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Implementation of a 25-minute Mini-lecture on Learning and Studying in Large-enrollment First-Year General Chemistry Courses

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Abstract

Poor results on the first exam in a course can be a shock to freshmen college students who found great success in high school. The experience can be demoralizing and put students in the mindset that academic success is out of reach. To convince such students that not only is academic success possible but readily achievable, I presented a 25-minute mini-lecture on learning and studying in two large-enrollment general chemistry courses (total N = 289) based on author Dr. Sandra McGuire's work. The mini-lecture discussed human learning and practical study tools. The purposes of the mini-lecture were to: 1) examine how well students could be convinced to critically assess their learning and study habits; and 2) motivate students to believe academic success is possible. I assessed the two goals via an anonymous survey utilizing Likert scale questions and essay questions. A majority (74%) of survey respondents who reported they watched the mini-lecture (N = 158) believed the mini-lecture assisted reflection on their study habits. Sixty-six percent of respondents reported changing their study habits. However, 38% of students who reported changing their study habits eventually reverted. When allowed to provide comments about the experience, students gave generally positive responses specifically citing how the mini-lecture prompted self-reflection and how the mini-lecture demonstrated the instructor cared about student success.

Keywords: higher education, first-year experience, undergraduate learning

The transition of students from their senior year of high school to their first year of college can be challenging due to the students being ill-prepared for the academic demands of higher education. Via a national survey of college freshmen, The Higher Education Research Institute reported that 57.8% of freshmen spent less than six hours each week on homework in high

school (Stolzenberg, Eagan, Romo, Tamargo, Aragon, Luedke, & Kang, 2018, p. 42), yet 96.9% received an average grade of B- or higher (Stolzenberg et.al., p. 27). This lack of preparation for the increased expectations of higher education can lead to unexpected poor performances on students' first exams during their first term. "The talk" often follows where instructors inform the underperforming students that they need to change how they approach learning and studying in order to succeed.

Instead of leaving students to struggle with this realization on their own, instructors can and should assist their students by showing them that approaches to learning and studying *can* change, and by providing specific guidance on *how* to change. This is the argument made by Dr. Saundra McGuire in the book *Teach Students How to Learn: Strategies You Can Incorporate Into Any Course to Improve Student Metacognition, Study Skills, and Motivation* (McGuire, 2013). McGuire believes a single 50-minute lecture given by a course instructor can convince students of the necessity of changing their learning and study habits. Once the students are convinced, the instructor can then provide tools to the students to facilitate the desired changes. McGuire, a chemist, believes this approach is effective regardless of instructional discipline.

McGuire's proposed lecture can be divided into three core components. The first is an opening with historical data of students who failed the first exam and then proceeded to earn A's or B's on subsequent exams to show improvement is possible. This discussion occurs in conjunction with reflection exercises on how current students in the course approach learning and studying. The second is a discussion of metacognition and Bloom's Taxonomy (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956) to provide possible explanations for why the students are struggling academically. The third is a description of tools students can use, such as institutional resources and studying techniques, to overcome these academic struggles. McGuire provides full PowerPoint presentations should an instructor not want to create one from scratch. Desiring to examine how this lecture could help my students, I administered a modified 25-minute version of the lecture to my CHEM 1210 (159 students) and CHEM 1220 (130 students) courses in the Fall of 2019. These courses are the first and second, respectively, of a two-semester general chemistry course sequence comprised primarily of first- and second-year students. The purposes of the mini-lecture were: 1) to examine how well students could be convinced to critically assess their learning and study habits; and 2) to motivate students to believe academic success is possible.

Methods

Due to time constraints and a desire to keep course content delivery consistent with other sections of CHEM 1210 held during the same semester, I distilled McGuire's 50-minute

lecture to a 25-minute mini-lecture. As recommended by McGuire, I presented the mini-lecture immediately after the grades for Exam 1 were released, and students were not warned of the mini-lecture ahead of time. The mini-lecture included discussion of:

1. The course-wide performance on Exam 1, with an emphasis on how some students might not have met their expectations
2. Historical Exam 1 to Exam 2 improvements by students in the course as evidence that significant improvement was possible
3. Metacognition, with an emphasis on how learning is a skill that can be trained and improved rather than an immutable inherent personal quality
4. Bloom's Taxonomy and of the greater expectations of college vs. high school as an explanation for why successful high school habits may not be successful in college
5. The Utah State University Academic Success Center (now Academic Success Programs) and how it provides resources to assist students in making changes to their study habits to improve academic performance
6. Two suggested study tools
 - a. A study cycle (useable for all university courses), which I described as a structured way to regularly engage with and practice course content inside and outside of the classroom
 - b. Regular low-stakes quizzes (specific to my course) that I explicitly state are designed primarily as feedback tools to help students prepare for exams, with a graphical depiction showing a clear correlation between quiz scores and course scores as evidence they work
7. A warning on how permanent changes in learning and study habits had to be made within 48 hours and consistently maintained or old habits would reassert themselves

The Supplemental Information to this manuscript contains an example set of the PowerPoint slides used in the mini-lecture.

The following week, I gave a brief reminder of this final warning at the start of the lecture. There was no further follow-up prior to Exam 2.

After Exam 2, I administered an anonymous survey to the course through Canvas, our institutional Learning Management System (LMS), to elucidate how well students retained the content of the learning and studying mini-lecture and to learn of student opinions on the mini-lecture. I categorized the mini-lecture's content into two components: human learning (metacognition, Bloom's taxonomy) and studying (institutional resources, study tools).

Results and Analyses

Multiple-choice questions in the survey used a Likert scale. The calculated percentage of respondent values are rounded to the nearest whole number and may not sum to 100%. Essay question responses are categorized by their contents and reported in aggregate. Some essay responses fit more than one category. CHEM 1210 enrolled 159 students and CHEM 1220 enrolled 130 students. 71% of CHEM 1210 students and 57% of CHEM 1220 students submitted the survey.

To determine how many students were exposed to the mini-lecture in some form, Question 01 asked if the respondent saw the mini-lecture either in person or via a recording. Ninety-three students (58% of total enrollment) in CHEM 1210 and 65 students (50% of total enrollment) in CHEM 1220 responded affirmatively (Table 1).

Table 1. Summary of Student Responses to Survey Question 01

Question 01: Did you attend or watch the recording of the mini-lecture on learning and studying given September 30? If you answer "No", please do not respond to the remaining questions and submit this evaluation now.

Student Response	CHEM 1210		CHEM 1220	
	Number of respondents	% respondents (% total enrollment)	Number of respondents	% respondents (% total enrollment)
Yes	93	82% (58%)	65	88% (50%)
No	20	18% (13%)	8	11% (6%)
No answer	0	0% (0%)	1	1% (1%)

Questions 02 and 03 investigated how well students believed they retained the information presented in the mini-lecture and provided the names of specific concepts to aid students in recall. Question 02 focused on the human learning concepts and asked students to rate how much content they retained on the following scale: 1 for “very little”, 2 for “some”, 3 for “most”, and 4 for “all” (Table 2). Most respondents did not believe they retained a large portion of the human learning material. Eighty-three percent of CHEM 1210 respondents and 59% of CHEM 1220 respondents reported ratings of 1 or 2 with means of 2.0 and 2.4, respectively. These strong majorities of low retention level ratings may result from a lack of student interest in understanding the reasons behind why some study strategies may be more effective than others.

Table 2. *Summary of Student Responses to Survey Question 02*

Question 02: Please respond to this question only if you answered "Yes" to Question 01. How much do you remember about the discussion of human learning (metacognition, Bloom's taxonomy)?

Student Response	CHEM 1210		CHEM 1220	
	Number of respondents	Percentage of respondents	Number of respondents	Percentage of respondents
4 - Almost all of it	2	2%	6	9%
3 - Most of it	16	16%	21	32%
2 - Some of it	63	65%	31	47%
1 - Very little of it	16	16%	8	12%
No answer	16		8	
Mean value	2.0		2.4	

In contrast, respondents reported retaining more of the studying content as shown by their responses to Question 03 (Table 3). Using the same scale as Question 02, only 41% of CHEM 1210 respondents and only 40% of CHEM 1220 respondents reported ratings of 1 or 2. The mean values of 2.6 for CHEM 1210 and 2.7 for CHEM 1220 were both increases over the reported human learning retention mean values. This may indicate that students are more focused on practical tools and advice with tangible benefits to academic success rather than the theoretical underpinnings of those tools and advice.

Table 3. *Summary of Student Responses to Survey Question 03*

Question 03: Please respond to this question only if you answered "Yes" to Question 01. How much do you remember about the discussion of studying (Academic Success Center, Study Cycle)?

Student Response	CHEM 1210		CHEM 1220	
	Number of respondents	Percentage of respondents	Number of respondents	Percentage of respondents
4 - Almost all of it	12	13%	11	17%
3 - Most of it	42	44%	29	44%
2 - Some of it	34	36%	23	35%
1 - Very little of it	7	7%	3	5%
No answer	18		8	
Mean value	2.6		2.7	

Questions 04, 05, and 06 investigated how students used the information presented in the mini-lecture. Question 04 prompted students to report on whether they agreed that the mini-lecture assisted their reflection on their study habits and academic success (Table 4). Students rated their agreement using the following scale: 1 for “strongly disagree”, 2 for “somewhat disagree”, 3 for “neither agree nor disagree”, 4 for “somewhat agree”, and 5 for “strongly agree”. Sixty-one percent of CHEM 1210 respondents and 73% of CHEM 1220 respondents reported ratings of 4 or 5 with a mean value for both courses of 3.8. This shows that many

respondents both performed a self-assessment of their study habits and believed the mini-lecture was valuable in that process.

Whether this self-assessment resulted in changed study habits was the focus of Question 05 (Table 5). Sixty percent of CHEM 1210 respondents and 71% of CHEM 1220 respondents reported they made changes to their study habits. The outcomes of Question 04 and 05 showed that a majority of respondents were convinced to critically assess their study habits and were sufficiently motivated to make changes to their study habits. However, this motivation was not persistent for all students. Of the 104 respondents between both courses who reported making changes to their study habits, 39 respondents (38%) reported reverting to their previous routines. This attrition echoes the warning in the final slide of the mini-lecture that stated changes in habits had to be maintained or old habits would reassert themselves.

Table 4. Summary of Student Responses to Survey Question 04

Question 04: Please respond to this question only if you answered "Yes" to Question 01. How strongly would you agree with the below statement? "The mini-lecture was helpful in reflecting on my study habits and what I need to do to succeed academically."

Student Response	CHEM 1210		CHEM 1220	
	Number of respondents	Percentage of respondents	Number of respondents	Percentage of respondents
5 – Strongly agree	14	15%	17	26%
4 – Somewhat agree	55	58%	31	47%
3 – Neither agree nor disagree	21	22%	10	15%
2 – Somewhat disagree	3	3%	5	8%
1 – Strongly disagree	2	2%	3	5%
No answer	18		8	
Mean value	3.8		3.8	

Table 5. Summary of Student Responses to Survey Question 05

Question 05: Please respond to this question only if you answered "Yes" to Question 01. Did you make changes to your studying habits as a result of what you learned in the mini-lecture?

Student Response	CHEM 1210		CHEM 1220	
	Number of respondents	Percentage of respondents	Number of respondents	Percentage of respondents
Yes, and continue today	34	36%	31	47%
Yes, but have stopped since	23	24%	16	24%
No	37	39%	19	29%
No answer	19		8	

While a majority of respondents made changes to their study habits, not all respondents did. To learn why some respondents did not change their study habits, Question 06 asked these respondents what would have made them more likely to change their study habits (Table 6). The question used a free-response format and the responses are categorized based on their content where some responses fit more than one category. In both CHEM 1210 and CHEM 1220, the most common reason to not change study habits was that the students were satisfied with their current study habits and were already succeeding in the course. Of the 56 respondents across both courses who reported not changing their study habits, 26 respondents (46%) reported being content with what they were already doing. While some of the other responses, such as better time management skills, were student-based and out of an instructor's direct control, an instructor could address some of the other responses. For example, integrating study tools directly into regular course content delivery would address the "a plan for students to utilize and assess studying changes" question response and the "in-lecture activities targeting changing study habits" question response.

Table 6. *Categorization of Student Responses to Free Response Question 06 for CHEM 1210*

Question 06 (Essay): Please respond to this question only if you answered "Yes" to Question 01. If you selected "Yes" to Question 05, leave this question blank. If you selected "No" to Question 05, please describe what could have been discussed that would have made it more likely you would actively seek to change your study habits.

Response Category	Number of responses		
	CHEM 1210	CHEM 1220	Total
Nothing because happy with current study habits	21	6	27
Access to additional resources (student-led help/tutoring)	5	1	6
Better personal time management	2	4	6
Response did not fit question prompt	1	5	6
A plan for students to utilize and assess studying changes	3	2	5
In-lecture activities targeting changing study habits	3	1	4
Suggestions on how to improve self-motivation or fully commit to change	1	3	4
Nothing because the content was previously learned and used	2	1	3
Don't know	3	-	3
Something to alleviate the fear that change would make things worse	1	-	1
Showing how better study habits result in a smaller time investment	1	-	1
Showing effects of better studying on student mental health	1	-	1

Making changes to study habits does not guarantee that those changes are successful and lead to greater academic success. Question 07 asked respondents that reported making changes to their study habits if they agreed that those changes helped them succeed academically (Table 7). Students rated their agreement using the following scale: 1 for "strongly disagree", 2 for "somewhat disagree", 3 for "neither agree nor disagree", 4 for "somewhat agree", and 5 for

“strongly agree”. Sixty-three percent of CHEM 1210 respondents and 71% of CHEM 1220 respondents reported values of 4 or 5 with mean values of 3.7 and 3.9, respectively. This indicates that most respondents who made changes to their study habits believed they found greater academic success afterward. On the other extreme, only 5 respondents (4%) across both courses disagreed that the changes they made led to greater academic success. This information can alleviate fears that changes to study habits could make student academic situations worse. Respondents who made a change to their study habits generally found success as a result or, at least, were usually not harmed.

Table 7. Summary of Student Responses to Survey Question 07

Question 07: Please respond to this question only if you answered "Yes" to Question 01 and Question 05. How strongly would you agree with the below statement? "The changes I made to my studying habits helped me to succeed academically."

Student Response	CHEM 1210		CHEM 1220	
	Number of respondents	Percentage of respondents	Number of respondents	Percentage of respondents
5 – Strongly agree	11	15%	12	24%
4 – Somewhat agree	34	48%	24	47%
3 – Neither agree nor disagree	24	34%	12	24%
2 – Somewhat disagree	1	1%	3	6%
1 – Strongly disagree	1	1%	0	0%
No answer	42		23	
Mean value	3.7		3.9	

Question 08 provided respondents an opportunity to give feedback on the mini-lecture and its outcomes outside of the previous questions (Table 8). Responses were overall positive with the most common negative response being a belief that lecture time should not have been used to discuss learning and studying ($n = 4$).

By far the most prominent specific response across both courses was how the mini-lecture provoked self-reflection ($n = 24$). This is consistent with the results of Questions 04 and 05 that showed many respondents performed self-reflection on their study habits. The next most common specific response was that the mini-lecture showed the instructor was invested in student success ($n = 17$), which can be a powerful motivational tool to convince students to self-reflect and make changes to study habits. In terms of student reported practical outcomes, several students reported not just being convinced that they could improve ($n = 9$), but that changes they made resulted in greater academic success both inside ($n = 6$) and outside of chemistry ($n = 3$). Consistent with respondents stating in-lecture activities would have helped convince them to change their study habits in Question 06 ($n = 4$), several respondents stated a desire for regular discussions on learning and studying ($n = 8$) in Question 08. While this

would be difficult to incorporate into a course's normal curriculum, this could be an opportunity to point students toward institutional resources that already exist to assist students with these skills.

Table 08. *Categorization of Student Responses to Free Response Question 08 for CHEM 1210*

Question 08 (Essay): Please respond to this question only if you answered "Yes" to Question 01. Provide any comments you would like to make about the mini-lecture.

Response Category	Number of responses		
	CHEM 1210	CHEM 1220	Total
Provoked self-reflection on learning/study habits	13	11	24
Non-specific positive comment about the experience	11	7	18
Instructor cared about students/provided hope	8	9	17
Convinced students they could improve	3	6	9
A desire for regular discussions on learning/studying	4	4	8
Studying changes improved academic performance in this course	5	1	6
Good for freshmen/sophomores	3	2	5
Mini-lecture should have been held earlier in the term	2	3	5
The content was not applicable to the student	-	4	4
Lecture time should not have been used for this purpose	3	1	4
Comforting to know other students also had similar problems and help was available	3	-	3
Studying changes improved academic performance in other courses	2	1	3
Student wished they learned the content earlier in their academic career	1	2	3
Useful for setting proper expectations for college	2	-	2
Student regret at not implementing the suggestions	2	-	2
Request for more studying resources	1	1	2
Only this course discussed learning and studying among all of a student's courses	-	2	2
Holding after Exam 1 meant students would be more receptive	1	-	1
Reflection on how changing habits is difficult	1	-	1
More student interaction in the lecture would have led to higher content retention	1	-	1
Response did not fit question prompt	1	-	1
Students should already know how to study	-	1	1
Finding time to make changes is difficult	-	1	1

Conclusions

I presented a 25-minute mini-lecture on learning and studying to students in two general chemistry courses. Based on student responses to a survey administered after the mini-lecture, the mini-lecture prompted students to perform an assessment of their learning and study habits. In terms of mini-lecture content retention, students reported retaining mini-lecture information on human learning to a lesser extent than mini-lecture information on studying. A majority of respondents reported making changes to their study habits and many of them reported finding greater academic success after doing so. However, some students returned to their original study habits after a few weeks. Reported student opinions on the mini-lecture were mostly positive and specifically cited its helpfulness in self-evaluation and how it showed instructor investment in student success. Overall, the mini-lecture appears to have been a valuable experience for the students and succeeded in both convincing students to perform self-reflection and in motivating students to believe that academic success is possible.

One extension to the evaluation of the mini-lecture would be to identify what specific concepts students remembered. This information could be used to tune the lecture to more effectively connect the theory behind learning techniques to their practical outcomes in order to help students see the value of the background theory. An area for iteration of the lecture would be utilizing a full 50-minute lecture, as intended by McGuire, for a deeper discussion or a series of mini-lectures throughout the semester for continuous reinforcement. A more ambitious iteration would present similar mini-lectures or full lectures in other traditional first-year or second-year college courses in a coordinated fashion for broad reinforcement.

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