



Effectiveness of GRE Workshops to Increase Awareness

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Abstract

Excelling on the Graduate Records Exam (GRE) can be an important milestone for students who wish to attend graduate school. As part of an NSF-STEM project, two GRE workshops were implemented to inform students about the importance of starting the preparation process earlier in their undergraduate career. The second workshop, occurring the year after the first, included minor modifications based on the feedback from responses from the first workshop. This paper examines the results of the two GRE workshops, and describes (1) the two workshops, (2) the survey used to evaluate the workshops, and (3) the results from the pre and post survey. The results indicated that 89% of participants agreed or strongly agreed that they were more prepared to take the GRE after attending the first workshop with an 11% increase in the level of awareness about the GRE from the pre and post survey. There were two major changes between the two workshops: (1) an increase in the advertisement to the students and (2) the Dean of Graduate School presented the opening information. The results from the second workshop indicated a 22% increase in the level of awareness about the GRE from the pre and post survey with 78% of the participants reporting that they agreed or strongly agreed to that they felt more prepared to take the GRE. The attendance from the two workshops was recorded by the number of survey responses collected, which increased from 36 to 51 (42% increase).

Introduction

The NSF S-STEM program provides student scholarship funds to encourage and enable academically talented but financially needy students to complete STEM degrees and enter the workforce. The Student Integrated Intern Research Experience (SIIRE) project [1] addresses NSF's programmatic goal by integrating external (industry supported) intern or co-op experiences for students with ongoing on-campus engineering research activities to provide a guided pathway to a graduate engineering degree. The requested scholarship funds defray student educational costs during their sophomore, junior, and senior years of undergraduate study and during 1.5 years of their graduate studies. In [1], the SIIRE project's motivation, goals/objectives, and structure were presented. As part of the program, the students must develop and submit a mock graduate school application as juniors before receiving an increase in their scholarship. This activity reduces the inertia associated with applying to graduate school. In [2], the project's extensive use of enrichment activities was discussed. Within the enrichment activities, a focus is on developing an understanding of the opportunities, benefits, and processes associated with pursuing a graduate degree in engineering. Based on the experiences with the enrichment activities and questions raised by student participants, we decided that additional help was needed to prepare students for the Graduate Record Examination.

Background Information

The Graduate Records Examination (GRE) is an important milestone for STEM students who are seeking to further their education by attending graduate school. The GRE is described by the Educational Testing Services (ETS) as a "standardized admission exam designed to predict performance in graduate school through verbal, quantitative, and analytical reasoning questions

[3].” The test is mostly taken as a computer-delivered test with the questions increasing in difficulty in the second section of the verbal and quantitative reasoning sections as the student correctly answers the questions in the first section. A paper test can also be taken in regions of the world where the computer test is not available. The paper test includes the same three sections as the computerized test taken, although the paper test slightly alters the number of questions and time allotted per section.

The verbal reasoning section of the test is comprised of two sections consisting of 20 questions and a time duration of 30 minutes each. Because this test is a computer-delivered test, it is set up to adjust to the performance of the student with increasing difficulty in the second section if the answers are correctly selected in the first section. The verbal reasoning section is measured on a scale of 130-170 with 1-point increments. The ETS website reports that the verbal reasoning section was designed to test the student’s ability to evaluate how well they can analyze a sentence and use specific information that can be obtained through the relationships from individual sentences that complete the entire thought or concept [4].

The quantitative reasoning section is structured similarly to the verbal reasoning with two sections each consisting of 20 questions with a time limit of 35 minutes each. The test questions in this section also adjust according to performance, getting more difficult in the second section as the student correctly answers previous questions from the first section. This section is measured on a scale of 130-170 with 1-point increments. The quantitative reasoning section, according to the ETS website, measures the ability of a student to problem-solve using arithmetic, algebra, trigonometry, geometry, and data analysis [4].

The analytical writing section is broken into two separate writing prompts, which are each 30 minutes long. This section of the test is scored differently than the verbal reasoning and quantitative reasoning sections ranging from 0-6 with half-point increments. According to the ETS website the writing section is focused more on the student’s critical thinking ability and analytical writing skills instead of the grammar and mechanics of the two essays [4]. All numerical scores in the verbal, quantitative, and analytical portions of the test are converted to a percentile score to allow for comparison of scores across testing dates.

Perceptions of the GRE

There have been studies conducted on how students perceive the GRE and whether it is viewed as being a fair test by different social classes and ethnic groups. Research conducted by Klieger et al. in 2017 concluded that for United States citizens, “the average standardized test scores of White and Asian examinees have generally exceeded the average scores of Black and Hispanic examinees by at least one half to a full standard deviation [5].” This seems to support the claim made by Groeger in 1998 who indicated that a “sample of 4,248 first-year graduate students showed that 96% of the Black applicants indicated that these tests are oriented toward the White middle-class culture [6].” A study conducted in 2010 by Unzueta et al. indicated that the survey respondents believed that on the math and verbal sections of the GRE the “participants expected Asian Americans to score the highest, followed by Whites, then Blacks and Latinos [7].”

Moneta-Koehler et al. found in 2017 that “students with a low socioeconomic status (SES) perform worse on standardized tests, and exams like the SAT [and the GRE] are highly correlated with parental income [8].” This could be part of the reason as to why groups such as African Americans and Hispanics perform worse on the GRE when compared with the Asian and White students. Because the GRE exam costs \$205 to take, it may inhibit those of lower SES from taking the exam more than once. Furthermore, GRE preparation materials such as a private tutoring class can be expensive, which may exclude those students with lower SES from being able to participate in the workshops. Fortunately, there are free exam preparation materials available, such as practice tests provided by the ETS that allow all the students to have access to resources that will help them succeed on the GRE.

There has also been research conducted on how international students perceive the GRE. For international students for which English is not their first language, it is important for the students to take English language competency classes in order to ensure that their English language skills are not a hindrance to taking the exam. With this being said, many of the students still feel that the GRE verbal reasoning section is not a fair representation of their abilities with the English language. The ETS reported in 2016 that “the international students interviewed felt that the GRE verbal section is culturally biased against international students” because many of them speak “English as a second, third, or even fourth language [3].”

Despite these caveats with the GRE exam, it remains a very important factor for graduate student evaluation for universities across the U.S. in the admissions decision. In fact, an emerging trend is that law schools are examining whether to admit students on the basis of their GRE scores instead of the long-standing use of the Law School Admission Test (LSAT).

Graduate Schools Admissions Using the GRE Scores

Graduate schools often use the GRE scores along with other factors such as a student’s undergraduate grade point average (GPA), letters of recommendation, interviews, personal research statement, extracurricular involvement, leadership and professional experience in internships. Moneta-Koehler et al. (2017) stated, “the Educational Testing Services (ETS), which administers the GRE, advises restrained use of general test scores for admissions and discourages the use of a cutoff score.” This provides further evidence as to the importance of using other admission factors in deciding whether a student will be admitted into a program [8].

An informal analysis conducted in 2001 suggested that “65% of schools offering a master’s in engineering management required GRE scores as part of the application [9].” According to the ETS website, the GRE is “accepted by thousands of graduate and business schools worldwide,” although an exact percentage is not given [4]. A study conducted by Klieger et al. in 2017 sent out a survey with several questions regarding the use of the GRE in the admissions process for multiple areas of study including the Science-Technology-Engineering-Mathematics (STEM) field, as well as the social sciences, arts, and humanities fields. From the responses, “72% of respondents indicated the GRE revised General Test is required for all candidates, 18% said it is required, but could be waived in some circumstances, 4% said it is required or recommended for some applicants, 1% said it is recommended for all applicants, fewer than 1% said it is neither required nor recommended but would be considered if submitted, and 5% said it is not used at all

[5].” The respondents from the STEM field indicated that 80% required the GRE General Test which was the highest of the three different areas of study [5]. This seems to indicate the STEM field places the most importance on the GRE in determining whether a student will be admitted into a graduate program.

It is difficult to find a consensus on the percentage of engineering graduate programs that require the GRE exam because each study represents a different percentage based on their research. One potential reason that the percentages differ could be because specific programs within a general college do not require the scores to be submitted. An example of this is that the Massachusetts Institute of Technology (MIT) Graduate Program requires the GRE to be submitted; however, the Electrical Engineering and Computer Science program does not require any GRE test score to be submitted [10]. A complete worldwide list of schools that accept the GRE test scores can be found on the ETS website or can be found at a specific school’s website [4].

The GRE also plays a role in decisions related to financial aid and graduate student assistantships/fellowships. While its role may vary at different institutions, because it allows for standardized comparisons it is often considered as a way to delineate differences in an already very competitive process. In 2001, Kuncel et al. stated that the “the GRE is often used to help decide which students will receive fellowships and other awards [11].” A study led by Klieger et al. in 2017 showed that within the STEM field, 80% of the respondents indicated that the GRE scores were used to help decide who received assistantships and fellowship awards [5]. The candidates that are accepted into the programs often share similar resumes and work experiences, so the GRE can be a way to help decide which person will receive the awards.

Most of the studies found regarding the GRE analyze the effectiveness in using the test scores as an indicator of the student’s success within a graduate program. There have been studies directed by Howell et al [12], Holt et al. [9], Willcockson et al. [13], Kuncel et al. [11], and Sternberg et al. [14] that all indicate that the GRE is a good indicator of predicting graduate school success and should continue to be used by graduate schools as an admission requirement. There have also been studies conducted by Moneta-Koehler et al. [8], Hale [15], Sternberg et al. [14], Morrison et al. [16], and the ETS [3] that warn against the use of the GRE in the admission process as they are weak indicators of a student’s success within a graduate program. This paper is not focused on analyzing the effectiveness of the GRE in predicting the student’s success, but rather the focus of this paper is on the student’s awareness, preparation, and the effects of two workshops conducted to improve student’s awareness of the GRE. Because a majority of graduate programs require the GRE, we concentrate on the student’s awareness of the need to prepare, regardless of the effectiveness of the GRE in predicting future success in graduate school.

Recommendations to Do Well on the GRE

There are many different types of study materials that a student can use to prepare for the GRE. There are multiple useful study schedules available online that range from one week to six months depending on the time a student has available to prepare for taking the test. While it may seem obvious, the earlier a student *decides* to take the test, the more time they have to prepare. Thus, one of the goals of the workshop is to increase the chances that students *decide* to take the

exam earlier in their academic career. This is done by providing information about the GRE and how to prepare using available study materials. Study materials include two free practice exams from ETS at the completion of the registration for the GRE test. There are also several different types of private classroom-like tutoring sessions that provide in-person training. Study books are also available that allow students to study at their own pace. Self-paced learning may be beneficial if time is an issue. There are also several different computer or mobile based applications that are available that allow students to practice anywhere.

Johnson recommends “taking lots of free practice tests, which you can download or get from a CD” as well as utilizing “test-preparation courses offer a structured setting that can help you maintain the discipline to take the test over and over” [17]. With any of these choices, the more time that a student prepares for the test, the more preparation choices the student has available. Each individual should choose their study materials and methods based upon their learning style.

Motivation and Development of the GRE Workshops

We could not find any reports suggesting that increasing undergraduate student awareness of the GRE would have a positive effect on their preparation for the exam. Thus, our research examined if increasing the awareness of the GRE exam would increase the number of preparation tools used or increase the number of hours the student would study because of new access to useful information about the test and how it works. This paper describes:

- (1) the two workshops, including the improvements made to the second workshop, based on feedback from the first workshop;
- (2) the survey used to evaluate the workshops; and
- (3) the results from the pre and post survey.

GRE Workshops

Workshop 1

The first GRE Workshop was hosted in the Fall 2016 semester and targeted students participating within the NSF-STEM Project [1]; however, it was also made open to all engineering students who were interested in attending graduate school. This workshop was developed in addition to various professional development workshops from the NSF-STEM Project [1]. The workshop was developed by graduate students who have already had success taking the GRE, as well as faculty members, to provide guidance and gather their input on successful strategies. The workshop was advertised on each of the engineering departments’ bulletin boards as well as the college of engineering email listservs to help promote awareness for students to attend the event.

The workshop was designed to discuss the three major portions of the GRE, each of which was discussed by a graduate student who oversaw the creation of that section of the presentation. Each of the sections lasted approximately 15 minutes followed by an open discussion where the participants could ask questions for a total time of nearly an hour. The three major sections of the workshop consisted of the following:

- (1) the content and structure of the GRE;
- (2) what a good score is for each portion of the exam; and
- (3) how to prepare for the test including study plans and materials.

The first section gave a brief overview of how the GRE is organized, discussing briefly each of the three sections: analytical reasoning, verbal reasoning, and the writing portion. If the students do not understand what the GRE consists of, then the rest of the workshop will not provide additional benefit for the student. The type of students who attended the first workshop ranged from freshman to graduate students, so some students had never previously heard of the GRE, other than that it is required for graduate school.

The second section of the workshop was designed to describe how the GRE is scored as well as what is considered a good score. Although the ETS advises against the use of a cut-off score for admission purposes, a majority of graduate schools still use such scores when evaluating potential new students. For this reason, it is important that students research schools they are interested in to see if cut-off scores are posted on their graduate school website.

In the last section, before an open discussion, various study timelines and techniques were discussed to show the students the vast amount of resources available to prepare for the exam. The types of resources discussed varied from the free tests the ETS offers once the student signs up for the GRE, to practice books, and apps downloaded electronically. Each of the presenters discussed their preparation technique as well as tips to help the participants understand different options they can take when preparing for the GRE.

At the end of the presentation there was a group discussion led by students who have recently completed the GRE exam and could give their insights as to what would have been helpful to know before taking the exam themselves. A survey was also conducted to obtain feedback regarding the session and examine the interest from students in attending graduate school. Based on the feedback, a second workshop was conducted in the Fall 2017 semester to continue to improve the awareness of the GRE in the graduate application process for future students.

Workshop 2

The second GRE workshop was hosted in the Fall 2017 semester for all engineering students who were interested in attending graduate school. The overall format of this second workshop was basically the same as the first workshop with a few noted exceptions.

Differences Between Workshops

The second workshop included changes based on feedback obtained from the survey responses from the first workshop. There were two major changes between the two workshops:

- (1) an increase in the advertisement to the students; and
- (2) the dean of the graduate school presented the opening information.

The first major change was added because the research team felt the turnout for the first GRE workshop could have been higher. The second workshop was advertised to all nine of the disciplines within the college of engineering using paper fliers and an email sent to the students. This resulted in a 42% increase in the number of survey responses from 36 in the first workshop to 51 in the second workshop.

The second major change was the addition of the dean of the graduate school, who presented the opening section of the workshop. This allowed the students to ask questions to a member of the admissions process, providing a first-hand account of the importance of students preparing for the GRE.

Assessment Methodology for Both Workshops

Survey Development and Implementation

To assess the effectiveness of the workshops, a paper survey was developed. It contained optional general identification and demographic questions as well as specific questions to assess the success of the workshop. The survey was distributed at the beginning of the workshop and collected prior to the participants leaving the session. Participants were asked the following questions:

- (1) Participant Information
 - a. Student Name (optional)
 - b. Student E-mail
 - c. Gender
 - d. Current Classification
 - e. Ethnicity (optional)
 - f. Major
- (2) Please indicate your level of awareness for each question:
 - a. GRE (before workshop)
 - b. GRE (after workshop)
 - c. Graduate school as future option
- (3) Please indicate your perceived level of importance for each question:
 - a. GRE
 - b. Graduate school
 - c. Studying for the GRE
- (4) I feel more prepared for the GRE since attending this workshop.
- (5) I found attending this workshop beneficial.
- (6) What were your expectations going into this seminar?
- (7) What did you gain from attending this seminar?

All questions except questions (2), (3), (4), and (5) used an open response or check box format. The level of awareness (2) and importance (3) questions utilized a 5-point Likert scale. The level of awareness question used a scale which included: not aware, very limited awareness, some awareness, average awareness, and above average awareness, while the level of importance question used a scale which included: not important, somewhat not important, important,

somewhat important, and very important. Questions (4) and (5) used the standard 5-point Likert scale for disagree to agree (strongly disagree, disagree, neither agree or disagree, agree, and strongly agree).

Survey Participants

Institutional Environment

The University of Arkansas is a large, public, rural university with approximately 27,000 students and around 3,400 undergraduate engineering students. The College of Engineering's undergraduate population is 24% female and 22% ethnic minority.

Survey Participant Data

The fall 2016 workshop contained 36 survey responses, while the fall 2017 workshop had 51 responses. There were four students who attended both the first and the second workshops. Table 1 shows the demographic information from both workshops, which helps identify potential biases from the responses.

Table 1: Survey Demographics

	Workshop	
	Fall 2016	Fall 2017
Gender		
Male	56%	71%
Female	44%	25%
Not Reported	0%	4%
Classification		
Freshman	3%	14%
Sophomore	6%	6%
Junior	39%	25%
Senior	33%	39%
Graduate Student	3%	0%
Not Reported	16%	16%
Ethnicity		
White/Caucasian	53%	55%
Black/African American	17%	6%
Multi-Racial	5%	2%
Hispanic/Latino	14%	12%
Asian/Pacific Islander	5%	6%
Native American	3%	0%
Not Reported	3%	20%
Major		
Biomedical Engineering	33%	2%

Biological Engineering	8%	10%
Chemical Engineering	3%	18%
Civil Engineering	19%	10%
Computer Engineering	0%	6%
Computer Science	3%	10%
Electrical Engineering	9%	6%
Industrial Engineering	8%	10%
Mechanical Engineering	11%	20%
Other	6%	2%
Not Reported	0%	6%

The survey demographics showed that a majority of the participants self-identified as white/Caucasian males. This is consistent with the College of Engineering's general demographics. Both workshops contained participants from all undergraduate classification levels with most of the participants self-identifying as juniors or seniors. This was expected since most students think about graduate school during their junior or senior year, but it was encouraging to see freshman and sophomore students in attendance, since students should ideally start planning for graduate school closer to their sophomore year.

Results

The results from the two surveys conducted provide positive insight into the effectiveness of the workshop. The survey results provide insights into how participants felt the workshop effected their awareness and importance of the GRE and graduate school. Additionally, it helped researchers determine the effectiveness of the workshop in general. Overall, participants felt more prepared for the GRE because of the workshops (workshop 1: 78% agree or strongly agree and workshop 2: 80% agree or strongly agree). Participants also indicated that they found the workshop beneficial (workshop 1: 89% agree or strongly agree and workshop 2: 90% agree or strongly).

Awareness was important to analyze on a before and after the workshop basis to determine how effectively the workshop exposed the GRE to students. The results from the level of awareness of the GRE and graduate school questions demonstrate that the workshop successfully exposed students to the GRE and the importance of a graduate engineering education (371% increase for the first workshop and 169% increase for the second workshop). Overall, around 84% of respondents indicated an average or above average awareness of graduate school as a future option. The awareness results are summarized in Table 2.

Table 2: Awareness Survey Results

	Workshop 1	Workshop 2
Number of Responses	36	51
Before the workshop - not aware, very little awareness, or some awareness of the GRE	81%	69%
After the workshop – average awareness or above average awareness of the GRE	92%	84%
After the workshop –average awareness, or above average awareness for considering graduate school as a future option	83%	84%

Level of importance of the GRE overall, studying for the GRE, and graduate school in general was another important factor to analyze. A majority of participants (at least 70%) indicated that studying for the GRE, the GRE overall, and graduate school were important or very important at the conclusion of both workshops. Capturing participants’ importance levels before the workshop would have helped us understand the impact the workshop had, but since this was not captured, it is not possible to determine the effect of the workshop on importance. It does indicate that participants think the GRE and graduate school are important, but the participants could have held this opinion before attending.

The last two questions on the survey were open-ended to the students. The first question asked about their expectations going into the seminar and the consensus from the students who attended for both workshops were looking to suggestions to prepare for both graduate school and how to prepare for the GRE. Responses from some of the students attending the first workshop include: *“To be aware of how to sign up for the GRE, learn study tips for the GRE, how the GRE is scored, and the timeline to prep for grad school”* and *“I expected to receive all the details of the GRE, including studying methodology and average GRE scores. I also expected to find out where/how to take the test.”* The second workshop responses included: *“to be given more info about timeline for preparation of GRE and grad school and learn some stats about grad school and GRE scores”* and *“tips for test taking and learn what GRE is and how admission committees use the score.”*

The second open-ended question asked what they gained from attending the seminar. Overall, responses from both workshops were positive and included how the students learned the study habits, the application process, and timeline to prepare for the test. A response from the first workshop included: *“I gained the basic information regarding where and how to start studying/preparing for the GRE. There was a lot of good information shared in this seminar!”* Some responses from the second workshop included: *“Study tools, how to apply, general schedule and timeline”* and *“Learned what the GRE is for and several study resources.”*

Summary and Future Work

The GRE is a major milestone for students who are considering attending graduate school and furthering their education. Because the GRE is used by universities as an admission standard to compare their applicants, it is crucial for the students to do well. With an increased awareness of the GRE, students can create a plan to better prepare for the test and hopefully receive a high score. These workshops showed many students are not aware of the GRE until they are required

to take the exam, which often leaves them with little time to study. This workshop was designed to increase the awareness of the GRE, provide information beneficial for their preparation and increase the chances that they decide to take the exam.

Although the results from these surveys showed the benefit of having a workshop similar to those in this study, further research needs to be conducted to fully understand the impact on students, especially diverse groups within the engineering student body. Additional research should be conducted to understand the different perceptions that might exist about the GRE and the workshop between domestic and international students. This can be completed by adding an additional demographic question in the survey. The program will continue to host this workshop to its members as well as students in the college of engineering to gather data on the effectiveness of the workshop. An additional way the program can determine the success of the workshop is to follow-up with students who attended the workshop to see whether they took the GRE, the score they received, the number of hours they studied, and the preparation tools they used.

As part of the SIIRE program, we have decided to reimburse students within the program if they take the GRE and apply to our university. We believe that the combination of a graduate school enrichment activity focused on the importance and benefits of graduate school, the practice of preparing a mock graduate school application, a GRE workshop, and reimbursement for taking the GRE can be powerful tools that increase the likelihood that undergraduates will apply, attend, and complete graduate school. Future research is planned to rigorously test this combination of activities. The exciting aspect of this approach is that it represents a relatively low-cost approach to increasing graduate school attendance within STEM fields.

Acknowledgements

This material is based upon work supported by the National Science Foundation under Grant No. 1154146. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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