The Influence of Momentary Goal Structures

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Adolescents' cognition is influenced by a dynamic educational environment. Studies examining the influence of schools, classrooms, and teachers often overlook the momentary variation found in these environments and the effect this variation has on student cognition. Using an achievement goal theory framework, this study examined the momentary variation of goal structures in high school science classrooms and their influence on students' cognitive engagement using objective observations and the Experience Sampling Method, a unique data collection method that elicits students' momentary subjective experiences related to the momentary classroom goal context. The results of this study indicate that goal structures significantly vary from moment to moment and have a considerable impact on student cognition substantiating the concept of momentary goal structures.

Adolescents' cognition is influenced by a dynamic educational environment. Studies examining the influence of schools, classrooms, and teachers often overlook the momentary variation found in these environments and the effect this variation has on student cognition. Studying the momentary variation in the classroom environment provides insight into how teachers may best effect student engagement and motivation (e.g., Shumow, Schmidt, & Zaleski, 2013; Uekewa, Borman, & Lee, 2007; Yair, 2000).

Using an achievement goal theory framework, this study examined the momentary variation of goal structures— the situational variation within educators' goal-related messages—and their influence on students' cognitive engagement in high school science classrooms. One of the strengths of achievement goal theory is that it considers the role of the classroom context in understanding student engagement and motivation (e.g., Anderman & Maehr, 1994; Linnenbrink, 2005; O'Keefe, Ben-Eliyahu, & Linnenbrink-Garcia, 2013; Patrick, Anderman, Ryan, Edelin, & Midgley, 2002; Shun & Youyan, 2008). This makes achievement goal theory the ideal framework for examining the momentary interaction between the classroom context and student cognition.

In order to link the momentary variation of goal structures to students' cognitive engagement, this study used the Experience Sampling Method (ESM; Hektner, Schmidt, & Csikszentmihalyi, 2007). ESM is a signal contingent data collection method that repeatedly samples individuals' cognition as it relates to the variation in their environment. The participants in this study wore vibrating pagers which signaled them unobtrusively. In response to each signal, students completed an Experience Sampling Form (ESF). The ESF asked students to record their activities and thoughts at the time of the signal, along with various dimensions of their subjective experience. ESM has been used over the past two decades to examine the dynamic relationship between context and cognition in educational environments (see Hektner et al., 2007, for a review).

Achievement Goal Theory

Within the context of achievement goal theory, there are two principal lines of investigation: the *person* perspective and the *contextual* perspective. The person perspective investigates how the individual adoption of personal goals influences achievement-related behavior (Pintrich, 2003). The contextual perspective investigates how different types of goal structures, or goal related messages conveyed within the classroom, influence achievement-related behavior (Ames, 1992). Although the perspectives are related (Roeser, 2004), this study only examined the influence of goal structures in high school science classrooms.

Goal Structures

The contextual perspective of achievement goal theory identifies classroom factors that are related to adaptive educational and motivational outcomes. Similar to the person perspective, performance goal structures may be identified as approach or avoidance depending on the emphasis of the classroom environment. However, this study focused on the dichotomous relationship between mastery and performance goal structures for the following two reasons.

First, Wolters (2004) found that the adoption of both performance approach and avoidance goals in students was linked to classrooms characterized as *performance approach structured*. This finding negated the requirement to differentiate between performance goal structures. Second, the literature examining the contextual perspective of achievement goal theory has predominantly focused on the dichotomy of mastery and performance goal structures due to Wolters' (2004) findings (e.g., Lau & Nie, 2008; Murayama & Elliot, 2009; Shim, Cho, & Cassady, 2013; Wolters & Daugherty, 2007). Consequently, this study did not differentiate between performance goal structures.

Goal structures are defined in relation to instructional practice. When instructional practices are mastery goal structured, teachers emphasize the importance of *developing* competence. When instructional practices are performance goal structured, teachers emphasize the importance of *demonstrating* competence (Ames, 1992). Research indicates that mastery goal structures are related to adaptive outcomes, such as attributing ability to effort; whereas performance goal structures are related to maladaptive outcomes such as learned helplessness (Ames, 1992; Dweck & Legget, 1988; Senko, Hulleman, & Harackiewicz, 2011; Urdan, 2004). Instructional practices may also be characterized as multiple goal structured, or exhibiting both mastery and performance goal structures simultaneously (Ames & Archer, 1988; Linnenbrink, 2005; Turner, Meyer, Midgley, & Patrick, 2003). As a result, this study examined the implications of momentary mastery, performance, and multiple goal structures on students' cognitive engagement in high school science.

Momentary Goal Structures

This study conceptualized momentary goal structures as the situational variation within educators' goal-related messages. To date, the momentary variation of goal structures has not been examined in the context of students' subjective experience within the high school science classroom. However, recent research indicates that adolescents' subjective experience significantly varies from moment to moment along with teachers' instructional practice (e.g., Schweinle & Turner, 2006; Shernoff, Knauth, & Makris, 2000; Shumow et al., 2013), reinforcing the supposition that goal structures may also significantly vary from moment to moment depending on teachers' instructional practice.

The momentary variation of goal structures were objectively observed in high school science classrooms. Investigations of goal structures have primarily utilized single administration surveys such as the Patterns of Adaptive Learning Survey (PALS; e.g., Senko et al., 2011). Though this method may provide measures of student perception, single administration surveys do not provide detailed information concerning momentary variation. For example, single administration surveys do not provide information about the variation in student cognition over time, or what specific contextual factors may effect this variation (Linnenbrink, 2005).

Research integrating objective observation of goal structures has proven to be a valuable method when coupled with survey administration (e.g., Meece, 1991; Patrick et al., 2002; Schweinle & Turner, 2006; Turner et al., 2002). Objective observations of the classroom environment assist in linking student self-reports to a given activity or instructional practice. For example, Turner and colleagues observed fifth- and sixth-grade mathematics classrooms and recorded teacher demeanor and classroom activities and discourse (Schweinle & Turner, 2006; Turner et al., 1998). These researchers linked their objective classroom observations with student self-reports using an ESF-type form. This work linked student experience to instructional practices that would not typically be discernible if only using self-report measures (Hektner et al., 2007). Similarly, the objective observation of the classroom environment coupled with ESM gave the current research a way to link the momentary variation in students' cognitive engagement to the momentary variation in classroom goal structure.

Instructional Practice

Patterns of instructional practice associated with specific goal structures (i.e., mastery, performance, or multiple goal structures) were also examined. Within the context of achievement goal theory, different patterns of instructional practice are associated with specific classroom goal structures. For example, in mastery structured classrooms, an emphasis is placed on mastery, personal improvement, and understanding. However, in performance structured classrooms, an emphasis is placed on relative ability and competition. Teachers may exhibit multiple instructional practices that contribute to the perception of different goal structures (Ames, 1992). In addition, Anderman, Patrick, Hruda, and Linnenbrink (2002) indicated that specific teacher behaviors may be more influential than general instructional practices. Within this study, the examples of instructional practice associated with each goal structure were used to develop the coding manual for the objective observation of momentary goal structures (Zaleski, 2012). As a result, the objective observation of instructional practice was used to provide insight into the variation of classroom goal structures from moment to moment.

Cognitive Engagement

For the purpose of this study, cognitive engagement is defined as a psychological investment in learning (e.g., Newmann, 1992; Wehlage, Rutter, Smith, Lesko, & Fernandez, 1989). Variation in student engagement results from interaction of the individual with the classroom environment (Bong, 2001; Connell, 1990; Finn & Rock, 1997). The Experience Sampling Method is often used to measure the relationship between students’ cognitive engagement and the variation in the classroom environment (e.g., Csikszentmihalyi & Schneider, 2000; Shernoff et al., 2000; Uekewa et al., 2007; Yair, 2000). Both Yair (2000) and Uekewa et al. (2007), for example, found that within high school math and science classrooms, student engagement significantly varied by classroom activity. Students were more engaged during student-centered activities such as laboratory work, group work, and discussion than during teacher-centered activities such as a lecture.

Research examining cognitive engagement in the context of achievement goal theory is limited, and does not provide a clear picture of the influence of goal structures on student engagement (e.g., Ames, 1992; Kaplan, Middleton, Urdan, & Midgley, 2002; Linnenbrink, 2005; Pintrich, 2000; Wolters, 2004). However, Ames and Archer (1988) found that students’ perceptions of mastery and performance goal structures showed different patterns of beliefs about the causes of success and failure, and that mastery goal structures foster sustained student interest and involvement in learning. In addition, students who adopt a mastery goal orientation in science or who have teachers who foster a mastery goal structure are more engaged and use more effective learning strategies than students who adopt a performance goal orientation or who have teachers who foster a performance goal structure (Anderman & Young, 1994; Anderman, Austin, & Johnson, 2002; Meece, Anderman, & Anderman, 2006; Nolen & Haladyna, 1990; Pugh, Linnenbrink-Garcia, Koskey, Stewart, & Manzey, 2010). Ainly, Hidi, and Berndorft (2002) found that clear instructional goals enhanced student engagement. In a review of engagement research, Fredericks, Blumenfeld, and Paris (2004) called for measures of engagement that are multidimensional and context dependent. The use of ESM paired with objective observations of classroom context answers this call.

Gender and Achievement

Finally, it may be important to consider both student gender and prior science achievement when examining the effects of classroom goal structures in high school science. Literature examining goal structures in the context of science education is relatively scarce (e.g., Meece et al., 2006; Pajares, Brinter, & Valiante, 2000). However, gender is a dominant theme within the study of science education (e.g., DeBacker & Nelson, 2000; Freeman, 2004; Jones, Howe, & Rua, 2000). Evidence also suggests gender is linked to students’ behaviors and beliefs, which vary in relation to the classroom context (Turner & Onorato, 1999). In addition, prior academic achievement has been linked to increased engagement in school (Goodenow, 1993; Lee & Smith, 1993, 1994). Therefore, gender and prior science achievement were taken into consideration in this study.

In summary, this study posed two questions: (1) Do classroom goal structures vary from moment to moment? (2) If so, what is the relationship between momentary classroom goal structures and students’ momentary cognitive engagement in high school science classrooms, controlling for student gender and prior science achievement?

Methodology

This study used data from the Science-in-the-Moment study (Schmidt, Smith, & Shumow, 2009), which was collected using the Experience Sampling Method (ESM). As noted earlier, ESM is a method that has been used to successfully document the link between students' subjective experience and momentary classroom context (Hektner et al., 2007).

Setting and Participants

Data were collected in 2009 from one high school serving a diverse community of students in a large metropolitan area in the Midwest. The school serves 9th through 12th grade students, with an approximate enrollment of 3300 at the time of data collection. The study included 244 high school students enrolled in 12 science classrooms, made up of three sections each of general science, biology, chemistry, and physics. The demographic characteristics of the participant sample are representative of the school at large (see Table 1). The overall student participation rate across all classrooms was 91%, with half of the classrooms studied having 100% participation.

Table 1
Student Demographics

Variable	% of Sample
Gender	
Male	53%
Female	47%
Ethnicity	
Hispanic	42%
White	37%
Black	12%
Multi-Racial	6%
Asian/Pacific Islander	2%
American Indian	1%

Note. Adapted from "Executive Summary of the Science-in-the-Moment Project," by J.A. Schmidt, M.C. Smith, and L. Shumow, 2009, unpublished manuscript.

Instruments and Procedures

Within each of the 12 science classrooms, data were collected over two time periods during the school year, once in the fall and once in the spring. For both periods, methods of data collection included traditional surveys, video data, and ESM. Data were collected from all classrooms during the same period so as to represent the same point in the science curriculum. In the fall period of data collection, students completed a survey that requested information such as demographic characteristics, educational and occupational aspirations, and school experiences.

Experience Sampling Method. During each period of data collection, students' subjective experiences were measured repeatedly over a period of five consecutive school days using a variant of ESM. All students wore vibrating pagers which signaled them unobtrusively at two randomly selected times during each day's class. Students were signaled a total of 4880 times. In response to each signal, students completed an Experience Sampling Form (ESF). The ESF asked students to record their activities and thoughts at the time of the signal, along with various dimensions of their subjective experience. In total, 4136 responses were collected, with an average response rate of 92%. Participant non-response to the ESM was nearly entirely attributable to school absence (Schmidt et al., 2009).

Video Data. During the 10 days in which ESM was administered, classrooms were also videotaped. One hundred hours of video were recorded. ESM signals were marked on the video, linking student responses to specific sections of the video footage. The video data was coded for momentary classroom goal structure five minutes before each ESM signal in order to link instructional practices that were most closely associated with the collection of ESM data. Four hundred and eighty video segments were coded.

Measures

The dependent measure used in this study is cognitive engagement. Using a zero to three Likert response scale (i.e., 0 = *not at all*, 1 = *a little*, 2 = *somewhat*, 3 = *very much*) students reported on cognitive dimensions of their subjective experience in the context of the activity at the time of the signal by responding to various questions. Cognitive engagement is a composite of a student's responses to the questions "How well were you concentrating?" and "How hard were you working?" (a =.80; M = 1.82; SD = .89). The independent measures used in this study are momentary classroom goal structure, student gender, and prior science achievement. Prior science achievement was measured using students' self-reported average prior science grades (i.e., 0 = F, 1 = D, 2 = C, 3 = B, 4 = A).

Momentary Classroom Goal Structure. Two primary goal structures, mastery and performance goal structure, were coded. Each video segment was coded as yes or no, indicating the presence or absence of each goal structure. It is possible that a video segment could be coded as either being simultaneously mastery structured *and* performance structured or as neither mastery nor performance structured. A detailed coding manual was created that outlines exactly how each segment of video was coded (Zaleski, 2012). The manual adapted aspects of both the Manual for the Patterns of Adaptive Learning Scales (PALS; Midgley et al., 2000) and the Observing Patterns of Adaptive Learning: A Protocol for Classroom Observations (OPAL; Patrick et al., 1997). It outlines the indicators of classroom goal structures as well as possible features of the classroom where instances of classroom goal structures may become apparent. A second coder coded 20% of the video segments for reliability purposes. The final reliability coding yielded a 99% rate of reliability.

Instructional Practice. The video data had previously been coded for teachers' instructional practices (Schmidt et al., 2009). The instructional practices were aligned with each ESM signal, and each lesson was coded for the instructional practices used. All classroom activities were categorized using 1 of 10 codes to indicate the dominant instructional practice at that moment. Categories included lecture or lecture/discussion, individual student seatwork, group seatwork, tests/quizzes, whole class discussion, student presentation/demonstration, showing a video/movie, lab work, non-instructional time (i.e., course-related but not content-related), and off-task activity. For many of these general instructional practice codes, more detailed coding was also applied. For example, activities coded as being related to tests/quizzes were also characterized using one of the following designators: test preparation/review activity, taking a test, or reviewing answers after the test has been completed (Schmidt et al., 2009).

Analytical Strategy

This research required a multilevel approach that considers multiple levels of data simultaneously. These data may be thought of as nested data structures which are commonly found in educational data sets (e.g., signal-level data nested within student-level data). To address this complex data structure, hierarchical linear modeling (HLM) was used. HLM may be used to analyze nested data with unequal numbers of observations across individuals and unequally spaced time intervals between observations (Raudenbush & Bryk, 2002). HLM is often used with signal-level data collected using ESM (Hektner et al., 2007).

The analysis may be thought of as a nested set of multiple regression equations. At the first level, coefficients are estimated for an equation within each person that expresses a dependent variable (e.g., cognitive engagement) as a function of one or more other response-level variables. These individual parameter estimates then become the dependent variables in the Level 2 equations, in which estimates of effects for each student are produced. For a review of HLM methods see Raudenbush & Bryk (2002).

Results

Descriptive statistics including means and standard deviations were generated for all signal-level and student-level variables included in this study (see Table 2). On average, students reported being “somewhat” cognitively engaged during science class. In addition, students reported that their average prior science achievement was “mostly B’s.” Finally, the frequency and percent of each momentary goal structure is presented in Table 3. Performance goal structures were the dominant goal structure present within this study.

Table 2
Descriptive Statistics

Variables	*M*	*SD*
Signal-Level (*N*=3960)		
Cognitive Engagement	1.82	0.89
Student-Level (*N*=230)		
Prior Achievement	3.23	0.91

Table 3
Observed Frequency of Momentary Classroom Goal Structures

Goal Structure	Frequency	(%)
Mastery	120	(25)
Performance	260	(54.2)
Multiple	40	(8.3)
None	60	(12.5)

Note. N=480.

Momentary Goal Structures and Cognitive Engagement

The relationship between momentary classroom goal structures and students' momentary cognitive engagement, student gender, and prior science achievement were examined. Multiple goal structures were rarely observed at the momentary level and therefore were not included in the models. The models presented in Table 4 compare momentary mastery and performance goal structures to moments that were coded as having no goal structure. In order to test all goal structures against one another, a similar model was run with performance goal structure as the omitted goal structure category (see Table 5).

This was accomplished through a series of two-level hierarchical linear models, with momentary responses at Level 1 and person level characteristics (i.e., gender and prior science achievement) at Level 2. Model 1(a) presented in Table 5 represents the unconditional model which examines the outcome, cognitive engagement, without any predictors. Model 1(b) includes gender and prior science achievement as predictor variables. The only random effect that was found to be significant was r_0. Therefore, the remaining error term was fixed. Model 1(c) represents the fully conditional model which includes the predictors, gender, and prior science achievement at Level 2, and momentary mastery classroom goal structures and momentary performance classroom goal structures at Level 1.

Model 1(d) indicates that students' reports of momentary cognitive engagement do not differ between males and females. However, significant positive relationships were found between students' momentary cognitive engagement and prior science achievement (γ_{02} = 0.10, *SE*= 0.04, p = .008) and students' momentary cognitive engagement and momentary mastery and performance classroom goal structures for students with average prior science achievement (γ_{10} = 0.09, *SE*= 0.03, p = .004; γ_{20} = 0.10, *SE*= 0.03, p = .003), respectively. Therefore, students' momentary cognitive engagement significantly increased when students reported higher prior science achievement. In addition, students' momentary cognitive engagement significantly increased when instructional moments were mastery or performance goal structured compared to moments that had no identifiable goal structure for students with average prior science achievement.

Table 4
Two-Level HLM Models Examining the Effects of Momentary Mastery and Performance Classroom Goal Structures on Cognitive Engagement

Fixed Effect	**Model 1(a)**		**Model 1(b)**		**Model 1(c)**		**Model 1(d)**	
Intercept, γ_{00}	1.82 (0.04)	***	1.45 (0.14)	***	1.37 (0.14)	***	1.38 (0.14)	***
Gender, γ_{01}			0.06 (0.07)		0.06 (0.07)		0.06 (0.07)	
Prior Achievement, γ_{02}			0.10 (0.04)	**	0.10 (0.04)	**	0.10 (0.04)	**
Mastery Slope, γ_{10}					0.09 (0.03)	**	0.09 (0.03)	**
Performance Slope, γ_{20}					0.10 (0.03)	**	0.10 (0.03)	**
Random Effect								
Level 1, e	0.52		0.52		0.51		0.51	
Level 2, r_0	0.26 (229)	***	0.25 (227)	***	0.30 (174)	***	0.28 (220)	***
Mastery Slope, r_1					0.02 (176)			
Performance Slope, r_2					0.08 (176)	***	0.06 (222)	***

Note. * $p<.05$, ** $p<.01$, *** $p<.001$; Under fixed effects the standard errors are presented within parentheses, and under random effects the degrees of freedom are presented within parentheses.

Table 5 presents similar two-level models examining the relationship between momentary classroom goal structures and students' momentary cognitive engagement. However, the reference group was changed to the performance goal structure category to allow for the direct comparison of mastery and performance goal structures. Model 2(a) represents the unconditional model which examines the outcome, cognitive engagement, without any predictors. Model 2(b) includes gender and prior science achievement as predictor variables. Model 2(c) represents the fully conditional model which includes the predictors, gender, prior science achievement, momentary mastery classroom goal structures, and no classroom goal structure. The only random effects that were found to be significant were r_0 and r_2. Therefore, r_1 was fixed. Model 2(d) represents the final conditional model. When the model was restructured to allow for the direct comparison of mastery and performance goal structures, students' momentary cognitive engagement was not significantly different during mastery goal structured moments than during performance goal structured moments.

Table 5
Two-Level HLM Models Examining the Effects of Momentary Mastery and Performance Classroom Goal Structures on Cognitive Engagement

Fixed Effect	**Model 2(a)**		**Model 2(b)**		**Model 2(c)**		**Model 2(d)**	
Intercept, γ_{00}	1.82 (0.04)	***	1.45 (0.14)	***	1.47 (0.14)	***	1.48 (0.14)	***
Gender, γ_{01}			0.06 (0.07)		0.06 (0.07)		0.06 (0.07)	
Prior Achievement, γ_{02}			0.10 (0.04)	**	0.11 (0.04)	**	0.11 (0.04)	**
Mastery Slope, γ_{10}					-0.01 (0.03)		-0.01 (0.03)	
None Slope, γ_{20}					-0.10 (0.04)	**	-0.10 (0.03)	**
Random Effect								
Level 1, e	0.52		0.52		0.51		0.51	
Level 2, r_0	0.26 (229)	***	0.25 (227)	***	0.25 (169)	***	0.25 (204)	***
Mastery Slope, r_1					0.03(171)			
Performance Slope, r_2					0.08 (171)	***	0.05 (206)	***

Note. * $p<.05$, ** $p<.01$, *** $p<.001$; Under fixed effects the standard errors are presented within parentheses, and under random effects the degrees of freedom are presented within parentheses.

Instructional Practices

Moments characterized as predominantly mastery structured, performance structured or multiple goal structured were examined for patterns of instructional practice. Instructional practices had been previously coded. Therefore, descriptive statistics were used to look for possible instructional patterns at the momentary level of analysis.

Table 6
Distribution of Instructional Practice by Momentary Classroom Goal Structure

	Mastery		**Performance**		**Multiple**		**None**		**Total**	
Practice	**Frequency (%)**									
Lecture	23	(19.2)	25	(9.6)	5	(12.5)	8	(13.3)	61	(12.7)
Seatwork	11	(9.2)	71	(27.3)	10	(25)	10	(16.7)	102	(21.3)
Test/Quiz	26	(21.5)	54	(20.8)	3	(7.5)	8	(13.3)	91	(18.9)
Discussion	6	(5)	2	(.8)	1	(2.5)	0	(0)	9	(1.9)
Presentation	25	(20.8)	12	(4.6)	2	(5)	0	(0)	39	(8.1)
Video	10	(8.4)	8	(3.1)	1	(2.5)	0	(0)	19	(4)
Lab	5	(4.2)	67	(25.7)	17	(42.5)	30	(50)	119	(24.8)
Non-Instructional	14	(11.7)	20	(7.7)	1	(2.5)	4	(6.7)	39	(8.1)
Off Task	0	(0)	1	(.4)	0	(0)	0	(0)	1	(.2)
Total	120	(100)	260	(100)	40	(100)	60	(100)	480	(100)

Note. N=480 instructional moments.

The primary instructional practices observed during mastery goal structured moments included tests and quizzes, presentation, and lecture. The primary instructional practices observed during performance goal structured moments included seatwork, lab activities, and tests and quizzes. Finally, the primary instructional practice observed during multiple goal structured moments and moments that had no goal structure was lab activities. As stated earlier, a majority of instructional moments were coded as performance goal structured.

Examples of mastery and performance goal structured moments, independent of instructional practice, aligned with the established definitions found in the achievement goal literature. For example, when instructional practices were mastery goal structured, teachers emphasized the importance of developing competence. When instructional practices were performance goal structured, teachers emphasized the importance of demonstrating competence (Ames, 1992). Therefore, the instructional practice did not determine the momentary goal structure; the momentary behaviors of the teacher determined the momentary goal structure. This finding supports prior studies examining instructional practice and goal structure (e.g., Anderman, Patrick et al., 2002). The following examples from this study demonstrate this finding.

In the first example, students are engaged in a lab activity. This moment was coded as having a multiple goal structure. In this example students are identifying different aspects of early man and why the skeletal structure evolved the way that it did. During this moment the participant teacher is encouraging students to ask questions. However, the teacher states that the lab is worth points and if the students do not finish the lab on time it will adversely affect their grade, thus demonstrating a moment containing both mastery and performance goal structures.

> (*Student says she's forgotten how to measure the brow ridge*)…Okay eyebrows, do you feel that bone under there? (*Teacher and student feel their eyebrows*). Look at his. (*Teacher points to worksheet*). Do you get what the word ridge means? (*Student says, 'It goes up'*). Yeah, does he have a brow ridge? (*Student says, 'Yes'*). What about him? (*Student says, 'A little bit'*). Okay are you seeing this? (*Teacher engages another student*). What about him? (*Student says, 'No'*). Okay that's all they're asking…is it present or is it bigger or smaller that's all. Good questions…
>
> Hey are you guys doing okay, are you getting that? (*Student asks a question*). You can just say a resistance to bacteria. Does that make sense to you when you put it in those words? (*Student says, 'Yeah'*). You're on the right track… (*Student asks a question*). Well what does it say? (*Student reads question aloud*)…We're looking at the jaw change and the teeth change. What might have been some things that led to the change, the evolution in the jaw structure? So I'm just asking you to brainstorm and be creative…I'll try not to give you answers but get your brain working in the right direction…
>
> Okay guys, the lab is due in six minutes. What you don't finish you don't get points for. I see some people working hard and I see some people not working, and the green sheet needs to be done for homework if you don't finish it in class. You have me to ask questions now, you don't during homework. Again, I see some people not really addressing what they need to be…

In the second example, students are engaged in preparing for a test. These moments were coded as mastery structured. In this example, the participant teacher utilized a review activity in order to check students' understanding of content, and encouraged students to ask questions and engage in discussion. The participant teacher began the class period by reviewing key terminology and checking students' understanding before going over the answers on a review assignment that had been completed as homework.

> Tomorrow is a test day. The test is actually pretty short so we'll probably have time to do some review at the beginning of class…Okay so real quick summary from Friday. So one of the things we talked about on Friday were two periodic trends in particular, and I think they're still up here on the board (*Key chemistry terminology is magnetized to the white board*). We talked about atomic radius and we also talked about ionization energy…
>
> So can anyone tell me what the trend is for atomic radius? As you go from left to right what happens to the size of the atom again? Does it get bigger or smaller? (*Multiple students answer*). Right, it actually gets smaller as you go from left to right, and as you go from top to bottom these things get larger, get bigger right?
>
> One of the cool things that happens here is that the trend for atomic radius and ionization energy are opposite of each other. So on the periodic table as you go from left to right your atomic radius gets smaller. So then what is your ionization energy doing? (*Multiple students answer*). It's getting larger, so they're exact opposites of each other. As you go from top to bottom on the periodic table your atomic radius is getting larger so that means

> your ionization energy is getting smaller. So let's go through here and check our answers. So what did you guys get for number one?

The participant teacher discussed each question on the review worksheet, asking questions, checking for student understanding, and answering student questions. After this activity was complete, the teacher began an interactive review activity where students answered practice test questions projected on the white board using remote controls or clickers. These systems are sometimes called student response systems or classroom response systems. The student response system allowed the teacher to immediately see how many students answered each question correctly, giving the teacher the opportunity to check for understanding and to review content:

> You guys remember how this works, right? We did this last time. I'm going to put questions up here and you're going to hit the answer to the question using the remote… So here we go…A lot of these questions are pretty similar to what you will see on the test tomorrow (*Teacher reads the first question aloud*). So how many periods are there in a periodic table? (*Students have five multiple choice answers to choose from*). There's a periodic table over there in case you forgot (*Teacher points to the periodic table on the wall*).
>
> Alright, what do you guys think is the answer? (*Students give multiple answers*). The answer is C. So what's a period again? Up and down or left and right? (*Students give multiple answers*). Periods are left and right. So left to right (*Teacher points to the periodic table and counts the periods*)…So there are seven periods on the periodic table, so if you missed that question that would be a good thing to jot down in your notes.

These examples demonstrate that instructional practices do not necessarily determine the momentary goal structure of the classroom. Often, lab activities are associated with mastery goal structures and test preparation is associated with performance goal structures. However, these two teachers demonstrated that their goal messages, supported by their momentary behaviors, determined the goal structure of their classrooms, rather than the instructional practice alone. Throughout this study, it was apparent that the momentary behaviors of the teacher determined the momentary goal structure of the classroom.

Discussion

The results of this study indicate that goal structures significantly vary from moment to moment and have a significant impact on student cognition substantiating the concept of momentary goal structures. Momentary goal structures are defined as the situational variation within educators' goal-related messages. This study developed an initial procedure for measuring momentary goal structures using objective observation. The objective observation and measurement of momentary goal structures provides an opportunity to improve understanding of achievement goal dynamics and clarify theoretical arguments within achievement goal theory.

For example, much of the achievement goal research has focused on the individual. This study extended achievement goal research beyond self-report measures and examined the interaction between the individual and the classroom in actual time. A number of achievement goal researchers have used classroom observations in addition to self-report data to provide richer descriptions of the influence of the classroom context (e.g., Patrick, et al., 2002; Turner et al., 2002). However, none have examined these relationships at the momentary level of analysis. The use of ESM provides achievement goal researchers opportunities to delve deeper into the momentary interaction between context and cognition.

In addition, the finding that promoting any identifiable goal structure, as opposed to no goal structure, is associated with increased cognitive engagement supports the argument of Senko et al. (2011) that both mastery and performance goals have potential benefits. In the case of this study, both momentary mastery and performance goal structures increased students' cognitive engagement. A possible interpretation of this finding may be that providing students with an instructional goal or learning target may be most important, due to the lack of identifiable goal structure found in many classrooms in this study.

Conclusions and Future Directions

Further development of the initial procedures for measuring momentary goal structure and the exploration of the relationship between momentary goal structure and student cognition is needed. From a theoretical perspective, the coding procedures for momentary goal structures may be expanded to include approach and avoidance goal structures, with the aim of further clarifying the influence of momentary mastery and performance goal structures on student cognition. In addition, research examining the impact of momentary classroom goal structures on students' adoption of personal goal orientations is needed. The literature supports the relationship between classroom goal structures and students' adoption of personal goal orientations (e.g., Kaplan, Gheen, & Midgley, 2002; Karabenick, 2004); however, no literature has examined the variation in this relationship at the momentary level of analysis. ESM may be adapted to examine the momentary variation of students' personal goal orientations in relation to the variation in momentary classroom goal structure. In addition, examining these relationships using HLM allows for the analysis of the momentary interaction between context and cognition within achievement goal theory. Examining the momentary variation of students' personal goal orientation along with the momentary variation of classroom goal structures may provide additional insight into achievement goal theory.

From an instructional perspective, the conclusions that classroom goal structures significantly vary from moment to moment, and that the momentary behaviors of the teacher determine the momentary goal structure, indicates that a teacher's actions and messages from moment to moment have a greater impact on classroom context than general instructional practices. This is supported by literature examining the relationship between instructional climate and teacher practices (e.g., Anderman, L.H. et al., 2002). It appears that teachers should focus on promoting specific classroom goal structures through their momentary interactions with students, and reflect on the influence that these momentary actions have on student cognition in order to increase engagement and achievement.

Author Notes

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