Learning Environments Research (2021) 24:299–313
https://doi.org/10.1007/s10984-020-09331-0

ORIGINAL PAPER

Effects of positive college classroom motivational environments on procrastination and achievement

Danya M. Serrano Corkin[1] · **Suzanne F. Lindt**[2] · **Patrick S. Williams**[3]

Received: 5 September 2019 / Accepted: 4 August 2020 / Published online: 8 August 2020

Abstract
Understanding factors within college learning environments that can ameliorate maladaptive academic behaviours such as procrastination could contribute to enhancing college students' success and persistence. Thus, the aims of the current study were to investigate: (a) the degree to which facets of the college classroom motivational environment predict college students' academic procrastination after controlling for students' level of conscientiousness (which is a strong predictor of procrastination); and (b) whether academic procrastination mediates the effect of classroom motivational environment facets on course grades. Participants were 223 students enrolled in two four-year institutions (one a Hispanic-serving institution) in southern US. Hierarchical regression analyses indicated that students who reported the presentation of course material in their classes as being more interesting (course situational interest) also tended to report procrastinating less. Furthermore, mediation analyses indicated that the positive effects on course grades of classroom motivational environments (in which instructors were perceived as providing academic and emotional support, promoting mutual respect and task-related interactions among students, and eliciting interest through the presentation of course material) were better explained as mediated by academic procrastination. These findings suggest that providing a supportive college classroom environment to engage students could cause them to procrastinate less and attain better academic outcomes.

Keywords Academic procrastination · Classroom environment · College students · Conscientiousness · Situational interest

✉ Danya M. Serrano Corkin
corkind@uhd.edu

[1] Department of Social Sciences, University of Houston-Downtown, One Main Street, N1063, Houston, TX 77002, USA

[2] Midwestern State University, Wichita Falls, TX, USA

[3] University of Houston-Downtown, Houston, TX, USA

Introduction

A recent report published by the American Council on Education (Jankowski 2017) reviewed evidence-based research supporting the integral role that higher-education classroom environments play in students' academic outcomes and behaviours. The report highlights that an important means by which instructors can facilitate student success is not only through effective pedagogical practices, but also by developing students' awareness and skills in behaviours that align with self-regulated learning, such as planning, goal-setting, monitoring progress, evaluating strategies and engaging in reflection (Jankowski 2017). However, research has consistently shown that a large percentage of college students demonstrate a failure to self-regulate when they procrastinate on academic tasks (Onwuegbuzie 2004; Schraw et al. 2007; Steel 2007). This is concerning given the well-documented negative implications that academic procrastination has for student achievement (Steel 2007). Moreover, research into specific aspects of the classroom environment at the college level that influence students' academic outcomes and behaviours, such as procrastination, is scant (Alansari and Rubie-Davies 2019). Therefore, furthering our understanding of factors within the college classroom environment that can ameliorate this problematic behaviour could contribute to enhancing college students' success and persistence.

Academic procrastination

Academic procrastination has been defined as "to voluntarily delay an intended course of *study-related* action despite expecting to be worse off for the delay" (Steel and Klingsieck 2016, p. 37). An abundance of research has identified the correlates most strongly associated with academic procrastination. Researchers have focused primarily on two broad categories of factors: characteristics of the individual and characteristics of the task. Though research on individual characteristics has predominated, some researchers have noted that procrastination is situational and could be influenced by contextual factors (Schouwenburg 2004), and others have even found that situational antecedents of procrastination are as great an influence as individual antecedents (Klingsieck et al. 2013). By contrast with research on individual and task characteristics, relatively little research has focused on characteristics of the environment within which the individual encounters a particular task. This is an important missing link in the quest to understand and solve the problem of academic procrastination. As the American Council on Education (Jankowski 2017) concluded in a review of research bearing on the relationship between instruction and student outcomes, "the learning environment matters" (p. 1). Thus the purpose of the current study was to examine aspects of the environment in college classrooms that can reduce students' academic procrastination and, thereby, enhance their achievement. We begin by reviewing research on personal characteristics that influence academic procrastination. Next we discuss environmental characteristics that could influence academic procrastination and we lay the groundwork for our hypothesis that academic procrastination mediates the effects of classroom motivational environment on academic achievement.

Personal factors that influence academic procrastination

Among the Big Five personality traits (Costa and McCrae 1992), *conscientiousness* has received the most attention as a correlate of both academic achievement (Vedel 2014) and procrastination (Steel and Klingsieck 2016). In their review of 38 meta-analyses of studies

of variables associated with achievement in higher education, Schneider and Preckel (2017) defined conscientiousness as "the tendency to be organized, achievement-focused, disciplined, and industrious" (p. 591). Conducted between 1980 and 2014, the original studies involved almost two million participants and 105 variables, divided between six instruction-related categories and five learner-related categories. The largest category was personality and the personality variable with the largest effect size ($d=0.47$) was conscientiousness. In terms of both effect size and rank (30th out of 105), conscientiousness was tied with intelligence in terms of its association with academic achievement.

In addition to the consciousness–academic achievement link, researchers have found a strong link between conscientiousness and academic procrastination. When Boysan and Kiral (2017) investigated associations between academic procrastination in graduate students and the Big Five personality traits, locus of control (three subscales), perfectionism (six subscales) and self-esteem, conscientiousness had the largest correlation with academic procrastination ($r=-0.47$).

When Steel (2007) conducted a meta-analysis of studies of the causes and effects of procrastination, this yielded 691 effect sizes in the form of correlations. All variables were separated into four categories: task nature, timing of rewards and punishments, task aversiveness, and individual differences. The largest category, individual differences, was organised according to the Big Five model. In this category, the trait most strongly related to procrastination was conscientiousness ($r=-0.62$). Steel and Klingsieck (2016) confirmed these findings, specifically with regard to academic procrastination. Theirs and other findings led them to conclude that "conscientiousness forms the core of procrastination" (p. 41).

Environmental characteristics that influence academic procrastination

Classroom motivational environment

The classroom environment refers to the social and psychological features of a learning setting that encompass its instructional methods, organisational structure, interpersonal relationships and physical characteristics (Moos 1979). Because of the multifaceted nature of classroom environments, classroom climate research has depended upon factor analytic methods to identify numerous distinct dimensions of the classroom social environment (Fraser and Fisher 1982; Fraser et al. 1986; Winston et al. 1994). In the current study, however, we focused on specific classroom social environment dimensions that have been identified as consistently related to adaptive motivational processes (Corkin et al. 2014; Deemer and Smith 2018; Fraser and Fisher 1982; Winston et al. 1994) and that are supported by theories of motivation (Ames and Archer 1988; Hidi and Renninger 2006). Informed by Patrick et al.'s (2011) research, we refer to these dimensions as *classroom motivational environment dimensions* (Patrick et al. 2011).

Research by Patrick et al. (2011) supports the notion that achievement goal theory (Ames and Archer 1988) provides a theoretical framework that overlays facets of the classroom social environment. Achievement goal theory explains student motivation by proposing two central purposes for which students engage in achievement-related behaviours: to *develop* competence in order to achieve *mastery goals*; and to *demonstrate* competence in order to achieve *performance goals*. According to achievement goal theory, instructors tend to create classroom environments that prioritize one of these purposes over the other. Wolters (2004) has shown that classrooms that promote

the development of competence, *mastery goal structured classrooms*, are associated with more adaptive motivational processes compared with those emphasising the demonstration of competence.

In their further examination of the mastery goal structured classroom, Patrick et al. (2011) found that four classroom social environment dimensions underlie this kind of classroom. *Teacher emotional support* refers to "student perceptions that the teacher cares about and likes the student as a person" (p. 372). *Teacher academic support* refers to "student perceptions that the teacher cares about how much the student learns and wants to help him or her learn" (p. 372). *Classroom mutual respect* refers to "the extent to which the teacher is perceived as encouraging respect among classmates" (p. 372). Finally, *task-related interaction* refers to "the extent to which the teacher is perceived as encouraging interaction among students in academic tasks" (p. 372).

Given the conclusions of Wolters (2004) and Patrick et al. (2011) that mastery goal structured classrooms are associated with adaptive motivational processes, and that four classroom social environment dimensions characterise the mastery goal structured classroom, it would seem that these dimensions are also associated with academic procrastination, which can be understood as resulting from the absence of adaptive motivational processes.

Course situational interest

Another aspect of the classroom environment which has been found to be associated with adaptive motivational processes is the degree to which students perceive the classroom environment as interesting. In considering the relationships between the characteristics of tasks and academic procrastination, Paden and Stell (1997) defined task appeal as a function of how interesting a task is and the degree to which it calls upon a variety of skills. In a test of Paden and Stell's suggestions, Ackerman and Gross (2005) found that tasks high in task appeal are associated with less procrastination. When Hidi and Renninger (2006) reviewed the abundant evidence that students' learning is powerfully influenced by their level of interest, they proposed a model describing four phases in the development of interest all the way up to the level typical of professionals in a field. In their discussion of the first phase, triggered situational interest, they cite evidence that students' interest can be triggered by features of the classroom environment such as presenting surprising or incongruous information and tasks that involve group work, puzzles and computers. In another study (Corkin et al. 2014), triggered situational interest, relabeled as course situational interest, was also found to be negatively associated with academic procrastination.

However, a limitation of the Corkin et al. (2014) study is that it did not control for the effect of students' level of conscientiousness on academic procrastination. Given the well-established associations between conscientiousness and both academic achievement and procrastination, we felt it important to control the effects of conscientiousness in our examination of the impact of the classroom environment on academic achievement and procrastination.

Research questions

Our study had two research questions:

(1) What is the extent to which facets of the classroom motivational environment (teacher support, classroom mutual respect, task-related interaction, and course situational interest) predict academic procrastination after controlling for conscientiousness?
(2) What is the extent to which academic procrastination mediates the effects of the classroom motivational environment on academic achievement?

The rationale underlying this second question is that, if classroom environment influences academic achievement, it can only do so indirectly through its influence on student behaviour, and the behaviour of procrastination has well-known negative effects on academic performance.

Method

Participants

Participants were 223 (80.2% female) students enrolled in two four-year institutions (46.2% University 1, 53.8% University 2) in the southern US and representing various student classification levels (9.0% freshmen, 9.5% sophomores, 39.6% juniors, 38.7% seniors, 3.2% post baccalaureate). The sample was also ethnically diverse (43.9% Hispanic, 34.4% Caucasian, 16.3% African American, 3.6% Asian/Asian American, 1.8% other). One of the universities is a Hispanic-serving institution (HSI). Consistent with the student population of the HSI, student participants from that university were predominantly Hispanic and female. Consistent with the student population of the non-HSI university, student participants from that university were predominantly Caucasian and female.

Procedure

Participants were recruited across three long semesters by announcements in pre-determined Education courses or through an online research participation portal for students enrolled in Psychology courses. Participants recruited via the online research participation portal received course credit for participation. Students recruited in the Education courses received no credit for participation.

The survey was administered face-to-face (Education courses) or online (Psychology courses). In the face-to-face classes, the researcher asked willing participants to complete the survey and place it in an envelope at the front of the room while the researcher left the room. Participants recruited through the online portal accessed the survey online and consented electronically. The survey was comprised of two sections: demographics and Likert-scaled items adapted from previous scales. At the beginning of the survey, participants selected a particular course that served as the 'target' course for which they answered questions about their perceptions of the course classroom environment and the extent to which they procrastinated in the course. Students also answered questions about their general level of conscientiousness. The response rate was understandably higher when the survey was administered face-to-face versus online, but the overall weighted average response rate across the two institutions was approximately 21%. Course grades were obtained from the instructor for students from University 1 and from the Office of Institutional Research for students from University 2.

Measures

All measures were deemed valid and reliable in prior studies (Johnson 2014; Linnenbrink-Garcia et al. 2010; Patrick et al. 2011; Steel 2010) and were assessed on a 7-point scale ranging from 1 to 7 (Strongly Disagree to Strongly Agree). All measures in the current study had adequate reliability based on Cronbach's alphas. Academic procrastination ($\alpha = 0.92$) was measured by adapting the 12-item Pure Procrastination Scale (Steel 2010) to assess the degree to which students procrastinate in the target course. The classroom social environment subscales found to underlie a mastery goal structured classroom and adapted from Patrick et al. (2011) were instructor emotional support ($\alpha = 0.77$), instructor academic support ($\alpha = 0.76$), classroom mutual respect ($\alpha = 0.78$) and task-related interactions ($\alpha = 0.69$). These subscales assessed students' perceptions of the aforementioned facets of the classroom social environment in the target course. Course situational interest ($\alpha = 0.85$) was adapted from Linnenbrink-Garcia et al.'s (2010) measure of triggered situational interest to assess the degree to which students' found the presentation of the target course material as interesting. Conscientiousness ($\alpha = 0.86$) was measured by students' responses to 20 conscientiousness items adopted from the Johnson (2014) Five Factor Model. Academic performance was assessed by course grades, which were numerically coded as A = 5, B = 4, C = 3, D = 2 and F = 1. Table 1 provides example items for each subscale, the number of items in each subscale and Cronbach's alpha reliabilities.

Results

To answer the first research question, a hierarchical multiple linear regression analysis was conducted with the dependent variable being academic procrastination. Several demographic characteristics were controlled in the first step: which university the student attended, gender, and whether the student belonged to an underrepresented ethnic minority group as classified by the National Science Foundation (2017). Students' level of conscientiousness was also controlled in the first step. In the second step, the five facets of classroom motivational environment were entered in the model.

For the second research question, mediation analysis assumptions were tested, using procedures recommended by Hayes (2013), to examine the degree to which academic procrastination mediated the effect of the classroom motivational environment dimensions on academic performance after controlling for students' level of conscientiousness.

Table 2 provides descriptive statistics for the main variables of interest. Table 3 presents bivariate correlations among the facets of the five classroom motivational environment variables, academic procrastination and course grades. Each facet of the classroom motivational environment was statistically significantly and negatively associated with academic procrastination, with the size of the correlations ranging from small ($r = -0.19$) to moderate (($r = -0.36$) Cohen 1992). Academic procrastination was negatively related to course grades ($r = -0.36$). Only one statistically significant association was found between facets of the classroom motivational environment and course grades: task-related interaction was positively associated with course grades ($r = 0.17$). Conscientiousness was negatively associated with academic procrastination ($r = -0.22$) but not significantly associated with course grades.

Table 1 Instrument used in the current study

Scale	Number of items	Example item	Cronbach's alpha
Academic procrastination	12	I often find myself doing work for this course that I had intended to do days before	0.92
Conscientiousness	20	I carry out my plans	0.86
Instructor academic support	4	My course instructor wants students to do their best in school	0.76
Instructor emotional support	4	My course instructor tries to help students when they are sad or upset	0.77
Classroom mutual respect	5	My course instructor makes sure that students don't say anything negative about each other in class	0.78
Task-related interaction	3	My course instructor allows students to discuss their work with classmates	0.69
Course situational interest	6	The lectures in this course are very interesting	0.85

Table 2 Descriptive statistics for included variables

Variable	*M*	SD	Range
Academic procrastination	3.54	1.34	1.00–7.00
Conscientiousness	4.97	0.87	1.00–7.00
Instructor academic support	6.33	0.71	1.00–7.00
Instructor emotional support	5.87	0.93	1.00–7.00
Classroom mutual respect	6.11	0.81	1.00–7.00
Task-related interactions	5.83	0.95	1.00–7.00
Course situational interest	5.57	1.06	1.00–7.00
Course grade	3.95	1.10	1.00–5.00

$N = 223$

Table 3 Pearson correlations among academic procrastination, conscientiousness, classroom motivational environment and course grades

Variable	Correlation						
	1	2	3	4	5	6	7
1. Procrastination	–						
2. Conscientiousness	−0.22**	–					
3. Academic support	−0.23*	0.11	–				
4. Emotional support	−0.29**	0.08	0.78***	–			
5. Mutual respect	−0.19**	0.13	0.57***	0.57***	–		
6. Task-related interaction	−0.20**	0.05	0.54***	0.50***	0.44***	–	
7. Situational interest	−0.36***	0.16*	0.62***	0.59***	0.37***	0.22**	–
8. Course grade	−0.36***	−0.02	0.06	0.13	0.02	0.17*	0.05

$N = 215$. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 4 Hierarchical regression analysis predicting academic procrastination

Variable	Academic procrastination	
	β Step 1	β Step 2
Step 1		
University 1	−0.16	−0.16
Female	−0.09	−0.09
URM	−0.04	0.01
Conscientiousness	−0.25***	−0.21**
Step 2		
Academic support		0.20
Emotional support		−0.08
Mutual respect		0.01
Task-related interaction		−0.12
Course situational interest		−0.39***
R^2	0.08**	0.23***
ΔR^2		0.15***

β indicates standardized regression coefficient. $N = 217$. **$p < 0.01$, ***$p < 0.001$

Table 4 presents the results of the hierarchical linear regression analysis for predicting academic procrastination. The first step of the regression analysis was statistically significant, $F(4216) = 4.59$, $p < 0.01$, $R^2 = 8\%$, and accounted for 8% of the variation in academic procrastination. Students' level of conscientiousness ($\beta = -0.25$) emerged as the only statistically-significant variable after controlling for demographic variables in the model. The second step of the regression analysis was also statistically significant and accounted for an additional 15% of the variation in academic procrastination, $F(9216) = 6.80$, $p < 0.001$, $R^2 = 23\%$. Again, conscientiousness had a small positive effect on academic procrastination after controlling for other variables in the model ($\beta = -0.21$). In addition, of the five classroom motivational environment facets entered in the second step of the model, only course situational interest emerged as a statistically-significant predictor of academic procrastination ($\beta = -0.39$). Even after controlling for students' level of conscientiousness, results indicate that course situational interest was the strongest predictor of academic procrastination after accounting for the other facets of classroom motivational environment.

Table 5 presents the results of mediation analyses of whether academic procrastination mediated the effect of the classroom motivational environment on final course grades. Despite the nonsignificant correlations between most of the classroom motivational environment dimensions and final course grades, further mediation analysis was still warranted because adding a mediator may reveal a mediation relation (MacKinnon 2014). Thus, we ran Hayes' (2013) PROCESS macro for SPSS with 1000 bootstrap samples to obtain the indirect effects that each motivational classroom environment facet had on course grades through academic procrastination. Table 5 presents all standardised indirect effects. Based on the 95% confidence intervals for mean indirect effects, academic procrastination mediated the effect of academic support, emotional support, mutual respect, task-related interaction and course situational interest on final course grades even after controlling for students' level of conscientiousness (Hayes 2013).

Discussion

The current study adds to our understanding about which facets of the classroom motivational environment predict students' academic procrastination when the influence of conscientiousness is controlled. While the facets of classroom motivational environment that underlie a mastery goal structured classroom (instructor support, classroom mutual respect, task-related interaction) were found to have a significant negative association with academic procrastination, the strongest negative predictor of academic procrastination was course situational interest. Findings from the current study are promising because they indicate that instructors can have an influence on students' level of procrastination in a class even after accounting for students' level of conscientiousness. Moreover, results suggest that creating a positive classroom motivational environment can reduce academic procrastination and, in turn, enhance academic achievement among college students.

Classroom motivational environment and procrastination

Consistent with previous research (Wolters 2004), the current findings suggest that a mastery goal structured classroom is negatively associated with procrastination. However, our study extends prior findings by examining the social climate elements

Table 5 Mediation analyses using bootstrapping: magnitude and statistical significance of indirect effects controlling for conscientiousness

Independent variable	Mediator variable	Dependent variable	β (standardised path coefficient)	*p*	SE	95% confidence interval for mean indirect effect (lower and upper)
Academic support	Procrastination	Course grade	0.12	< 0.05	0.051	0.05, 0.21
Emotional support	Procrastination	Course grade	0.12	< 0.05	0.039	0.05, 0.21
Mutual respect	Procrastination	Course grade	0.08	< 0.05	0.037	0.02, 0.16
Task-related interaction	Procrastination	Course grade	0.08	< 0.05	0.031	0.02, 0.14
Situational interest	Procrastination	Course grade	0.14	< 0.05	0.035	0.07, 0.21

$N = 219$

underlying a mastery goal structured classroom and their relationships with academic procrastination. Current findings indicate that academic procrastination might be reduced when instructors show care and concern for students' well-being and academic success, facilitate interactions among peers, and emphasise a classroom environment where students respect one another. Some but not all of these relationships between the classroom social environment and academic procrastination have been examined in previous research. For example, negative relationships between instructors' academic and emotional support with academic procrastination are consistent with findings from a prior study using a similar measure of instructor support that also captured the degree to which instructors were organised (Corkin et al. 2014).

The current study is the first identified to date that has found that instructors who promote interactions among their students and encourage a mutually-respectful environment help to reduce academic procrastination. These findings can perhaps be explained by the fact that both of these facets of the classroom motivational environment encourage students to engage in social forms of self-regulation such as the co-regulation of course tasks (Hadwin et al. 2018). Through co-regulation, students engage in social regulation processes such as questioning, explaining and externalising ideas in the classroom. A prior study in which co-regulation was measured through the active participation of students with other peers in discussion forums in an online course revealed that low-procrastinators interact more frequently with other learners compared with high-procrastinators, suggesting that co-regulation has an inverse relationship with academic procrastination (Michinov et al. 2011). This is consistent with our findings.

Current findings also indicate that students who reported greater interest in the course material were less likely to procrastinate. Instructors who create interesting lessons could be likely to elicit greater sustained attention in the classroom (Ainley et al. 2002). Hidi and Renninger (2006) explain that situational interest is first triggered and can then lead to maintained situational interest and eventually to personal interest. Triggered situational interest can be generated from surprising information that causes short-term changes in affective and cognitive processing (Hidi and Baird 1986, 1988). This could result in less procrastination because students demonstrate greater cognitive engagement with the course material.

While instructor support, mutual respect and task-related interactions were all significantly associated with academic procrastination, consistent with Corkin et al. (2014), course situational interest emerged as the facet of the classroom motivational environment most strongly related with academic procrastination. Perhaps creating situational interest could be of greater importance to decreasing procrastination because students are more likely to engage cognitively with the course material for a longer period of time. By creating an interesting course and delivering material in an interesting way to empower students (Mitchell 1993) and providing them with an opportunity to use a variety of skills (Ackerman and Gross 2005), instructors can help students to develop long-term personal interest in the course material.

These results extend findings by Corkin et al. (2014) that classroom environmental factors are associated with academic procrastination. However, by controlling for conscientiousness, this study strengthens the evidence that contextual variables matter when studying academic procrastination. In other words, regardless of a person's conscientiousness level, environmental factors still play a role in students' academic procrastination. Our findings reinforce the assertion that, "for students to persist, complete, and be successful in college, the learning environment matters" (Jankowski 2017, p. iii).

Academic procrastination as a mediator between classroom environment and grades

In addition, the current study demonstrates the positive effect of a supportive classroom environment on students' academic grades, as mediated by students' tendency to procrastinate. Previous studies have utilised mediational analyses to demonstrate the effect that motivational beliefs can have on other academic variables (Corkin et al. 2014), but no study identified to date has utilised procrastination as a mediating variable between the classroom motivational environment and academic grades. A significant body of research has documented the relationship between greater student engagement and positive learning outcomes, such as higher achievement (Miserandino 1996; Skinner et al. 1990). The current findings support these results, which suggest that providing a supportive environment to engage students can cause students to procrastinate less and attain greater academic outcomes. Though previous research has demonstrated the relationship between a motivational environment and positive academic outcomes, the current research offers further evidence to support the relationship between the learning environment and academic outcomes. By creating a mastery goal structured classroom that demonstrates support and respect for students and provides interactive tasks to engage and trigger situational interest, instructors could be more likely to provide students with an opportunity for greater academic achievement mediated by less procrastination.

Limitations

Although our research demonstrates the positive effects of the social climate elements underlying a mastery goal structured classroom on students' academic grades, some limitations should be considered. First, data gathered from students was self-reported data. Although some researchers suggest utilising other methods (e.g., observations) to better understand student motivations (Turner and Meyer 2000), most motivational researchers feel that students' self-reported data best reflect students' beliefs. A second limitation is the dependent variable in the mediation analysis, namely, course grades. Because the samples came from two different universities and course grades were gathered from several different classes, results should be interpreted cautiously. Another limitation relates to only course grades being used to assess academic achievement. While this study indicated that the classroom motivational environment facets do not have significant direct effects on achievement, could significant direct effects on achievement emerge if measured through other means? Perhaps this is an avenue for future studies to explore.

Conclusion

It has always been an article of faith that instructors should make learning interesting for their students, care about them as individuals and as learners, and encourage respect and interaction among them. Although these are well-worn platitudes that would seem to go without saying, often platitudes go not only without saying, but also without the benefit of evidence. The current study contributes to elevating these maxims from platitude to established fact by clarifying the connections among these features of the classroom environment, the maladaptive behaviour of procrastination, and concrete student achievement in

the form of grades. That clarification comes in part from bolstering previous findings, but also from separating the effects of conscientiousness on procrastination from the effects of classroom environment on procrastination and, thereby, grades.

Our findings suggest that an effective way to improve student achievement is by reducing procrastination, and that an effective way to reduce procrastination is through deliberate engineering of the classroom environment. One of the best ways to combat procrastination is by triggering students' interest in what they are learning, perhaps by providing information that students find surprising or incongruous or by involving students in group work, especially on tasks that require multiple skills, including grappling with puzzles and working with computer applications (Ackerman and Gross 2005; Hidi and Renninger 2006; Paden and Stell 1997). In addition to the short-term benefits that could arise from stimulating interest in a particular classroom situation, triggered situational interest also might be a first step towards a deeper and longer-lasting personal interest that benefits students over their career or even lifetime (Hidi and Renninger 2006).

Our findings also suggest that instructors should take concrete steps to promote and reward relationships among students that are characterised by respect. Moreover, current findings suggest that caring for students' well-being and success as individuals and learners is not a merely a personal disposition possessed to a greater or lesser degree by different instructors, but also a set of behaviours that should be deliberately cultivated and consistently demonstrated in ways that students cannot miss.

Finally, given recent evidence of the importance of self-regulated learning strategies to college student success (Jankowski 2017) and that students who enact self-regulated learning strategies in the classroom (e.g., cognitive and metacognitive learning strategies) are less likely to procrastinate (Corkin et al. 2011; Howell and Watson 2007), future studies should not only examine the effects that classroom motivational environmental facets have on academic procrastination and achievement, but they also should examine specific instructional methods that explicitly teach students how to effectively implement self-regulated learning strategies in college courses. This will help educators to understand the degree to which these methods help to reduce academic procrastination through the use of self-regulated learning strategies in college courses, which ultimately will lead to greater college student success and persistence.

Acknowledgements This study was supported by an Organized Research and Creative Activities (ORCA) Grant from the University of Houston-Downtown.

References

Ackerman, D., & Gross, B. (2005). My instructor made me do it: Task characteristics of procrastination. *Journal of Marketing Education, 27,* 5–13. https://doi.org/10.1177/0273475304273842.

Ainley, M., Hidi, S., & Berndorff, D. (2002). Interest, learning, and the psychological processes that mediate their relationship. *Journal of Educational Psychology, 94*(3), 545–561. https://doi.org/10.1037/0022-0663.94.3.545.

Alansari, M., & Rubie-Davies, C. (2019). What about the tertiary climate? Reflecting on five decades of class climate research. *Learning Environments Research*. https://doi.org/10.1007/s10984-019-09288-9.

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology, 80*(3), 260–267. https://doi.org/10.1037/0022-0663.80.3.260.

Boysan, M., & Kiral, E. (2017). Associations between procrastination, personality, perfectionism, self-esteem and locus of control. *British Journal of Guidance and Counselling, 45*(3), 284–296. https://doi.org/10.1080/03069885.2016.1213374.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112,* 155–159. https://doi.org/10.1037/0033-2909.112.1.155.

Corkin, D. M., Yu, S. L., & Lindt, S. F. (2011). Comparing active delay and procrastination from a self-regulated learning perspective. *Learning and Individual Differences, 21*(5), 602–606. https://doi.org/10.1016/j.lindif.2011.07.005.

Corkin, D. M., Yu, S. L., Wolters, C. A., & Wiesner, M. (2014). The role of the college classroom climate on academic procrastination. *Learning and Individual Differences, 32,* 294–303. https://doi.org/10.1016/j.lindif.2014.04.001.

Costa, P. T., & McCrae, R. R. (1992). *NEO PI-R: Professional manual: Revised NEO PI-R and NEO-FFI.* Lutz: Psychological Assessment Resources Inc.

Deemer, E. D., & Smith, J. L. (2018). Motivational climates: Assessing and testing how science classroom environments contribute to undergraduates' self-determined and achievement-based science goals. *Learning Environments Research, 21,* 245–266. https://doi.org/10.1007/s10984-017-9252-y.

Fraser, B. J., & Fisher, D. L. (1982). Predicting students' outcomes from their perceptions of classroom psychosocial environment. *American Educational Research Journal, 19*(4), 498–518.

Fraser, B. J., Treagust, D. F., & Dennis, N. C. (1986). Development of an instrument for assessing classroom psychosocial environment in universities and colleges. *Studies in Higher Education, 11,* 43–54.

Hadwin, A., Järvelä, S., & Miller, M. (2018). Self-regulation, co-regulation, and shared regulation in collaborative learning environments. In D. H. Schunk & J. A. Greene (Eds.), *Handbook of self-regulation of learning and performance* (pp. 83–106). New York: Routledge.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Press.

Hidi, S., & Baird, W. (1986). Interestingness—A neglected variable in discourse processing. *Cognitive Science, 10,* 179–194. https://doi.org/10.1207/s15516709cog1002_3.

Hidi, S., & Baird, W. (1988). Strategies for increasing text-based interest and students' recall of expository texts. *Reading Research Quarterly, 23,* 465–483. https://doi.org/10.2307/747644.

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist, 41*(2), 111–127. https://doi.org/10.1207/s15326985ep4102_4.

Howell, A. J., & Watson, D. C. (2007). Procrastination: Associations with achievement goal orientation and learning strategies. *Personality and Individual Differences, 43,* 167–178.

Jankowski, N. A. (2017). *Unpacking relationships: Instruction and student outcomes*. Washington, DC: American Council on Education.

Johnson, J. A. (2014). Measuring thirty facets of the Five Factor Model with a 120-item public domain inventory: Development of the IPIP-NEO-120. *Journal of Research in Personality, 51,* 78–89. https://doi.org/10.1016/j.jrp.2014.05.003.

Klingsieck, K. B., Grund, A., Schmid, S., & Fries, S. (2013). Why students procrastinate: A qualitative approach. *Journal of College Student Development, 54*(4), 397–412. https://doi.org/10.1353/csd.2013.0060.

Linnenbrink-Garcia, L., Durik, A. M., Conley, A. M., Barron, K., Tauer, J. M., Karabenick, S. A., et al. (2010). Measuring situational interest in academic domains. *Educational and Psychological Measurement, 70,* 647–671. https://doi.org/10.1177/0013164409355699.

MacKinnon, D. P. (2014, January). *Modern mediation analysis*. Paper presented at the University of Massachusetts Medical School, Worcester, MA.

Michinov, N., Brunot, S., Le Bohec, O., Juhel, J., & Delaval, M. (2011). Procrastination, participation, and performance in online learning environments. *Computers & Education, 56,* 243–252. https://doi.org/10.1037//0022-0663.85.3.424.

Miserandino, M. (1996). Children who do well in school: Individual differences in perceived competence and autonomy in above-average children. *Journal of Educational Psychology, 88*(2), 203–214. https://doi.org/10.1037//0022-0663.88.2.203.

Mitchell, M. (1993). Situational interest: Its multifaceted structure in the secondary school mathematics classroom. *Journal of Educational Psychology, 85*(3), 424–436. https://doi.org/10.1037//0022-0663.85.3.424.

Moos, R. H. (1979). *Evaluating educational environments: Procedures, measures, findings and policy implications*. San Francisco: Jossey-Bass.

National Science Foundation. (2017). *Women, minorities, and persons with disabilities in science and engineering*. https://www.nsf.gov/statistics/2017/nsf17310/.

Onwuegbuzie, A. (2004). Academic procrastination and statistics anxiety. *Assessment & Evaluation in Higher Education, 29*(1), 3–19. https://doi.org/10.1080/0260293042000160384.

Paden, N., & Stell, R. (1997). Reducing procrastination through assignment and course design. *Marketing Education Review, 7*(2), 17–25. https://doi.org/10.1080/10528008.1997.11488587.

Patrick, H., Kaplan, A., & Ryan, A. M. (2011). Positive classroom motivational environments: Convergence between mastery goal structure and classroom social climate. *Journal of Educational Psychology, 103*(2), 367–382. https://doi.org/10.1037/a0023311.

Schneider, M., & Preckel, F. (2017). Variables associated with achievement in higher education: A systematic review of meta-analyses. *Psychological Bulletin, 143*(6), 565–600. https://doi.org/10.1037/bul0000098.

Schouwenburg, H. (2004). Procrastination in academic settings: General introduction. In H. C. Schouwenburg, C. H. Lay, T. A. Pychyl, & J. R. Ferrari (Eds.), *Counseling the procrastinator in academic settings* (pp. 3–17). Washington, DC: American Psychological Association.

Schraw, G., Wadkins, T., & Olafson, L. (2007). Doing the things we do: A grounded theory of academic procrastination. *Journal of Educational Psychology, 99,* 12–25. https://doi.org/10.1037/0022-0663.99.1.12.

Skinner, E. A., Wellborn, J. G., & Connell, J. P. (1990). What it takes to do well in school and whether I've got it: A process model of perceived control and children's engagement and achievement in school. *Journal of Educational Psychology, 82*(1), 22–32. https://doi.org/10.1037//0022-0663.82.1.22.

Steel, P. (2007). The nature of procrastination: A meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychological Bulletin, 133*(1), 65–94. https://doi.org/10.1037/0033-2909.133.1.65.

Steel, P. (2010). Arousal, avoidant and decisional procrastinators: Do they exist? *Personality and Individual Differences, 48*(8), 926–934. https://doi.org/10.1016/j.paid.2010.02.025.

Steel, P., & Klingsieck, K. B. (2016). Academic procrastination: Psychological antecedents revisited. *Australian Psychologist, 51,* 36–46. https://doi.org/10.1111/ap.12173.

Turner, J. C., & Meyer, D. K. (2000). Studying and understanding the instructional contexts of classrooms: Using our past to forge our future. *Educational Psychologist, 35,* 69–85. https://doi.org/10.1207/s15326985ep3502_2.

Vedel, A. (2014). The Big Five and tertiary academic performance: A systematic review and meta-analysis. *Personality and Individual Differences, 71,* 66–76. https://doi.org/10.1016/j.paid.2014.07.011.

Winston, R., Vahala, M., Nichols, E., Gillis, M., Wintrow, M., & Rome, K. (1994). A measure of college classroom climate: The college classroom environment scales. *Journal of College Student Development, 35,* 11–18.

Wolters, C. A. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students' motivation, cognition, and achievement. *Journal of Educational Psychology, 96,* 236–8250. https://doi.org/10.1037/0022-0663.96.2.236.