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Perception shapes experience: The influence of actual and perceived classroom environment dimensions on girls' motivations for science

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1. Introduction

- Girls have been found to feel less capable than boys, and under-participate in science classrooms, even though their achievement levels are similar (Else-Quest, Hyde, & Linn, 2010; Watt, Eccles, & Durik, 2006).
- Girls start to lose interest in STEM subjects during secondary school, which begins the progressive "opting out" of females from STEM fields along their educational track leading to disproportionately fewer women than men in STEM careers (Simpkins & Davis-Kean, 2005; Watt, 2007, 2008).
- Working to promote the motivation of girls in early adolescence has been pursued to address the gender imbalance in STEM careers, since motivations are central to students' career plans (Eccles, Adler, & Meece, 1984).
- Hence, there is a specific need to know which particular aspects of different classrooms can most impact on students' motivations within the domain of science.
- The expectancy-value model (Eccles et al., 1983), used in the present study, explains the processes by which motivations impact students' participation choices. Expectations for success and the value students attribute to a task, influences their choices, performance and persistence for that task.
- Classroom environments have the potential to promote a positive learning climate that fosters students' motivation and engagement. However, students differ in their perceptions of the same classroom setting, which can result in a vast array of classroom experiences, within the one class of students (Wolters, 2004).

2. The Present Study

- The current study set out to examine the extent to which observed and student perceived classroom environment features explained changes in girls' science motivation in junior high school science over the period of 2 school terms.
- Multiple perspectives of the classroom environment were examined:
  - Teacher perceptions
  - Student perceptions
  - Observed environment
- The inclusion of longitudinal data at 2 timepoints allowed students' initial motivations to be taken into account when assessing the influence of classroom environment on Time 2 motivations.

- Four main hypotheses were proposed:

1. students' perceived classroom environment would exert more influence on their motivations than observed classroom environment dimensions;
2. observed classroom environment features would impact students' perceptions of the classroom environment;
3. students' extrinsic utility value would be the motivation most likely to be affected by observed and perceived classroom environment, since by definition, it is influenced by external features; and
4. teachers' perceptions of the classroom environment would be more positive than students', for the same environment.

3. Methodology

Measures

- The ***Teacher Style Scale*** (*TSS*; Watt & Richardson, 2007, unpublished). Parallel teacher and student versions tapped latent constructs of expectations, relatedness, negative feedback, and structure.
- ***Student Motivations Questionnaire*** (adapted from Eccles & Wigfield, 1995) investigated students' ability expectancies and task value (subfactors: intrinsic interest value, attainment importance, and extrinsic utility value) for science.
- Classroom observations were conducted using the ***Classroom Assessment Scoring System – Secondary*** (*CLASS-S*, Pianta et al., unpublished). Those dimensions of the *CLASS-S* that most closely resembled latent constructs of the *TSS* were selected for inclusion: positive climate, negative climate, regard for adolescent perspectives, behaviour management, quality of feedback, and student engagement.

Participants

- 4 science teachers (3 females, 1 male) and 5 classrooms of their students ($N = 52$)
- All student participants were females
- Age: ranged from 11 to 14 years (M= 12.79, SD=0.75)
- 42% were in Year 7, 58% were in Year 8
- 88% attended an independent singe-sex girls' school
- 12% attended an independent co-educational school

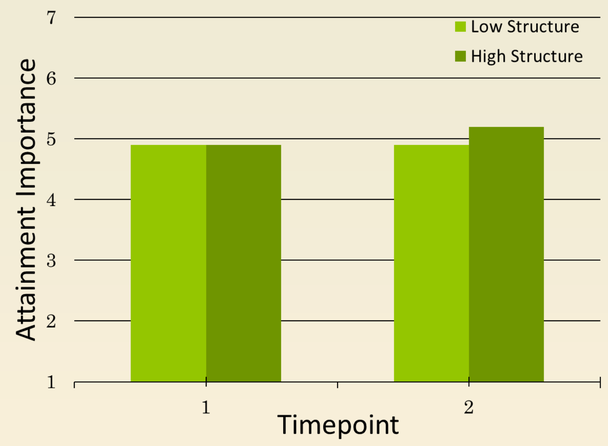
Data Analysis

Due to the nested nature of the data, hierarchical linear modelling was used:
Level 1: Timepoint – students' science motivations
Level 2: Individual – students' classroom perceptions
Level 3: Classroom – classroom observations.

4. Key findings

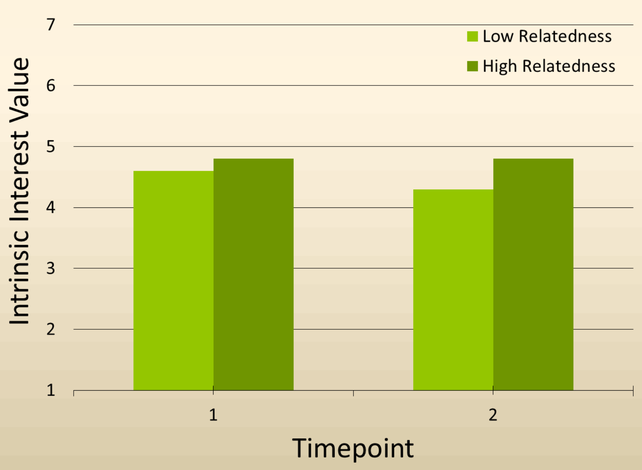
As predicted, students' own perceptions of the classroom were more influential than the observed, or "actual", classroom environment.

Perceptions of structure emerged as a key influence on all three measured motivational values: attainment importance, extrinsic utility and intrinsic interest in science.



Perceptions of relatedness had a protective effect on girls' science motivations:

Girls who perceived high levels of relatedness in the classroom had stable intrinsic interest for science across time; whereas, girls who thought the class exhibited low relatedness showed diminished intrinsic interest over time.



Despite the strong influence of students' own perceptions, the observed classroom environment still impacted on their perceptions.

- All 6 observed classroom features influenced perceptions of structure
- Observed regard for adolescent perspective affected perceived negativity
- Observed quality of feedback influenced student perceived structure.

Students' extrinsic utility value for science was affected by both perceived classroom structure and all 6 of the observed classroom features.

- For girls who perceived the classroom to be low on a particular dimension who were also situated in a classroom where the environment was observed to be low on a certain dimension, their motivations fared the worst (low-low group).
- However, girls who perceived the classroom to be high on a certain aspect, and were in a classroom that was judged to be high on an environmental dimension, often had decreases in their motivation across time (high-high group). These girls still maintained relatively high motivations, but any declines were counter to our expectation.
- Instead, it was girls with high perceptions who were in classes low on an environmental dimension who tended to show the highest motivations at Time 2 (high-low group).

Teachers' perceptions of the classroom environment were more positive than those of the students on some dimensions of teacher style.

In most classrooms, students rated their teachers significantly lower on dimensions of relatedness and structure, which may be particularly problematic since these two dimensions had significant influences on students' science motivations.

5. Conclusions & Implications

The results indicate that girls' perceptions of the classroom are very influential on their motivations for science but that the observed classroom is still important and can impact their perceptions.

Teachers may be able to help combat the trend of girls opting out of science related fields by enhancing certain classroom features that enhance girls' specific motivations:

- If girls perceive the environment to be structured they are more likely to be motivated by other positive aspects of the classroom environment.
- Creating an environment of relatedness is a protective factor for girls' intrinsic interest in science.

These results are consistent with self-determination theory (SDT), which proposes three psychological preconditions of learning: autonomy, relatedness, and competence (Deci & Ryan, 2000).

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