Gratitude Interventions in a Biology Course to Foster Student Persistence and Success

Lani U. Gleason

Abstract

College students are experiencing a mental health crisis, which has been further exacerbated by the COVID-19 pandemic. This is problematic because stress and anxiety impede learning. One way to combat stress and anxiety is to focus on gratitude, the emotion experienced when we are thankful for positive aspects of our life. In the classroom gratitude has been associated with higher classroom engagement, higher school life satisfaction, higher academic motivation, and higher academic retention. Importantly, a grateful attitude can be taught with interventions. However, more information regarding the implementation and effects of gratitude interventions in the STEM college classroom is needed. Here I describe two simple gratitude interventions that I implemented in an Introduction to Scientific Analysis course in a Biological Sciences Department. A treatment section received gratitude interventions that included 1) keeping a weekly gratitude journal (e.g., listing five things you are grateful for), and 2) writing three letters of gratitude throughout the semester. A control section received regular curriculum. Preliminary comparison of treatment and control sections indicated these interventions are indeed successful at increasing student gratitude. For example, students reported feeling grateful more frequently after the gratitude interventions than they did before the interventions. Student feedback regarding the gratitude interventions was also overwhelmingly positive. Ultimately, the relatively simple technique of gratitude interventions could be easily implemented across a variety of higher education courses to have long-term positive effects and foster student success.

INTRODUCTION

Even before the start of the COVID-19 pandemic, college students were experiencing a mental health crisis (1). Unsurprisingly, the COVID-19 pandemic that led to hundreds of thousands of deaths, job loss, increased financial insecurity, and disrupted social support networks further exacerbated this crisis. Specifically, ~70% of college students felt increased stress during COVID-19 in 2020 (2). Increased anxiety and stress cause many negative effects, but perhaps most relevant to the college classroom is the impediment to learning – a student who is stressed cannot learn effectively (3).

Given the negative effect stress has on learning, solutions to reduce stress in the college classroom and foster greater student success should be explored. One potential strategy is to increase focus on gratitude, which has been shown to reduce stress and anxiety (4, 5). Gratitude is the emotion experienced when we are thankful for positive aspects of our life (6). In addition to less context-specific physical and social benefits (7–9), in the classroom gratitude is associated with higher school life satisfaction (10), higher classroom engagement (11), higher feelings of accomplishment (12), higher academic motivation (13), and increased focus and resilience in learning (14). Gratitude has also been associated with predictors of academic retention and success in college students (15).

Evidence suggests that gratitude results in positive effects through the process of emotional regulation (16). Such self-regulation, which involves metacognition (knowledge and experiences of our own cognitive processes [17]), motivation, and behavior, is crucial for learning (18). For example, science, technology, engineering, and mathematics (STEM) students with more explicit metacognitive beliefs learn new information better and more quickly (19, 20). Moreover, emotion and metacognition influence goal setting, learning, and self-regulated adaptive behaviors (21–23). Given that writing about gratitude increases the emotion-regulation efficacy of undergraduate students (16), a focus on gratitude could thus provide students with essential self-regulation skills to succeed in the college classroom.

Just like other academic skills, gratitude can be developed and improved with deliberate practice. Specifically, a grateful attitude can be taught through interventions such as listing five things we are grateful for (10) or writing a gratitude letter to tell someone we are thankful for how they have improved our lives (24). Gratitude interventions have been well-studied in other contexts and levels of schooling, and several studies have assessed the effects of gratitude interventions in university students (13, 14, 25–29). However, there is currently no information regarding the efficacy of gratitude interventions, and any subsequent positive outcomes, in STEM and biology classrooms at the college level.
For this initial implementation of gratitude interventions, two sections of an Introduction to Scientific Analysis course served as treatment and control groups, with the treatment section receiving gratitude interventions across a 15-week semester. The control section received normal curriculum. I taught both sections to reduce confounding variables. Gratitude interventions consisted of 1) weekly gratitude journaling (e.g., each student lists five things they are grateful for), and 2) letters of gratitude (three letters spread throughout the semester). Both interventions have previously been shown to increase gratitude (10, 24, 30).

DESIGN

I implemented gratitude interventions at California State University Sacramento (Sacramento State) in the Biological Sciences Department. Sacramento State is a minority-serving institution with both Hispanic-Serving Institution (HSL) and Asian-American Native American Pacific Islander Serving Institution (AANAPISI) designations. Overall, the student population consists of a diverse array of various ethnicities, races, and socio-economic classes. In fact, the 2022 U.S. News and World Reports ranks Sacramento State as the fourth most ethnically diverse regional university in the west. In the College of Natural Sciences and Mathematics and specifically in the Biological Sciences Department, many faculty use evidence-based teaching strategies to develop students’ self-regulatory (31) and peer leadership (32) skills.

I implemented gratitude interventions during Spring 2021 in the course BIO100: Introduction to Scientific Analysis (IRB-approved protocol number Cayuse-20-21-142). This course prepares students for upper division Biology coursework and careers in science using a curriculum centered on critical thinking and evidence-based instruction and activities. BIO100 covers core competencies required for the practice of science: 1) evaluative reading, 2) written and oral communication, 3) analysis/quantitative reasoning, and 4) experimental design. In BIO100 students work together in groups of three to complete weekly lecture assignments and lab activities. As a class we spend considerable time in the first few weeks of the semester establishing community guidelines and ensuring students get to know the other members of their group; this is especially important because students work with the same group all semester. In addition, at the start of the semester we discuss the importance of a growth mindset (33) and how every student in the class has the ability to succeed. Overall, the structure of BIO100 creates an environment of trust and helps to facilitate a sense of belonging for all students. This positively influences student motivation (34) and makes students more likely to see the value of required work (35), including gratitude practice.

As noted above, other faculty in my Department and College use similar “non-traditional” approaches in their STEM classrooms to enhance student learning and success. Thus, BIO100 students have potentially been exposed to similar teaching approaches in other courses, priming them for participation in gratitude interventions. I acknowledge that it may be more challenging to implement such interventions in other departments and institutions, especially if the instructor is the only one in their department using such evidence-based practices, and/or is a member themselves of a population that has historically been excluded from STEM (36, 37).

IMPLEMENTATION

Introducing Gratitude Interventions to Students

At the beginning of the semester, I introduced students in the treatment section to the semester-long gratitude interventions in several ways. The syllabus, distributed through the Learning Management System (LMS) before the course started, informed students that they were invited to participate in practices to enhance gratitude in biology students (S1. Gratitude Interventions - Detailed Implementation). On the very first day of class, I verbally reminded students that they would be practicing gratitude that semester. At the end of the first class, I asked students to respond to the question “What are you grateful for today?” in the Zoom chat. (I used the Zoom chat function because I implemented these gratitude interventions in a virtual course environment due to the COVID-19 pandemic.) I intentionally used these initial mentions of gratitude and gratitude practices to make the students more aware of gratitude and its benefits. The discussion on the first day of class also primed students to be more receptive to the semester's gratitude intervention activities.

Week 3 was the first week students were asked to write a gratitude journal entry and a letter of gratitude. I recorded a ~3.5 minute long video describing what gratitude exercises were assigned, and why they were assigned (S2. Gratitude Interventions – Introduction to Students). I embedded this video into the Week 3 module of the LMS so students would see it before completing the week's gratitude intervention assignments.

Weekly Gratitude Journal

The first gratitude intervention consisted of weekly gratitude journaling. I provided this intervention as graded surveys through the LMS Canvas (S3. Gratitude Interventions – Weekly Journal Assignment). As graded surveys, students automatically received full credit for submitting this assignment, regardless of assignment content. Each gratitude journal was worth 1 point. For weekly gratitude journals, I gave students the following prompt through the LMS during Weeks 2-15 of the semester (10):

“There are many things in our lives, both large and small, to be grateful for. Think back over the past week and write down five things in your life that you are thankful for.”

I provided this prompt as an essay question, and students typed their responses directly into the space provided in the Canvas assignment.

Letters of Gratitude

The second gratitude intervention consisted of writing three letters of gratitude throughout the semester during Weeks 3, 8, and 13. Like the gratitude journal, I provided this intervention as graded surveys through the LMS (S4. Gratitude Interventions – Letter of Gratitude Assignments). However, these letters were worth 2 points each. For each letter of gratitude assignment, I asked students to upload a digital copy of their letter; a typed version or a picture of a handwritten letter was accepted. For the first letter of gratitude in Week 3 of the semester, I gave students the following prompt through Canvas (24):
Gratitude Interventions in a Biology Course to Foster Student Persistence and Success

“Call to mind someone who did something for you for which you are extremely grateful but to whom you never expressed your gratitude. Write a one-page letter of gratitude to this individual to express appreciation for them. In your letter describe what this person did, why you are grateful to this person, and how this person’s behavior affected your life.”

For the second letter of gratitude in Week 8 of the semester, I gave students a very similar prompt through Canvas, with the additional instruction that they needed to choose a different person than they did for Gratitude Letter #1.

For the third letter of gratitude in Week 13 of the semester, I again gave students a similar prompt through Canvas. However, for this letter I specifically instructed students to write a letter of gratitude to a previous science, technology, engineering, or math (STEM) teacher, instructor, or professor. Full instructions and prompts for each letter are provided in S4. Gratitude Interventions – Letter of Gratitude Assignments.

**DISCUSSION**

**Increasing Gratitude and Degree Commitment**

Here I present a novel instructional approach based on positive psychology principles to increase student gratitude, and hence reduce stress and enhance student learning and success. The effects of these gratitude interventions will be presented in a future manuscript. Briefly, I chose to assess the effectiveness of these gratitude interventions by using validated pre-post surveys to measure gratitude (6) and college persistence (38, 39). The Gratitude Resentment and Appreciation Test-Revised (GRAT-R) was used to measure gratitude; full survey questions and scoring instructions are available here. The College Persistence Questionnaire (CPQ) was used to measure college persistence; full survey questions are available here.

Preliminary results indicate that students self-report feeling grateful more often after receiving gratitude interventions (Figure 1). For example, 70% of students in the treatment section reported feeling grateful “Always” (46.7%) or “Most of the time” (23.3%) before gratitude interventions. This number increased to 95% after gratitude interventions (“Always” = 60%; “Most of the time” = 35%). Furthermore, the total GRAT-R score of students in the treatment section was higher post-intervention (Figure 2). There were no increases in GRAT-R scores over the course of the semester in the control group that did not receive interventions. Thus, evidence suggests that simple gratitude interventions throughout the course of a single semester may effectively increase student gratitude. In addition, preliminary results also indicate that gratitude interventions may positively impact degree commitment, which the CPQ assessed by measuring 1) the personal importance and value that students and their supportive network place on degree completion, and 2) the student’s sense of certainty in degree attainment (40). Specifically, the preliminary data in Figure 3 suggest that gratitude interventions may decrease differences in degree commitment between persons excluded due to ethnicity or race, PEER (41) vs. white non-PEER students (42). I acknowledge that post-intervention sample sizes in the control section are very small. Nevertheless, this preliminary result is worth further investigation given the need to increase diversity, equity, and inclusion in the STEM fields (41, 43, 44).

**Student Response**

Student response to gratitude interventions was overwhelmingly positive. For example, when I asked students to provide their feedback on the course, either through informal group discussions with me or through anonymous mid-semester surveys in the LMS, multiple students mentioned that they really liked doing the gratitude interventions assignments. Several students specifically mentioned that they never had an instructor who asked them to do this type of assignment, and that they really enjoyed the assignments because it 1) gave them something to look forward to every week, and 2) provided an outlet for expressing gratitude that they otherwise did not have. One student stated on their mid-semester survey:
I initially implemented gratitude interventions in a 30-student upper division Biological Sciences course, but these interventions can be easily implemented in a course of any size and at any level of curriculum. BIO100 is a skills-based lab class in which students work together in groups. Thus, gratitude interventions could also be easily implemented in other wet-lab courses that follow a similar group work structure. Moreover, because the gratitude interventions are provided to students as graded surveys in the LMS and students automatically get credit for completing them, there is no time burden on the instructor to review or grade these assignments. Thus, these interventions are feasible even in very large lecture courses with hundreds of students enrolled. Furthermore, the gratitude interventions are not related to course content, and can therefore be effectively used in any course level, ranging from introductory to upper division. Interestingly, evidence suggests that gratitude interventions may be especially beneficial for students just starting their higher education journey; one study found that gratitude interventions can have positive long-term effects on brain activity (47). Therefore, implementation of these gratitude interventions early can provide students with the tools they need to help them succeed in their subsequent coursework.

Lastly, these interventions can also be implemented in any discipline, and at any type of institution. The prompt for the third letter of gratitude specifically instructs students to write to a previous STEM teacher, instructor, or professor, but this could easily be changed to accurately reflect the discipline of the course. I initially implemented these interventions at a four-year primarily undergraduate institution (PUI), but the interventions can also easily be implemented at two-year community colleges, as well as four-year research focused institutions. For example, previous research using study participants enrolled at various institutions has shown that gratitude interventions are beneficial for students at community colleges (48), private liberal arts colleges (25), private Catholic universities (29), medium-large size urban universities in large metropolitan areas (49), and large public research universities (50). Moreover, gratitude interventions are appropriate for any institution that serves today’s typical college student: according to the National Center for Education Statistics, at public 2 and 4-year institutions 16% of part-time students are 35 and over, while at private non-profit institutions this number jumps to ~30%. Because gratitude interventions benefit both young (18-35 years old) and middle adults (36-59 years old) (51), this is an effective teaching strategy for a wide age range of undergraduate and graduate students.

**SCIENTIFIC TEACHING THEMES**

**Active Learning**

Students actively engage in gratitude practices through guided self-reflection and writing (52). The things and people that we are grateful for are different for everyone, so each student must individually reflect on their own lives, identify the positive aspects that they are grateful for, and then express
this in writing through the gratitude intervention assignments. In addition, students get prescribed, regular repeated practice with expressing gratitude (53, 54): gratitude journals are completed weekly, and each student also writes three letters of gratitude throughout the semester.

Assessment
Both informal and formal assessments can be used to evaluate the efficacy of gratitude interventions. As an informal way of gauging general student learning and attitudes towards the course, the open-ended question “What is going well in the course?” can be included on a mid-semester feedback survey. Although this question doesn’t directly mention gratitude interventions, in my experience many students list these gratitude assignments as something they believe is helpful for their learning and growth. In addition, on the last day of the semester students can be asked to respond on a Google Jamboard to the prompt, “What can you do better now than you could on the first day of the semester?” Again, although this question doesn’t directly relate to gratitude interventions, in my experience several students list their ability to reflect on and express their gratitude as skills they gained during the course. Importantly, these attitudinal survey questions could be helpful for any college-level classroom to help gauge efficacy of instruction, whether gratitude interventions are implemented or not.

For instructors wishing to assess gratitude intervention efficacy more formally, verified gratitude (6) and college persistence surveys (18, 19) can be provided to students at the beginning and end of the semester. Specifically, to assess the efficacy of these gratitude interventions to increase gratitude, instructors could ask students, “How often do you feel grateful on a daily basis?” (7) and provide the following response options: “Always,” “Most of the time,” “About half of the time,” “Sometimes,” and “Never.” To assess the efficacy of these gratitude interventions to increase college persistence, instructors could ask students, “How strong is your commitment to earning a college degree, here or elsewhere?” (38). The following Likert scale response options could be provided: “Very strong,” “Somewhat strong,” “Neutral,” “Somewhat weak,” and “Very weak.”

Inclusive Teaching
Gratitude interventions are accessible to all students, including those with disabilities. To meet Universal Design for Learning (UDL) requirements to create learning experiences for the widest audience possible (55), the prompts for the two gratitude interventions are distributed through the Canvas Learning Management System, which is compatible with multiple devices, including computers, smart phones, and tablets (56). To allow alternatives for visual information, the text portion of the interventions is high contrast to facilitate use of screen readers by visually impaired students, and the text portion of the interventions also contains properly organized heading structures. Students can also elect to have printed versions of the online gratitude interventions if they so choose. Gratitude interventions also acknowledge the value of multicultural diversity in the classroom (57) by allowing each student to individually reflect on their own background, identity, and experience when choosing 1) what they are grateful for that week, and 2) who to write three letters of gratitude to.

SUPPORTING MATERIALS
- S1. Gratitude Interventions – Detailed Implementation
- S2. Gratitude Interventions – Introduction to Students
- S3. Gratitude Interventions – Weekly Journal Assignment
- S4. Gratitude Interventions – Letters of Gratitude Assignments
- S5. Gratitude Interventions – Gratitude Resources

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Gratitude Interventions in a Biology Course to Foster Student Persistence and Success

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