UNDERGRADUATES' AFFECTIVE-LEARNING PROFILES: THEIR EFFECTS ON ACADEMIC EMOTIONS AND ACADEMIC ACHIEVEMENT

Spiridon Kamtsios & Evangelia Karagiannopoulou
University of Ioannina, Greece

Abstract: The present study investigated students' learning profiles taking account of two variables that relate to stress and coping in academic situations, namely test anxiety and academic hardiness, along with approaches to learning. The study explored differences in learning outcomes such as academic emotions and academic achievement among student profiles. The sample comprised 210 undergraduates. Students completed the Approaches to Learning and Studying Inventory (ALSI), the Revised Academic Hardiness Scale (RAHS), the Test Anxiety Inventory (TAI) and the Student Experience of Emotions Inventory. Academic achievement was measured using students' grade point average (GPA). Cluster analysis revealed three profiles: (a) the Deep - Emotionally positive/Learning engaged - Hardy profile, (b) the Surface - Anxious-committed/ Surface engaged profile, and (c) the Dissonant - Learning disengaged/Affective relaxed profile. These profiles were differentially related to student academic emotions and academic achievement. The Deep - Emotionally positive/Learning engaged - Hardy profile, was associated to students' positive emotions and academic performance. The other two profiles were similar in terms of low GPA and academic emotions whilst, not surprisingly, surface profile students scored the highest on both negative academic emotions.

Key words: Academic achievement, Academic emotions, Academic hardiness, Approaches to learning, Test anxiety

Address: Spiridon Kamtsios, PhD, Department of Psychology, University of Ioannina, 45 110 Ioannina, Greece. E-mail: skamtsios@uoi.gr

INTRODUCTION

In educational research there is increasing interest in academic emotions and their effect on student learning and achievement (Pekrun & Linnenbrink-Garcia, 2014; Trigwell, Ellis, & Han, 2012). Experimental studies have found that emotions affect a variety of cognitive processes that contribute to student learning (Perkun, 2011), playing a central role in any learning process (Niculescu et al., 2015). According to Trigwell et al. (2012), emotions are related to students' learning strategies and learning behaviors, thus, supporting or impeding learning and achievement (Perkun & Linnenbrink-Garcia, 2014). Moreover, the way students approach knowledge (students' approaches to learning) (Entwistle, McCune, & Walker, 2001) plays an important role in their learning and achievement (Karagiannopoulou & Milienos, 2013, 2014; Rytkönen, Parpala, Lindblom-Ylänne, Virtanen, & Postareff, 2012). Furthermore, individual differences variables personality characteristics appear to be intertwined with learning and academic emotions (Karagiannopoulou, Milienos, & Athanasopoulos, 2018), having a further effect on students' achievement. In this line of thinking, the present study explored the contribution of individual variables related to stress and coping, namely academic hardiness (Benishek, Feldman, Shipon, Mecham, & Lopez, 2005) and test anxiety (Zuckerman & Spielberger, 2015) to student learning. In particular, the study explored whether they are associated with approaches to learning in student profiles.

Approaches to learning and achievement

Approaches to learning were introduced by Marton and Säljö (1976) and were further developed by Entwistle and Ramsden (1983). Three major approaches are discussed in the educational literature: deep, surface, and organized. Undergraduates adopting a deep approach seek meaning in order to understand for themselves (Trigwell & Prosser, 1991). These students engage in active conceptual analysis to construct the meaning of the content of the study material (Entwistle et al., 2001); they emphasize the importance of critical thinking and create their own understanding of their majors (Lindblom-Ylänne, Parpala, & Postareff, 2018). On the contrary, the surface approach to learning is considered a combination of memorizing and reproducing information. Students adopting the surface approach are motivated by factors that are external to the learning task, while their main goal is to meet assessment demands (Biggs, 1987; Entwistle et al., 2001). Surface approach is associated with low or extrinsic motivation, low interest in the study field (Coertjens, Vanthournout, Lindblom-Ylänne, & Postareff, 2016; Lindblom-Ylänne et al., 2018), which in turn,

leads to lower academic achievement (Lindblom-Ylänne et al., 2018). Students are not interested in the task *per se*, but aim at learning the minimum amount of material, as soon as possible, to relief academic stress (Chamorro-Premuzic, Furnham, & Lewis, 2007). Students reporting an organized approach use well-directed effort and well-organized study methods. This approach refers to students' everyday practices in terms of how they organize and manage their time (Lindblom-Ylänne et al., 2018). These students have the intention to manage their effort and to achieve the highest possible grades (Entwistle & Ramsden, 1983; Entwistle & McCune, 2004).

In the educational literature, approaches to learning have been associated with academic achievement and study success (Haarala-Muhonen, Ruohoniemi, Parpala, Komulainen, & Lindblom-Ylänne, 2017; Herrmann, McCune, & Bager-Elsborg, 2017) as well as with students' perceived stress (Öhrstedt & Lindfors, 2016). High achievement is negatively related to a surface approach and positively to deep and organized approaches to learning (Diseth & Martinsen, 2003; Richardson, Abraham, & Bond, 2012). However, the deep approach to learning has recently been found to be unassociated to academic achievement (e.g., Karagiannopoulou & Milienos, 2014; Trigwell, Ashwin, & Millan, 2013), whereas a range of studies indicate consistent positive associations between organized study and academic achievement (Diseth, Pallesen, Brunborg, & Larsen, 2010; Duff, 2003; Karagiannopoulou & Milienos, 2013, 2014; Rytkönen et al., 2012). However, weak correlations have been reported by most of the studies (Diseth et al., 2010; Richardson et al., 2012; Watkins, 2001). The aforementioned studies indicate inconsistent associations between study success and approaches to learning (Καραγιαννοπούλου & Χριστοδουλίδης, 2009; Karagiannopoulou & Milienos, 2014; Trigwell et al., 2013).

Moreover, higher education students' perceptions of stress are associated with the learning and teaching context and have an impact on academic outcomes (Öhrstedt & Lindfors, 2016). Research suggests that a surface approach is positively associated with undergraduates' high levels of perceived stress, which, in turn, leads to lower levels of expected grades (Öhrstedt & Lindfors, 2016). Finally, a surface approach seems also to be present in "immature" student profiles, associated with maladaptive learning activities involving "instrumental learning" (studying with the intention to pass the exams as one and ultimate goal) (Karagiannopoulou et al., 2018).

Students' approaches to learning and academic emotions

Recent studies have explored the association between emotions, approaches to learning and achievement (e.g., Postareff, Mattsson, Lindblom-Ylänne, & Hailikari, 2017). There is evidence indicating that academic emotions are crucial for learning, influence almost

every aspect of students' life, and impact a wide range of cognitive processes that contribute to learning (Pekrun, 2011; Pekrun & Linnenbrink-Garcia, 2014). Academic emotions refer to the specific emotions that students experience in various academic contexts and are directly linked to academic activities (Govaerts & Gregoire, 2008; Pekrun, Goetz, & Titz, 2002). Positive academic emotions have been found to be positively associated with students' engagement with learning (Robinson, Ranellucci, Lee, Wormington, Roseth, & Linnenbrink-Garcia (2017) and with approaches to learning that enhance comprehension (Jarrell, Harley, & Lajoie, 2016; Robinson et al., 2017), leading to higher academic achievement (Pekrun et al., 2017; Pekrun & Stephens, 2009). Undergraduates who feel proud of their performance may seek to reinforce that emotion through deeper engagement with their courses (Trigwell et al., 2012). A feeling of pride may be produced by the satisfaction achieved through meaningful learning. On the contrary, negative emotions have been found to be associated with surface approach (Robnison et al., 2017; Shell & Husman, 2008), either supporting or inhibiting learning (Jarrell et al., 2016; Robinson et al., 2017). Trigwell et al. (2012) reported that feelings of frustration or anger inhibit students' effort to concentrate meaningfully on basic principles and relationships amongst ideas, or perceptions that the course comes upon.

According to Pekrun and Stephens (2009), achievement-related emotions have been shown to be important outcomes of achievement goals which may be affected by motivational and cognitive factors or individual traits (Pekrun et al., 2002). The latter, defined as distal antecedents, are assumed to influence both motivation and emotions and, through them, have a further effect on learning. In this line of thinking, further research to explore associations between particular distal antecedents, proximal antecedents, academic emotions, and learning and achievement is needed.

Test anxiety, academic performance and learning

Among academic emotions, test anxiety as trait (Pekrun, 2001) has been extensively investigated as predictor of university students' achievement and learning (Steinmayr, Grede, McElvany, & Wirthnein, 2016). Test anxiety occurs before exams and lasts during the exam period (Cassady & Johnson, 2002). Negative effects of test anxiety are evident on students' self-regulated learning (Ostovar & Khayyer, 2004) and students' memory and understanding (Cassady, 2004). Test anxious undergraduates seem to perceive themselves as less competent and are less likely to regulate their study environment or persist in the face of difficulty (Brackney & Karabenick, 1995; Chapell et al., 2005). Moreover, test anxious students are characterized by acquired habits and attitudes that involve self-perceptions and expectations (Spielberger & Vagg, 1995; Steinmayr et al., 2016). High and persisting test anxiety along with

difficulties handling a "stress situation" may result to increased psychological distress, reduced academic performance (Dwyer & Cummings, 2001), and lower scores in course examinations (Cassady & Johnson, 2002; Cassady, 2004; Metallidou & Vlachou, 2007; Papantoniou, Moraitou, & Filippidou, 2011). However, test anxiety has been found to relate positively to higher emotion-focus (e.g., students trying to control anxiety symptoms) and greater avoidance (e.g., students detached from their studies or trying not to think of the test/exam) (Steinmayr et al., 2016). Furthermore, Ringeisen and Buchwould (2010) reported that before the exams, test anxiety was moderately related to challenge and benefit emotions.

Test anxiety is a multidimensional construct consisting of "emotionality" and "worry" components. Worry refers to the cognitive component of test anxiety, such as negative derogatory self-statements related to failure. In other words, worry refers to cognitive concerns about the consequences of failure (Spielberger & Vagg, 1995). Emotionality refers to the affective physiological component of test anxiety, that is, students' perception of autonomic arousal and tension. Worry and emotionality correlate to a high degree (Ware, Galassi, & Dew, 1990). Nevertheless, they are triggered and preserved by different conditions. Worry is elicited by external or internal evaluative situations that are perceived as threatening to one's self-esteem. Emotionality is elicited by external cues of the immediate assessment situation itself (Eysenk, 1992). Worry is associated with performance reduction, but emotionality is not necessarily so (Spielberger & Vagg, 1995).

Test anxiety emerges as a result of an individual subjective evaluation of the test situation as stressful (Hoferichter, Raufelder,Ringeisen, Rohrmann, & Bukowski, 2015). Research has shown that students' personality characteristics may contribute to the development of test anxiety (Hoferichter, Raufelder, & Eid, 2014), but may also act effectively to reduce test anxiety (Abdollahi, Carbring, Vaez, & Ghahfarokhi, 2018). For example, academic hardiness (Benishek et al., 2005), which is an affective personality trait that involves student motivation and aspects of psychological hardiness, is buffering student stress and test anxiety and has beneficial effects on performance.

Academic hardiness, student achievement, and test anxiety

Psychological hardiness is a personality trait (Maddi, 2006; Maddi, Harvey, Khoshaba, Fazel, & Resurreccion, 2011) that acts as a personal resource against stressful environmental situations (Lang, Goulet, & Amsel, 2004). It refers to individuals' capability to perceive and experience stressful life events as amenable and conceive of changes as an interesting and normal part of life (Maddi, 2005, 2006). Hardiness

immunes undergraduate students against extrinsic and intrinsic pressures (Maddi, 2005). It comprises three components: control, commitment, and challenge. People high in control believe that they can exert an effect on outcomes. People high in commitment think that it is meaningful for them to stay involved with whatever seems interesting and important. Challenge, on the other hand, refers to an internal belief that change is a challenge and an opportunity for evolution and not a threat (Kobasa, Maddi, & Khan, 1982; Maddi et al., 2011).

Maddi et al. (2011) found a negative relationship between hardiness and anxiety (see also Glaser & Glaser, 1990). Recent research introduced psychological hardiness in education, trying to explore which might be the positive impact that hardiness may have on academic settings (Benishek et al., 2005; Kamtsios & Karagiannopoulou, 2013a, b). The educational literature discusses the meaning of academic hardiness (Benishek et al., 2005). Academic hardiness refers to the resilience of students to academic failure (Creed, Conlon, & Dhaliwal, 2013). Academic hardiness is comprised of three, integrated cognitive appraisal processes: commitment, control and challenge (Benishek et al., 2005): commitment refers to students' promptness to expend effort and to engage in learning activities that have personal cost. Control reflects students' self-confidence that they can achieve desired educational outcomes based on personal effort and through effective emotional self-regulation. Challenge is conceptualized as students' seeking out difficult academic coursework because doing so will result in long-term personal growth (Benishek et al., 2005).

Academic hardiness as a construct comprising personality and motivation has been seen to contribute to our understanding of how students (from different academic levels) may behave to academic challenges and difficulties (Kamtsios & Karagiannopoulou, 2015), and how hardy academic students will be motivated to learning class material and more strongly engaged to their lessons (Cole, Field, & Harris, 2004). Academic hardiness has been associated with effective dealing despite academic stressors (Kamtsios & Karagiannopoulou, 2015; Sheard & Goldy, 2007), student achievement motivation (Busato, Prins, Elshout, & Hamaker, 2000), adjustment to university life (Lifton et al., 2006), future well-being and performance (Sheard & Golby, 2007).

The relevant literature has shown associations among academic hardiness and academic self-worth, math efficacy and math anxiety in secondary school students (Benishek & Lopez, 2001). Moreover, higher levels of hardiness were associated with positive attitudes to university and academic self-efficacy (Maddi et al., 2011). Lifton et al. (2006) reported that university students who graduated in minimum time had above average academic hardiness scores, whereas students who dropped out recorded the lowest hardiness scores. Hardy students display a willingness to engage

in challenging academic work, commit to academic activities and pursuits, and perceive they have control over their academic performance and outcomes (Benishek & Lopez, 2001; Creed et al., 2013).

The present study

Given that (a) understanding academic hardiness has the potential to assist students to cope better with the stresses and strains of studying and to survive in academic institutions (Creed et al., 2013) and (b) the fact that associations have been reported between learning factors and students' academic emotions and achievement, the present study uses a person-oriented approach:

      - to explore students profiles based on academic hardiness, anxiety trait (test anxiety: worry and emotionality) and approaches to learning and

      - to identify links to students' academic emotions and achievement.

The person-oriented approach has already been applied to a range of studies in university students' learning, in order to explore learning and affective variables; these studies have adopted different variants of cluster analysis (Haarala-Muhonen et al., 2017; Parpala, Lindblom-Ylänne, Komulainen, Litmanen, & Hirsto, 2010; Vettori, Vazzani, Bigozzi, & Pinto, 2020). Student profiles were explored based on students' approaches to learning (Karagiannopoulou & Milienos, 2013; Parpala et al., 2010; Vanthournout, Coertjens, Gijbels, Donche, & Van Petegem 2013), and trait emotions in relation to studying in academic settings (Ganotice, Datu, & King, 2016; Jarrell et al., 2016; Robinson et al., 2017). Postareff et al. (2017) identified three clusters involving learning approaches, emotions, and study success, supporting the existence of adaptive and less adaptive learning patterns. Three groups of first-year teacher-training students were revealed by Heikkilä, Niemivirta, Nieminen, and Lonka (2011), whereas the findings of Vanthournout et al. (2013) showed four groups of students in a teacher-training program. The students' profile methodology has been used by a range of Greek studies focusing on university student learning (Karagiannopoulou, Milienos, Kamtsios, & Rentzios, 2019; Karagiannopoulou & Milienos, 2013; Karagiannopoulou, Milienos, & Rentzios, 2020). Karagiannopoulou and Milienos (2013) identified links between study profiles, assessment preference, and achievement. Karagiannopoulou et al. (2019) underlined the association between learning approach and emotion regulation-defense mechanisms (e.g., immature, neurotic, and mature defense styles) among undergraduate students. In both of the above studies, the authors suggested three profiles while in an earlier study they had suggested either three or four profiles (Karagiannopoulou et al., 2020).

To sum up, the aim of this study was twofold. Firstly, to identify potential sub-groups of students with qualitatively different profiles on the basis of two personality traits (hardiness and anxiety) and three approaches to learning (deep, surface, organized). According to the studies reported so far it was hypothesized that students may be differentiated into three clusters: (a) Moderate-low test anxiety scores along with moderate-low deep and surface approach scores; (b) High surface and test anxiety scores along with low academic hardiness and deep approach scores; (c) High academic hardiness scores, high deep and organized approach scores along with low surface approach and test anxiety scores.

Regarding the second aim, we expected different associations between students' clusters, achievement and academic emotions. It was hypothesized that academic achievement would be highest in the third profile (high academic hardiness /high deep and organized approaches/low surface approach and test anxiety scores), comparing with the other two profiles. It was also hypothesized that student clusters may be differentiated in terms of students' academic emotions. We expected that students in the third profile (high academic hardiness /high deep and organized approaches/low surface approach and test anxiety scores) will report more positive academic emotions than students in the other two clusters.

METHOD

Participants

A sample of 210 undergraduates (53 [25.2%] males and 157 [74.8%] females), studying for a joint degree in social sciences with three majors: philosophy, education and psychology, participated in the study. The mean age of the participants was 21.37 years ($SD = 4.56$). Of the participants, 31.7% were first year-, 20% second year-, 30% third year-, and 18.3% fourth-year students. The aim of the study was presented to the students before the distribution of the questionnaires. Participation was voluntary. Students were assured that they could walk out whenever they wanted and their responses to the questionnaires would be anonymous. The response rate was 96%.

Measures

Approaches to Learning and Studying Inventory (ALSI)

The Finnish Learn Questionnaire (Parpala & Lindblom-Ylänne, 2012), a Finnish

version of the Approaches to Learning and Studying Inventory (ALSI) (Entwistle, McCune, & Hounsell, 2003) was used to measure approaches to learning. This questionnaire has been used in previous studies with Greek undergraduates (Karagiannopoulou, Naka, Kamtsios, Savvidou, & Michalis, 2014; Rentzios, Kamtsios, & Karagiannopoulou, 2019). It consists of 16 items that correspond to the *deep* approach (eight items; e.g., I try to relate new material, as I am reading it, to what I already know in that topic), *organized* studying (four items; e.g., I put a lot of effort into my studying) and *surface* approach (four items; e.g., I often have trouble making sense of the things I have to remember). Responses are on a 5-point scale. Confirmatory factor analysis of the three-factor model indicated that the model fit the data well, $\chi^2(144, N = 210) = 256.3$, $p < .001$, CFI = .90, GFI = .90, AGFI = .89, NFI = .90, RMSEA = .05 (CI = .04 - .06). All factor loadings were within acceptable range. Cronbach's alphas were: deep approach, $\alpha = .75$, organized studying, $\alpha = .78$, surface approach, $\alpha = .80$.

Revised Academic Hardiness Scale (RAHS)

Academic hardiness was measured through the Revised Academic Hardiness Scale (RAHS) (Benishek et al., 2005). The RAHS consists of 40 items, with responses on a 4-point Likert scale. The scale assesses students' behavioral, affective and cognitive reactions and beliefs relating to the three academic hardiness factors, namely, control (16 items; e.g., With hard work I can meet my educational goals), commitment (13 items; e.g., I consider myself a serious student) and challenge (11 items; e.g., I take classes that require the least amount of work [reverse scoring]). The factorial structure of the scale has been examined in previous studies with Greek late elementary school children (Kamtsios & Karagiannopoulou, 2011) and Greek undergraduates (Kamtsios & Karagiannopoulou, 2014, 2015; Karagiannopoulou & Kamtsios, 2016). In the present study, Cronbach's α coefficients were satisfactory for all RAH sub-scales (Commitment, $\alpha = .75$; Control, $\alpha = .85$; Challenge, $\alpha = .85$).

Test Anxiety Inventory (TAI)

The Test Anxiety Inventory (Spielberger, 1980) is a 20-item self-report scale developed to measure individual differences in test anxiety. TAI measures two dimensions of anxiety: worry (8 items; e.g., Thoughts of doing poorly interfere with concentration on tests) and emotionality (8 items; e.g., During tests I feel very tense). Responses are on a 5-point Likert scale, how frequently one experiences specific symptoms of anxiety, before, during and after examinations. TAI has been used in

previous studies with Greek undergraduates (Metallidou, 1995; Metallidou & Vlachou, 2007; Παπαντωνίου & Ευκλείδη, 2004; Papantoniou et al., 2011). Confirmatory factor analysis testing the two-factor model indicated that the model fit the data well, χ^2(97, N = 210) 157.83, p < .001, CFI = .96, GFI = .91, AGFI = .90, NFI = .91, RMSEA = .05 (CI = .03 - .06). All factor loading was within an acceptable range. Cronbach's α coefficients were .84 for Worry and .90 for Emotionality, respectively.

Student Experience of Emotion Inventory

Student Experience of Emotions Inventory (Trigwell et al., 2012) is an 18-item instrument which measures student emotional responses to courses they attended. The 18-item instrument comprises three sub-scales: (1) *Positive emotion scale* (6 items; e.g., I feel optimistic and proud of my progress in this course), (2) *Negative emotion scale I*: Frustration (anger & boredom) (5 items; e.g., I get angry with this course) and (3) *Negative emotion scale II*: anxiety and shame (7 items; e.g., When I think about this course, I become panicky). Confirmatory factor analysis of the three-factor model indicated that the model fit the data well, χ^2(118, N = 210) = 229.3, p < .001, CFI = .91, GFI = .90, AGFI = .86, NFI = .85, RMSEA = .05 [CI = .05- .07). All factor loading was within an acceptable range. Cronbach's alpha coefficient was .84 for Positive Emotions, .77 for Negative Emotions I, and .81 for Negative Emotions II, respectively.

Academic achievement

Students' academic achievement was measured by self-reported grade point average (GPA). Students were asked to report their GPA based on the marks they had gotten on courses they had attended thus far. GPA has been used as a criterion variable in many studies (Karagiannopoulou & Milienos, 2013, 2014; Kuncel, Crebe, & Thomas, 2005; Wagerman & Funder, 2007). Despite the limitations of this procedure of collecting data about students' academic achievement (Cole & Conyea, 2010; Dickinson & Adelson, 2016), this was the only way to get such information, as the questionnaires were anonymously filled out (see also Karagiannopoulou & Milienos, 2013).

Data analysis

Cluster analysis, an exploratory multivariate data reduction technique, was used to classify the participants on the basis of their responses to the questionnaires into

homogenous groups (Everitt, Landau, Leese, & Stahl, 2011). These groups were based on their ALSI, RAHS, Worry and Emotionality scores, by maximizing similarities within students belonging to a particular group and dissimilarities between students belonging to different clusters (Putwain & Daly, 2013). To make a decision about the number of clusters, a hierarchical (Ward's method) followed by non-hierarchical (two-step) cluster analytic procedure was carried out. The two-step procedure is the recommended method to identify the most distinct set of profiles (Hair, Anderson, Tatham, & Black, 1998). Although latent profile analysis is used as a confirmatory method when there are specific hypotheses about the constitution of the profiles, in the case there is no prior research on the number and constitution of profiles, exploratory cluster analysis is used. Moreover, latent profile analysis is the preferable method in case of mixed type variables (see, e.g., Bacher, Wenzig, & Vogler, 2004). However, in this study, all variables were continuous. Nevertheless, given that ALSI, RAHS, Worry and Emotionality were measured using different scale metrics, these scales were standardized prior to the analysis using z-scores transformations. Finally, to investigate whether students belonging to the various clusters show identifiable differences in their academic emotions and academic achievement, a multivariate analysis of variance (MANOVA) was carried out. Clusters represented the independent variable, while Positive Emotions, Negative Emotions I (Frustration: anger and boredom), Negative Emotions II (anxiety and shame), and GPA were the dependent variables. Partial eta squared (η_p^2) was used as the effect size index.

RESULTS

Initially, in order to identify differences in study variables across the four years of study, the technique of ANOVA was used. Although we expected to find differences, according to the relevant literature, on study variables and especially on approaches to learning (Asikainen, Parpala, Lindblom- Ylänne, Vanthournout, & Coertjens, 2014; Karagiannopoulou et al., 2019) across the years of study, ANOVA's results (not included due to space limitations) did not indicate any significant differences in all study variables across the years of study ($p > .05$), except for control attitude ($p < .05$). As a result, we treated the sample as one whole.

Relations between the variables of the study

To investigate relationships between approaches to learning, academic hardiness, test anxiety, academic emotions and academic achievement, Pearson correlation analysis

was performed (see Table 1). Deep, $r = .190$, and organized, $r = .433$, approaches to learning as well as two dimensions of hardiness, namely commitment, $r = .333$, and control, $r = .398$, were positively correlated with positive emotions. There were also positive correlations between (a) the surface approach of the Approaches to Learning, emotionality and worry (Anxiety) with Negative Emotions I (Frustration: anger and boredom), $r = .539$, $r = .261$, $r = .356$, respectively, and Negative Emotions II (anxiety and shame), $r = .358$, $r = .570$, $r = .503$, respectively. Moreover, there were strong negative correlations of Control and Challenge with Negative Emotions I (Frustration: anger and boredom), $r = -.307$ and $r = -.371$, respectively, and Negative Emotions II (anxiety and shame), $r = -.605$ and $r = -.308$, respectively. Commitment and Control were the only variables with a statistically significant correlation with GPA, $r = .153$ and $r = .145$, respectively.

Student profiles

Two-step cluster analysis was used. Initially, Ward's method (using the squared Euclidean distance as a similarity measure) was chosen (Hastie, Tibshirani, & Friedman, 2009; Hill & Lewicki, 2007). Based on this analysis (on the distance between the clusters), a dendrogram was provided. According to the dendrogram, a three-cluster solution was selected. In order to verify and confirm the validity of this three-cluster solution, a K-means clustering method was used (using the log-likelihood as distance measure and BIC/AIC as clustering criterion). K-means cluster analysis generated profiles that were very similar to what was obtained from the hierarchical cluster analysis. Furthermore, ANOVA statistical test and Tuckey post hoc tests were used to explore statistical differences between the three groups. Table 2 shows the mean values and multiple-comparisons tests across the derived three cluster-solution; all the independent variables revealed statistically significant differences between clusters (multiple comparisons were based on bootstrap method and 1000 samples).

The first cluster was labeled "Learning Disengaged-Affectively Relaxed profile". This cluster consisted of 72 students (see Table 2). Students in Cluster 1 had the lowest scores on organized approach and on commitment. At the same time, they had the second lowest mean values on control, challenge and worry, as well as on emotionality, deep and surface approaches. It is to be noted that on the last three scales, there was no significant difference with students in Cluster 3 for emotionality and worry   and Cluster 2 for deep approach.

Cluster 2 comprised 68 students. It was labeled "Anxious Committed-Surface Engaged". Students had the highest values on surface approach, on emotionality and worry. They also had the second highest score on commitment and on organized

S. Kamtsios & E. Karagiannopoulou

Table 1: Pearson correlation coefficients of Deep, Surface, and Organized approaches to learning, Control, Commitment, and Challenge dimensions of hardiness, Emotionality and Worry dimensions of test anxiety with Positive emotions, Negative emotions I & II and GPA.

	Deep	Surface	Organized	Commitment	Control	Challenge	Emotionality	Worry	Positive emotions	Negative emotions I: Frustration (anger & boredom)	Negative emotions II: Anxiety & shame	GPA
Deep		-.065	-.284**	.145*	.145*	.115	.035	.013	.190**	-.057	-.034	.122
Surface			-.075	.081	-.363**	-.346**	.420**	.518**	-.201**	.539**	.358**	-.111
Organize				.558**	.164*	.116	.030	-.132	.433**	-.073	.019	.121
Commitment					.046	.101	.211**	-.022	.333**	-.123	.135	.153*
Control						.360**	-.638**	-.584**	.398**	-.307**	-.605**	.145*
Challenge							-.274**	-.308**	.127	-.371**	-.308**	.095
Emotionality								.730**	-.309**	.261**	.570**	-.113
Worry									-.304**	.356**	.503**	-.100
Positive emotions										.008	-.292**	.186**
Negative emotions I: Frustration (anger & boredom)											.191**	-.058
Negative emotions II: Anxiety & shame												-.108
GPA												

* p =.05, ** p =.01

Table 2: Mean values and standard deviations of the variables of the study and the Fs of the multiple comparisons across the three clusters

	Clusters				
	Cluster 1 (N = 72)	Cluster 2 (N = 68)	Cluster 3 (N = 70)		
Variables	M (SD)	M (SD)	M (SD)	F	p
Commitment	2.61 (.26)[1,2]	2.98 (.30)[1]	3.07 (.29)[2]	53.45	< .001
Control	2.81 (.32)[1,2]	2.41 (.39)[1,3]	3.01 (.29)[2,3]	56.01	< .001
Challenge	2.41 (.43)[1,2]	2.17 (.48)[1,3]	2.58 (.44)[2,3]	13.76	< .001
Emotionality	12.81 (3.39)[1]	21.60 (5.16)[1,3]	13.12 (2.94)[3]	110.80	< .001
Worry	12.79 (3.30)[1,2]	19.00 (4.54)[1,3]	11.48 (2.66)[2,3]	86.76	< .001
Deep	3.83 (.70)[2]	3.72 (.63)[3]	4.31 (.44)[2,3]	19.26	< .001
Surface	2.70 (.97)[1]	3.54 (.78)[1,3]	2.52 (1.09)[3]	22.06	< .001
Organized	2.96 (.86)[1,2]	3.61 (.86)[1,3]	4.34 (.65)[2,3]	52.39	< .001

Note: [1] = Differences between Cluster 1 and Cluster 2; [2] = Differences between Cluster 1 and Cluster 3; [3] = Differences between Cluster 2 and Cluster 3

approach (although there was no significant difference on commitment with students in Cluster 3). Moreover, students in this cluster had the lowest scores on control, challenge and deep approach (although there was no significant difference with students in Cluster 1).

Cluster 3 (*n* = 70) was labeled "Emotionally Positive-Learning Engaged-Hardy" profile. As shown in Table 2, students had the highest mean on deep and organized approaches. At the same time, they had the highest scores on control, challenge and commitment (although there were no significant differences on commitment with students in Cluster 2). Besides, students in Cluster 3 had the lowest scores on worry, emotionality and surface approach (although in the last two scores, there were no significant differences with students in Cluster 1).

Profile effects on academic emotions and achievement

The effect of cluster membership on positive emotions, negative emotions I, negative emotions II, and GPA was tested using MANOVA. The selection of the multivariate method instead of a univariate method (e.g., ANOVA) was justified by the significant correlations shown in Table 1.

A 3(Cluster membership) by 3(Emotions: positive, negative I, negative II) and GPA scores MANOVA indicated a significant multivariate effect, Wilk's λ = .583, $F(2, 207)$ = 15.803, $p < .001$, η_p^2 = .237. As can be seen in Table 3, cluster membership had a significant effect on the mean vector of the four dependent variables. Univariate tests (see Table 4) revealed significant differences between

Table 3: The results of MANOVA with grades, positive emotions, negative emotions I & II as dependent variables

Effect	Value	F	df	Error df	Sig.	Partial η²	Noncent Parameter	Observed Power
Intercept								
Pillai's Trace	.989	4527.21	4.0	204	.000	.989	18108.85	1
Wilks' Lambda	.011	4527.21	4.0	204	.000	.989	18108.85	1
Hotelling's trace	88.769	4527.21	4.0	204	.000	.989	18108.85	1
Roy's Largest Root	88.769	4527.21	4.0	204	.000	.989	18108.85	1
Cluster								
Pillai's Trace	.461	15.362	8.0	410	.000	.231	122.865	1
Wilks' Lambda	.583	15.803	8.0	410	.000	.237	126.428	1
Hotelling's trace	.640	16.244	8.0	410	.000	.242	129.952	1
Roy's Largest Root	.484	24.801	8.0	410	.000	.326	99.202	1

Table 4: Univariate F values between the three clusters, and grades, positive and negative emotions as dependent variables

	Clusters			F	p	ηp²
	Cluster 1 M (SD)	Cluster 2 M (SD)	Cluster 3 M (SD)			
Grades (GPA)	7.36 (.20)[1]	7.41 (.20)[2]	8.03 (.22)[1,2]	3.37	.036	.032
Positive emotions	4.82 (.098)[1]	4.82 (.101)[2]	5.67 (1.0)[1,2]	23.91	< .001	.188
Negative emotions I: Frustration (anger & boredom)	4.05 (.12)[1,3]	4.50 (.12)[2,3]	3.63 (.12)[1,2]	12.44	< .001	.107
Negative emotions II: Anxiety & shame	3.68 (.13)[3]	4.88 (.15)[2,3]	3.56 (.17)[2]	30.22	< .001	.226

Note: [1]= Differences between Cluster 1 and Cluster 3; [2]= Differences between Cluster 2 and Cluster 3; [3]= Differences between Cluster 1 and Cluster 2

clusters in GPA, $F(2, 207) = 3.37$, $p = .036$, $\eta_p^2 = .032$; positive emotions, $F(2, 207) = 23.91$, $p < .001$, $\eta_p^2 = .188$; negative emotions I (Frustration: anger and boredom), $F(2, 207) = 12.44$, $p < .001$, $\eta_p^2 = .107$, and negative emotions II (Anxiety and shame), $F(2, 207) = 30.22$, $p < .001$, $\eta_p^2 = .226$. Post hoc tests with Tuckey correction showed: (a) significant differences between all clusters (all ps < .001). Specifically, clusters differed between them in Negative Emotions I (Frustration: anger and boredom); (b) there were significant differences between clusters in positive

emotions: students in Cluster 3 had the highest mean on positive emotions compared to the other two clusters; (c) there were also significant differences in Negative Emotions II: students in Cluster 2 had the highest scores compared to the other two clusters; (d) significant differences in GPA were observed between Clusters 1 and 3 ($p = .03$) and Cluster 2 and 3 ($p = .03$). Students in Cluster 3 had the highest GPA.

DISCUSSION

The study explored student profiles taking account of two personality traits that relate to stress and coping (Nowack, 1989) in academic situations, namely test anxiety and academic hardiness, along with approaches to learning. Consistent with the study's main hypothesis, there were three student profiles. This 3-factor solution provided satisfactory explanation of the data with empirically distinct clusters in terms of academic hardiness, test anxiety and approaches to learning. These profiles, which correspond to a deep, surface and dissonant profile, previously suggested by studies (Karagiannopoulou et al., 2019; Parpala et al., 2010; Vanthournout et al., 2013), varied in academic emotions and academic achievement. This pattern of results suggests that different personality traits, such as academic hardiness, test anxiety and approaches to learning, operate quite differently to affect students' academic emotions and achievement.

Learning Disengaged-Affectively Relaxed profile

The first profile, Learning Disengaged-Affectively Relaxed profile, also called dissonant in previous research, is difficult to interpret. This profile comprises of students with low scores on commitment and approaches to learning. Less committed students show inconsistent involvement (Benishek & Lopez, 2001) and low commitment does not provide students with the motivation to engage in their learning activities (Cole et al., 2004; Kamtsios & Karagiannopoulou, 2013a) leading students to disengage from their studies. This might explain why students in Cluster 1 had low GPA scores in comparison to students in Cluster 3. Although these scores suggest low engagement with learning and lack of organized study, students in this cluster had moderate scores on control and challenge. Such hardy characteristics seem to be in line with their moderate scores on worry and low scores on emotionality. These students seem to be detached from their studies without feeling anxious for their disinterest. This is reflected in their low scores on emotionality. It is likely that students' moderate scores on control and challenge reflect that they believe they can

manage situations they encounter (Maddi, 2005; Sheard & Golby, 2007) as they are unlikely to feel powerless (Maddi, 2006). In this sense, they positively appraise potentially stressful academic situations (Beniskek et al., 2005; Maddi et al., 2011). They may also believe that it is best to continue to grow through learning experiences whether positive or negative (Benishek et al., 2005; Maddi, 2006). Students live in a work-loaded, pressurized and competitive academic environment (university) (Hysrad, Eid, Laberg, & Johnsen 2009; Robotham, 2008) and their moderate worry levels may indicate that they are aware of the academic demands and that their insufficient effort may result to poor academic achievement. This is suggested by their low GPA that was similar to that of surface students (Cluster 2).

This mixed, rather 'relaxed' profile, in terms of anxiety and engagement with learning, could be seen to comprise students with a "positive illusion" about their abilities and their sense of control that does not seem to reflect "reality." The differentiation of this group from the other two in terms of moderate scores on negative affect (frustration) may support such an assumption. These students appear frustrated and possibly fail to see any personal relevance with the course. Further, this group had low scores on positive emotions and moderate scores on anxiety and shame. This suggests that they are unlikely to be motivated by positive emotions or negative emotions involving anxiety and shame. These students may be at risk to delay their studies since emotions (as motivational resources) and learning strategies are poor to lead to academic success. They seem to survive the academic demands through their sense of control and challenge of difficult situations.

Anxious-Committed-Surface Engaged profile

Students in the Anxious-Committed-Surface Engaged profile (Cluster 2) were characterized by a surface learning approach and high test-anxiety scores, on both emotionality and worry sub-scales. The use of maladaptive learning strategies, namely, reproduction of knowledge and "instrumental learning", comes along with lower scores on deep approach. Cluster 2 students also had lower scores on control and challenge. Students' high scores on surface approach included lack of interest, meaninglessness, memorizing and fear of failure (Entwistle et al., 2001). These student self-reports likely involved stressful experiences in school (Öhrstedt & Lindfors, 2016). Possibly students opt for surface approach, because "being fast" helps them to regulate stress (Chamorro-Premuzic et al., 2007). Such an assumption is supported by students' high scores on both emotionality and worry sub-scales. Test anxiety may interfere with performance, directly or indirectly. Test anxiety may reduce a students' attentional focus to the task and instead make a student focus his or her

attention to other stimuli such as thoughts of worry (Steinmayr et al., 2016). High levels of worry interfere with thinking during the test session itself, constraining performance through a retrieval-blocking process (Zolar, 1998).

Furthermore, Cluster 2 students had low scores on challenge and control, possibly because they appraised university stressful situations as threatening without being able to have control over the outcomes (Crowley, Hayslip, & Hobdy, 2003) and without taking responsibility for their own development and learning (Benishek et al., 2005). Such a situation may reflect students' beliefs that they do not have the ability to achieve educational outcomes through personal effort and through effective emotion regulation (Benishek et al., 2005). Interestingly, they reported moderate scores on organized studying and commitment. These scores may reflect their intention to stay involved with their studies because that is a meaningful thing to do they adopt strategies that they believe are appropriate for them. They also try to find the motivation to cope with university difficulties and demands in order to complete their studies. In such a way they may try to stay somehow organized with their studies.

Moreover, these students had the second higher score on GPA. Cluster 2 students had lower scores on positive emotions compared to students of Cluster 3. This means that organized studying may constitute an efficient way of buffering exam anxiety (Öhrstedt & Lindfors, 2016). The way commitment and an organized approach operate to buffer stress is supported by the higher scores on negative emotions II (anxiety and shame). Presumably, negative emotions motivate students as they serve to signal that more effort and attention is needed, and this impacts academic achievement (e.g., grades) (Robinson et al., 2012; Trevors, Muis, Perkin, Sinoctra, & Muijselaar, 2017). Still, this is a maladaptive process as reflected in students' higher scores on negative emotions such as frustration (anxiety and shame) and lower scores on positive emotions.

Emotionally Positive-Learning Engaged-Hardy profile

The deep, Emotionally Positive-Learning Engaged-Hardy profile, (Cluster 3) represents students adopting an adaptive affective - learning approach profile (Karagiannopoulou et al., 2018, 2019). High scores on deep and organized approaches and a low score on a surface approach came along with low scores on emotionality and worry and high scores on the three components of academic hardiness. This adaptive, hardy, profile has an association on learning-related emotions and student achievement. Not surprisingly, these students reported low scores on negative emotions and high scores on positive emotions and GPA.

This finding is in line with previous research (Karagiannopoulou & Milienos, 2013;

Karagiannopoulou et al., 2019). Such a profile is supported by studies suggesting positive associations between adaptive ways of coping (Dolbier, Smith, & Steinhardt, 2007), academic hardiness attitudes (Abdollahi et al., 2018; Kamtsios & Karagiannopoulou, 2013a, b), a deep approach to learning (Sandover, Jonas-Dwyer, & Marr, 2015) and academic achievement (De la Fuerte & Cardelle-Elawar, 2009). Such a profile may be exhibited by undergraduates becoming deeply engaged with their studies, seeing this as the best way to turn whatever they are experiencing into something that seems important, beneficial and valuable (Sheard & Golby, 2007). This profile may reflect students' willingness to manage their studies, adapting their learning to the perceived exam requirements (Entwistle & McCune, 2004), prioritizing those activities deemed most contributory to academic success (Maddi, 2006; Sheard & Golby, 2007). Moreover, high challenge attitude score gives students the opportunity to appraise potential stressful situations (e.g., exams, tests) as motivating and exciting rather than threatening; students in this cluster had the lowest scores on test anxiety, both worry and emotionality. Worry is considered as an avoidant coping style, which is inconsistent with hardiness and academic hardiness, in particular (Kobasa et al., 1985).

Moreover, these findings are reasonable to the extent that students who control their behavior would make better use of mechanisms that restrict or restrain negative emotionality and test anxiety, in particular. Such a profile is associated with higher GPA, confirming previous findings that highly committed students (Kamtsios & Karagiannopoulou, 2015) and deep/organized approaches to learning are associated with better grades (Richardson et al., 2012; Rytkönen et al., 2012). Undergraduates' academic success may enhance their motivation and strengthen their commitment attitudes (Sheard & Golby, 2007). Students will be able to commit in their studies and to dedicate themselves in the future (Maddi & Khoshaba, 2005). Furthermore, this student profile is associated with positive academic emotions, confirming previous research about the relation between students' approaches to learning and experienced emotions (Trigwell et al., 2012) as well as studies linking positive emotions with hardy personality traits and lower stress (Kobasa et al., 1982).

Overall, the present study contributes to the research tradition that brings together cognitive and non-cognitive (affective) factors and their effect on student achievement. The study provided a broader understanding of the interplay between approaches to learning, test anxiety, academic hardiness and academic emotions. This selection of person characteristics that are associated with learning has the potential to bring to the fore adaptive and less adaptive patterns in students' learning (Karagiannopoulou et al., 2018). Also, the study supports the existence of dissonant mid-low scores profile (Karagiannopoulou et al., 2018) (where inconsistent scores of

the variables exists). The study supports the discussion about the role of distal antecedents, in particular anxiety and hardiness, in student learning along with academic emotions.

Educational implications

During university studies undergraduates will inevitably feel pressure and encounter academic setbacks (Wong, Liang, & Tsai, 2019). The way students respond to academic failure and disappointments, which might indicate different motivational processes, has been found to have a significant and adverse effect on all students, and has been linked to students' characteristics. The educational implications of this research involve possible benefits for students' academic performance in case of high academic hardiness attitudes and approaches to learning. In this line of thinking, results of the study can provide directions for interventions for students in Cluster 1 and Cluster 2 on the basis of the constituents of the profiles. Academic hardiness as a psychological construct (Abdollahi, Oanahipour, Tofti, & Allen, 2020), and a personal resource (Maddi, 2006) is a factor amenable to change (Maddi, 2006; Mathews & Sevraty-Seib, 2007). Past research suggests that hardiness training has been effective in helping students appraise positively academic demands. In the high academic hardy person, the three facets of commitment, control and challenge work together in synchrony, creating a mindset that is highly effective and make them resilience in coping with academic conditions (Stein & Bartone, 2020). As a result, high academic hardy students have the motivation and drive to achieve academically and they are willing to choose more difficult subjects or learning tasks. Such a willingness will enable them to get into a deep approach and struggle with meaning. Hardy students are distinguished of their self-awareness over one's ability to achieve positive academic outcomes and use emotional self-regulation and coping skills to manage academic stress and difficulties (Abdollahi et al., 2020; Benishek et al., 2006; Wong et al., 2019). They perceive academic stressors to motivate them to learn and influence their performance (Karagiannopoulou & Kamtsios, 2016). Future longitudinal research might investigate the benefits of tailoring educational interventions to increase the use of deep and strategic approaches along with psychoeducational interventions in order to strengthen students' academic hardiness components. This will go hand in hand with reduced stress and less test anxiety that in turn will increase one's performance. Interventions that involve the reduction of test anxiety have been reported of valuable importance in higher education. The present study suggests both anxiety as a trait and academic hardiness to be taken into account together in supporting students to survive academic demands and adjustment

in the university. Such interventions may enhance students' self-development along with learning and academic achievement.

Limitations

The study belongs in the research strand in affect and learning in higher education. Despite the intriguing results, our study has several limitations, which suggest the need for a more comprehensive examination of the potential complex relationships between the study constructs. Although the study was designed to target a representative sample of undergraduates from social science department, the sample was predominantly female due to the overrepresentation of females in this department. It must be emphasized that the results and the grouping of students cannot be generalized to other university disciplines without further investigation. Also, students' familiarity with the academic context/demands may play a part influencing one another. Moreover, given that a cross-sectional design has been used to check differences in students' profiles, a longitudinal design would allow us to keep up with the progress of the same group of students in time possibly leading to different findings. The employment also of alternative and/or mixed approaches (e.g., self-report measures with interviews) may lead us to fully understand the 'educational and affective' profiles of university students.

REFERENCES

Abdollahi, A., Carlbring, P., Vaez, E., & Ghahfarokhi, A. (2018). Perfectionism and test anxiety among high school students: The moderating role of academic hardiness. *Current Psychology, 37*, 632-639. https://doi.org/10.1007/s12144-016-9550-z

Abdollahi, A., Oanahipour, S., Tofti, M., & Allen, K. (2020). Academic hardiness as a mediator for the relationship between school belonging and academic stress. *Psychology in the Schools, 57*(5), 823-832. https://doi.org/10.1002/pits.22339

Asikainen, H., Parpala, A., Lindblom- Ylänne, S., Vantournout, G., & Goertjens, L. (2014). The development of approaches to learning and perceptions of the teaching-learning environment during bachelor level studies and their relation to study success. *Higher Education Studies, 4*(4), 24-36. https://doi.org/10.5539/hes.v4n4p24

Bacher, J., Wenzig, K., & Vogler, M. (2004). SPSS Two-Step Cluster–A first evaluation. In Work and Discussion paper (pp. 1-30). Erlangen-Nuremberg, Germany: Department of Sociology, Social Science Institute, Friedrich-Alexander-University.

Benishek, L., Feldman, J., Shipon, W., Mecham, S., & Lopez, F. (2005). Development and evaluation of the Revised Academic Hardiness Scale. *Journal of Career Assessment, 13*, 59-76. https://doi.org/10.1177/1069072704270274

Benishek, L., & Lopez, F. (2001). Development and initial validation of academic hardiness scale. *Journal of Career Assessment, 9*, 333-352. doi: 10.1177/106907270100900402

Biggs, J. (1987). *Student approaches to learning and studying.* Melbourne, Australia: Australian Council for Educational Research.

Brackney, E., & Karabenick, A. (1995). Psychopathology and academic performance: The role of motivation and learning strategies. *Journal of Counseling Psychology, 42*(4), 456-465. https://doi.org/10.1037/0022-0167.42.4.456

Busato, V., Prins, J., Elshout, J., & Hamaker, C. (2000). Intellectual ability, learning style, personality achievement motivation and academic success of psychology students in higher education. *Personality and Individual Differences, 29*, 1057-1068. https://doi.org/10.1016/S0191-8869(99)00253-6

Cassady, J. C. (2004). The influence of cognitive test anxiety across the learning-testing cycle. *Learning and Instruction, 14*, 569-592. https://doi.org/10.1016/j.learninstruc.2004.09.002

Cassady, C., & Johnson, E. (2002). Cognitive test anxiety and academic performance. *Contemporary Educational Psychology, 27*, 270-295. https://doi.org/10.1006/ceps.2001.1094

Chamorro-Premuzic, T., Furnham, A., & Lewis, M. (2007). Personality and approaches to learning predict preference for different teaching methods. *Learning and Individual Differences, 17*, 241-25. https://doi.org/10.1016/j.paid.2008.01.003

Chapell, M. S., Blanding, Z. B., Silverstein, M. E., Takahashi, M., Newman, B., Gubi, A., & McCann, N. (2005). Test anxiety and academic performance in undergraduate and graduate students. *Journal of Educational Psychology, 97*, 268-274. https://doi.org/10.1037/0022-0663.97.2.268

Coertjens, L., Vanthournout, G., Lindblom-Ylänne, S., & Postareff, L. (2016). Understanding individual differences in approaches to learning across courses: A mixed method approach. *Learning and Individual Differences, 51*, 69-80. https://doi.org/10.1016/j.lindif.2016.07.003

Cole, M., Field, H., & Harris, S. (2004). Student learning motivation and psychological hardiness: Interactive effects on students' reaction to a management class. *Academy of Management Learning and Education, 3*(1), 64-85. https://doi.org/10.5465/amle.2004.12436819

Cole, S., & Conyea, M. (2010). Accuracy of self-reported SAT and ACT test scores: Implications for research. *Research in Higher Education, 51*, 305-319. https://doi.org/10.1007/s11162-009-9160-9

Creed, P. A., Conlon, E. G., & Dhaliwal, K. (2013). Revisiting the Academic Hardiness Scale: Revision and revalidation. *Journal of Career Assessment, 21,* 537-554. doi:10.1177/1069072712475285

Crowley, B., Hayslip, B., & Hobdy, J. (2003). Psychological hardiness and adjustment to life events in adulthood. *Journal of Adult Development, 10*(4), 237-248. https://doi.org/10.1023/A:1026007510134

De la Fuente J., & Cardelle-Elawar M. (2009). Research on action–emotion style and study habits: Effects of individual differences on learning and academic performance of undergraduate students. *Learning and Individual Differences, 19*, 567-576. https://doi.org/10.1016/j.lindif.2009.07.009

Dickinson, E., & Adelson, J. (2016). Choosing among multiple achievement measures: Applying multi trait-multimethod confirmatory factor analysis to state assessment ACT, and student GPA data. *Journal of Advanced Academics, 27*, 4-22. https://doi.org/ 10.1177/1932202X15621905

Diseth, Å., & Martinsen, O. (2003). Approaches to learning, cognitive style and motives as predictors of academic achievement. *Educational Psychology, 23*(2), 195-207. https://doi. org/10.1080/01443410303225

Diseth, Å., Pallesen, S., Brunborg, G., & Larsen, S. (2010). Academic achievement among first semester undergraduate psychology students: The role of course experience, effort, motives and learning strategies. *Higher Education, 59*, 335-352. http://dx.doi.org/10.1007/s10734-009-9251-8

Dolbier, C. L., Smith, S. E., & Steinhardt, M. A. (2007). Relationships of protective factors to stress and symptoms of illness. *American Journal of Health Behavior, 31*, 423-433. https://doi.org/10.5993/AJHB.31.4.9

Duff, A. (2003). Quality of learning on an MBA program: The impact of approaches to learning in academic performance. *Educational Psychology, 23*, 127-139. https://doi.org/ 10.1080/ 01443410303230

Dwyer, A. L., & Cummings, L. (2001). Stress, self-efficacy, social support and coping strategies in university students. *Canadian Journal of Counseling, 35*(3), 208-220.

Entwistle, N. J., & McCune, V. (2004). The conceptual basis of study strategy inventories. *Educational Psychology Review, 16*, 325-346. https://doi.org/ 10.1007/s10648-004-0003-0

Entwistle, N., McCune, V., & Hounsell, J. (2003). Investigating ways of enhancing university teaching-learning environments: Measuring students' approaches to studying and perceptions of teaching. In E. De Corte, L. Verschaffel, N. Entwistle, & J. van Merrienboer (Eds.), *Unravelling basic components and dimensions of powerful learning environments* (pp. 89-107). Oxford, UK: Elsevier.

Entwistle, N., McCune, V., & Walker, P. (2001). Conceptions, styles, and approaches within higher education: Analytical abstractions and everyday experience. In R. J. Sternberg & L. F. Zhang (Eds.), *Perspectives on thinking, learning and cognitive styles* (pp. 103-136). Mahwah, NJ: Erlbaum.

Entwistle, N. J., & Ramsden, P. (1983). *Understanding student learning.* London, UK: Croom Helm.

Eysenck, M. W. (1992). *Anxiety: The cognitive perspective.* Hove, UK: Erlbaum.

Everitt, B. S., Landau, S., Leese, M., & Stahl, D. (2011*). Cluster analysis.* Chichester, UK: Wiley.

Ganotice, A., Datu, D., & King, B. (2016). Which emotional profiles exhibit the best learning outcomes? A person-centered analysis of students' academic emotions. *School Psychology International, 37*(5), 498-518. https://doi.org/10.1177/0143034316660147

Glaser, K., & Glaser, R. (1990). Stress and immune function in humans. In R. Ader, L. Felter, & N. Cohen (Eds.*), Psychoneuroimmunology* (2nd ed.) (pp. 72-114). New York, NY: Academic.

Govaerts, S., & Gregoire, J. (2008). Development and construct validation of an academic

emotions scale. *International Journal of Testing, 8*, 34-54. https://doi.org/ 10.1080/15305050701808649

Haarala-Muhonen, A., Ruohoniemi, M., Parpala, A., Komulainen, E., & Lindblom-Ylänne, S. (2017). How do the different study profiles of first-year students predict their study success, study progress and the completion of degrees? *Higher Education, 74*(6), 949-962. https://doi.org/10.1007/s10734-016-0087-8

Hair, J., Anderson, R., Tatham, R., & Black, W. (1998). *Multivariate data analysis* (5th edition). Upper Saddle River, NJ: Prentice Hall.

Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The elements of statistical learning.* Stanford, CA: Springer.

Heikkilä, A., Lonka, K., Niemivirta, M. J., & Nieminen, J. (2012). Relations between teacher students' approaches to learning, cognitive- and attributional strategies, well-being, and study success. *Higher Education, 64*(4), 455-471. https://doi.org/10.1007/s10734-012-9504-9

Heikkilä, A., Niemivirta, M., Nieminen, J., & Lonka, K. (2011). Interrelations among university students' approaches to learning, regulation of learning, and cognitive and attributional strategies: A person oriented approach. *Higher Education, 61*(5), 513–529. https://doi:10.1007/s10734-010-9346-2

Herrmann, K. J., McCune, V., & Bager-Elsborg, A. (2017). Approaches to learning as predictors of academic achievement: Results from a large scale, multi-level analysis. *Högre utbildning, 7*(1), 29-42. https://doi.org/10.23865/hu.v7.905

Hill, T., & Lewicki, P. (2007). *Statistics methods and applications.* Tolsa, UK: Statsoft.

Hoferichter, F., Raufelder, D., & Eid, M. (2014). The mediating role of socio-motivational relationships in the interplay of perceived stress, neuroticism, and test anxiety among adolescent students. *Psychology in the Schools, 51*, 736-752. https://doi.org/10.1002/pits.21778

Hoferichter, F., Raufelder, D., Ringeisen, T., Rohrmann, S., & Bukowski, M. (2015). Assessing the multi-faced nature of test anxiety among secondary students: An English version of the German Test Anxiety Questionnaire: PAF-E. *The Journal of Psychology, 150*, 450-468. https://doi.org/ 10.1080/00223980.2015.1087374

Hysrad, S., Eid, J., Laberg, J., & Johnsen, B. (2009). Academic stress and health: Exploring the moderating role of personality hardiness. *Scandinavian Journal of Educational Research, 53*(5), 421-429. https://doi.org/10.1080/00313830903180349

Jarrell, A., Harley, M., & LaJoie, P. (2016). The link between achievement emotions, appraisals and task performance: Pedagogical considerations for emotions in CBLEs. *Journal of Computers in Education, 3*(3), 1-19. https://doi. 10.1007/s40692-016-0064-3

Kamtsios, S., & Karagianopoulou, E. (2015). Exploring relationships between academic hardiness and academic stressors in university undergraduates. *Journal of Applied Educational and Policy Research, 1*(1), 53-73.

Kamtsios, S., & Karagiannopoulou, E. (2014). Exploring academic hardiness in Greek students. Links with achievement and year of study. *Yearbook of the Department of Early Education Studies: A Journal of Research in Education and Training, 6,* 250-266.

Kamtsios, S., & Karagianopoulou, E. (2013a). Conceptualizing students' academic hardiness

dimensions: A qualitative approach. *European Journal of Psychology of Education, 28*(3), 807-823. https://doi. 10.1007/s10212-012-0141-6

Kamtsios, S., & Karagianopoulou, E. (2013b). The development of a questionnaire on academic hardiness for late elementary school children. *International Journal of Educational Research, 58*, 69-78. https://doi. 10.1016/j.ijer.2012.12.001

Kamtsios, S., & Karagiannopoulou, E. (2011). Psychometric characteristics of the "Academic Hardiness Scale" in a Greek sample: A pilot study. *Scientific Annals, School of Psychology, Aristotle University of Thessaloniki, 9*, 67-88.

Karagianopoulou, E., & Kamtsios, S. (2016). Multi-dimensionality vs. unitary of Academic Hardiness: An under-explored issue...? *Learning and Individual Differences, 51*, 149-156. https://doi.org/10.1016/j.lindif.2016.08.008

Karagiannopoulou, E., Milienos, F., Kamtsios, S., & Rentzios, Ch. (2019). Do defense styles and approaches to learning "fit together" in students' profiles? Differences between years of study. *Educational Psychology.* https://doi.org/10.1080/01443410.2019.1600661

Karagiannopoulou, E., Milienos, F., & Athanasopoulos, V. (2018). Associations between defense styles, approaches to learning, and achievement among university students. *Frontiers in Education, 3*(53), 1-16. https://doi.org/10.3389/feduc.2018.00053

Karagiannopoulou, E., Milienos, F., & Rentzios, Ch. (2020). Grouping cognitive and emotional factors to predict students' academic progress.   Submitted for publication.

Karagiannopoulou, E., & Milienos, F. S. (2014). Testing two path models to explain relationships between experiences of the learning environment, approaches to learning and achievement. *Educational Psychology, 35*, 26-52. https://doi.org/10.1080/ 01443410.2014.895800

Karagiannopoulou, E., & Milienos, F. S. (2013). Exploring the relationship between experienced students' preference for open and closed-book examinations, approaches to learning and achievement. *Education Research and Evaluation: An International Journal on Theory and Practice, 19*(4), 271-296. https://doi.org/ 10.1080/13803611.2013.765691

Karagiannopoulou, E., Naka, K., Kamtsios, S., Savvidou, E., & Michalis, L. (2014). Medical students' approaches to learning before and after problem-based learning cardiology practice. *Journal of Contemporary Medical Education, 2*(3), 152-157. https://doi.org/ 10.5455/jcme.2014092804040

Καραγιαννοπούλου, Ε., & Χριστοδουλίδης, Π. (2009). Το ερωτηματολόγιο για τις προσεγγίσεις και δεξιότητες. In A. Μπρούζος, Π. Μισαηλίδη, & A. Ευκλείδη (Eds.), *Scientific Annals of the Psychological Society of Northern Greece: Studies on psychological assessment* (Vol. 7, pp. 217-243). Athens, Greece: Ellinika Grammata.

Kobasa, S. C., Maddi, S. R., & Khan, S. (1982). Hardiness and health: A prospective study. *Journal of Personality and Social Psychology, 42,* 168-177. https://doi.org/10.1037//0022-3514.42.1.168

Kuncel, N., Crebe, M., & Thomas, L. (2005). The validity of self-reported grade point averages, class ranks and test scores: A meta-analysis and review of the literature. *Review of Educational Research, 75*, 63-82. https://doi.org/10.3102/00346543075001063

Lang, A., Goulet, C., & Amsel, R. (2004). Explanatory model of health in bereaved parents post-fetal/infant death. *International Journal of Nursing Studies, 41*, 869-880. https://doi.org/10.1016/j.ijnurstu.2004.03.013

Lindblom-Ylänne, S., Parpala, A., & Postareff, L. (2018). What constitutes the surface approach to learning in the light of new empirical evidence? *Studies in Higher Education, 44*(12), 2183-2195. https://doi.org/10.1080/03075079.2018.1482267

Lifton, D., Seay, S., McCarly, N., Olive Taylor, R., Seeger, R., & Bighee, D. (2006). Correlating hardiness with graduation persistence. *Academic Exchange Quarterly, 10*, 277-282.

Maddi, S. (2006). Hardiness: The courage to grow from stresses. *The Journal of Positive Psychology, 1*(3), 160-168. https://doi.org/10.1080/17439760600619609

Maddi, S. (2005). On hardiness and other pathways to resilience. *American Psychologist, 60*(3), 261-272. https://doi.org/10.1037/0003-066X.60.3.261

Maddi, S., Harvey, R., Khoshaba, D., Fazel, M., & Resurreccion, N. (2011). The relationship of hardiness and some other relevant variables to college performance. *Journal of Humanistic Psychology, 52*(2), 190-205. https://doi.org/10.1177/0022167811422497

Maddi, S., & Khoshaba, D. (2005). *Resilience at work: How to succeed no matter what life throws at you.* New York, NY: Amacon Books.

Marton, F., & Säljö, R. (1976). On qualitative differences in learning: I-outcome and process. *British Journal of Educational Psychology, 46*, 4-11. https://doi.org/10.1111/j.2044-8279.1976.tb02980.x

Mathews, L., & Heather, L. (2007). Hardiness and grief in a sample of bereaved college students. *Death Studies, 31*, 183-204. https://doi.org/10.1080/07481180601152328

Metallidou, P. (1995). *Cognitive abilities and cognitive-affective dimensions of self in adolescence: Structure and development.* Unpublished Doctoral Dissertation, Aristotle University of Thessaloniki, Department of Psychology, Thessaloniki, Greece.

Metallidou, P., & Vlachou, A. (2007). Motivational beliefs, cognitive engagement, and achievement in language and mathematics in elementary school children. *International Journal of Psychology, 42*(1), 2-15. https://doi.org/10.1080/00207590500411179

Niculescu, A. C., Tempelaar, D., Dailey-Hebert, A., Segers, M., & Gijselaers, W. (2015). Exploring the antecedents of learning-related emotions and their relations with achievement outcomes. *Frontline Learning Research, 3*(1), 1-17. https://doi.org/10.14786

Nowack, M. (1989). Coping style, cognitive hardiness and health status. *Journal of Behavioral Medicine, 12*(2), 145-158.

Öhrstedt, M., & Lindfors, P. (2016). Linkages between approaches to learning, perceived stress and expected and actual academic outcomes among first-semester psychology students. *Journal of Further and Higher Education, 42*(1), 116-129. https://doi.org/10.1080/0309877X.2016.1206856

Ostovar, S., & Khayyer, M. (2004). Relation of motivational beliefs and self-regulated learning outcomes for Iranian college students. *Psychological Reports, 1*, 1202-1204. https://doi.org/10.2466/pr0.94.3c.1202-1204

Παπαντωνίου, Γ., & Ευκλείδη, Α. (2004). Επιδράσεις θυμικών και γνωστικών παραγόντων

στον έλεγχο της δράσης [Affective and cognitive effects on action control]. *Ψυχολογία, 11*(3), 285-302.

Papantoniou, G., Moraitou, D., & Filippidou, D. (2011). Psychometric properties of the Greek version of the Test Anxiety Inventory. *Psychology, 2*(3), 241-247. https://doi.org/10.4236/psych.2011.23038

Parpala, A., & Lindblom-Ylänne, S. (2012). Using a research instrument for developing quality at the University. *Quality in Higher Education, 18*(3), 313-328. https://doi.org/10.1080/13538322.2012.733493

Pekrun, R., Lichtenfeld, S., Marsh, H. W., Murayama, K., & Goetz, T. (2017). Achievement emotions and academic performance: A longitudinal model of reciprocal effects. *Child Development, 88*(5), 1653-1670. https:// doi: 10.1111/cdev.12704.

Parpala, A., Lindblom-Ylänne, S,. Komulainen, E., Litmanen, T., & Hirsto, L. (2010). Students' approaches to learning and their experiences of the teaching-learning environment in different disciplines. *British Journal of Educational Psychology, 80*(2), 269-282. https://doi.org/10.1348/000709909X476946

Perkun, R. (2011*)*. Emotions as drivers of learning and cognitive development. In R. Calvo & S. D'Mello (Eds.), *New perspectives of affect and learning technologies* (pp. 23-39). New York, NY: Springer.

Perkun, R. (2001). Test anxiety and academic achievement. In N. Smelser & P. Baltes (Eds.), *International Encyclopedia of the Social and Behavioral Sciences* (pp. 15610-15613). London, UK: Elsevier, Pergamon.

Perkun, R., Goetz, T., & Titz, W. (2002). Academic emotions in students' self-regulated learning and achievement: A program of quantitative and qualitative research. *Educational Psychologist*, *37*, 91-106. https://doi.org/10.1207/S15326985EP3702_4

Pekrun, R., & Linnenbrink-Garcia, L. (2014). *International handbook of emotions in education.* New York, NY: Routledge.

Pekrun, R., & Stephens, E. (2009). Goals, emotions and emotion regulation: Perspectives of control-value theory. *Human Development, 52*, 359-365. https://doi.org/10.1159/000242349

Postareff, L., Mattsson, M., Lindblom-Ylanne, S., & Hailikari, T. (2017). The complex relationship between emotions, approaches to learning, study success and study progress during the transition to university. *Higher Education*, *73*(3), 441-457. http://dx.doi.org/10.1007/s10734-016-0096-7

Putwain, D., & Daly, A. (2013). Do clusters of test anxiety and academic buoyant differentially predict academic performance? *Learning and Indicidual Dirrerences, 27,* 157-162. https://doi.org/10.1016/j.lindif.2013.07.010

Rentzios, Ch., Kamtsios, S., & Karagiannopoulou, E. (2019). The mediating role of implicit and explicit emotion regulation in the relationship between academic emotions and approaches to learning: Do defense styles matter? *Journal of Nervous and Mental Disease*, *207*, 683-692. https://doi.org/10.1097/nmd.0000000000001027.

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological*

Bulletin, 138, 353-387. https://doi.org/10.1037/a0026838

Ringeisen, T., & Buchwald, P. (2010). Test anxiety and positive and negative emotional states during examination. *Cognition, Brain and Behavior, 4*, 431-447.

Robinson, K. A., Ranellucci, J., Lee, Y. K., Wormington, S. V., Roseth, C. J., & Linnenbrink-Garcia, L. (2017). Affective profiles and academic success in a college science course. *Contemporary Educational Psychology, 51*, 209-221. htpps://doi: 10.1016/j.cedpsych.2017.08.004

Robotham, D. (2008). Stress among higher education students: Towards a research agenda. *Higher Education, 56*, 735-746.

Rytkönen, H., Parpala, A., Lindblom-Ylänne, S., Virtanen, V., & Postareff, L. (2012). Factors affecting bioscience students' academic achievement. *Instructional Science, 40,* 241-256. https://doi.org/10.1007/s11251-011-9176-3

Sandover, S., Jonas-Dwyer, D., & Marr, T. (2015). Graduate entry and undergraduate medical students' study approaches, stress levels and ways of coping: A five-year longitudinal study. *Medical Education, 15*(5), 1-11.

Sheard, M., & Golby, J. (2007). Hardiness and undergraduate academic study: The moderating role of commitment. *Personality and Individual Differences, 43*, 579-588. https://doi.org/10.1016/j.paid.2007.01.006

Shell, F., & Husman, J. (2008). Control, motivation, affect and strategic self-regulation in the college classroom: A multidimensional phenomenon. *Journal of Educational Psychology, 100*(2), 443-459. https://doi.org/10.1037/0022-0663.100.2.443

Spielberger, C. D. (1980). *Test Anxiety Inventory: Preliminary professional manual*. Palo Alto, CA: Consulting Psychologists Press.

Spielberger, C. D., & Vagg, P. R. (1995). *Test anxiety: Theory, assessement and treatment*. Washington, DC: Taylor & Francis.

Stein, S., & Bartone, P. (2020). *Hardiness: Making stress work for you to achieve your life goals*. Hoboken, NJ: Wiley.

Steinmayr, R., Grede, J., McElvany, W., & Wirthnein, L. (2016). Subjective well-being, test anxiety, academic achievement: Testing for reciprocal effects. *Frontiers in Psychology, 6*, 1-13. https://doi.org/10.3389/fpsyg.2015.01994

Trevors, J., Muis, S., Perkin, R., Sinoctra, M., & Muijselaar, L. (2017). Exploring the reltionship between epistemic beliefs, emotions and learning from texts. *Contemporary Educational Psychology, 48*, 116-132. https://doi.org/10.1016/j.cedpsych.2016.10.001

Trigwell, K., Ashwin, P., & Millan, E. (2013). Evoked prior learning experience and approach to learning as predictors of academic achievement. *British Journal of Educational Psychology, 83*, 363-378. https://doi.org/10.1111/j.2044-8279.2012.02066.x

Trigwell, K., Ellis, R. A., & Han, F. (2012). Relations between students' approaches to learning, experienced emotions and outcomes of learning. *Studies in Higher Education, 37*(7), 811-824. https://doi.org/10.1080/03075079.2010.549220).

Trigwell, K., & Prosser, M. (1991). Improving the quality of student learning: The influence of learning context and student approaches to learning on learning outcomes. *Higher Education, 22*, 251-266. https://doi.org/10.1007/BF00132290

Vanthournout, G., Coertjens, L., Gijbels, D., Donche, V., & Van Petegem, P. (2013). Assessing students' development in learning approaches according to initial learning profiles: A person oriented perspective. *Studies in Educational Evaluation, 39*(1), 33-40. https://doi:10.1016/j.stueduc.2012.08.002

Vettori, G., Vazzani, C., Bigozzi, L., & Pinto, G. (2020). Cluster profiles of university students' conceptions of learning according to gender, educational level and academic discipline. *Learning and Motivation.* https://doi.org/10.1016/j.lmot.2020.101628

Wagerman, A., & Funder, D. (2007). Acquaintance reports of personality and academic achievement: A case for conscientiousness. *Journal of Research in Personality, 41*, 221-229. https://doi.org/10.1016/j.jrp.2006.03.001

Ware, W. B., Galassi, J. P., & Dew, K. M. H. (1990). The Test Anxiety Inventory: A Confirmatory Factor Analysis. *Anxiety Research, 3,* 205-212. https://doi.org/10.1080/08917779008248753

Watkins, D. (2001). Correlates of approaches to learning: A cross-cultural meta-analysis. In R. J. Sternberg & F. Zang (Eds.), *Perspective on thinking, learning and cognitive styles* (pp. 165-195). Mahwah, NJ: Erlbaum.

Wong, S., Liang, J., & Tsai, C. (2019). Uncovering Malaysian secondary school students' academic hardiness in science, conceptions of learning science, and science learning self-efficacy. A structural equational modelling analysis. *Research in Science Education.* https://doi.org/10.1007/s11165-019-09908-7

Zolar, D. (1998). An additive model of test anxiety: The role of exam-specific expectations. *Journal of Educational Psychology, 90,* 330-340. https://doi.org/10.1037/0022-0663.90.2.330

Zuckerman, M., & Spielberger, C. (2015). *Emotions and anxiety: New concepts, methods and applications.* London, UK: Taylor & Francis.