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Work in Progress: RIEF - A Peer-Led Study Group Intervention for the Improvement of First Generation Student Pass Rates, Self-Efficacy, Identify Formation and Retention

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Work in Progress: RIEF - A Peer-Led Study Group Intervention for the Improvement of First Generation Student Pass Rates, Self-Efficacy, Identity Formation and Retention

Abstract - This work-in-progress study analyzes the impact a Peer-Led Study Group (PLSG) model, implemented in a thermodynamics course, on First-Generation College Students (FGCS) by addressing whether the PLSG intervention enhances FGCS pass rates, degree retention, and undergraduate major persistence. The FGCS group is four times more likely to drop from their program than their non-FGCS peers, often due to factors such as lack of support and low aspirations for degree attainment and learning [1, 2, 3].

Initial comparisons show FGCS in PLSGs (FG-PLSG) passing at a rate over 15% greater than their non-PLSG peers during Spring semesters. However, the Fall semesters indicate FG-PLSGs passing at a rate 5% lower than their non-PLSG peers. We predict this could be attributed to differences in student demographics between semesters, for example, student degree programs, which have course ordering recommendations, potentially influence course preparedness. The team used logistic regression statistical analysis to analyze differences between pass rates of FG-PLSGs and non-FGCS in PLSGs, but initial results indicate no statistical significance.

Although not yet analyzed for statistical significance, the team began comparing the percent differences between rates of degree retention and major persistence between FGCS and non-FGCS in PLSGs. Much like pass rates, degree retention also varies with semester. Notably, the gap in major persistence between FGCS and non-FGCS in PLSG has decreased as the PLSG implementation has progressed from Spring 2022 to Spring 2023.

In future work, using pre-/post- surveys regarding the course, FGCS sense of belonging, engineering identity, and self-efficacy will be compared to that non-FGCS and statistically analyzed for significance.

INTRODUCTION & BACKGROUND

First Generation College Students (FGCS) are four times more likely to drop out of their program due to factors including, but not limited to, level of family support, parent education attainment, and aspirations for degree attainment [1, 2, 3]. To improve retention rates of FGCS, many of whom are transfer students, [the institution] has implemented a cooperative learning model in an engineering thermodynamics recitation course called the Peer-Led, Study Group (PLSG) model [4].

The PLSG model is based on the work of calculus professor Uri Treisman [5]. Treisman observed that Black students in his course who worked independently experienced high course failure rates compared to Asian students, who naturally formed peer groups to work together on problem-solving. Noticing the impact of group work, Treisman implemented a requirement for students to work in peer groups, and, as a result, he saw his once struggling students begin to pass the course at higher rates.

The PLSG model was implemented by placing students with similar GPAs at the beginning of the term into small groups of 4-5 members and guiding them to solve difficult problems cooperatively. Every two groups were assigned to one facilitator who intervened to promote discussion and provide assistance when necessary. The PLSG recitation itself was a

semester-long supplemental course that met once a week for 50 minutes, during which students worked on 1-3 challenging course-related questions. Students not placed in PLSGs were assigned to a more traditional TA-led Recitation (TAR), where a teaching assistant or professor typically solved problems at the front of a classroom of 25 or more students.

The cooperative learning environment fostered by PLSGs resulted in many students forming relationships outside the classroom. PLSG alumni have chosen future classes together, formed study groups for other courses, and developed social connections. Even in cases where these relationships did not extend beyond the classroom, we hypothesize that the peer support they received during PLSG recitations was enough to help improve self-efficacy, sense of belonging, pass rates, and degree retention.

This study specifically examines the impact of PLSGs on FGCS by addressing whether the PLSG intervention enhances FGCS pass rates, degree retention, and undergraduate major persistence.

METHODOLOGY

The student demographics (by self reported racial identity from institutional data) are included in Figure 1, and student course populations, percentage of PLSG students, and percentage of First Generation PLSG (FG-PLSG) students for the Spring 2022, Fall 2022, and Spring 2023 semesters are listed in Table 1. The research team used logistic regression models to determine whether FG-PLSG students were more likely to pass the course or achieve higher grades than their non-PLSG FGCS counterparts. These models were developed using the R Project for Statistical Computing program, and demographic data and course grades for the models were provided by [the institution]. Percent differences between FG-PLSG students and their non-PLSG FGCS peers were also calculated for pass rates, degrees earned, and degree persistence rates from the time of the course to graduation. These comparisons will be analyzed for statistical significance using logistic regression in the R Project for Statistical Computing software in the future; however, for now, percent difference values have been provided for comparison in the results section.

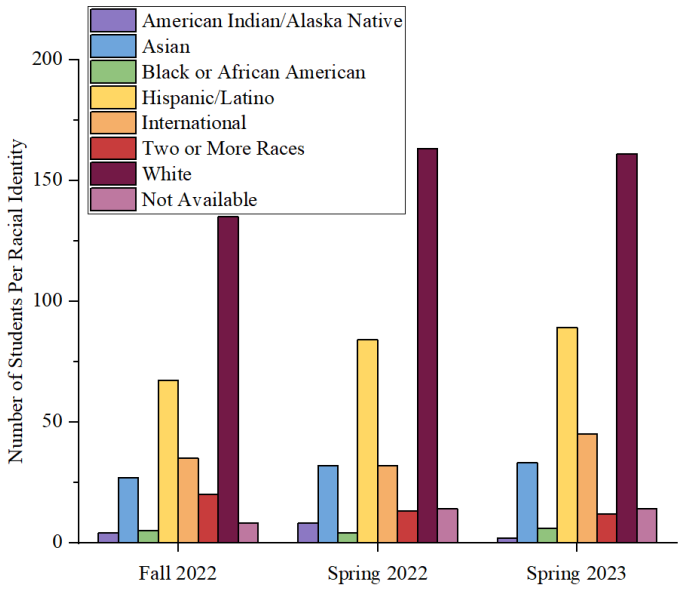

Figure 1. *Number of Students Self-Reported Racial Identity Per Semester*

Table 1. *Student Course Population by Semester*

Semester	Student Course Population	% PLSG Students	% FG-PLSG Students
Spring 2022	350	42.9	26.0
Fall 2022	301	50.8	25.5
Spring 2023	362	53.6	22.2

To investigate potential differences between FG-PLSG students and non-FGCS PLSG students, the team analyzed the types of interactions occurring in the PLSG groups. These interactions included student-to-student discussions, with questions acting as the starting point for each data collection, more succinctly labelled as *question-prompted discussions*. The methodology for collecting and categorizing these discussions was based on previous work supported by this grant utilizing the Revised Bloom's Taxonomy (RBT), a framework for categorizing levels of student understanding of course content [6, 7]. For simplification, the levels analyzed in the original work have been compressed to include: *low-level*, *mid-level*, *high-level*, and *facilitator*. These levels correspond to those listed in Table 2, below, with *mid-level* signifying question-prompted discussions aligning with the highest course expected outcomes. The facilitator designation corresponds to student-to-facilitator question-prompted discussions to capture all interactions, not just those amongst group members.

Table 2. *Simplified Cognitive Levels Based on the Revised Bloom's Taxonomy [6, 7]*

Level	Cognitive Model Levels	Description
Low-Level	Logistic, checking value	Content relating to course, below course outcome level
Mid-Level	Remember, understand	Lower levels of RBT, at course outcome level
High-Level	Apply, analyze, evaluate	Upper levels of RBT, above course outcome level
Facilitator	Facilitator	Student question-prompted discussion towards facilitator

RESULTS

The logistic regression models predicting pass rates and course grades revealed no statistically significant differences between FG-PLSG students and non-PLSG FGCS. We see these as positive results since all student groups are equally benefitting from the implementation of the PLSG model.

Reviewing the types of interactions started by FG-PLSG students, we continued to see no statistically significant differences between them and non-PLSG FGCS. However, as seen in Figure 2, FGCS interactions, depicted as the pie chart on the left, included far fewer question-prompted discussions directed at facilitators when compared to non-FGCS (all of which were in PLSGs). The percent difference of question-prompted discussions directed at facilitators, nearly 9% between the groups, was made up for in a greater number of *mid-level* question-prompted discussions started by FG-PLSGs. Initial predictions attributed these differences to beginning of term GPA, since current research has found lower GPA groups start more question-prompted discussions with their facilitators; however, the FGCS in this study collectively had a beginning of term average GPA of 3.15 compared to 3.38 for non-FGCS. This means despite having an overall lower incoming GPA, the FGCS are engaging more with their groups than with their facilitators.

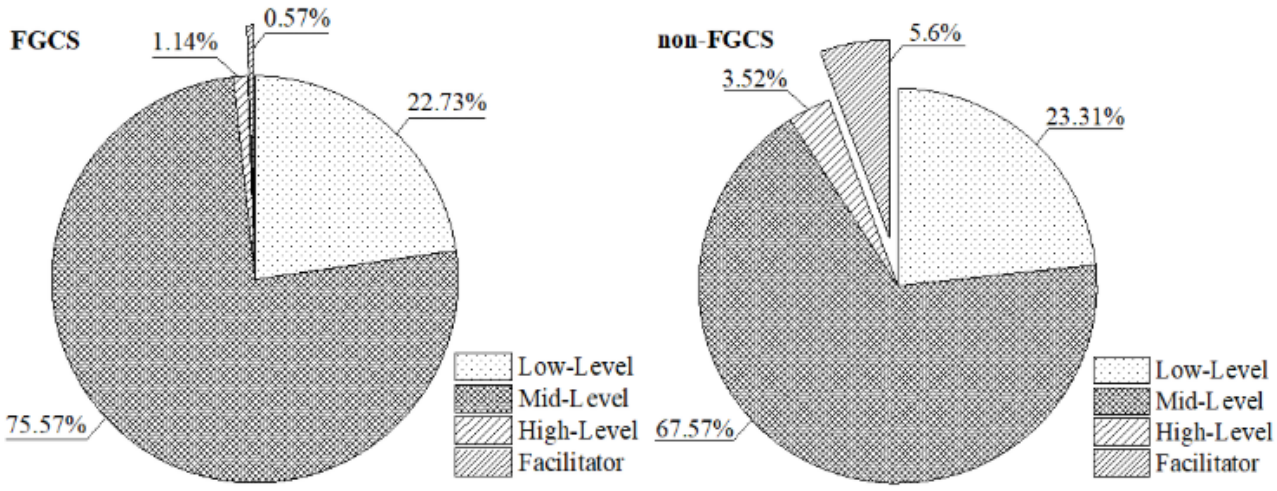

Figure 2*. Interaction Level Distributions of FGCS and non-FGCS in PLSGs*

Reviewing the percent differences between FG-PLSG students and non-PLSG FGCS for each semester, found in Table 3 below, we see a large variability across semesters. Although there are insignificant percent differences in pass rates between the two groups, we can see higher pass rates for FG-PLSG students in the spring semesters. The percent difference between the two groups' degrees earned also shows variability between spring and fall semesters, albeit to different magnitudes. Finally, as we observe from the Spring 2022 to Spring 2023 semester, the gap in the percentage of degree persisters from the time of the course to graduation has decreased between FG-PLSG students and non-PLSG FGCS. These differences may be attributed to differences in student demographics between the Spring and Fall semesters. Specifically, at [the institution], this course is taken in the Fall by a large number of Aerospace students who have prior knowledge from a previous course. Additionally, course load and courses offered differ between the Spring and Fall semesters.

Table 3. *Percent Differences Between Pass Rates, Number of Degrees Earned, and Number of Degrees Retained of FG-PLSG Students Compared to Non-PLSG FGCS*

Semester	**Spring 2022**	**Fall 2022**	**Spring 2023**
% Difference Pass Rates	20.5	-5.3	18.0
% Difference Degrees Earned	-3.6	32.5	-32.6
% Difference Degree Persisters	-9.5	-4.8	0.0

DISCUSSION & FUTURE WORK

Considering our research question, we found no significant differences in pass rates between FG-PLSG students and non-PLSG FGCS. We consider these results promising as they validate the PLSG model is equally impacting both groups. As this study continues, we will investigate whether differences in degree retention and degree persistence rates between the groups are statistically significant. Notably, although statistical significance has yet to be tested, preliminary observations indicate that differences in these rates between FG-PLSG students and non-PLSG FGCS are far smaller than the fourfold greater likelihood of program dropout reported in other

research [1]. This finding in itself underscores the potential of the PLSG model to improve retention among FGCS, demonstrating its value as a supportive intervention.

In the future, we plan to investigate whether the PLSG intervention improves FGCS self-efficacy and/or sense of belonging by comparing survey responses from FGCS. These surveys included rankings of factors such as sense of belonging to [the institution], sense of belonging with the engineering community, sense of belonging with other engineering students, perceived value of the recitation, and confidence in asking a professor or peer for help. This analysis will include linear regression modeling similar to the analyses contained in the current paper to compare pass rates and course grades. We also plan to further study the differences between FGCS and non-FGCS who have participated in the PLSG model now that it has been fully implemented in the course. This will include, but not be limited to, statistical analysis of interaction levels.

ACKNOWLEDGEMENT

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