

Student and Faculty Perspective and Survey Results on an Innovative Home-work Process

Dr. Emily Kate Book, The Citadel

Dr. Emily Book is an Assistant Professor in the Department of Mechanical Engineering at The Citadel. She received her B.S. in Mechanical Engineering from Purdue University, her M.B.A. from Clarke College, her M.S. in Mechanical Engineering from University of Wisconsin, and her Ph.D. in Mechanical Engineering from North Carolina State University. Her research and interests' areas include high pressure combustion, internal combustion engines, and engineering education.

Timothy Aaron Wood Ph.D., The Citadel

Timothy A Wood is an Assistant Professor of Civil and Environmental Engineering at The Citadel. He acquired a Bachelor's in Engineering Physics Summa Cum Laude with Honors followed by Civil Engineering Master's and Doctoral degrees from Texas Tech University. His technical research focuses on the intersection of soil-structure interaction and structural/geotechnical data. He encourages students pushing them toward self-directed learning through reading, and inspiring enthusiasm for the fields of structural and geotechnical engineering. Dr. Wood aims to recover the benefits of classical-model, literature-based learning in civil engineering education.

Dr. Jeffery M Plumblee II, The Citadel

Dr. Jeffery Plumblee is an Assistant Professor in the Department of Engineering Leadership and Program Management (ELPM) in the School of Engineering (SOE) at The Citadel. Dr. Plumblee earned his BS in Civil Engineering at Clemson University (2008), Masters in Civil Engineering at Clemson University (2009), Masters of Business Administration at Clemson University (2013), and Doctorate of Philosophy in Civil Engineering at Clemson University (2013). Dr. Plumblee's dissertation research sought to better understand the relationship between sustainability and resilience in residential construction. He continued his work in resilience by helping to kick start a new business line at Fluor Corporation in Business Continuity and Disaster Management Solutions, where he primarily worked as a consultant with Fortune 100 aerospace and pharmaceutical clients.

Plumblee's research interests focus on building a more resilient society, as well as innovation in resource constrained settings (primarily humanitarian technology and delivery). Plumblee founded an international award winning organization (Clemson Engineers for Developing Countries), which has successfully completed over \$2 million of infrastructure improvements in rural Haiti. He continues his research to drive innovation of experiential learning within engineering education.

Student and Faculty Perspectives and Survey Results on an Innovative Homework Process

Abstract

An engineering program at The Citadel has demonstrated favorable results from both the faculty and students with an innovative homework process. The process requires the students to review and submit their homework twice. The first submission consists of the students' independent effort on the homework problems submitted online by the initial due date. The faculty member provides solutions after the due date. The students then review their work using the solutions provided, making corrections in a different color. This grading forces the students to look at the homework and determine where he or she made any mistakes. The second submission is a hard copy. If the students meet all of these requirements, they receive a 100% on the homework. With only an online initial submission, the students receive 70%. Turning in only a hard copy, after reviewing solutions, the students receive 50%. This paper provides results from a survey of a group of students who took a two-class sequence with the same instructor; the first class used a traditional homework process, and the second class used the innovative homework process. The students report they experience less stress and better comprehension using the innovative process. Multiple faculty members were able to reduce their time spent grading homework using this process. A survey of several classes involving multiple professors and disciplines indicates student preference for the innovative homework system. The student author describes his experience with the homework processes. Faculty members saw a significant increase in homework engagement. This innovative homework process encourages formative learning through practice and immediate feedback.

Keywords

Homework Process, Student Results, Perspectives

Introduction

The availability of web-based content to students has created an evolving challenge in engineering education. Most student learning takes place outside the classroom (1,6); for many engineering courses grade-earning homework is the primary learning tool. Students who focus on earning a high grade rather than learning the material often resort to copying solutions from previous semesters, seeking publisher solutions available via the internet, or using homework solution websites. Students now will consistently use the popular online solutions of Chegg (2). The approach some students are taking to homework is to automatically use the internet without giving the problems an initial effort alone. An online survey completed in 2005 suggests that 51% of students admit to cheating at least once on written work assignment (3). Faculty have the challenge to come up with different homework problems and processes to motivate students to complete the homework without the use of the available solutions. In a different study where students self-graded their homework for correctness, it was suggested that students' engagement and commitment to learning objectives are increased (4).

In addition to student benefits, a self-grading policy can be beneficial where grading resources are limited or for online classes (5), while the professors review the dual-submission process, it does reduce the amount of time required. Professors time is not well spent grading homework that was completed via sources other than the student. This time could be spent in research, service, or lecture preparation.

Current Work

These challenges leave faculty seeking methods to provide students the opportunity to learn from feedback on homework where there was a diligent effort from the student. Students still need practice and repetition to learn from their mistakes. Faculty at The Citadel developed a homework policy that encourages student learning through practice and rapid feedback. Students and faculty benefit from this innovative, dual-submission homework policy that accounts for the availability of online solutions, student interest in instructor feedback, and faculty time management (6). This dual-submission homework is in use by various faculty across multiple engineering disciplines at The Citadel. The opportunity to teach the same group of students for two semesters was available for a comparison of two different homework processes. The first semester the students followed a traditional method and the second semester the same group of students were introduced to this innovative dual-submission homework process.

Description of Homework Process

As part of the mechanical engineering major, students must take and pass a two-course series: Thermo-Fluid Dynamics I (MECH 310) and Thermo-Fluids II (MECH 311). This course sequence is taken during the junior year. The same faculty member taught both courses, and in MECH 310, the course used a traditional, single turn-in homework method. Homework was handed out and a hard copy was collected and graded by the professor. The following semester in MECH 311, the same group of students used the dual-submission, innovative homework method. For the dual-submission, the students scanned in or took a picture of the completed homework. For the first attempt, it is only submitted online. The difficulty level of the homework and exams are comparable for both classes. The number of the problems in each homework assignment is similar between the two courses. The number of homework's assigned in both classes is the same. Syllabus excerpts regarding the homework policy for MECH 310 and MECH 311 are in Table 1 and 2.

Table 1. MECH 310 Syllabus Excerpt

<p>Homework is a practice in applying new course concepts. Effort is more important than correctness. Working in groups is allowed and encouraged. Any late homework will automatically get 50% of the points reduced unless the instructor is notified the day before the homework is due. Document aid of any kind received on all homework, e.g. Jane Doe helped with part (b) or referred to solution on the internet for this problem. You do not need to document aid received from the instructor. You must turn in all homework in order to pass the class.</p>
--

Table 2. MECH 311 Syllabus Excerpt

All homework must be submitted in order to pass the class. Homework will be handed out on Thursdays. Students will submit the homework on CitLearn on Tuesdays. Homework solutions will be posted on CitLearn on Tuesdays. Students will grade his/her homework and make corrections. A hard copy of the graded homework will be submitted on Thursdays.
<ul style="list-style-type: none">• Grading must provide clear documentation of the corrections made in a different color.• A minimum of a check mark in a different color next to the correct answer is required.
Grade Earned (Maximum of 50 points)
50 pts: On-time, complete , CitLearn-submitted homework with an on-time self-graded, hard-copy homework submission.
35 pts: On-time, complete, Citlearn-submitted homework without an on-time, self-graded, hard-copy homework submission.
25 pts: On-time, self-graded, hard-copy homework without an on-time, complete, CitLearn submission.
20 pts: Up to two weeks late, complete, self-graded, hard-copy homework without an on-time complete, CitLearn submission.
0 pts: All other homework submissions.
Homework will not be accepted after two weeks past the due date.

While the second submission of the homework is a hard copy for this class, there is not a specific reason why the second submission of the homework could not be electronic if there are online feedback methods provided at the university.

Survey

There were 63 subjects, 59 males and 4 females, in the study sample for the two courses. Each student completed the survey in Table 3 at the end of the second semester. MECH 310 and MECH 311 are taken during the junior year, the students in the survey are in their third year of college. The benefits of having the survey after both classes were taken allows for the students to have fully experienced both methods to be able to compare one method to the other. While this perspective does give insight from students who have completed both courses, there is a difference in timing between when MECH 310 and MECH 311 ended and when the survey was taken. MECH 311, with the dual-submission homework, had just been completed. The students had a greater amount of time pass when asked to recall details about MECH 310 versus MECH 311. It is not believed this time difference would impact the results however this is an unknown.

Table 3. Homework Process for MECH 310 and MECH 311

	Question	Response
1	What do you like most and least about the homework process for MECH 310?	<i>Open Ended</i>
2	What do you like most and least about the homework process for MECH 311?	<i>Open Ended</i>
3	On average how many hours a week did you spend work on homework for MECH 310?	<i>Open Ended</i>
4	On average how many hours a week did you spend work on homework for MECH 311?	<i>Open Ended</i>
5	On average how many times a week did you look at homework for MECH 310?	a. Never b. Once c. Twice d. More than two times
6	On average how many times a week did you look at homework for MECH 311?	a. Never b. Once c. Twice d. More than two times
7	What homework method helped you understand the material better?	a. MECH 310 b. MECH 311
8	What class do you have a higher homework grade in?	a. MECH 310 b. MECH 311
9	What class do you have a higher exam average in?	a. MECH 310 b. MECH 311
10	What class did you learn more in?	a. MECH 310 b. MECH 311
11	What would you change about the process for homework in MECH 311?	<i>Open Ended</i>
12	Do you have any other feedback on the class set up that you would to give?	<i>Open Ended</i>

Survey Results

Results from the survey indicate that the number of times a student looked at the homework per week increased when using the innovative homework method. Figure 1 shows the number of times per week that students reported looking at the homework. The professor intended for this question to determine how many different times the student spent any amount of time attempting homework. This was not clarified during the survey and therefore left to the students' interpretation. The number of students who reported looking at the homework twice a week increased from 23 to 35 students, a 52% increase. The number of students who looked at the homework more than twice a week increased from 9 to 19, a 111% increase from the traditional method.

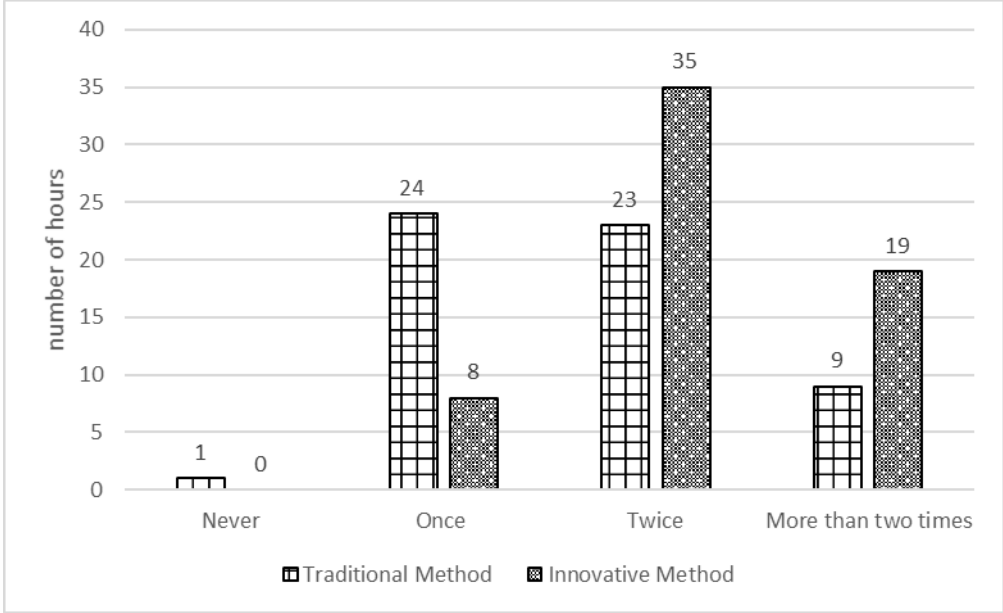


Figure 1. Comparison of number of times students looked at the homework between the traditional and innovative method.

Figure 2 shows the number of hours a student spent on the homework did not change significantly between the two methods. There was a 5% decrease in the time students reported spending on homework when going from the traditional to the innovative method.

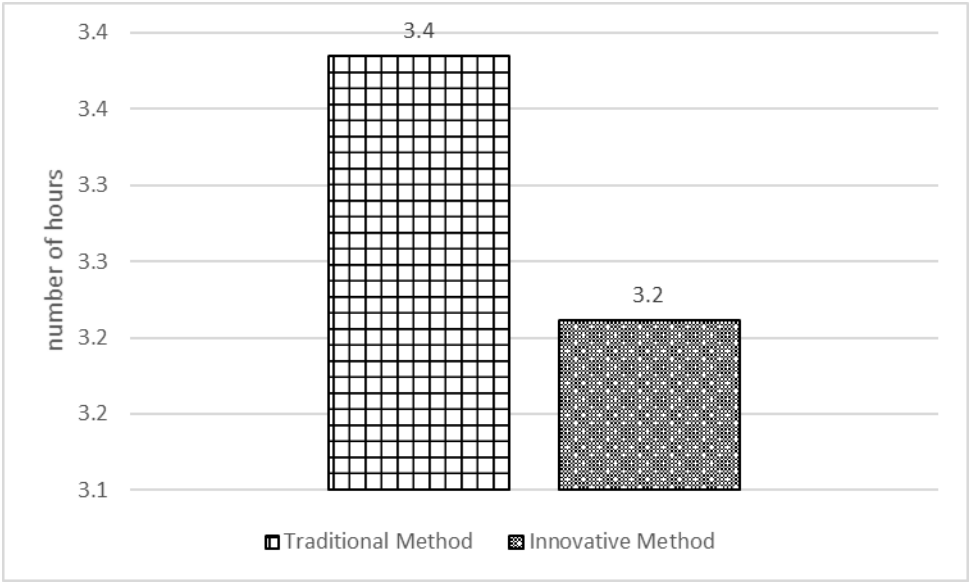


Figure 2. Number of hours spent on the homework comparing the traditional and innovative method separated by section.

The students were asked which class, MECH 310 or MECH 311, they had a higher grade in homework and exams. Figure 3 shows, for the homework grade, 56 students had a higher grade in MECH 311 with the innovative homework method versus MECH 310 with the traditional

homework method. Five of the students reported they had a higher grade in MECH 310, and the remaining two students reported the same grade between the two classes. The number of students that reported a higher exam average in MECH 311 was 45 versus the 13 students who reported having a higher exam average in MECH 310. The remaining 5 students reported having the same grade, Figure 4.

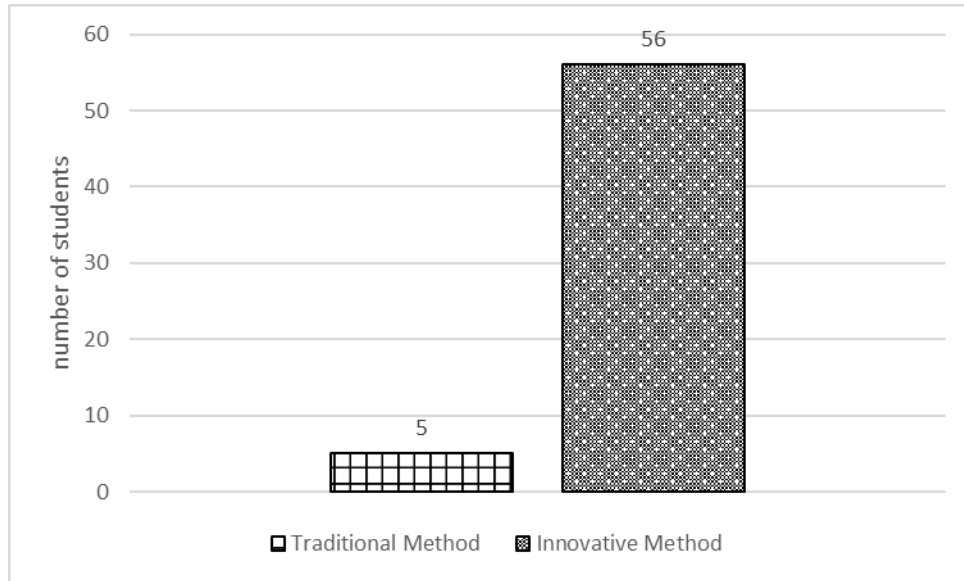


Figure 3. Students’ response to: Which class did you have a higher homework grade in?

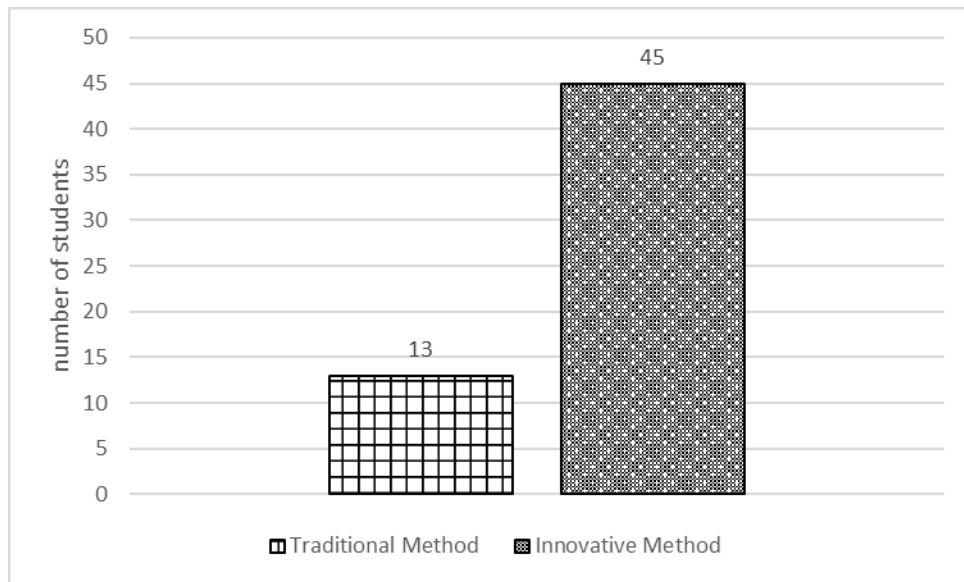


Figure 4. Students’ response to: Which class did you have a higher exam average in?

The students were asked which homework method gave them a better understanding of the material, as seen in Figure 5. Of the 63 participants in the survey, 56 students reported having a better understanding of the material when using the innovative method rather than the traditional method. Two of the students reported the traditional method gave them a better understanding,

and the remaining 5 students reported no difference in understanding of the material. The students were asked which class they learned more in, MECH 310 or MECH 311, and 51 students reported they learned more in MECH 311 and 2 reported they learned more in MECH 310, represented in Figure 6. The remaining 10 reported no difference in learning between the two classes.

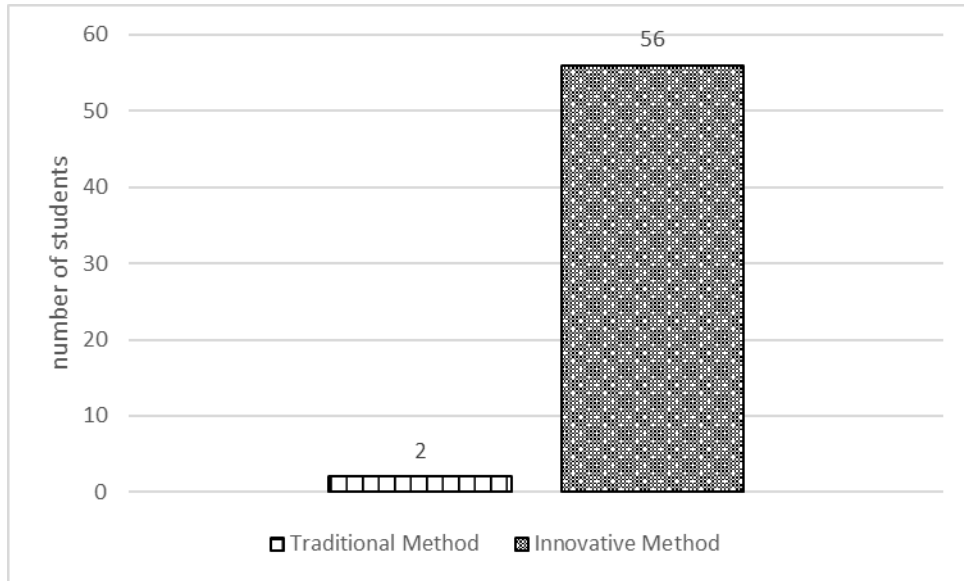


Figure 5. Homework method that provided a better understanding of the material.

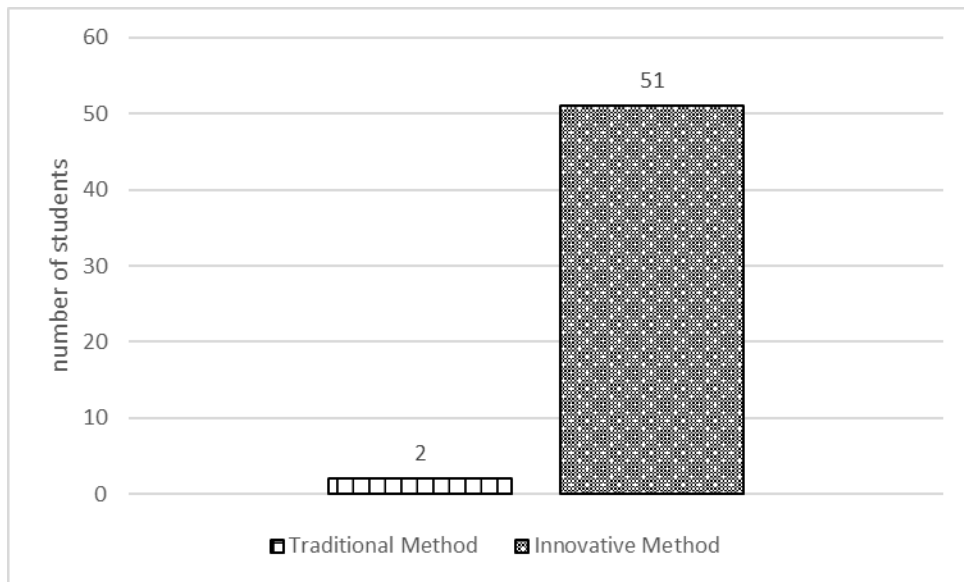


Figure 6. Student response to: Which class did you learn more in, MECH 310 or MECH 311?

The open-ended responses to the survey varied. A response heard multiple times for what was best about the MECH 310 homework process is the increased partial credit and only having one homework submission per week. A response heard multiple times for what was best about the MECH 311 homework process was less stress and grading on effort rather than correctness. The

feedback on what the students like least about MECH 311 was remembering to turn in the online submission.

Student Perspective

One student in the sample was asked to write his perspective of the homework process. The student described his experience as follows:

Traditional homework methods involve students taking specific assignments and finding the easiest way to get a problem done correctly. This is because many professors grade for correctness. There is nothing worse than being forced to work on assignments for hours on end, finding an answer you think is correct, and receiving half credit for your answer. In many classes, homework counts for 15-20% of your final grade, so even receiving a 75% on all your homework assignments can drop you half a letter grade. While this is fair, it is not conducive to motivating students to complete assignments by themselves.

One of the biggest drawbacks to doing homework in the traditional fashion is the bounty of resources on the internet. It is not a benefit to spend three hours on homework, do it yourself and chance failing. Instead, spend an hour, go to Chegg, copy the answers, cite Chegg, and receive a 100%.

There are plenty of reasons to do homework yourself. The first is the sense of accomplishment knowing you put the effort in. Typically, if you just do a little bit of searching, the homework assignments are examples in the text, or at least very similar. If that fails and you are stuck, there is nothing wrong with getting a boost from Chegg. Just get it started, and then finish it yourself. Another reason to complete the homework by yourself is how much better you learn the material. It is much easier to remember information when you write it down. Exams are based on homework, so simply completing the homework with no or minimal assistance is one of the easiest ways to help improve performance on exams.

One of the biggest helps in learning material has been a new, innovative method of homework. This method is better because no matter how incorrect the homework was, you still received credit. Typically, this method took just as much or more time as the traditional method, but it allowed you to find your mistake and correct it. It is much easier to learn when you are forced to find your mistakes.

I knew it was worth my time to work hard and spend my time on the homework and I was less focused on getting the correct answer. My exam scores were better during MECH 311. During MECH 310, I habitually used Chegg. During MECH 311, I found myself scoring high As without the use of Chegg.

A consistent reason for support for the process was a greater feeling of satisfaction, knowing that there was no penalization if a reasonable amount of effort was devoted to the homework. Some students also reported more group work, which can often lead to better understanding of material through sharing ideas. While study tools such as Chegg started out to help students prepare for exams and other assignments, it has morphed into a tool for students to take the easy way out.

This new style of homework allows students to think and solve problems by themselves while also removing the urge to take the easy path for grade preservation.

Faculty Perspective

For the MECH 311 course, homework grading that formerly took two to four hours now takes under an hour for completion. Faculty frustration is lower because students are responsible for interpreting their own efforts. More and more faculty at The Citadel are implementing the dual-submission homework policy to the perceived improvement of their teaching effectiveness. A specific concern from a faculty member was that she would lose site of the struggling student. However, this is not an issue as it is still apparent to the faculty by reviewing the graded submission. This approach reinforces to the student that completing homework is solely for the benefit of the student.

Conclusion

The results from this study suggest that the innovative homework process is a method where students perceive that they learn more and will earn a higher grade, when compared with the traditional homework process. The faculty spend less time grading homework knowing that the students have reviewed and graded their own homework prior to final submission. The amount of effort a student puts into the initial submission is a variable for a future study of this process. It could be possible that the students do not put in the upfront effort, knowing there is a second chance for submission. The authors plan to continue studying the impacts of this homework process on students' confidence in their understanding of the material, their actual understanding of the material, and their level of engagement with the content outside of class.

References

1. Landis, R. B. *Studying Engineering: A Road Map to a Rewarding Career*. Discovery Press, 2013.
2. Chegg.Com. <https://prod.cheggstudy.prod2.cheggnet.com/study>. Accessed Nov. 13, 2018.
3. McCabe, D.L., *It Takes a Village Academic Dishonesty*. Liberal Education – Washington D.C. 91(3):26-31, 2005.
4. Simkin, M. G., *Should you allow your Students to Grade their own Homework?* Journal of Information Systems Education, Vol.26(2), 2015.
5. Simkin, M., Stiver, D., *Self-graded homework: Some empirical tests of efficacy*. Journal of Education for Business, 2106.
6. Wood, T.W., Batouli, M., Michalaka, D., Brown, K., Book, E. K., *Perspectives on an Innovative Homework Policy*. American Society of Engineering Education SE Conference, 2019.