

The Promise of Faculty Care in Undergraduate STEM Courses

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Abstract - Work in Progress. Introductory, or “weed out” chemistry courses are well-known for deterring undergraduate students from pursuing STEM (Science, Technology, Engineering, and Mathematics) fields. Specifically, students’ motivations resulting from experiences in these courses can influence STEM retention. Using grounded theory, our preliminary analysis of qualitative data collected in an undergraduate chemistry course has identified “faculty care” as an emergent construct of importance to student motivations. Our emergent definition of care is students’ perception that their instructors recognize and communicate actionable steps towards self-improvement or illustrate concern, encouragement, or relational interest for the students in academic and non-academic settings, or in an unexpected, personal way. We found that students hold gendered interpretations of faculty care, and these interpretations may give rise to gendered motivational attitudes. This work raises questions about the ways specific classroom activities or faculty-student interactions allow faculty to communicate a sense of care for their students and thereby affect students’ motivational attitudes in their classrooms. More broadly, this work may have implications for our understanding of the ways faculty can address gendered patterns in STEM participation.

Keywords—care, faculty-student interaction, motivation, emotion, affect, relatedness, gender

I. INTRODUCTION

Seemingly simple faculty-student interactions can have powerful impacts on learner engagement in the classroom. Social-cognitive and motivation theories posit that when students enter a learning environment, they initiate a complex evaluation of the contextual conditions relative to their beliefs, expectations, and goals. The ways in which students make sense of classroom conditions influence how they feel, motivate themselves, engage with others, and perform in their classes.

Social-cognitive theorists emphasize that learners’ acquisition of new knowledge and skills is determined by personal perceptions such as self-efficacy and values, behavioral feedback (e.g., successfully seeking help or managing time) and environmental cues such as positive instructor feedback or directly observable outcomes (e.g.,

fabricating a working prototype or solving a problem) [1,2]. Social-cognitive theory assumes that all learners continually observe, judge, and react to personal, behavioral, and environmental signals [3]. Relative skill in these processes varies from person to person, and the strength and impact of personal, behavioral, and environmental stimuli vary from classroom to classroom. For example, individuals may be more or less sensitive to instructors’ verbal optimism or pessimism [4], more or less able to internalize instructors’ learning goals, or more or less distressed by unexpected changes in the course schedule or content coverage.

Cognitive Evaluation Theory (CET), a sub-theory of Self-Determination Theory (SDT), describes how learners interpret and respond *motivationally* to certain social and environmental influences [5]. CET focuses on learners’ psychological needs of competence and autonomy, and postulates that effectance-promoting performance feedback, individual choice, and learner control will enhance motivation, while threats, controlling directives, and pressured evaluations can undermine motivation [5]. Empirical research supports CET, and shows that negative feedback has detrimental effects on learners’ sense of competence and intrinsic motivation, while positive feedback has the opposite effect [6,7]. Some studies indicate that instructor feedback may have important gender-specific effects on student engagement and motivation [4,8-10].

An important aspect of learners’ evaluation of, and response to, classroom situations is their perception of the *relational nature* of the environment, specifically with regard to instructor interactions [11]. Will the professor understand and support their learning needs and goals? Will they build a personal rapport with their instructor? Will the professor’s input be critical or compassionate? Will the instructor’s course approaches align with their academic beliefs and expectations? SDT describes interpersonal dynamics with its *relatedness* construct, defined as a sense of social belonging and connection to others. Relatedness emphasizes learners’ need to feel safe and secure in the learning environment, and to experience support by warm and caring teachers and peers [5]. Relatedness has been shown to correlate positively with students’ emotional and behavioral engagement, and with positive motivations, satisfaction, and persistence [12-15].

In this paper, we examine how learners evaluate and respond to introductory STEM learning experiences through the analytical construct of *student perceptions of faculty*

care. Faculty care as a construct is not new in the educational literature [e.g., 16-19]; however, much of the prior work is focused on K-12 [e.g., 11,12,20] or nursing student populations [e.g., 21,22]. This study contributes to the educational community's understanding of faculty care by applying a grounded theory approach to identify an emergent construct of students' perceptions of faculty care, and by directly linking faculty care to students' motivational and emotional responses in specific classroom situations.

II. METHODS

This work is part of a larger, mixed-methods study seeking to understand student situational motivation in STEM courses. This qualitative analysis focuses on one study site, a medium-sized, private university. The study population consisted of students from one section of a general chemistry course taught by a male professor: 12 students in total, with 5 men and 7 women. The students selected for this analysis completed at least 7 of the 10 seven-item open-ended surveys, administered roughly every other week. Survey respondents reflected on their activities, emotions, motivations, perceived relevance, and performance as they pertained to the course during the previous week. The instrument was interpretively validated through participant feedback [23]. Other data sources included institutional learning contextual information, self-reported demographic information, and course materials.

Grounded theory was used as the main analytical approach [24-26]. The data were coded for important concepts and themes using the constant comparative method. In-vivo and open coding methods were used as the beginning stages of the analytical process. Theoretical validity checks were performed using peer review strategies through larger research group discussions and codebook re-evaluations, a process that continued until a saturation point was reached and reliability was achieved through inter-coder reliability testing (86%). Thematic matrices and analytical memos were then created with particular focus on the gender variable [23,27-28].

III. RESULTS AND DISCUSSION

Grounded theory approach allowed for identification of a "faculty care" construct. Our emergent definition of this construct is students' perception that their instructor recognizes and communicates actionable steps towards self-improvement or demonstrates concern, encouragement, or interest for the students in academic and non-academic settings. We also identified an emergent construct of "lack of faculty care," which is defined as students' perception that the instructor does not have an interest in their own or the class's well-being, growth, or success, be it academic or personal. We found that these two constructs play an important role in influencing students' motivations, both positively and negatively, throughout a semester.

In the following sections, we describe three themes that underlie our preliminary emergent theoretical framework: (a) the effect of students' perceptions of faculty care and lack thereof on motivations, (b) the academic contexts that

shape students' perceptions of faculty care, and (c) gendered patterns in students' perceptions and interpretations of faculty care.

A. The Effect of Perceived Care on Students' Motivations and Motivation-Related Emotions

Our findings suggest that students' perceptions of the presence or lack of faculty care are linked to their motivations, and to the emotions they associate with their motivations. We found that when students relate stories of faculty care, they also describe their motivations which are often associated with positive emotional responses. For example, Samuel's response to a prompt asking him to describe his motivation, written as a comma-separated list, illustrates his impression of faculty care alongside his motivation to succeed in the course:

Wanting to go to medical school, pride in myself that I know the stuff, I generally like chemistry and want to do the best I can, expectations for my grade and from the teacher, wanting not to disappoint the teacher now that I have a relationship with him. (Samuel, Week 7)

In this response, Samuel discusses his long- and short-term goals in conjunction with his "relationship with [the instructor]". His description of the "expectations" he feels from his professor gives insight into how this relationship engenders a motivation for Samuel "to not disappoint the teacher." Of significance, however, is that Samuel perceives these expectations, whether or not they actually exist. He also details positive emotions in this response, discussing "pride" in himself and "generally like[ing] chemistry."

In contrast, during weeks when students perceive an explicit or implicit lack of care, nearly half of the respondents describe difficulty feeling motivated in the class. In the words of Sage,

My professor sent out a study guide, which should have been very helpful. However, it didn't get sent out until the night before the test, so I didn't base most of my studying around it and I think I lost some points because of that. (Sage, Week 8)

Sage implies a lack of care in her perception that the faculty member was inconsiderate in providing timely exam-related information. In the same survey, Sage also pronounces,

It's hard to focus on this when I have so many other things to do- finals start in about 7 days and I am really spread thin. It's getting hard to motivate myself. (Sage, Week 8)

Although Sage does not directly connect the faculty's lack of care to her struggle to find focus and motivation, it is significant that she describes negative emotions associated with absence of motivation during the same week that she perceives lack of faculty care.

These initial findings indicate that a perception of faculty care or lack thereof may be related to students' evolving motivational attitudes, as well as the emotional component of their drive to learn. This is consistent with prior social-cognitive and motivation research that

illustrates relationships among students' appraisals of environmental support, academic emotions, and motivation and engagement [3,5] as well as students' perceived pedagogical care and motivation mediated by the sense of relatedness [13]. In the case of Samuel, the combination of personal goals (medical school), intrinsic interest in chemistry, and relatedness to and support from his instructor (caring via perceived high expectations), triggers positive emotions (pride) and a desire to succeed [13,29,30]. For Sage, a perceived lack of instructor care generates test anxiety, helplessness, and decreased motivation – reactions that are expected, in light of existing theoretical and empirical research [13,29,30]. Sage's emphasis on performance goals, as opposed to Samuel's mastery goal to "know the stuff," may also contribute a psychological and emotional vulnerability to her chemistry experience [31].

B. The Contexts in Which Care is Perceived

We identified several contexts and faculty actions or behaviors that correlate with students' perceptions of faculty care, within both academic and non-academic settings. As these contexts are still emergent, we will only discuss the four situations that respondents most frequently cite.

Firstly, students perceive faculty availability for academic help as a way of caring for them. Several students discuss how the professor makes himself available in class, during office hours, or review sessions. Cordelia acknowledges the professor's availability by saying,

He was available almost every single day and was always there to give encouraging words as well as help me with the material. (Cordelia, Final Week)

Cordelia appreciates the access she has to her professor for academic support and encouragement, something that many other students also describe favorably. This aspect of our emergent construct of faculty care is consistent with literature on perceived pedagogical care [13].

Secondly, we found that faculty thoughtfulness about the course structure or assignment design is an academic action that indicates care to many students. Hugh attributes his learning progress to the instructor's pedagogical choices,

The homework is integral in my understanding of the material and the way that our professor has structured it is encouraging... It is structured so that there is a due date, but you are not penalized for how many times you attempt a question prior to ... due date... (Hugh, Week 1)

Hugh illustrates the homework's usefulness to his learning and credits the professor with thoughtful assignment design oriented toward mastery learning. Hugh echoes many students in finding care and encouragement through a well-designed course structure. To our knowledge, this aspect of our emergent faculty care construct has not been described in literature on perceived pedagogical care [13,20].

Students also perceive faculty care in the extent to which course content is covered. As an example, May said:

...[W]e had a review session that focused on problem solving. I appreciated that the professor also explained

the concept behind each problem before working out the solution to make sure that everyone understood why we were doing the problem one way. (May, Week 9)

May finds significance in the professor's attentiveness to thoroughly covering material such that all students may understand. This emergent aspect of our faculty care construct seems to be new to the pedagogical care literature as well [13,20]. From the SDT perspective, it is interesting that the instructor's detailed structure appears to address May's psychological need for competence, which is essential for positive motivations [5], while potentially reducing autonomy (choice, control, freedom), which is a strong psychological mediator for internalized motivation [7]. As such, one might expect to see somewhat externalized motivations among students in these specific situations [6].

Finally, faculty care, as related to both efficacy and emotion, also appears when students believe that the professor is not doing enough to cover all the material. This is the most common context in which students perceive a lack of care. Allison describes her frustrations by saying,

I'm just really frustrated because the professor isn't teaching the material very clearly. He goes over simple concepts in depth but skims over the harder questions, often making comments like "you guys know how to do that." (Allison, Week 6)

Allison believes the professor is rushing through important aspects of learning, engendering frustration. She implies that the professor needs to recognize his students' understanding and teach for comprehension. This finding is consistent with prior quantitative studies demonstrating that learners' positive or negative judgments of the instruction quality relate to positive and negative emotions, respectively [32]; however, this aspect of faculty care, to our knowledge, is currently absent from the literature on faculty care [e.g., 13].

C. Gendered Patterns within the Perception of and Interpretation of Care

A final emergent theme is gendered patterns in students' perception and interpretation of faculty care. Both men and women perceive care in academic contexts; however, 4 of the 5 men and 0 of the 7 women perceive faculty care in non-academic contexts. In other words, male students perceive their instructor as caring in both academic and personal contexts, potentially developing a more holistic student-instructor relationship than female students [33].

1) Perception of Faculty Care in Academic Contexts: Men and women in our study describe faculty care in academic contexts differently: women interpret instances of faculty care as purely academic, while men interpret similar instances as relevant to both academic and more personal aspects of their lives. To illustrate this, we compare how one woman and one man interpret similar faculty feedback on their exam. Allison relays her excitement about faculty feedback by saying,

... [the professor] wrote a personal note on my exam congratulating me on my efforts, so I was on Cloud 9...

[which] has also opened up the opportunity for a future letter of recommendation. I'm stoked. (Allison, Week 2)

Allison describes the positive feedback as only relevant to a possible letter of recommendation. Hugh's response to and interpretation of the same situation is more extensive,

When handing back the test my professor congratulated me on my test grade which turned out to be a B+. It was okay, but it made me want to get an A on the next one even more so. I want to show him that I can improve to an A that I would love to have... (Hugh, Week 2)

Hugh depicts faculty feedback as relevant to his future academic aspirations and his desire to prove himself to the professor; but Hugh also discusses his relationship with the professor and his motivations to make the instructor happy and to succeed for him, a more personal and less academic goal. This form of motivation, termed "introjected regulation" in SDT, is certainly better for learning engagement and performance than negatively-framed motives (e.g., avoiding punishment or shame); but it may not reflect a fully internalized motivational response [6].

2) *Perception of Faculty Care in Non-Academic Contexts:* Our findings indicate that male students' perceptions of care are developed through one-on-one meetings, discussions, or general interaction with the professor. Scott directly connects his communication with the instructor after a review session to his motivation:

This week reaffirmed that if I keep close contact with my professor I will feel even more motivated to do well. (Scott, week 9)

Scott recognizes the impact contact with his professor has on him, but does not detail why. Significantly, Scott does not discuss any academic topics in this response.

Some responses reveal that men feel a desire to succeed because of their perceived professor expectations of them. In this way, the relationship they develop with their professor leads them to believe that he is invested in their own success. Samuel feels motivated by this perception:

...I went to meet with the professor before class and just talked to him, now he knows me and I don't ... want to disappoint him. (Samuel, Week 5)

Samuel's desire to not "disappoint" his professor provides insight into why the relationship he has developed affects his motivational attitudes.

Some responses reflect an existing belief the student holds about the professor and their relationship. Hugh illustrates a personal desire to succeed for his professor that stems from his own pre-conceived perception:

Seeing my professor outside of class walking across the university and being happy makes me want to do well in the class not just for myself, but for him as well. In this way his general positive attitude towards the learning of his students and his eagerness to help the students struggling motivates me to do well. (Hugh, Week 2)

By observing the professor's "general positive attitude towards" his students and "eagerness to help the students struggling," Hugh develops a perception of the instructor that motivates him to succeed not only for himself, but also for his professor. Hugh indicates a belief that his success in the class is a way to give back to the instructor for the care he has demonstrated to his students. Potentially through a process of "emotional contagion" [29], his professor "being happy" becomes a motivating factor for Hugh because he cares about the professor on a personal level.

CONCLUSIONS AND FUTURE WORK

Our emergent constructs of faculty care and lack thereof include features that to date have not been attributed to a perception of pedagogical care. Specifically, course structure or pedagogical practices used in class have not been, to our knowledge, explicitly included as important attributes of pedagogical care [e.g., 13]. Of importance is that these emergent constructs also do not explicitly include aspects of relatedness, as defined by SDT [5]; rather, similar to the work of Huff (2009), relatedness seems to serve as a mitigating factor in determining students' emotional responses and corresponding motivational attitudes [11,13]. Further work needs to be done to position our emergent constructs within the landscape of educational literature and specifically determine its positionality vis-à-vis relatedness; in doing so, we hope to use more extensive literature review to enrich our data sources for further analysis.

The three themes underlying our emergent theoretical framework indicate that faculty care and lack thereof influence student motivations, often via relatedness, a finding that is consistent with literature [10-13,15,30]. Our findings suggest that certain actions or contexts may indicate care to a broad cross section of students. However, we have found that gendered perception of context and faculty actions may play a role in students' construction of pedagogical care. Specifically, men may be much more likely to perceive care from their instructors in non-academic context than women. If we are to improve diversity in STEM education, we must further understand the role that faculty care can play on motivational attitudes and motivation-related emotions for all types of students.

This preliminary analysis is based on a small subset of data from an ongoing study, and thus could be expanded in the future. Significantly, our gendered findings were derived from a dataset with a male instructor; our future analyses will include data from courses taught by female faculty, which will allow for comparison of any gendered differences in environments created by male and female instructors. By including datasets from other institutional and pedagogical contexts, we hope to examine how and when faculty care is perceived and what role, if any they may play in establishing students' motivational responses.

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