	.67	3.32[a]	.62	2.73[b]	.73	$F_{(3, 284)}$=6.21**	.06
Deep strategies	2.04[b]	.74	2.53[a]	.65	2.46[a]	.70	1.73[b]	.64	$F_{(3, 269)}$=7.99**	.08
Surface strategies	3.10[b]	.69	2.55[a]	.69	2.53[a]	.71	2.92[b]	.76	$F_{(3, 269)}$=4.78*	.05
Deep motives	2.96[b]	.71	3.54[a]	.66	3.19[b]	.67	2.39[c]	.70	$F_{(3, 269)}$=16.82**	.16
Surface motives	3.14[b]	.60	2.69[a]	.76	2.44[a]	.72	2.90[a]	.79	$F_{(3, 269)}$=4.78**	.05
Negative attitudes	2.83[b]	.61	2.34[a]	.75	2.31[a]	.66	2.92[b]	.86	$F_{(3, 279)}$=5.37**	.05
Positive attitudes	2.52[b]	.75	3.38[a]	.72	3.30[a]	.75	2.12[b]	.78	$F_{(3, 279)}$=18.12**	.16
Grade aspiration	2.25[b]	1.4	3.43[a]	1.1	3.00[a]	1.3	1.24[c]	1.5	$F_{(3, 287)}$=11.17**	.10

Note 1: Values superscripted differently were significantly different from each other*;* all MANOVA tests were significant, * *p<.0001; *p<.01

These findings indicate that students in the all-goal and motivated groups were generally more engaged in learning mathematics, perceived a more motivating and supportive learning environment offered by their mathematics teachers, and had a higher expectation to get a better grade in mathematics. In contrast, students in the performance anxious and avoidant groups showed a disengaged pattern of learning, perceived a less supportive environment offered by their mathematics teachers and had relatively lower levels of grade aspiration by the end of the year. While performance-anxious and avoidant students had similar motivational profiles, avoidant students had the lowest scores on deep learning motives and grade aspiration compared to students in the other three groups. These results indicate that students focusing overtly on performance-avoidance goals seriously lacked learning motivation in learning mathematics and did not expect themselves to do well in this school subject.

Discussion

The current study investigated the effects of multiple goals on perceived classroom goal structures, perceived support, learning strategies and motives, attitudes and grade aspiration in mathematics using a Chinese sample of upper secondary students from Hong Kong. As expected, regression analyses showed that mastery goals, performance-approach goals and pro-social goals had significant main effects on positive learning variables, including deep strategies, deep motives, positive attitudes, perceived mastery structures, perceived social structures, perceived teacher support and grade aspiration, in this study. In contrast, performance-avoidance goals were positively related to negative variables such as surface motives, surface strategies and negative attitudes. Compared to mastery goals, performance-approach and pro-social goals had fewer counts of independent relationship with positive variables. In particular, performance-approach goals predicted both perceived mastery and performance goal structures, deep motives and positive attitudes towards learning mathematics. As for pro-social goals, the main effects were confined to predicting perceived social structure, a higher level of grade aspiration and a lower level of negative attitudes. In general, these findings were consistent with previous achievement goals studies using Chinese samples (e.g. Chan, 2008; Lau & Lee, 2008).

Combined effects of multiple goals

The significant regression models in Step 2 and 3 consistently found that mastery goals were the dominant predictor for the current cohort of Chinese students in learning mathematics. Mastery goals were associated with a higher level of perceived mastery structure, deep strategies, deep motives, positive attitudes and grade aspiration but with lower levels in surface strategies, surface motive and negative attitudes. These findings highlighted the significant role of mastery goals on learning and were consistent with both Western and Chinese studies that found positive effects of mastery goals on strategy use and learning (e.g. Barron & Harackiewicz, 2001; Chan, 2008; Church, Elliot & Gable, 2001; Harackiewicz et al., 2002; Lau & lee, 2008). Taken together, these results supported the hypothesis (H1) that adaptive goals in learning mathematics would have positive independent effects on dependent variables in this study.

From the multiple-goal perspective, the effect of mastery goals on learning is not the point of contention (Harackiewicz et al., 2002). The main question is whether endorsing other goals alongside mastery goals will enhance or dampen the positive effects. Regression analyses in this study found few cases of significant interactions including mastery x pro-social goals, mastery x performance-avoidance goals, and performance-approach goals x pro-social goals. Specifically, endorsing pro-social goals alongside mastery goals would enhance the positive benefits in developing positive learning attitudes and preventing surface learning motives. Pro-social goals also interacted with performance-approach goals in dampening students' surface motives. Adopting performance-avoidance goals simultaneously with mastery goals would heighten students' perceptions that their mathematics teachers focused them more on grades and relative performance. These findings lent support to the second hypothesis (H2) that the positive effects of adaptive goals in learning mathematics would be enhanced by another adaptive goals whilst maladaptive goals would dampen the positive effects of adaptive goals.

In general, these findings were supportive of the multiple-goal perspective, though the enhanced effects were derived from pro-social goals rather than performance-approach goals. However, the promotion of multiple goals in relation to the endorsement of performance-approach and pro-social goals in the context of the current study needs to take into account several important considerations. First, the current study did not locate any significant interaction between mastery goals and performance-approach goals on various learning variables. Therefore the regression analyses in this study could not ascertain the effects of performance-approach goals on mastery goals. However, performance-approach goals in this study had significant main effects on perceived mastery and performance goal structures, deep motives and positive learning attitudes. In addition, performance-approach goals in this study were correlated positively with an adaptive pattern of learning characterized by deep motives, deep strategies, positive attitudes and high levels of grade aspiration. Along with other Chinese studies (e.g. Chan, 2008; Lau & Lee, 2008; Liem, Lau & Nie, 2008), these additional results indicate clearly that performance-approach goals are adaptive in nature among Chinese students.

Second, performance-approach goals are culturally significant goals among Chinese students. Educational researchers (e.g. Author, 2009) have argued that learning for relative performance was rooted in the Chinese cultural heritage, thrived within an elite educational system crafted during the colonial period, and has been taken continuously as an accepted schooling practice in Hong Kong classrooms, albeit negative influences associated with competition for performance. In addition, the study of Watkins (2007) showed that Chinese students considered competition important for self-improvement. In line with this conception, the current study, as well as others (e.g. Chan, 2008), recorded a positive relationship between performance-approach goals and mastery goals, which was not normally found in Western studies using Euro-American student samples (Harackiewicz et al., 2002). In addition, the current study found that Chinese students' perception of a performance-approach classroom was related to deep strategies, positive learning attitudes and high levels of grade aspiration. This pattern of association was rather different from the findings in Western studies that perceived performance-approach structures are often linked with maladaptive behaviours such as the use of self-handicapping strategies and disruptive classroom behaviours (e.g. Kaplan, Gheen & Midgley, 2002). In short, it is inappropriate and impossible to remove performance-approach goals altogether from the Chinese cultural and educational context and focus students and teachers solely on mastery goals (Author, 2009).

Third, endorsing pro-social goals simultaneously with mastery goals would enhance the positive effects of mastery goals in developing positive attitudes and preventing surface motives among this group of Chinese students in learning mathematics. This particular interaction was consistent with the study of Chan (2008) which found that mastery goals and pro-social goals interacted significantly in predicting higher levels of achievement among a large sample of Chinese gifted students in Hong Kong. In line with the multiple-goal perspective, this significant interaction supports the endorsement of additional adaptive goals alongside mastery goals, though the enhancement effects in this study derived not from performance-approach goals.

Students' goal profiles

While regression results showed several counts of evidence regarding the interaction effects of goals, cluster analyses provided greater details about how goals can be mixed together at the individual level. Four groups of multiple-goal students were located (performance-anxious, all-goal, motivated, avoidant groups). Given that the current sample was drawn from an examination-oriented education system, it was not surprising that cluster analyses did not locate a group of students focusing solely on mastery goals. The cluster findings showed that combining mastery goals with performance-approach goals or pro-social goals at the individual level (both Cluster 2 and 3) would result in a goal profile characterized by a more adaptive pattern of learning when compared to those derived from a combination of performance-approach and performance-avoidance goals (Cluster 1) or focusing solely on performance-avoidance goals (cluster 4). In addition, when adaptive goals are populated in a goal profile, such as Cluster 2, endorsing potentially maladaptive goals, i.e. performance-avoidance goals in the current study, may not lead to detrimental effects on learning and aspiration in mathematics. These results provided empirical evidence supporting the hypothesis (H3) that personal goal profiles dominated by adaptive goals would be associated with engaged patterns of learning, attitudes and perceptions in mathematics. In other words, adaptive goals can buffer against the detrimental effects of maladaptive goals (Pintrich, 2000). When adaptive goals are not dominant in a goal profile, detrimental effects will result in a disengaged learning pattern in this school subject; in the current study, it means the use of surface strategies, the development of negative attitudes and lower levels of grade aspiration among students in Cluster 1 and 4.

The inclusion of performance-avoidance goals in the profile of all-goal students (Cluster 2) contradicts the negative association between performance-avoidance goals and adaptive goals such as mastery goals in most studies. It can be argued that performance-avoidance goals play a role in protecting students' self-worth in facing intense competition. By trying not to show any signs of incompetence in doing mathematics, these students are able to project a positive self-image. Alternatively, performance-avoidance goals can be seen as a way for managing external pressure by setting a minimum achievement target and forming a basic form of motivation in the pursuit of academic excellence in mathematics among the current group of Chinese students. Bong's study of Korean middle school students (2001) also located unexpected positive correlation between performance-avoidance, performance-approach goals, mastery goals, valuing of mathematics and self-efficacy beliefs. Bong offered a cultural explanation that Korean students were conscious about pleasing their parents and therefore they adopted both avoidance goals alongside other goals to deal with external pressure to perform. In line with this interpretation, the minimum target argument builds on Chinese students' need to manage external pressure to perform. However, Chinese students in the current sample were in their senior high school, and presumably, the external pressure comes mainly from ensuring personal academic success rather than solely originated from the need to please others. The minimum target was by no means the main driving force motivating students in the all-goal group to learn mathematics. However, when this minimum level of motivation becomes the dominant or sole source of motivation within a goal profile, as shown in the case of Cluster 4, negative effects on learning, attitudes and aspiration can be expected. This discussion highlights the importance of understanding the impact variation of a goal within the goal profiles of different types of multiple-goal students.

This study did not locate a group of mathematics students that focused solely on mastery goals, and therefore, it was not possible to make any claim regarding the relative benefits of multiple goals over mastery-only goals on learning in the domain of school mathematics.

Nevertheless, empirical evidence derived from both regression and cluster analyses showed consistently that endorsing additional adaptive goals alongside mastery goals will be beneficial to learning mathematics. This position is rather important for the current sample of Chinese students in Hong Kong who were expected to learn, to perform within in a competitive learning environment, and to meet various forms of social obligations (such as meeting parental expectation) through learning engagement and high achievement. Different goals will provide Chinese students with different motivational sources to fuel their academic pursuit in mathematics learning. The worst scenario occurs when students focus solely on performance-avoidance (Cluster 4), which provides limited motivational resource to drive continuous learning engagement in mathematics. Too anxious about performance without a concern for mastery and relevant social responsibilities, such as helping others to learn, is not adaptive (Cluster 1) in learning mathematics.

Implications for promoting learning and teaching of mathematics

An important consideration based on the current results is developing instructional practices to support students' multiple goals in mathematics. The creation of such a motivating learning environment should extend beyond a mastery focus and explore how other adaptive goals can be utilized to develop a multiple-goal framework for promoting learning and teaching of mathematics, given the current findings that performance-approach and pro-social goals, alongside mastery goals, had positive effects on Chinese students' motivation for learning mathematics. Empirical evidence derived particularly from the clustering analyses indicates clearly that motivated Chinese students held different types of goals in learning mathematics. Developing classroom practices to support learning (mastery goals), promote high performance (performance-approach goals), and develop collaboration (pro-social goals) can inform the development of a multiple-goal environment for learning mathematics in Hong Kong and other Chinese societies. Another important consideration is to develop innovative practice to assist students who hold performance-avoidance goals for learning mathematics. These reformative practices should aim to shift their focus from avoiding showing incompetence (performance-avoidance goals) to seeking competence development and improvement (mastery goals). This major challenge needs additional investigation.

Limitations, Further Research and Conclusion

This study was limited in several ways. It did not examine the effects of multiple goals on students' actual achievement levels. In addition, causal relationships between goals and learning variables in this study could not be firmly established based on short-term longitudinal survey data. Also, some of the constructs did not achieve an acceptable reliability score of .70. The results should be interpreted with this limitation in mind. This study did not include mastery-avoidance goals as it predated the separation of mastery goals into approaching and avoidance orientations. Future studies should include mastery-avoidance goals when examining the effects of multiple goals.

Given that performance-approach and performance-avoidance goals were related and that performance anxious and performance avoidant clusters held rather similar learning and motivational patterns, there is certainly a need to examine issues and problems associated with performance-approach goals among Chinese students. A major research question is whether performance-approach goals would give way to performance avoidance goals, and under what circumstances such a demotivating process may take place. In addition, future research needs to examine teachers' instructional practices and doing so will provide additional information on the possible discrepancy between teachers' practices and students' perceptions, which will enhance our understanding how multiple goals act as a frame to guide, and probably affect, students' perceptions of classroom learning climate. In addition, classroom goal structures can further be distinguished between approach and avoidance orientations (Kaplan, Gheen & Midgley, 2002; Church, Elliot, & Gable, 2001; Wolters, 2004). Future studies need to explore how multiple goals are related to both approaching and avoidant forms of perceived goal structures. In addition, future research can explore the effects of multiple goals within a hierarchical structure of data involving different contextual influences. The current data set did not record student participants' class information, rendering it impossible to conduct multi-level analyses.

To conclude, the current findings provide evidence supporting the benefits of multiple goals in a cultural context different from western studies. By mixing mastery goals with other adaptive goals, students are more motivated as different types of goals provide different forms of motivational resources for learning mathematics. In the current case, pro-social goals that focus Chinese students on helping and learning with friends in their mathematics classes enhanced the beneficial effects of mastery goals on learning mathematics.

References

Aiken, L. S., West, S. G. (1991). *Multiple regression*. Newbury Park, CA: Sage.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*(3), 261-271. doi:10.1037/0022-0663.84.3.261

Author (2009). Reforming learning: Concepts, issues and practice in the Asia-Pacific region

Barron, K. E., & Harackiewicz, J. M. (2001). Achievement goals and optimal motivation: Testing multiple goal models. *Journal of Educational Psychology, 80*(5), 706-722. doi:10.1037/0022-3514.80.5.706

Biggs, J. (1987). *Student appraoches to learning and studying*. Melbourne: ACER.

Bong, M. (2001). Between-and within-domain relations of academic motivation among middle and high school students: Self-efficacy, task value, and achievement goals. *Journal of Educational Psychology, 93*(1), 23-34. doi:10.1037/0022-0663.93.1.23

Chan, D. W. (2008). Goal orientations and achievement among Chinese gifted students in Hong Kong. *High Ability Studies, 19*(1), 37-51. doi:10.1080/13598130801980307

Church, M. A., Elliot, A. J., & Gable, S. L. (2001). Perceptions of classroom environment, achievement goals, and achievement outcomes. *Journal of Educational Psychology, 93*, 43-54. doi:10.1037/0022-0663.93.1.43

Chouinard, R., Karsenti, T., & Roy, N. (2007). Relations among competence beliefs, utility value, achievement goals, and effort in mathematics. *British Journal of Educational Psychology, 77*(3), 501-517. doi: 10.1348/000709906X133589

Dowson, M., & McInerney, D. M. (2001). Psychological parameters of students' social and work avoidance goals: A qualitative investigation. *Journal of Educational Psychology, 93*(1), 35-42. doi:10.1037/0022-0663.93.1.35Friedel, J. M., Cortina, K. S., Turner, J. C., & Midgley, C. (2007). Achievement goals, efficacy beliefs and coping strategies in mathematics: The roles of perceived parent and teacher goal emphases. *Contemporary Educational Psychology, 32*, 434-458. doi:10.1016/j.cedpsych.2006.10.009

Goldin, G. A. (2014). Perspectives on emotion in mathematical engagement, learning, and problem solving. In R. Pekrun, & L. Linnenbrink-Garcia (Eds.), *International Handbook of Emotions in Education* (pp.391-414). New York: Routledge.

Hair, J. F., Tatham, R. L., Anderson, R. E., & Black, W. (1998). *Multivariate Data Analysis*. Upper Saddle River, N.J: Prentice Hall.

Hannula, M. S. (2006). Motivation in mathematics: Goals reflected in emotions. *Educational Studies in mathematics, 63*, 165–178. doi: 10.1007/s10649-005-9019-8

Harackiewicz, J. M., Barron, K. E., Pintrich, P. R., Elliot, A. J., & Thrash, T. M. (2002). Revision of achievement goal theory: Necessary and illuminating. *Journal of Educational Psychology, 94*(3), 638-645. doi:10.1037/0022-0663.94.3.638

Johnson, D. W., & Johnson, R. T. (1983). Social interdependence and perceived academic and personal support in the classroom. *Journal of Social Psychology, 120*(1), 77-82. doi:10.1080/00224545.1983.9712012

Kaplan, A., Gheen, M., & Midgley, C. (2002). Classroom goal structure and student disruptive behaviour. *British Journal of Educational Psychology, 72*, 191-211. doi: 10.1348/000709902158847

Kaufman, A., & Dodge, T. (2009). Student perceptions and motivation in the classroom: Exploring relatedness and value. *Social Psychology of Education, 12*, 101-112. doi: 10.1007/s11218-008-9070-2

Lau, K.-L., & Lee, J. (2008). Examining Hong Kong students' achievement goals and their relations with students' perceived classroom environment and strategy use. *Educational Psychology, 28*(4), 357-372. doi:10.1080/01443410701612008

Liem, A. D., Lau, S., & Nie, Y. (2008). The role of self-efficacy, task value, and achievement goals in predicting learning strategies, task disengagement, peer relationship, and achievement outcome. *Contemporary Educational Psychology, 33*, 486-512. doi:10.1016/j.cedpsych.2007.08.001

Liu, H. K. (1997). *Secondary school students' approaches to learning mathematics.* Unpublished PhD thesis, University of Queensland, Brisbane, Australia.

Meece, J. L., & Holt, K. (1993). A pattern analysis of students' achievement goals. *Journal of Educational Psychology*, *85*(4), 582-590. doi:10.1037/0022-0663.85.4.582

Midgley, C., Kaplan, A., & Middleton, M. (2001). Performance-approach goals: What, for whom, under what circumstances, and at what cost? *Journal of Educational Psychology, 93*(1), 77-86. doi:10.1037/0022-0663.93.1.77

Midgley, C., Maehr, M. L., Hruda, L. Z., Anderman, E., Anderman, L., Freeman, K. E., Gheen, M., Kaplan, A., Kumar, R., Middleton, M.J., Nelson, J., Roeser, R., & Urdan, T. (2000). *The Patterns of Adaptive Learning Scales*. Ann Arbor: University of Michigan.

Midgley, C., & Urdan, T. (2001). Academic self-handicapping and achievement goals: A further examination. *Contemporary Educational Psychology, 26*(61-75). doi:10.1006/ceps.2000.1041

Mullis, I. V., Martin, M. O., Foy, P., & Arora, A. (2012). *TIMSS 2011 international results in mathematics*. International Association for the Evaluation of Educational Achievement. Herengracht 487, Amsterdam, 1017 BT, The Netherlands.

Pintrich, P. R. (2000). Multiple goals, multiple pathways: The role of goal orientation in learning and achievement. *Journal of Educational Psychology, 92*(3), 544-555. doi:10.1037/0022-0663.92.3.544

Pintrich, P. R., Conley, A. M., & Kempler, T. M. (2003). Current issues in achievement goal theory and research. *International Journal of Educational Research*, *39*, 319-337. doi:10.1016/j.ijer.2004.06.002

Pantziara, M., & Philippou, G. N. (2015). Students' Motivation in the mathematics Classroom. Revealing Causes and Consequences. *International Journal of Science and mathematics Education*, *13*(2), 385-411. doi:10.1007/s10763-013-9502-0

Ryan, A.M., & Shim, S. O. (2006). Social achievement goals: the nature and consequences of different orientations toward social competence. *Personality and Social Psychology Bulletin*, *26*, 419–435. doi:10.1177/0146167206289345

Schoenfeld, A. H. (2014). What makes for powerful classrooms, and how can we support teachers in creating them? A story of research and practice, productively intertwined. *Educational Researcher*, *43*(8), 404-412. doi: 10.3102/0013189X14554450

Senko, C., Hulleman, C. S., & Harackiewicz, J. (2011). Achievement goal theory at the crossroads: Old controversies, current challenges, and new directions. *Educational Psychologist, 46*(1), 26-27. doi:10.1080/00461520.2011.538646

Tapola, A., & Niemivirta, M. (2008). The role of achievement goal orientations in students' perceptions of and preferences for classroom environment. *British Journal of Educational Psychology, 78*(2), 291-312. doi: 10.1348/000709907X205272

Urdan, T. (2004). Can achievement goal theory guide school reform? In P. R. Pintrich & M. L. Maehr (Eds.), *Advances in motivation and achievement: Motivating students, improving schools: The legacy of Carol Midgley* (Vol. 13, pp. 361-392). Stamford, CT: JAI Press.

Urdan, T. C., & Maehr, M. L. (1995). Beyond a two-goal theory of motivation and achievement: A case for social goals. *Review of Educational Research, 65*(3), 213-243.doi: 10.3102/00346543065003213

Watkins, D. (2007). The nature of competition: The views of students from three regions ofthe People's Republic of China. In F. Salili & R. Hossain (Eds.), *Culture, motivation and learning: A multicultural perspective* (pp. 217-233). Charlotte, NC: IAP.

Wentzel, K. R. (1989). Adolescent classroom goals, standards for performance, and academic achievement: An interactionist perspective. *Journal of Educational Psychology, 81*(2), 131-142. doi:10.1037/0022-0663.81.2.131

Wolters, C. A. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students' motivation, cognition, and achievement. *Journal of Educational Psychology*, *96*(2), 236-250. doi:10.1037/0022-0663.96.2.236

Zhu, Y., & Leung, F. K. (2011). Motivation and achievement: Is there an East Asian model?. *International Journal of Science and mathematics Education*, *9*(5), 1189-1212. doi:10.1007/s10763-010-9255-y