

BRIEF REPORT

Academic Buoyancy in Secondary School:

Exploring Patterns of Convergence in English, Mathematics, Science, and Physical Education

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BRIEF REPORT

Academic Buoyancy in High School:

Exploring Patterns of Convergence in Mathematics, Science, English and Physical Education

1. Introduction

Academic challenge, setback, and adversity are a reality of everyday school life (e.g., Finn & Rock, 1997; Martin & Marsh, 2006, 2009) and recent research has suggested a student's capacity to successfully negotiate these circumstances is an important element of their academic development. For example, this capacity has been referred to as 'academic buoyancy' (Martin & Marsh, 2009). The present study addresses gaps in such current academic buoyancy research to expand our understanding of this capacity and the factors that are associated with it. The study does so in five ways. First, it considers buoyancy as school subject-specific. Second, buoyancy is simultaneously considered across a broader range of school subjects than previously: English, mathematics, science, and physical education. Third, findings and interpretations are demarcated as a function of academic (English, mathematics, science) or non-academic subjects (physical education). Fourth, the study includes theoretically-based external validity constructs (perceptions of competence, effort, difficulty) as aspects of primary and secondary appraisal (e.g. Lazarus & Folkman, 1984) to further extend our current understanding of buoyancy and its potential effects. Fifth and finally, the study is conducted in a new national context (England) to extend earlier research from Australia.

1.1 Subject-Specific Buoyancy Research from a Multilevel Perspective

When assessments are made of psycho-educational phenomena, research has demonstrated a notable trend towards subject-general measures that are specified across all school subjects. However, it may be that some measured concepts are simply too subject-specific to be validly assessed using a subject-general approach (Marsh, Martin, & Debus, 2001). The most evident

example of this is academic self-concept which can be conceptually broken down, and empirically distinguished, into academic and non-academic domains, as well as specific domains such as math, verbal, and physical (e.g., Marsh, 1992). The implications of this potential (school) subject-specificity are significant. For example, if academic buoyancy is subject-specific, then interventions will need to be delivered to distinct school subjects – whereas if buoyancy is subject-general, then broader interventions are more appropriate (Green, Martin, & Marsh, 2007). The present study examines this issue and extends previous subject-general research into academic buoyancy by assessing both academic (mathematics, English, science) and non-academic subjects (physical education). This previous research has found subject-general academic buoyancy to be significantly associated with engagement, teacher-student relationships, and general school achievement (Martin & Marsh, 2008). Further, other recent research has differentiated academic buoyancy from general adaptive coping, finding that it explained unique variance when negatively predicting students' worrying, test-irrelevant thoughts, tension, and unpleasant physical symptoms during exams (Putwain, Connors, Symes, & Douglas-Osborn, 2012).

1.2 Theoretically-Based Constructs to test External Validity

Our understanding of academic buoyancy and its variation between students and school subjects is greatly expanded by considering external validity constructs against which we can juxtapose buoyancy effects. A failure to do so risks misspecification of effects as particular to buoyancy alone. Considering past research, academic buoyancy has been primarily assessed against predictors of motivation (e.g., Martin, Colmar et al., 2010; Martin & Marsh, 2006) and academic outcomes (e.g., Martin & Marsh, 2007). For example, in terms of predictors, prior research has shown self-efficacy, planning, persistence, control, and (low) levels of anxiety to be predictors of academic buoyancy (Martin, Colmar et al., 2010). As noted above, in terms of outcomes, academic buoyancy has also predicted various engagement, relationship, achievement, and stress outcomes (Martin & Marsh, 2007; Putwain et al., 2012). However, the selection of predictors and outcomes in buoyancy research has been somewhat *ad hoc*. Importantly, in recent

buoyancy research, Parker and Martin (2009) identified direct and palliative *coping* (which includes primary and secondary appraisals, e.g. Lazarus and Folkman, 1984) as particularly relevant to buoyancy. Following from this, we harnessed theorizing around primary and secondary appraisal as a guiding perspective informing the selection of external validity constructs against which to correlate academic buoyancy.

Broadly, primary appraisals are of aspects of the task or situation at-hand while secondary appraisals are then of relevant aspects of the self that together, lead to various task- or situation-relevant responses (Parker & Martin, 2009; Smith & Kirby, 2000). These two ideas provide a useful basis by which to select external validity constructs for the present study. Consistent with work by Malmberg and colleagues (Malmberg & Little, 2007; Malmberg, Wanner, & Little, 2008; Malmberg, Little, Walls, Martin, & Lim, 2012), the present study selects appraisal-related constructs that are related to students' perceptions of their: *competence* (secondary appraisal), *task difficulty* (primary appraisal), and *effort* (response). We utilize this constellation of constructs in two ways: (a) by correlating academic buoyancy with each of these three perceptions, and (b) by comparing between-subject correlations for buoyancy against between-subject correlations for competence, difficulty, and effort (e.g., comparing the correlation of science-buoyancy with English-buoyancy against the correlation of science-effort and English-effort).

1.3 Research Questions

In this study, we operationalized academic buoyancy in a methodologically-novel manner and harnessed recent theoretical links between buoyancy and appraisal. In doing so, we specified three research questions:

- (1) How does subject-specific buoyancy (relative to perceptions of competence, difficulty, and effort) converge across school subjects?
- (2) How does subject-specific buoyancy (relative to competence, difficulty, and effort) converge across only *academic* subjects (mathematics, English, science)?

- (3) To what extent are subject-*general* constructs of buoyancy (relative to competence, difficulty and effort perceptions) related to subject-*specific* constructs of buoyancy (relative to competence, difficulty and effort perceptions), across school subjects?

2. Method

2.1 Sample and Procedure

In total, 260 students aged 11-16 years who attended 3 secondary schools in England (year-groups 7-11) were sampled after receipt of signed parent/guardian consent for participation. Students were administered a questionnaire that took about 15 minutes to complete. Of the student sample, 80 (30.8%) were in Year 7, 85 (32.7%) were in Year 8, 50 (19.2%) were in Year 9, 31 (11.9%) were in Year 10 and 14 (5.4%) in Year 11. There were 117 (45.0%) boys and 143 girls (55.0%). Mean student age was 13.2 years ($SD = 1.23$). 12.6% of students reported that they were of an ethnic minority background.

2.2 Materials

Students responded to questions on 7-point Likert rating scales (1 = strongly disagree, 4 = neither agree nor disagree, 7 = strongly agree) and the questions were grouped in two sets. The first of these sets of questions were *subject-general* perceptions, framed as perceptions “about yourself at school”, while the second set of questions were about *subject-specific* perceptions. These two sets of questions were presented in four sections corresponding to each of four school subjects here investigated: three concerned academic subjects (mathematics, science, and English) and one a non-academic subject (physical education). In order to minimize effects from answering-fatigue due to the repetitive nature of the questionnaire items, four different versions of the questionnaire were printed in which the order of the four sections was counter-balanced.

2.2.1 Subject-general (non-subject-specific) measures

Subject-general *academic buoyancy* was measured with four items: ‘I don't let study stress get on top of me’, ‘I think I'm good at dealing with schoolwork pressures’, ‘I don't let bad marks

affect my confidence' and 'I'm good at dealing with setbacks at school (e.g. negative feedback on my work, poor results)'. Internal consistency was $\alpha = .81$. Consistent with appraisal theory we included instruments that assessed agency beliefs in relation to competence (secondary appraisal), difficulty (primary appraisal) and effort (response), as developed by Malmberg and colleagues (2012; modified from Little & Wanner, 1997). Students' subject-general perception of their *competence* was measured by three items ('I'm quite clever', 'I'm bright', 'I'm pretty smart'; $\alpha = .92$), subject-general perceptions of *difficulty* by three items ('Learning something new is difficult for me', 'I think understanding new things in school is hard', 'I have trouble figuring out new lessons in school'; $\alpha = .72$), and subject-general perceptions of *effort* by three items ('In class I really pay attention', 'I really work hard in class', 'I put in effort in class'; $\alpha = .76$).

2.2.2 Subject-specific measures

We asked students to report on their subject-specific buoyancy, competence, effort, and difficulty as related to four school subjects. Subject-specific *academic buoyancy* was measured with four items: 'When I learn [subject], I don't let study stress get on top of me', 'When I learn [subject], I think I'm good at dealing with pressure', 'When I learn [subject], I don't let bad marks affect my confidence', 'When I learn [subject], I'm good at dealing with setbacks (e.g. negative feedback on my work, poor results)'. Subject-specific perceptions of *competence* were measured with two items 'I am good at [subject]', 'I understand a lot in [subject]'; subject-specific perceptions of *difficulty* with two items 'I have problems with [subject]', '[subject] is difficult for me'; and subject-specific perceptions of *effort* with three items 'I work hard in [subject]', 'I put effort into [subject]' and 'I try hard in [subject]'. Table 1 shows that the internal consistency for these measures ranged between $\alpha = .78$ to $\alpha = .95$.

2.3 Analytic strategy

As 2.4% of the data were missing, these were imputed with a single imputation using the Monte Carlo Multiple Chain (MCMC) procedure in SPSS 17. We then carried out a Confirmatory Factor Analysis (CFA) on all indicators of buoyancy together with our perception measures of

competence, difficulty, and effort as they varied across all four school subjects using the MPlus software (Muthén and Muthén, 2009) where we observed correlations between latent construct (thus: 'latent correlations'). Applying the fit criteria of $<.05$ for both the Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Square Residual (SRMR), while using $>.90$ for both the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) our measurement model was found to fit our data well ($\chi^2_{[1267]} = 2047.62$; $p < .001$; RMSEA = 0.049; SRMR = 0.042; CFI = .937; TLI = .921) which demonstrates the structural validity of our measures. This means that all items loaded on their respective intended (*a priori*) latent construct while partialling out the random measurement error into the residuals. We then inspected the latent correlations (ρ) which are disattenuated (i.e., net of) random measurement error.

In order to investigate the first research question (to what extent academic buoyancy converged across school subjects relative to the appraisal constructs) we calculated the average latent correlations between subject-specific constructs (e.g., the correlation between the four buoyancy measures specific to the four school subjects). In multitrait-multimethod (MTMM) studies this is referred to as the, 'convergent validity coefficient' (i.e., the extent to which a trait is similarly measured with different methods; Campbell & Fiske, 1959). A construct of high subject-generalness (i.e., low subject-specificity) would be suggested by a relatively high correlation between this construct's repeated measurement across different school subjects (e.g., buoyancy in math, English, science, P.E.). The opposite would be suggested if these correlations were relatively low (i.e. low correlations would imply a latent measure such as buoyancy was subject-specific rather than subject-general).

In order to investigate the second research question (whether buoyancy converged across academic school subjects relative to the appraisal constructs) we calculated the average latent correlations between the three academic subject-specific constructs (e.g., buoyancy in English, Maths, Science).