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A Person-Centered Approach to Students' Evaluations of Perceived Fear Appeals and their Association with Engagement

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Abstract

A person-centered approach was employed to investigate how students' evaluation of perceived teacher utility value messages, i.e., fear appeals, as a threat and as a challenge, combined within individuals and how these combinations related to student engagement. Two studies were conducted with students in their final two years of secondary education. Empirically-distinct clusters emerged at two time-points in the academic year. Evaluating the message in the fear appeal at a higher level of challenge than threat was beneficial. Unexpectedly, high threat was associated with high engagement, as long as high challenge was also present, however, this combination was also related to high emotional disaffection. Moderate threat combined with moderate challenge had the most detrimental relationship with student engagement. Educational interventions should aim to increase the likelihood of a challenge evaluation.

Keywords: Fear appeals, Student engagement, Cluster analysis, Threat evaluation, Challenge evaluation

This research employed a person-centered approach to investigate student perceptions of utility value messages that focus on failure, i.e., fear appeals, made by the class teacher, in relation to a high-stakes examination. Specifically, we focused on how threat and challenge evaluations of fear appeals combined within students. Fear appeals are made by teachers in an effort to increase motivation amongst students, however, when they are evaluated by students as threatening, they have been found to exert negative effects on several variables related to academic achievement, as well as on examination performance itself (e.g., Putwain & Remedios, 2014). In contrast, challenge evaluations are associated with educational gains (e.g., Putwain, Nicholson, Nakhla, Reece, Porter, & Liversidge, 2016). Threat and challenge evaluations are conceptually independent and fear appeals can be evaluated as both threatening and challenging (e.g., Putwain & Symes, 2014). In two studies, we investigated how these evaluations combined within students who were studying for their GCSE (General Certificate of Secondary Education)[1] mathematics examination. Differences in clusters identified at the beginning and middle of the academic year were identified, as well as whether the combinations of threat and challenge evaluations were differentially associated with concurrent student engagement, gender and previous performance on examinations.

Evaluation of Fear Appeals

In an educational context, fear appeals refer to persuasive messages given by teachers to students prior to a high-stakes test and are designed to "(a) elicit fear through highlighting the negative consequences of failure along with (b) those courses of action are likely to increase the threat of failure and/or (c), how the threat of failure can be avoided by adopting an alternative course of action" (Putwain & Symes, 2014, p. 231). For instance, a teacher may remind students that they would not get into college if they failed the test, and that failure would be more likely if they did not complete the necessary revision. Although used regularly by teachers (e.g., Putwain, Remedios, & Symes, 2016) as a motivational strategy, students respond in different ways depending on how they evaluate these messages, which can range from 'invigorating excitement to overwhelming dread' (Seery, 2011, p. 1603-04). These two types of evaluation, termed challenge and threat respectively, are particularly influential over students' responses to fear appeals made in the classroom. They both involve cognitive, affective and physiological processes, and are anticipatory states; threat evaluations refer to the potential for harm or loss, and are characterized by activating emotions such as worry, fear and anxiety, and challenge evaluations convey the potential for growth, mastery and gain, and typically include activating emotions such as confidence, hope, excitement and eagerness (Blascovich, 2008; Blascovich & Mendes, 2000; Folkman & Lazarus, 1985; Lazarus, 2006). Therefore, threat evaluations have a negative valence and challenge evaluations have a positive valence.

Research has revealed a two-part process in which students arrive at either a threat or challenge evaluation (or the message could be disregarded altogether; Putwain, Remedios, & Symes, 2014, 2015; Putwain & Symes, 2014). In order to evaluate a fear appeal as threatening or challenging, a given student must primarily value their performance on the high-stakes test in which the fear appeal relates, and/or believe that their performance on the test is important to the fulfilment of their goals. If these values are high, they will evaluate the message as personally relevant and meaningful. If they are low, however, the message will be viewed as irrelevant and be discounted. In a secondary evaluation, relevant messages are judged by the student to be a challenge if success is likely and a threat if success is not likely (Putwain *et al.*, 2014, 2015; Putwain & Symes, 2014). This premise corroborates previous research on threat and challenge evaluations (e.g., Blascovich & Mendes, 2000; Meijen, Jones, McCarthy, Sheffield, & Allen, 2013; Skinner & Brewer, 2002). Threat evaluations have been found to predict maladaptive cognitions, emotions and behaviors, while challenge evaluations have been linked to adaptive outcomes (McGregor & Elliot, 2002; Putwain, Nakhla, Liversidge, Nicholson, Porter, & Reece, 2017; Putwain, Nicholson *et al.*, 2016; Putwain & Remedios, 2014; Putwain *et al.*, 2015; Putwain & Symes, 2011a, 2011b; Putwain, Symes, & Wilkinson, 2016; Skinner & Brewer, 2002). Crucially, threat and challenge evaluations are also associated with reduced and improved performance on examinations, respectively (Putwain & Remedios, 2014; Putwain & Symes, 2011a; Putwain, Symes *et al.*, 2016). Threat and challenge evaluations therefore exhibit distinct antecedents and relate to different academic outcomes.

Co-existence of Threat and Challenge Evaluations

Threat and challenge are not mutually exclusive, and have been found to co-exist during stressful and ambiguous situations (Folkman & Lazarus, 1985), such as a high-stakes examination. Relatedly, research has revealed a strong positive correlation between threat and challenge evaluations of fear appeals, likely due to the shared antecedent of the perceived importance of achievement (Putwain *et al.*, 2014, 2015; Putwain & Symes, 2014). This suggests that students can evaluate a fear appeal as both threatening and challenging, simultaneously. Research in the sports psychology field advances this line of reasoning. Cerin (2003) found that, when appraising a competitive event, 51.24% of 202 athletes displayed a mixed pattern whereby they reported both a threat and challenge evaluation. A further 42.29% of athletes evaluated the event as challenging, but not threatening, 3.48% reported a threat evaluation without challenge and 2.99% stated neither a threat or challenge evaluation.

Meijen *et al.* (2013) similarly showed that athletes, who were attending college, evaluated an upcoming competition as both threatening and challenging. The typical response, however, was high challenge and low threat, and only 2% of the sample reported high threat and low challenge. The group reporting high levels of both threat and challenge scored lower on self-efficacy and higher on avoidance goals and anxiety than the high challenge/low threat group, and higher on anxiety than the low challenge/low threat group. Thus, the different patterns of threat and challenge evaluations were associated with distinct responses on other educational variables. This suggests that threat and challenge are not opposite ends of a continuum (Meijen *et al.*, 2013), as has been stated previously (Seery, 2011). They are distinct concepts, and it is important to consider both types of evaluation to understand how individuals approach stressful achievement situations (Skinner & Brewer, 2002).

Skinner and Brewer (2004) proposed that, under stressful conditions, a dual threat/challenge approach may be optimal, as it increases the stakes and therefore increases motivation compared to a threat or challenge evaluation alone. Cerin, Szabo, Hunt, and Williams's (2000) interactional model of stress suggested that a profile characterized by mild to moderate intensity levels of threat, accompanied by an acceptance or confrontation of the situation, would facilitate performance on a high-stakes examination. Conversely, moderate to high intensity levels of threat, alongside an avoidance of the situation, would diminish performance. As discussed above, Meijen *et al.* (2013) found that when individuals reported high challenge, simultaneous low threat was more beneficial than high threat. Meijen *et al.* (2013) dichotomized participants into high or low levels of threat and challenge, however, and so did not identify groups reporting moderate levels. Research conducted in the psychopathology field has found that a ratio of 1.6:1.0 for positive and negative thinking represents the most psychologically healthy state of mind (Kendall, Howard, & Hays, 1989). Taking the literature together, it is plausible to argue that a high level of challenge evaluation, in combination with a moderate level of threat evaluation, may be more beneficial than an accompanying low level of threat. This premise has not been tested in an educational setting using a person-centered analysis.

Student Engagement

It is important to examine the relationship between aspects of the classroom environment, such as fear appeals and how they are evaluated by students, and other educationally-relevant variables. Student engagement is a malleable construct, that is responsive to contextual features, such as the school and classroom, and is the key mediator in the link between these factors and the most crucial educational outcome, that of academic attainment (Fredricks, Blumenfeld, & Paris, 2004; Reschly & Christenson, 2012). Student engagement is a multidimensional construct consisting of affective/emotional (e.g., enjoyment of learning), cognitive (e.g., psychological investment in learning) and behavioral (e.g., involvement in academic tasks) elements (Fredricks *et al.*, 2004).

Skinner, Kindermann and Furrer (2009) argued that assessments of student engagement should include markers of both engagement and disaffection. They conceptualized student engagement as comprising mental effort, on-task behavior, class participation and energized emotion, and proposed that, rather than simply being the opposite of engagement, disaffection also includes mental withdrawal, ritualistic participation, enervated emotion, alienated emotion and pressured participation. Skinner *et al.* (2009) empirically demonstrated that student engagement consisted of four components: behavioral engagement (e.g., effort, participation), emotional engagement (e.g., interest, enjoyment), behavioral disaffection (e.g., passivity, lack of attention) and emotional disaffection (e.g., boredom, frustration). Thus, they conceptualized cognitive engagement as nested within the behavioral and emotional components (e.g., mental effort/withdrawal), and reasoned that this model represents the core indicators of engagement in the classroom. Although the components are typically inter-correlated, students can differ on each, for example, displaying low emotional engagement but high behavioral engagement (e.g., Patrick, Skinner, & Connell, 1993). Each component has distinct antecedents and a unique role to play in the internal dynamics of engagement (Skinner, Furrer, Marchand, & Kindermann, 2008), and therefore all four must be measured for a comprehensive assessment (Skinner at al., 2009).

Associations between Fear Appeal Evaluations and Student Engagement

Three studies have explicitly addressed the relationship between fear appeal evaluation and student engagement (Putwain *et al.*, 2017; Putwain, Nicholson *et al.*, 2016; Putwain, Symes *et al.*, 2016). They revealed that the impact of fear appeals on student engagement was mediated by fear appeal evaluation. Importantly, threat and challenge evaluations were related to lower and greater engagement, respectively. Regarding differences between emotional and behavioral engagement, after previous engagement was controlled, a challenge evaluation was more strongly related to behavioral than emotional engagement, however, there was no difference in the magnitude of the relationships between a threat evaluation and emotional and behavioral engagement (Putwain, *et al.*, 2017; Putwain, Nicholson *et al.*, 2016). One study showed that reporting a threat evaluation predicted a lower examination grade through lower behavioral engagement, and a challenge evaluation predicted a higher grade through higher behavioral engagement (Putwain, Symes *et al.*, 2016). Student disaffection was not measured in any of the three studies.

The Present Research

In light of evidence that threat and challenge evaluations are conceptually distinct, and that students can evaluate fear appeals as both threatening and challenging, the next steps are to investigate how these evaluations combine in different ways within students, how these combinations differentially relate to other variables, such as student engagement, and whether different profiles can be predicted. Research in psychology has traditionally used variable-centered analyses in which the focus is on the assessed variables and on examining the absolute effect of one variable (e.g., threat or challenge evaluations) on another (e.g., student engagement; Hart, Atkins, & Fegley, 2003). This approach can be misleading because it does not provide critical information about how variables combine at the level of the individual or how these naturally-occurring profiles relate to other variables of interest (Corpus & Wormington, 2014; Linnenbrink-Garcia, Pugh, Koskey, & Stewart, 2012; Meece & Holt, 1993). A person-centered approach in which the individual, as opposed to the variable, is the focal unit of analysis (Hart *et al.*, 2003), is able to provide this information and more accurately approximates real-world motivation (Linnenbrink-Garcia & Wormington, in press). This research extended the existing literature by using a person-centered approach to investigate how threat and challenge evaluations combine and how the resulting clusters relate to student engagement, revealing the most and least adaptive profiles of students.

In two studies, evaluations of perceived fear appeals and student engagement, in relation to an upcoming mathematics examination, were measured in two samples of secondary school students. A mathematics examination was chosen primarily because a pass grade was required for entry into post-compulsory education and employment, and therefore it would likely be perceived as high-stakes by students. Additionally, previous research has found that students view mathematics as more important, useful and interesting than other school subjects (Wolters & Pintrich, 1998). Gender differences are apparent in this domain; male students report more positive beliefs and emotions towards mathematics, than females (Frenzel, Pekrun, & Goetz, 2007; Meece, Glienke, & Burg, 2006; Watt, 2006; Wigfield, Eccles, Fredricks, Simpkins, Roeser, & Schiefele, 2015). Importantly, female students report higher behavioral engagement, but lower emotional engagement, in mathematics, and higher threat evaluations of fear appeals in relation to mathematics (Putwain *et al.*, 2017). There is also an age-related decline in the value of mathematics, competence beliefs and motivation during secondary school (Wigfield *et al.*, 2015). In the present research, the effects of gender and year group as antecedents to profile membership (i.e., how threat and challenge evaluations of fear appeals combined within individuals) were examined. Identifying the antecedents of profile membership is an important endeavor, having both theoretical and practical implications, as well as being a significant advancement in the field of person-centered studies more generally.

Moreover, it is likely that students' previous performance on examinations will be associated with their evaluation of fear appeals. Indeed, effects of past performance on achievement-related beliefs, values and emotions are proposed in expectancy-value theory (Eccles, 2005; Wigfield & Eccles, 2000). As previously discussed, the evaluation of a fear appeal as a threat and/or a challenge is a function of attainment/utility value and self-efficacy. Students with lower prior academic performance report lower self-efficacy (Diseth, 2011;

Liem, Lau, & Nie, 2008), and a devaluing of academic achievement possibly as a self-protection mechanism (Loose, Regner, Morin, & Dumas, 2012). The effects of past performance in mathematics on clusters of threat and challenge evaluations were therefore examined (Study 2).

An additional focus of Study 1 was on the changes in threat/challenge combinations from the beginning of the school year (Time 1) to four months later (Time 2), and whether these profile shifts predicted engagement at Time 2. Little empirical research has examined changes in motivation using a person-centered approach (Linnenbrink-Garcia & Wormington, in press). Existing studies have examined how motivational profiles have changed over the course of the academic year using I-states as Objects Analysis (ISOA; Bergman & El-Kouri, 1999), which assumes that the same profiles are present at all points in time but that individuals can shift between profiles over time. In the present research, however, we were interested in identifying clusters of threat and challenge evaluation at both time points, rather than assuming that profiles would stay the same (as in the ISOA method). Students studying for a high-stakes examination have been found to develop a more maladaptive approach to their learning as the academic year progresses and the test draws nearer. For example, decreases in academic self-efficacy and increases in negative affect and detrimental goal orientations have been reported (Smith, 2004; Smith, Sinclair, & Chapman, 2002). It is likely that a similar pattern also exists for the evaluation of fear appeals made by teachers, but this has so far not been investigated across the academic year. A comparison of profiles of fear appeal evaluation, generated from two time points, and the resulting profile shifts (i.e., from a Time 1 cluster to a Time 2 cluster) extends this literature and provides a detailed account of how temporal changes in threat and challenge combinations over the year relate to student engagement. Finally, the present research adds to the relatively limited literature base assessing profile stability across different studies/samples (Linnenbrink-Garcia

& Wormington, in press) and integrates person-oriented and variable-oriented approaches to form a more complete investigation (Laursen & Hoff, 2006).

Study 1

The first aim was to investigate whether, and if so how, threat and challenge evaluations clustered together within students at the beginning of the school year (Time 1) and four months later (Time 2). As past research has shown that fear appeals can be evaluated as both a threat and a challenge (Cerin, 2003; Meijen *et al.*, 2013), we expected a range of different clusters to emerge, including groups reporting high, moderate and low levels of both threat and challenge, as well as a mixture of different combinations of threat and challenge levels (H_1). Second, we examined whether cluster membership was differentially associated with the four components of student engagement, at both time points. Although variable-centered analyses have found that threat evaluations lead to lower engagement and challenge evaluations to higher engagement, the literature suggests that a moderate level of threat, combined with high challenge, may be optimal (Cerin *et al.*, 2000; Kendall *et al.*, 1989; Skinner & Brewer, 2004), although low threat with high challenge is also adaptive (Meijen *et al.*, 2013). Conversely, patterns of high threat and high challenge evaluations, and moderate/high threat and low challenge evaluations may be detrimental (Cerin *et al.*, 2000; Meijen *et al.*, 2013). Although dependent on the clusters that emerged at each time point, it was hypothesized that moderate threat/high challenge would be associated with the highest behavioral and emotional engagement, and lowest behavioral and emotional disaffection, but also low threat/high challenge would be related to high engagement and low disaffection (H_2). In addition, high threat/high challenge and/or moderate/high threat and low challenge would be associated with low engagement and high disaffection (H_3).

The third aim was to investigate whether gender and/or year group (Year 10/11) predicted cluster membership. It was predicted that male students would report a more adaptive combination of threat/challenge evaluations (i.e., as determined by their associations with student engagement) than females (H_4), and that Year 10 students would display a more adaptive profile than Year 11 students (H_5). Finally, we investigated how cluster membership changed from Time 1 to Time 2 and whether profile shifts were related to engagement at Time 2. It was predicted that students would display a more detrimental fear appeal evaluation pattern at Time 2 (i.e., as determined by their associations with student engagement; H_6). The clearest shifts from adaptive to maladaptive profiles were expected to be associated with the lowest engagement and highest disaffection (H_7).

Method

Participants

Participants were 2,015 students, drawn from six secondary schools in England, who were in the final two years of compulsory schooling (1,070 Year 10 students, 944 Year 11 students, 1 unknown) and were therefore following the GCSE program of study. In England, students take their GCSE examinations at the end of Year 11, and the ‘mock’ examinations at the end of Year 10 (both normally in June). Participants had a mean age of 14.61 (*SD* = 0.62), and consisted of 1,015 males (50.4%), 968 females (48.0%) and 32 students who did not disclose their gender (1.6%). The majority of students described their ethnicity as White (81.2%), with the remainder stating Asian (10.5%), Black (1.9%), Other (2.7%) and mixed heritage (3.1%), while a minority did not specify (0.6%). Two hundred and eleven students (10.5% of the sample) qualified for free school meals due to low parental income (1.1% did not disclose this information). Some of the schools did not provide data for some of their classes at one of the time points; specifically, we collected valid data from 1,741 students at Time 1 (102 classes), 1,367 students at Time 2 (79 classes), and 1,093 students for both time points (72 classes). Thus, the rather low attrition rate was due to the non-response of the classes/schools, rather than to the students opting out.[2]

Measures

Fear Appeals. The evaluation of fear appeals was measured using items from the 'Revised Teachers Use of Fear Appeals Questionnaire' (Putwain & Symes, 2014) that were adapted to be specific to GCSE mathematics. Participants responded on a five-point scale (1 = never, 3 = sometimes, 5 = most of the time) to three items assessing the extent to which they evaluated fear appeals as a threat (e.g., 'Do you feel worried when your teacher tells you that unless you work hard you will fail your maths GCSE?') and three items pertaining to a challenge evaluation (e.g., 'Does it make you want to pass GCSE maths when your teacher tells you that unless you work hard you will fail?'). Responses for threat and challenge evaluation were averaged over the three items with a higher score representing a higher evaluation. The reliability and validity of data collected using these scales have been established in past research (Putwain *et al.*, 2014; Putwain & Symes, 2014). In the present study, at both time points, the internal reliabilities were acceptable (threat evaluation: α = .81/.84; challenge evaluation: α = .76/.77) and the two-factor confirmatory models yielded an excellent fit to the data ($\chi^2(5) = 16.03$, $p < .01$, CFI = 1.00, RMSEA = 0.04, at Time 1; $\chi^2(5) = 18.93$, $p < .01$, CFI = 1.00, RMSEA = 0.05, at Time 2). Configural, metric, scalar and residual invariance of the measure over time were established (ΔCFI < 0.01, ΔRMSEA < 0.015, Chen, 2007; Marsh, Nagengast, & Morin, 2012), and threat and challenge evaluations were strongly related at both time points ($r = .55$, $p < .001$ at Time 1; $r = .57$, $p < .001$ at Time 2).

Student Engagement. Engagement was assessed using items from the 'Engagement versus Disaffection with Learning Questionnaire' (Skinner *et al.*, 2009), adapted to be specific to GCSE mathematics. Five items measured each of the components; behavioral engagement (e.g., 'I participate in the activities and tasks in my GCSE maths class'), emotional engagement (e.g., 'I enjoy learning things in GCSE maths'), behavioral disaffection (e.g., ‘I don’t try very hard in GCSE maths’) and emotional disaffection (e.g., ‘When I’m doing GCSE maths work in class, I feel bored’)[3]. Participants responded on a five-point scale (1 = strongly disagree, 3 = neither agree nor disagree, 5 = strongly agree). Responses for each component were averaged with a higher score representing higher engagement/disaffection. Data collected using the original version of the scales showed satisfactory reliability and validity (Skinner, Furrer, Marchand, & Kinderman, 2008; Skinner *et al.*, 2009) and internal consistencies in the present study were acceptable at Times 1 and 2 (behavioral engagement: α = .87/.86; emotional engagement: α = .88/.87; behavioral disaffection: α = .78/.82; emotional disaffection: α = .77/.78). The four-factor confirmatory models yielded a reasonable fit to the data ($\chi^2(158) = 1131.45$, $p < .001$, CFI = 0.93, RMSEA = 0.06, at Time 1; $\chi^2(158) = 994.52$, $p < .001$, CFI = 0.92, RMSEA = 0.06, at Time 2), and displayed configural, metric, scalar and residual invariance over time (ΔCFI < 0.01, ΔRMSEA < 0.015, Chen, 2007; Marsh *et al.*, 2012).

Procedure

Fear appeal evaluation and student engagement were measured at the beginning of the academic year (October, 2014; Time 1) and four months later (February, 2015; Time 2). Questionnaires were administered by tutors (not students’ mathematics teachers) during a period within the school timetable reserved for pastoral and administrative purposes. Tutors read out information about the study and ethical issues (e.g., anonymity, voluntary participation, withdrawal of data) to students and emphasized that the questions were not part of a test. Students then read an instruction sheet, which re-iterated what the tutor had said, before completing a consent form, demographic questions and the main questionnaires.

Results

Characteristics of Variables over Time

Descriptive statistics for threat and challenge evaluations, and the four components of student engagement at both time points are presented in Table 1 (i.e., for participants who provided data at both time points for the given variables, to allow comparison between time points). On average, at both time points, students scored higher on challenge than threat evaluations, and higher on the engagement components than on the disaffection components (all *p*s $< .001$). Challenge evaluations, behavioral engagement and emotional engagement significantly decreased from Time 1 to 2, however, there were no changes in threat evaluations, behavioral disaffection or emotional disaffection.

Table 1 about here

Zero-Order Correlations

Correlations between the main variables are presented in Table 2. The pattern of relationships was remarkably similar across time points. Threat evaluation showed no relationship with behavioral engagement, a weak negative correlation with emotional engagement, a weak positive correlation with behavioral disaffection, and a moderate positive correlation with emotional disaffection. Challenge evaluation displayed weak-moderate positive relationships with both engagement components, a weak negative relationship with behavioral disaffection, and a negligible relationship with emotional disaffection. Females scored higher on threat evaluation but there was no relationship between gender and challenge evaluation. Year group was not associated with evaluation of fear appeals.

Table 2 about here

Cluster Analysis

Cluster analysis, an exploratory multivariate data reduction technique, was used to investigate whether students naturally grouped into distinct clusters based on their evaluation of fear appeals as a threat and as a challenge. As the sample size exceeded 1000, the two-step cluster analysis was performed (Norusis, 2011). This technique identifies inherent clusters in the data that exhibit similar response patterns. It specifically involves pre-clustering the data into small clusters and then grouping these small clusters into homogeneous larger clusters, based on a hierarchical clustering algorithm (Norusis, 2011). Similarity between clusters was determined based on the log-likelihood measure and the clustering algorithm established the optimal number of clusters using the Bayesian Information Criterion (BIC). As the clustering algorithm is influenced by the order of cases in the dataset, all cluster analyses were performed several times with cases arranged in a different random order to assess the stability of the cluster solution (Horn & Huang, 2009; Mooi & Sarstedt, 2011; Norusis, 2011).

In order to assess the internal validity of the cluster solutions, the double-split cross-validation procedure advocated by Breckenridge (2000) was followed. The dataset was randomly split into two halves and hierarchical cluster analysis, using Ward’s method, followed by k-means cluster analysis, were conducted on each half. Next, the participants from each half were assigned to new clusters based on their Euclidean distances from the cluster centroids identified in the other half. Cohen’s kappa was then used to compare the agreement rate of the new clusters with the original cluster solutions, of which a value of at least .60 was considered acceptable (Vansteenkiste *et al.*, 2012). Our analyses of the association between cluster membership and student engagement also serves as a test of the external/predictive validity of the cluster solutions. If statistically significant differences are found between the clusters on the components of student engagement, predictive validity is established (Hair, Anderson, Tatham, & Black, 1998).

Time 1. The algorithm automatically revealed a two-cluster solution to be optimal. The silhouette coefficient, which indicates the overall goodness-of-fit of the clustering solution, indicated a good cluster quality (0.6). The cross-validation procedure revealed that the clusters had excellent internal validity (average kappa = .93). MANOVA confirmed a statistically significant multivariate effect of cluster group on threat and challenge evaluations, *F*(2, 1738) = 1677.66, *p* < .001; V = .66, and follow-up univariate analyses showed that the two clusters significantly differed on threat evaluation, *F*(1, 1739) = 1653.21, *p* < .001, η_p^2 = .49, and challenge evaluation, *F*(1, 1739) = 1973.11, *p* < .001, η_p^2 = .53. In further support of this, the classification feature of discriminant function analysis revealed that the variables of threat and challenge evaluation were able to predict cluster membership in 97.2% of cases. Students in the first cluster (*n* = 843, 48.4%) reported low threat (*M* = 1.87, *SD* = .74) combined with moderate challenge (*M* = 2.71, *SD* = .90; hereafter LT/MC), while students in the second cluster (*n* = 898, 51.6%) displayed a pattern of moderate threat (*M* = 3.47, *SD* = .90) combined with high challenge (*M* = 4.30, *SD* = .57; hereafter MT/HC). The two-cluster solution is illustrated in Figure 1.

Figure 1 about here

Time 2. The clustering algorithm automatically selected a four-cluster solution, which the silhouette coefficient indicated was of a good quality (0.5). Internal validity was excellent (average kappa = .90). MANOVA revealed a statistically significant multivariate effect of cluster group, *F*(6, 2726) = 1018.51, *p* < .001; V = 1.38, and univariate follow-up analyses showed significant differences between all four clusters for threat evaluation, *F*(3, 1363) = 1682.20, *p* < .001, η_p^2 = .79, and challenge evaluation, *F*(3, 1363) = 1484.84, *p* < .001, η_p^2 = .77. The classification feature of discriminant function analysis confirmed that threat and challenge evaluation predicted cluster membership in 97.9% of cases. Students in the first cluster (*n* = 267, 19.5%) displayed low threat (*M* = 1.87, *SD* = .53) combined with high challenge (*M* = 4.15, *SD* = .54; hereafter LT/HC), students in the second cluster (*n* = 351, 25.7%) reported low levels of both threat (*M* = 1.52, *SD* = .51) and challenge (*M* = 2.01, *SD* = .66; hereafter LT/LC), students in the third cluster (*n* = 410, 30.0%) showed moderate levels of both threat (*M* = 3.15, *SD* = .50) and challenge (*M* = 3.31, *SD* = .49; hereafter MT/MC), and students in the final cluster (*n* = 339, 24.8%) reported high levels of both threat (*M* =

4.13, *SD* = .61) and challenge (*M* = 4.54, *SD* = .42; hereafter HT/HC). The four-cluster solution is presented in Figure 2.

Figure 2 about here

Associations with Student Engagement

MANCOVA were used to examine whether cluster membership was associated with student engagement, while controlling for the effects of gender and year group, at both time points. The dependent variables at Time 1 were the engagement components measured at Time 1, and at Time 2, the engagement components assessed at Time 2. Descriptive and inferential statistics are reported in Table 3.

Table 3 about here

Time 1. There was a statistically significant multivariate effect of cluster group on student engagement and follow-up univariate analyses revealed that the two clusters significantly differed on all four engagement components. Students in the LT/MC cluster scored lower than those in the MT/HC cluster on behavioral engagement, emotional engagement and emotional disaffection, and higher on behavioral disaffection (see Figure 3).

Time 2. A statistically significant multivariate effect of cluster group on student engagement was found, and the four clusters significantly differed on all engagement components. Behavioral engagement was highest amongst the students in the clusters of LT/HC and HT/HC, compared with those in the clusters of LT/LC and MT/MC. Emotional engagement was highest for the students in the LT/HC cluster, followed by those in the clusters of HT/HC, LT/LC and MT/MC. Regarding behavioral disaffection, students in the MT/MC cluster reported the highest levels, followed by those in the clusters of LT/LC and HT/HC, and finally those in the LT/HC cluster. Emotional disaffection was highest amongst the students in the clusters of HT/HC and MT/MC, compared with those in the clusters of LT/LC and LT/HC (see, Figure 4).

Figures 3 and 4 about here

Gender and Year Group as Predictors of Cluster Membership

Logistic regression showed that gender and year group significantly predicted cluster membership at Time 1, $R^2 = .02$ (Cox & Snell), .02 (Nagelkerke), $\chi^2(2) = 27.00$, $p < .001$. Only gender, $B = -.50$ (0.10), $p < .001$, Exp(B) = 0.61, however, exerted a statistically significant influence on cluster membership (year group, $B = .06$ (0.10), $p = .55$, Exp(B) = 1.06). Female students were more likely than males to report MT/HC than LT/MC. At Time 2, the model including gender and year group significantly predicted cluster membership (R^2 = .02 (Cox & Snell), .03 (Nagelkerke), $\chi^2(6) = 31.42$, $p < .001$. Again, only gender, $\chi^2(3)$ = 26.71, $p < .001$, was a statistically significant predictor (year group, $\chi^2(3) = 4.71$, $p = .19$). Females were more likely than males to report HT/HC than LT/HC, $B = .84$ (0.17), $p < .001$, Exp(B) = 2.31, LT/LC, $B = .51$ (0.16), $p < .001$, Exp(B) = 1.67, and MT/MC, $B = .34$ (0.15), $p < .05$, Exp(B) = 1.41. Males were more likely than females to report LT/HC than MT/MC, $B = -.50$ (0.16), $p < .01$, Exp(B) = 0.61.

Profile Shifts

With the effects of gender controlled, the Time 1 clusters significantly predicted the Time 2 clusters, $R^2 = .21$ (Cox & Snell), .22 (Nagelkerke), $\chi^2(3) = 229.68$, $p < .001$. Students in the LT/MC cluster were significantly more likely than those in the MT/HC cluster to move into the LT/LC cluster, rather than the LT/HC cluster,, $B = 1.37$ (0.20), $p < .001$, the MT/MC cluster, $B = 1.64$ (0.18), $p < .001$, or the HT/HC cluster, $B = 2.86$ (0.22), $p < .001$. They were also significantly more likely to transition into the LT/HC cluster than the MT/MC cluster, B = 0.27 (0.18), $p < .001$, or the HT/HC cluster, $B = -1.49$ (0.21), $p < .001$, and more likely to move into the MT/MC cluster than the HT/HC cluster, $B = 1.22$ (0.20), $p < .001$, than those in the MT/HC cluster at Time 1.

Students were coded according to which cluster they belonged to at Time 1 and Time 2 to produce a profile shift variable which had eight levels representing every possible combination of clusters over time. MANCOVA, controlling for gender, year group and the engagement components measured at Time 1, was conducted in which profile shifts predicted engagement at Time 2. There was a statistically significant multivariate effect of profile shifts on engagement, and in the univariate analyses, all four components of engagement significantly differed. The full results are reported in Table 4.

Table 4 about here

Students belonging to both of the Time 1 clusters scored higher on behavioral engagement when they moved into either the LT/HC or HT/HC cluster at Time 2, compared to those moving into the remaining two clusters. For emotional engagement, students from both clusters at Time 1 scored higher than the other profile shifts when they moved into the LT/HC at Time 2. There was only one significant finding for behavioral disaffection, which indicated that those moving from the LT/MC cluster to the MT/MC scored higher than those moving from the MT/HC cluster to the LT/HC cluster. Finally, higher scores for emotional disaffection were found for students in both of the Time 1 clusters when they moved to the HT/HC cluster at Time 2, and also for those in the Time 1 MT/HC cluster who moved to the Time 2 MT/MC cluster.

Discussion

This study investigated how threat and challenge evaluations of perceived fear appeals combined within students and how these combinations changed over time and related to student engagement, gender and year group. Students displayed a range of empirically distinct profiles of threat and challenge evaluations at both time points, which supports H_1. At the beginning of the year, students clustered into two groups, either reporting LT/MC, or MT/HC. Four months into the school year, four combinations of responses to fear appeals were apparent; students either reported LT/HC, LT/LC, MT/MC, or HT/HC. Therefore, as the academic year progressed, a wider range of evaluation combinations emerged. All of the clusters comprised students with either higher levels of challenge than threat, or equivalent levels, which supports the literature (Cerin, 2003; Meijen *et al.*, 2013), and suggests a relatively favorable profile for most students. It is clear that many students do evaluate fear appeals as both threatening and challenging. The students reporting MT/HC at Time 1 were more behaviorally and emotionally engaged, and less behaviorally disaffected in relation to their mathematics work than those reporting LT/MC. On the other hand, they were also more emotionally disaffected. Therefore, students in the MT/HC cluster displayed the most adaptive pattern in three out of the four components of engagement, which partly supports previous theorizing that a moderate level of threat may be beneficial if accompanied by challenge (Cerin *et al.*, 2000; Kendall *et al.*, 1989; Skinner & Brewer, 2004). Taking all of the results for Time 2 together, students reporting LT/HC were the most engaged and least disaffected, and those reporting MT/MC were the least engaged and most disaffected. In sum, these findings partially support H_2 and suggest that the most beneficial response to fear appeals, in terms of student engagement, is a high level of challenge, accompanied by either a low or moderate level of threat. A direct test of which combination is most optimal (i.e., LT/HC versus MT/HC) was not possible as the two clusters did not emerge from the same analysis.

It was hypothesized (H_3) that students reporting HT/HC would score lower on engagement and higher on disaffection, however, this was not the case. This cluster represented the second most optimal profile out of the four clusters identified at Time 2 (however, students in this cluster did score the highest on emotional disaffection). Previous variable-centered studies have found that evaluating fear appeals as a threat is associated with a range of detrimental educational outcomes, including lower engagement and academic performance (e.g., Putwain, Symes *et al.*, 2016). The finding that a high level of threat may actually be adaptive, as long as students also experience a high level of challenge, is a novel finding and would not have been detected if we had not utilized a person-centered approach. Clusters of moderate threat/low challenge and high threat/low challenge did not emerge, and so could not be investigated. Effect sizes for the associations between cluster membership and student engagement were stronger at Time 2 than Time 1, which we argue is due to their measurement being closer to the high-stakes examinations. This perhaps made them more salient and 'real' to students, resulting in their combined evaluations being more strongly associated with engagement/disaffection. This may also have contributed to a greater range of profiles emerging at Time 2.

At Time 1, females were more likely to belong to the MT/HC cluster, which was the most adaptive in terms of relationships with student engagement, and at Time 2, males were more likely than females to report LT/HC (the most adaptive) than MT/MC (the least adaptive). This provides mixed support for H_4 and the associated literature (e.g., Meece *et al.*, 2006). It may be that the previously-established gender differences in mathematics beliefs and emotions, i.e., more positive for males, increase as the high-stakes test approaches. Year group was not associated with cluster membership at any time point, which contradicts H_5. This finding is surprising, as motivation, competence beliefs and value of mathematics have previously been found to decline with age (Wigfield *et al.*, 2015). This may be due to the requirement for Year 10 students to sit a mock GCSE examination at the end of the year, which they may perceive as comparably high-stakes to the actual examination, and so their evaluations of fear appeals combine in the same way as those of Year 11 students. Future research is needed to ascertain this, and whether the age-related decline in motivation and associated variables stabilizes in Year 10 (i.e., in the UK education system or comparable).

The sample, as a whole, reported lower challenge evaluations at Time 2 compared with Time 1, however, there were no differences in threat evaluations. More of the students who reported LT/MC at Time 1 reported LT/LC at Time 2. Therefore, they reported lower challenge evaluations at Time 2 than Time 1. More students reporting MT/HC at Time 1 went on to report HT/HC at Time 2. These students reported higher threat evaluations at Time 2 than Time 1. Taken together, this reinforces previous findings that students develop a more maladaptive psychological approach to learning as the high stakes test draws nearer (Smith, 2004; Smith *et al.*, 2002), and supports H_6. Both behavioral and emotional engagement also diminished over time in the overall sample. It is noted, however, that there were no differences in the Time 1 clusters of those appearing in the most and least adaptive clusters (according to their relations with student engagement) at Time 2.

For student engagement, it was cluster membership at Time 2 which was the most crucial for behavioral and emotional engagement, rather than profile shifts. Regardless of their Time 1 cluster, students belonging to either the LT/HC or HT/HC clusters at Time 2 scored higher on behavioral engagement, while membership of the former cluster only, was associated with higher emotional engagement. On the other hand, profile shifts did influence disaffection. Transitioning from LT/MC to MT/MC was associated with higher behavioral disaffection, compared to those moving from MT/HC to LT/HC. For emotional disaffection, students scored higher when they moved from MT/HC to MT/MC, as well as when they reported HT/HC at Time 2, regardless of their Time 1 cluster membership. Therefore, maladaptive profile shifts were those that were relatively favorable at the beginning of the year (i.e., the level of challenge evaluation exceeded the level of threat) but that transitioned into a combination of moderate threat and moderate challenge, via either an increase in threat (behavioral disaffection) or a reduction in challenge (emotional disaffection). As MT/MC was found to be a detrimental profile, these results partly support $H_{7,}$ but only for disaffection.

Disaffection may be more likely, than engagement, to build up over time, perhaps as a result of how students evaluate fear appeals made by their teacher. Indeed, a key feature of disaffection in mathematics is that it pervades over time (Lewis, 2016).

Study 2

To extend the findings from Study 1, examination scores, from mathematics tests taken at the end of Year 10, were obtained, and evaluations of perceived fear appeals and student engagement were measured at the beginning of Year 11. The aims were to (i) provide a more stringent test of the associations between the clusters and student engagement by controlling for previous examination grade, as well as gender, and (ii) determine whether past examination performance and gender were able to predict cluster membership. As data were collected at the start of the academic year, as at Time 1 in Study 1, we expected the same two clusters to emerge, i.e., LT/MC and MT/HC (H_1), and that students in the latter group would score higher on engagement and lower on behavioral disaffection, but higher on emotional disaffection, as in Study 1 (H_2). It was also predicted that the cluster comprising students with the highest level of challenge, i.e., MT/HC, would be associated with higher previous examination performance (H_3) and with being male (H_4).

Method

Participants

Participants were 192 students, drawn from 12 classes in two secondary schools in England, who were in their final year of compulsory schooling (Year 11) when the self-report data were collected. Participants had a mean age of 14.55 (*SD* = 0.22), and comprised 101 males (52.6%) and 90 females (46.9%; one student, 0.5%, did not disclose their gender). The majority of students described their ethnicity as White (90.6%), and the remainder stated Asian (2.6%), Black (1.6%), other (3.6%) and mixed heritage (1.5%). Six students (3.1% of the sample) qualified for free school meals (0.5% did not disclose).

Measures

Mock GCSE examination grades from mathematics examinations that students had sat at the end of Year 10 were provided by the participating schools. Teachers marked the examinations using standardized GCSE assessment criteria (appropriate to the end of the first year of study, i.e., Year 10) and graded them A* to G, which is the usual practice of marking GCSE examinations. This 8-point scale was converted into a numerical format (i.e., grade A* = 8, grade A = 7, grade B = 6, etc.) and therefore a higher score represented a higher grade. The same items were used to measure fear appeals (threat evaluation: $\alpha = .87$; challenge evaluation: $\alpha = .73$; $\chi^2(5) = 0.71$, $p = 0.98$, RMSEA = 0.00, CFI = 1.00; $r = .55$, $p < .001$) and student engagement (behavioral engagement: $\alpha = .88$; emotional engagement: $\alpha = .90$; behavioral disaffection: $\alpha = .84$; emotional disaffection: $\alpha = .79$; $\chi^2(158) = 485.10$, $p < .001$, CFI = 0.91, RMSEA = 0.07) as in Study 1.

Procedure

Mathematics grades were obtained for examinations taken by the students at the end of Year 10 (June, 2015). Fear appeal evaluation and student engagement were measured at the beginning of the following academic year (September, 2015). Students were provided with information about the study and made aware of the necessary ethical issues, before providing written consent and completing the questionnaires, which were administered by their tutor (not their mathematics teacher).

Results

Characteristics of Variables and Zero-Order Correlations

Descriptive statistics for all of the variables are reported in Table 5 and zero-order correlations are shown in Table 6. Students reported higher challenge than threat evaluations ($p < .001$), higher behavioral engagement than behavioral and emotional disaffection (ps < .001), and higher emotional engagement than behavioral disaffection ($p < .001$; although there was no statistically significant difference between emotional engagement and emotional disaffection, $p = .15$). Threat evaluation was not significantly related to behavioral or emotional engagement, however, it displayed weak-moderate positive relationships with behavioral and emotional disaffection. Conversely, there were moderate positive correlations between challenge evaluation and both of the engagement components, but challenge evaluation was not significantly related to disaffection. Male students and, unexpectedly, having a higher previous mathematics examination grade, were associated with a higher threat evaluation, however, neither gender nor examination score correlated significantly with challenge evaluation.

Tables 5 and 6 about here

Cluster Analysis

Due to the relatively small sample size (compared with Study 1), agglomerative hierarchical cluster analysis using Ward's method was conducted on the data (Norusis, 2011). This technique starts with every case being its own cluster before being merged with similar clusters at successive steps (Norusis, 2011). The largest change in agglomeration coefficients was found from step 1 to 2 (54.98%, compared to 25.16% change from step 2 to 3, 21.32% change from step 3 to 4, and 22.24% change from step 4 to 5) indicating that a two-cluster solution was optimal. The cross-validation procedure described in Study 1 revealed that the solution had excellent internal validity (average kappa = .94). MANOVA confirmed that threat and challenge evaluations were significantly different between the two clusters, $F(2, 189) = 274.45$, $p < .001$; V = .74. Follow-up univariate analyses showed that the two clusters significantly differed on threat, $F(1, 190) = 500.58$, $p < .001$, $\eta_p^2 = .73$, and challenge, $F(1, 190) = 95.99$, $p < .001$, $\eta_p^2 = .34$, evaluation. Discriminant function analysis revealed that threat and challenge evaluations were able to correctly predict cluster membership in 98.4% of cases. Students in the first cluster ($n = 96$, 50.0%) reported low threat ($M = 1.49$, $SD =$

0.51) combined with moderate challenge (*M* = 2.42, *SD* = 1.02; LT/MC), while students in the second cluster (*n* = 96, 50.0%) reported moderate levels of both threat (*M* = 3.55, *SD* = 0.75) and challenge (*M* = 3.69, *SD* = 0.76; MT/MC). The two-cluster solution is illustrated in Figure 5.

Figure 5 about here

Associations with Student Engagement

After controlling for previous examination grade and gender, there was a statistically significant multivariate effect of cluster group on student engagement, $F(4, 184) = 5.39$, $p < .001$; V = .11. In the univariate analyses, the two clusters significantly differed on only emotional disaffection, $F(1, 187) = 6.23$, $p < .05$, $\eta_p^2 = .03$. Students in the LT/MC cluster (*M* = 2.65, *SD* = 0.76) scored lower than those in the MT/MC cluster (*M* = 3.06, *SD* = 0.90). This result is graphed in Figure 6.

Figure 6 about here

Examination Performance and Gender as Predictors of Cluster Membership

Examination performance and gender significantly predicted cluster membership, R^2 = .11 (Cox & Snell), .14 (Nagelkerke), $\chi^2(2) = 21.34$, $p < .001$. Students with higher examination scores were more likely to report LT/MC (*M* = 6.30, *SD* = 1.27) than MT/MC (*M* = 5.47, *SD* = 1.49), *B* = -.48 (0.12), $p < .001$, Exp(*B*) = 0.62. Females were more likely than males to report MT/MC as opposed to LT/MC, *B* = -.64 (0.31), $p < .05$, Exp(*B*) = 0.53.

Discussion

This study replicated Study 1 in that clusters of students based on fear appeal evaluation were identified empirically, and more rigorously tested their associations with student engagement, by controlling for previous mathematics performance. It also investigated whether past examination performance and gender were able to predict combinations of fear appeal evaluation. Two clusters emerged, one characterized by LT/MC and the other representing MT/MC. These clusters were qualitatively similar to those found at Time 1 in Study 1. Specifically, a cluster of LT/MC was identified in both studies, and the remaining cluster differed only in the level of challenge, i.e., MT/HC in Study 1 and MT/MC in Study 2. This partly supports H_1 and adds to the validity of a two-cluster solution at the beginning of the academic year.

The students reporting LT/MC scored lower on emotional disaffection than those reporting MT/MC. There were no differences in the clusters for the remaining three engagement components. As identical clusters to those found in Study 1 did not emerge, H_2 could not be directly tested. In Study 1, the LT/MC profile was the least adaptive in terms of behavioral and emotional engagement, and behavioral disaffection, but most adaptive on emotional disaffection, and in Study 2, the same cluster appeared the most favorable, but only in terms of emotional disaffection. In line with Study 1, the absence of a cluster comprising high challenge in Study 2 may explain the equivalent levels of behavioral and emotional engagement in the two clusters. Emotional disaffection was lower in the LT/MC cluster in both studies, indicating a stable finding for this engagement component.

Previous examination performance predicted cluster membership in that students with a higher score were more likely to report LT/MC than MT/MC. As the results of this study suggest that the former cluster is the most adaptive, this finding may be attributed to changes in self-efficacy (e.g., Diseth, 2011) and/or in the perceived value of mathematics/academic achievement (Loose *et al*., 2012), in response to examination results. Including a measure of self-efficacy and/or attainment/utility value in order to test this hypothesis would be a useful venture for future person-centered studies in the field. As in Study 1, at Time 1, males were more likely to belong to the LT/MC cluster than females, which was associated with lower emotional disaffection in both studies. This supports past research that males display lower levels of negative academic emotions in relation to mathematics (e.g., anxiety, hopelessness and shame, Frenzel *et al.*, 2007). A full test of H_3 and H_4 was not possible due to the lack of high challenge within a cluster, however, higher previous performance and being male were associated with the cluster comprising a higher level of challenge than threat.

General Discussion

This research used a person-centered approach to extend the educational psychology literature on how students evaluate perceived fear appeals made by the class teacher in relation to an upcoming high-stakes test. Literature in the sports psychology field suggested that students can and do evaluate fear appeals as both threatening and challenging, and that a moderate level of threat combined with high challenge may be the optimal profile (e.g., Cerin *et al.*, 2000). Indeed, a range of empirically distinct clusters emerged from three analyses conducted over two studies, all of which demonstrated acceptable internal and external validity. These included profiles of high and moderate levels of both threat and challenge evaluations, which confirmed that threat and challenge evaluation are separate concepts, rather than being opposite ends of the same continuum (e.g., Meijen *et al.*, 2013). Two clusters appeared prominent at the beginning of the academic year and four clusters were identified mid-year. There was some evidence to suggest that students displayed a more detrimental combination of fear appeal evaluations mid-year, which adds to the research on students' psychological approach to learning throughout the academic year. Further, shifts from relatively adaptive profiles to maladaptive profiles across the year were associated with higher disaffection.

The literature on the dual threat/challenge approach (e.g., Skinner & Brewer, 2004) suggested that a moderate level of threat may be beneficial, if accompanied by challenge. As clusters of MT/HC and LT/HC did not emerge from the same analysis, we were unable to directly compare their relations with student engagement. In general, a higher level of challenge than threat was beneficial for student engagement. An unexpected, important, finding emerged, however, in that a relatively high level of threat was positively associated with engagement, as long as it was combined with high challenge. This clearly extends the variable-centered findings on fear appeal evaluations and student engagement (e.g., Putwain, Nicholson *et al.*, 2016), as discussed earlier. Despite positive relationships with both behavioral and emotional engagement, however, the HT/HC cluster was also associated with the highest emotional disaffection. This notable drawback must be taken into consideration, especially when dealing with at risk and vulnerable students, as emotional disaffection can lead to a range of undesirable educational outcomes (Skinner, 2016). A moderate level of threat in combination with a moderate level of challenge was the most detrimental profile overall. It would be fruitful for future research to directly compare LT/HC, MT/HC, HT/HC and MT/MT clusters within the same study, both quantitatively and qualitatively. A qualitative approach would allow for an in-depth exploration of the cognitions underlying these profiles and why they are differentially associated with the four components of student engagement.

The two clusters identified in both studies, at the start of the academic year, were qualitatively similar, and the identical cluster, i.e., LT/MC, was associated with lower emotional disaffection in both cases. As these findings emerged from different samples, they produce generalizable knowledge about typical responses to fear appeals (Linnenbrink-Garcia & Wormington, in press). Of further theoretical significance is the investigation of the antecedents of cluster membership, in order to be able to predict whether students will adopt a more or less adaptive response to fear appeals. Students in the LT/MC cluster had previously scored higher in their mathematics examinations than those in the MT/MC cluster. This enhances our theoretical understanding of why threat and challenge evaluations combine in particular ways, and again signifies a more adaptive trajectory for students reporting a higher level of challenge than threat evaluation, and a more detrimental profile for students evaluating fear appeals at a moderate level of both threat and challenge. Students who have performed poorly in mathematics examinations in the past evaluate perceived fear appeals made by the teacher in a more harmful way in terms of their combined threat and challenge evaluation, and this resulted in increased emotional disaffection. Results for gender were mixed in terms of adaptive profile membership, however, in both studies, at the beginning of the year, male students more frequently reported low threat in combination with moderate challenge, which attests to the generalizability of this response (Linnenbrink-Garcia & Wormington, in press). It was beyond the scope of the research to investigate mediational hypotheses but it would be interesting for future research to examine whether the combination of fear appeal evaluations mediate the relationship between prior performance and/or gender, and emotional disaffection. Finally, it is noteworthy that the findings extend previous research in the area by measuring disaffection (e.g., Putwain, Nicholson *et al.*, 2016), and support previous theorizing that all four components of engagement should be assessed (Skinner *et al.*, 2008; Skinner *et al.*, 2009).

Limitations

As only two clusters of students were identified in two of the analyses, students within each cluster may have had only limited resemblance to each other and therefore it may be misleading to regard this group as representing a type of person (Hart *et al.*, 2003). The use of different clustering techniques in the two studies makes it difficult to directly compare the results, although the finding that two clusters were extracted at the beginning of the academic year in both cases, and that these clusters were qualitatively similar, increases their validity. Fear appeal evaluations and student engagement were measured at the same time point, which precludes causal inferences. As student engagement is a crucial precursor for future academic achievement, we argue that fear appeal evaluations precede engagement, however it is possible that there were also bidirectional relations. Effect sizes found in this research were also generally small, although it is noted that we controlled for relevant variables in our analyses making the tests more rigorous.

The majority of data were self-reported (except for past examination grade), leaving it vulnerable to several response biases, for instance, social desirability (Marlowe & Crowne, 1961). Future studies may wish to collect more reliable data using real-time reporting of fear appeal evaluation, for example, students could be asked to respond to a digital application several times per day which would allow the tracking of intrapersonal change. Relatedly, the extent to which teachers actually made fear appeals is unknown. It would be fruitful to obtain multiple measures of fear appeal frequency such as teacher reports or observational methods. The focus in this research was on the individual evaluations of fear appeals. Fear appeal messages, however, are a teacher-centric phenomena, and it is possible that the classes in which the students belonged to may have had an effect on the results. Further research investigating the teacher messages at the class level may wish to examine links between class-aggregated evaluations and outcomes. Finally, all of the variables were measured in relation to GCSE mathematics, which limits the generalizability of the findings to other schools subjects.

Educational Implications

Teachers use fear appeals in an effort to motivate students to work hard and engage in study so that they perform better on a particular high-stakes examination. Linking student perceptions and evaluations of teacher practices, i.e., fear appeals, to educationally-relevant variables is important as these factors are able to be changed. Students can evaluate the messages in fear appeals at varying degrees of threat and challenge, including at high levels of both. The present research suggests that the priority for educational interventions for students attending mainstream secondary school should be to promote a high challenge evaluation, perhaps by focusing on increasing academic self-efficacy and/or attainment/utility value. Efforts directed to reducing a threat evaluation are not as crucial as variable-centered analyses may have indicated and may even be unnecessary, provided that the level of challenge is high. Students with low performance on previous mathematics examinations may be at greater risk for evaluating fear appeals in a detrimental concoction of threat and challenge evaluation. It may be advantageous to target those students early on in the academic year. For students at risk of dropout or attending alternative provision schools in particular, it may also be beneficial to direct efforts into diminishing threat evaluations of fear appeals in order to reduce emotional disaffection, which can lead to undesirable educational outcomes, such as underachievement, burnout and dropout (Skinner, 2016).

Conclusions

Previous research into the evaluation of fear appeals was extended with the use of a person-centered approach to analysis. Specific profiles of students were identified based on the extent to which they evaluated perceived fear appeals made in relation to GCSE mathematics as threatening and challenging. Evaluating the message in the fear appeal at a higher level of challenge than threat was generally optimal, however, even a high level of threat was associated with higher engagement, as long as a high challenge evaluation was also present. A profile of moderate threat and moderate challenge had the most detrimental relationship with student engagement.

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Endnotes

[1] In England, the GCSE program of study is taken over the final two years of secondary education (Years 10 and 11) and leads to school exit examinations.

[2] Cluster analysis conducted on the Time 1 data collected from only those participants who remained in the study at Time 2 produced the same results as those of the full sample, indicating that any differences between time-points were not due to attrition.

[3] Although the emotional disaffection subscale of the ‘Engagement versus Disaffection with Learning Questionnaire’ developed by Skinner *et al.* (2009) consisted of 12 items, five items were selected based on their face validity to reduce the burden on student participants.

Table 1

Descriptive statistics for all variables at both time points

	Time 1		**Time 2**	
Variable	***M***	***SD***	***M***	***SD***
Threat evaluation	2.64	1.12	2.68	1.17
Challenge evaluation[a]	3.55	1.10	3.41	1.13
Behavioral engagement[a]	4.14	0.61	4.03	0.64
Emotional engagement[a]	3.24	0.85	3.16	0.87
Behavioral disaffection	2.41	0.78	2.41	0.85
Emotional disaffection	2.83	0.84	2.83	0.86

Note. [a] Means were significantly different over time ($ps < .05$)

Table 2

Zero-order correlations between all variables at both time points

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 Threat evaluation	-	.55***	.02	-.07**	.09***	.35***	.17***	.03
2 Challenge evaluation	.57***	-	.26***	.21***	-.16***	.01	.04	.01
3 Behavioral engagement	.04	.26***	-	.56***	-.45***	-.26***	.04	-.01
4 Emotional engagement	-.09***	.16***	.54***	-	-.36***	-.52***	-.12***	.04
5 Behavioral disaffection	.09**	-.11***	-.49***	-.32***	-	.53***	-.00	.05*
6 Emotional disaffection	.36***	.06*	-.29***	-.52***	.55***	-	.18***	-.01
7 Gender[a]	.13***	.04	.07*	-.12***	-.09**	.16***	-	.02
8 Year group[b]	-.04	.00	.10***	.08**	-.06*	-.04	.02	-

Notes. *p < .05, **p < 01, ***p < .001; Values above the diagonal represent the Time 1 results; values below the diagonal represent the Time 2 results; [a]Gender: 0 = Male, 1 = Female; [b]Year group: 0 = Year 10, 1 = Year 11

Table 3

Student engagement as a function of cluster group at Times 1 and 2

Cluster Group		Behavioral Engagement		Emotional Engagement		Behavioral Disaffection		Emotional Disaffection	
Time 1									
$F(4, 1686) = 38.05$, $p < .001$; V = .08		$F(1, 1689) = 61.45$, $p < .001$, $\eta_p^2 = .04$		$F(1, 1689) = 17.95$, $p < .001$, $\eta_p^2 = .01$		$F(1, 1689) = 5.32$, $p < .05$, $\eta_p^2 < .00$		$F(1, 1689) = 27.56$, $p < .001$, $\eta_p^2 = .02$	
	n	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
LT/MC	821	3.95[a]	0.69	3.10[a]	0.88	2.52[a]	0.78	2.76[a]	0.78
MT/HC	872	4.20[b]	0.60	3.25[b]	0.87	2.43[b]	0.84	3.01[b]	0.89
Time 2									
$F(12, 3990) = 24.41$, $p < .001$; V = .21		$F(3, 1331) = 42.76$, $p < .001$, $\eta_p^2 = .09$,		$F(3, 1331) = 17.58$, $p < .001$, $\eta_p^2 = .04$		$F(3, 1331) = 19.72$, $p < .001$, $\eta_p^2 = .04$		$F(3, 1331) = 41.49$, $p < .001$, $\eta_p^2 = .09$	
	n	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
LT/HC	258	4.24[a]	0.58	3.48[a]	0.83	2.20[a]	0.77	2.50[a]	0.79
LT/LC	345	3.89[b]	0.74	3.05[b]	0.91	2.43[b]	0.91	2.63[a]	0.83
MT/MC	400	3.80[b]	0.63	3.00[bc]	0.77	2.67[c]	0.77	3.07[b]	0.76
HT/HC	334	4.23[a]	0.54	3.19[bd]	0.88	2.36[b]	0.85	3.13[b]	0.90

Note. At each time point, means in the same column with different superscripts were significantly different (*p*s < .05); at Time 2, Bonferroni corrections were applied

Table 4

Student engagement as a function of profile shifts

Profile Shifts	***n***	**Behavioral Engagement**		**Emotional Engagement**		**Behavioral Disaffection**		**Emotional Disaffection**	
$F(28, 4208) = 6.01$, $p < .001$; V = .15		$F(7, 1052) = 8.18$, $p < .001$, $\eta_p^2 = .05$		$F(7, 1052) = 5.32$, $p < .001$, $\eta_p^2 = .03$		$F(7, 1052) = 2.08$, $p < .05$, $\eta_p^2 = .01$		$F(7, 1052) = 9.95$, $p < .001$, $\eta_p^2 = .06$	
	n	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
T1 LT/MC - T2 LT/HC	103	4.20[ac]	0.55	3.55[a]	0.81	2.21	0.75	2.42[a]	0.78
T1 LT/MC - T2 LT/LC	236	3.94[bc]	0.70	3.09[b]	0.89	2.40	0.88	2.59[ac]	0.82
T1 LT/MC - T2 MT/MC	128	3.73[b]	0.57	2.93	0.71	2.72[a]	0.75	2.98	0.72
T1 LT/MC - T2 HT/HC	48	4.23[a]	0.53	3.37	0.84	2.49	1.01	2.98[bc]	0.81
T1 MT/HC - T2 LT/HC	102	4.28[a]	0.62	3.50[a]	0.87	2.13[b]	0.79	2.54[a]	0.79
T1 MT/HC - T2 LT/LC	59	3.87[bc]	0.76	3.05	0.96	2.33	0.96	2.69[ac]	0.89
T1 MT/HC - T2 MT/MC	174	3.90[bc]	0.63	3.01[b]	0.83	2.58	0.77	3.07[b]	0.77
T1 MT/HC - T2 HT/HC	216	4.24[a]	0.52	3.16	0.89	2.28	0.82	3.16[b]	0.90

Notes. T1 = Time 1; T2 = Time 2; Means in the same column with different superscripts were significantly different (*p*s < .05; according to post-hoc tests with Bonferroni correction)

Table 5

Descriptive statistics for all variables in Study 2

Variable	***M***	***SD***
Threat evaluation	2.52	1.22
Challenge evaluation	3.06	1.10
Behavioral engagement	3.96	0.68
Emotional engagement	3.00	0.91
Behavioral disaffection	2.44	0.84
Emotional disaffection	2.84	0.86
Past examination grade	5.87	1.46

Table 6

Zero-order correlations between all variables in Study 2

	1	2	3	4	5	6	7	8
1 Threat evaluation	-							
2 Challenge evaluation	.55***	-						
3 Behavioral engagement	-.14	.27***	-					
4 Emotional engagement	-.08	.25***	.56***	-				
5 Behavioral disaffection	.22**	-.10	-.54***	-.45***	-			
6 Emotional disaffection	.33***	.07	-.33***	-.54***	.60***	-		
7 Gender[a]	-.36***	-.08	.37***	.24***	-.22**	-.16*	-	
8 Past examination grade	.16*	.04	.02	-.07	-.04	.16*	.05	-

Notes. **p* < .05, ***p* < 01, ****p* < .001; [a]Gender: 0 = Male, 1 = Female

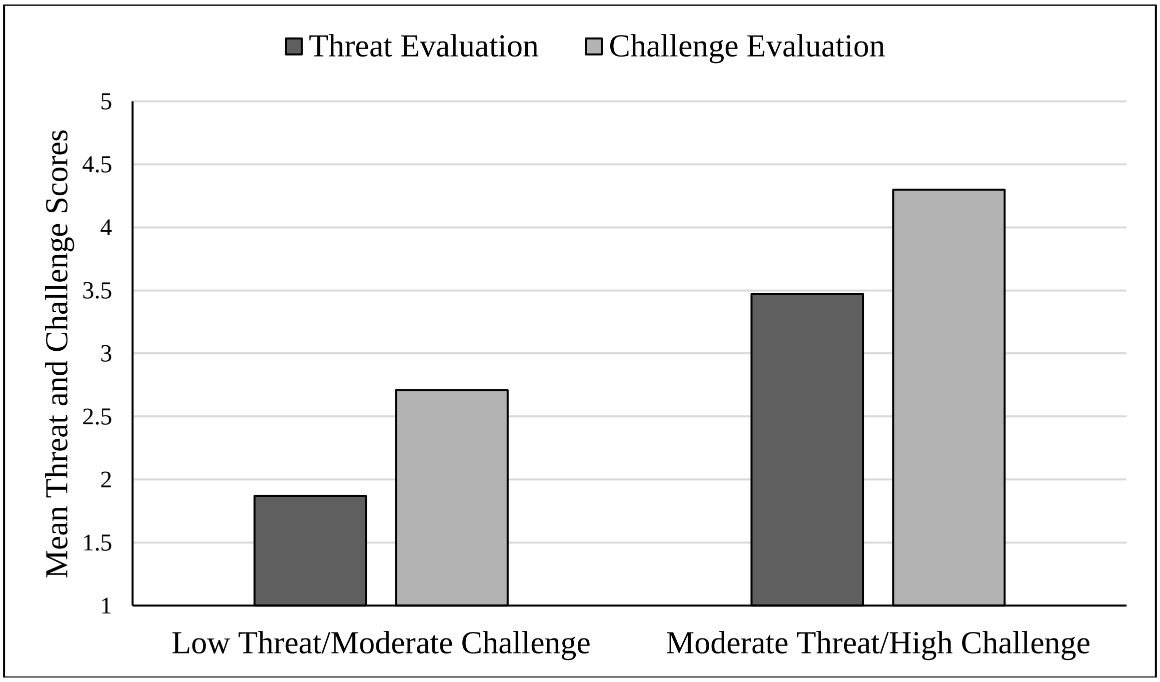

Figure 1. Scores on threat and challenge evaluation for the two clusters identified at Time 1

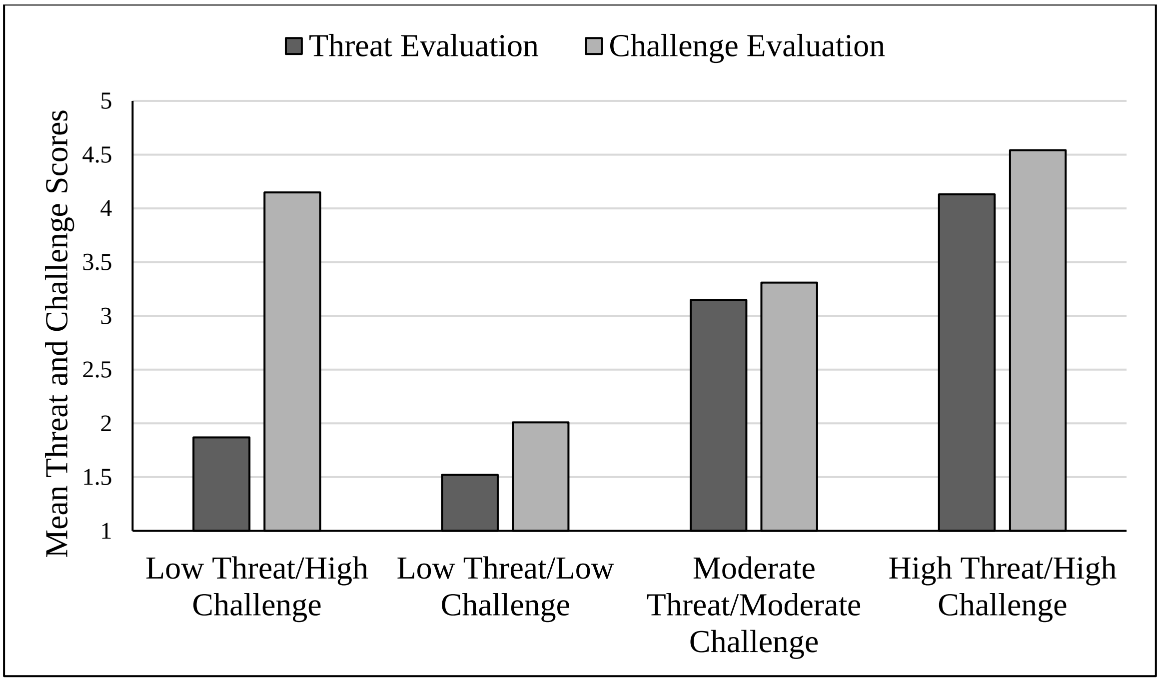

Figure 2. Scores on threat and challenge evaluation for the four clusters identified at Time 2

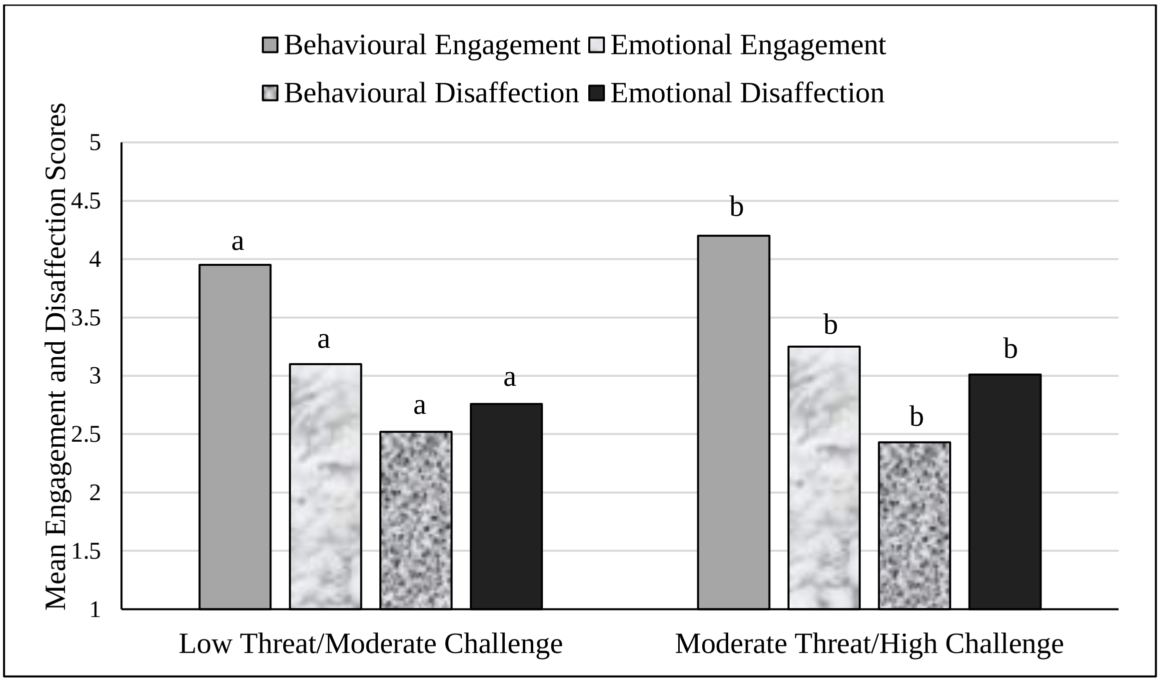

Figure 3. Scores on student engagement components for the two clusters identified at Time 1
Note. Different letters within engagement components denote statistically significant differences between clusters (*p*s < .05)

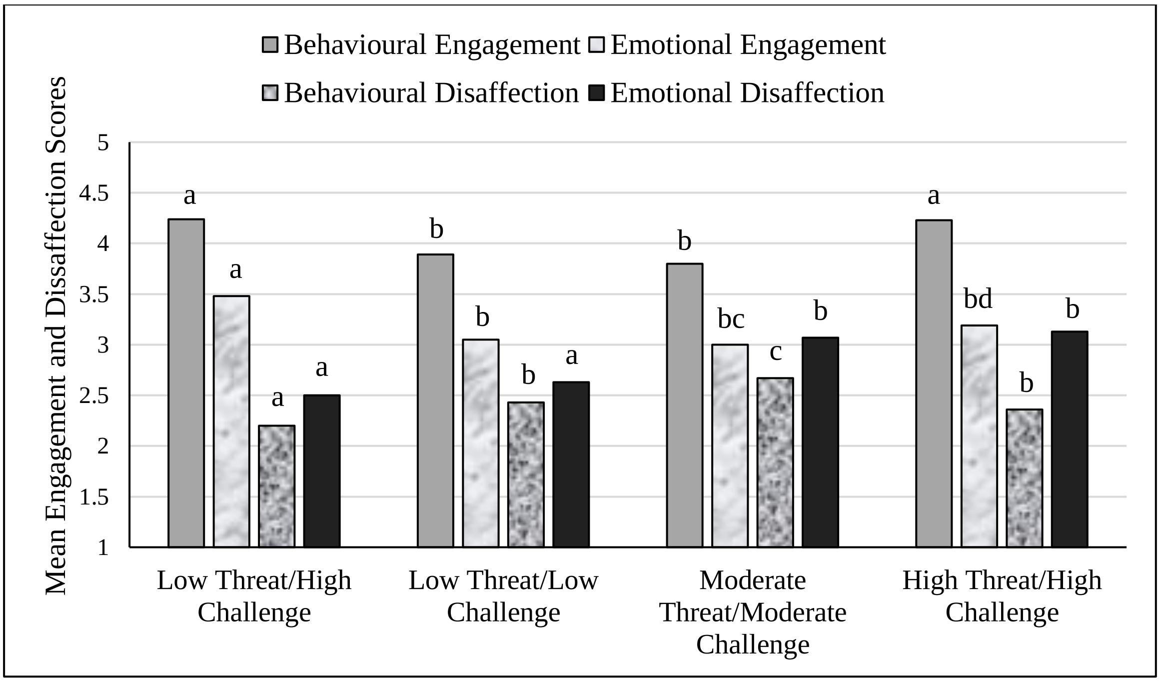

Figure 4. Scores on student engagement components for the four clusters identified at Time 2
Note. Different letters within engagement components denote statistically significant differences between clusters (*p*s < .05), Bonferroni corrections applied

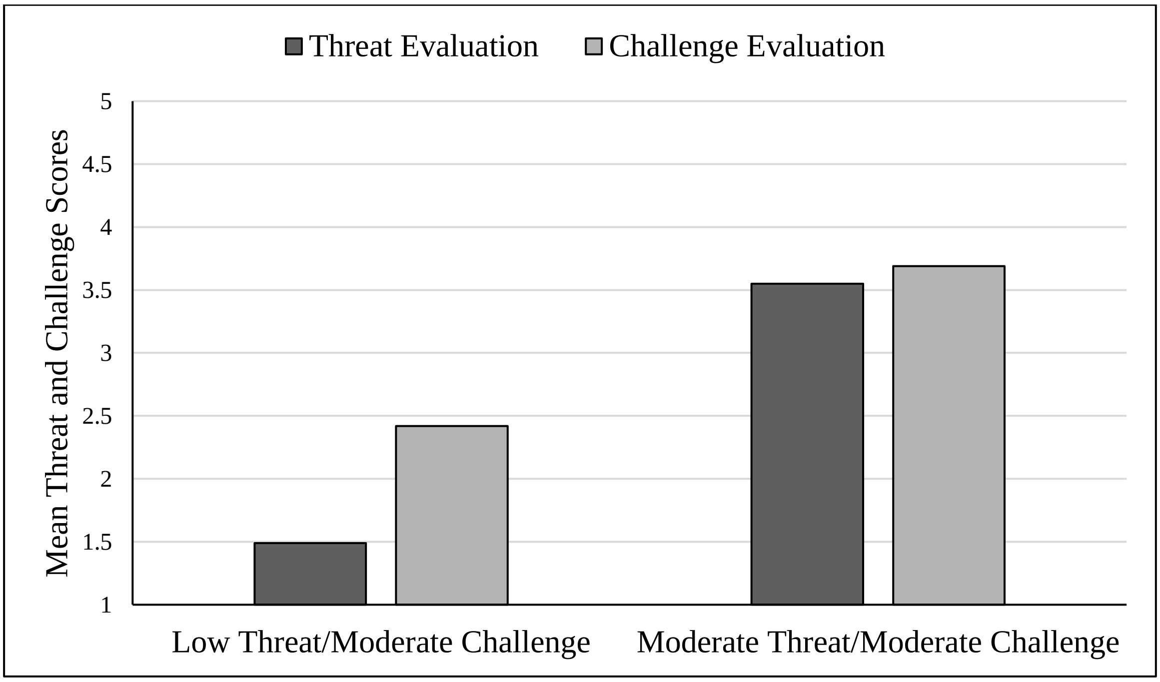

Figure 5. Scores on threat and challenge evaluation for the two clusters identified in Study 2

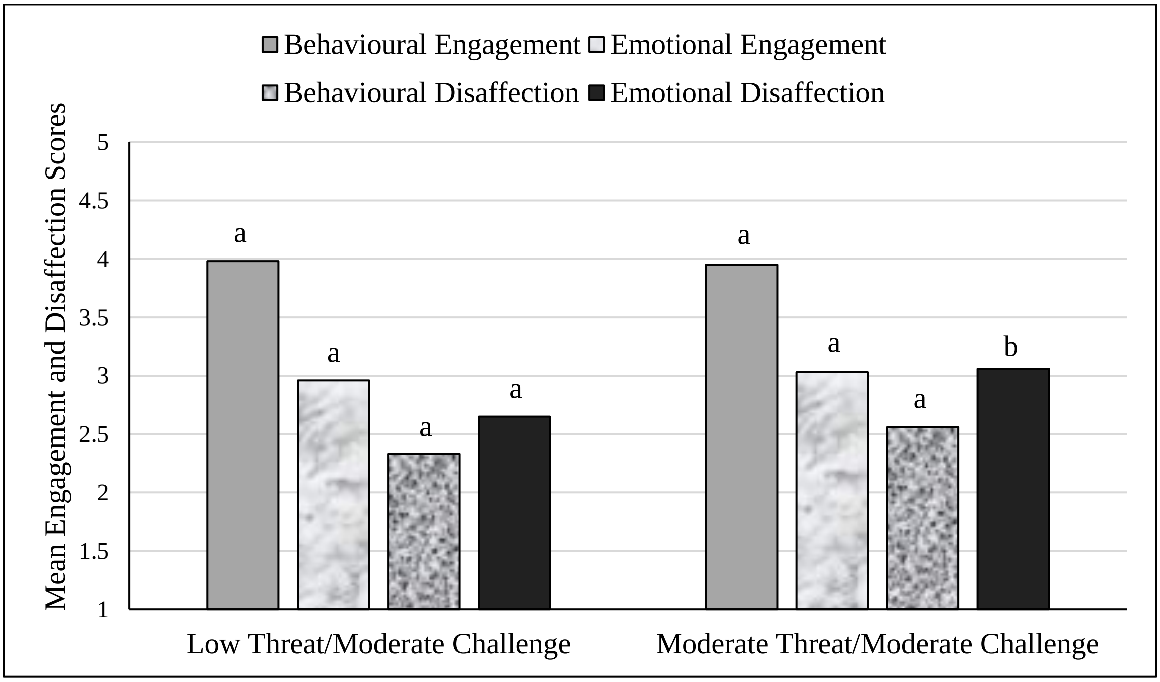

Figure 6. Scores on student engagement components for the two clusters identified in Study 2
Note. Different letters within engagement components denote statistically significant differences between clusters (*p*s < .05)