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PHYSICS STUDENT PARTICIPATION TEST IN THE ONLINE GROUP HOMEWORK FORUM

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ABSTRACT

This article analyzes the publishing behavior of insufficient research between the upper and lower material science courses, and the publishing mode of one semester on a web discussion board. Analyze the nature of high school students' posts, and analyze the brutal frequency of posts through t-test and analysis of variance to determine the chance of a noteworthy contrast between the two classes and throughout the semester. It was found that compared with the upper-grade students, the lower-grade students have more positions in general and more positions related to solutions. In addition, during the semester, the number of positions related to homework and feedback increased. This shows that students in introductory and advanced physics courses use the tool differently, and students will also change their publishing behavior over time.

INTRODUCTION

It is important to improve our current state of physics education in order to train more students, enable them to join the workforce in the fields of science and engineering, and enable students to better understand how the universe works. This research examines the discourse and problem-solving methods of physics students in the context of online media. Many high school and university courses use online discussion boards as part of the class, and they have become one of the most commonly used tools in online teaching. This study studied student discussion behaviors related to problem-solving physics in an online discussion board, hoping to provide educators with more knowledge about how students use such tools and how to successfully apply them in the classroom. So that students have a better understanding of physics.

METHODOLOGY

The purpose of this research is to better understand student discourse in an online environment and how it may differ between novice and expert students as well as over the course of a semester. The research questions of this study are:

• How does student posting behavior in an online discussion board differ between GROUP 01 and GROUP 02?

• How does student discussion in an online discussion board change over the course of a semester?

• What factors affect how students use an online discussion board (GPA, discussion board experience, etc.)?

Student discussions posted on an online discussion board are analyzed and coded based on students' post content in two classes, GROUP 01 and GROUP 02. ZOOM was the specific discussion board used by students in the study. Students work in groups to solve homework problems within a thread on ZOOM where students within the groups must work together to solve the problem. Additionally, students outside of the group can post and contribute to the problem-solving discussion as well.

GROUP 01 is an introductory calculus-based mechanics class intended for STEM majors early in their university careers. For this class, students are assigned into groups of four to eight students in order to create a

problem-solving team for use in ZOOM as well as in-class activities. Each group is assigned one problem from the week's homework set, which are back of the chapter book problems, and must solve the problem as a team within a thread on ZOOM every week. Each student in the group is assigned a different role in the problem-solving process and must post according to an assigned problem-solving role; the designated group roles are: Director, Investigator, Executor, and Skeptic. If the group is larger than four there may be a repetition of roles such as two Skeptics or two Executors. This class was selected for this investigation because of its nature as an introductory physics class. The students in this course are new to university physics with limited or no experience. Some students may have experience from high school physics or physical science courses, lower level university physics, or from potentially retaking GROUP 01.

GROUP 02 is an intermediate calculus and differential equations-based mechanics course that is intended for physics majors as they begin their upper level studies in physics. As in GROUP 01, students are put into groups of four to eight students with each student having a different ZOOM role. Each group is assigned one problem from the week's homework, which are back-of-the-chapter book problems that students must solve within a thread on ZOOM every other week. Each student in the group is assigned a different role in the problem-solving process and must post according to their assigned role (Director, Investigator, Executive, or Skeptic). This class was selected because it is an upper level physics class. Students in this class are physics majors and presumably have more experience in both physics and problem-solving.

All students that elected to participate in the study were given a short survey to complete. This survey asked students to provide the following: the student's self-reported approximate GPA, thestudent's preference of individual or group work, whether or not the student has taken a class with teacher in the past, if the student started at CSULB as a freshman or was a transfer student, the student's familiarity with online discussion board usage in courses, and the student's prior experience with ZOOM. This survey was done in the beginning of the semester for both courses and provided a profile for the students. The survey can be seen in Appendix A. The survey data was collected and used to both better understand individual students as well as to get a better understanding of the students in both of these classes. This data was to be linked to students using a five-digit ID to protect the students' identities. Posting data from each consenting student was linked to the student's survey responses. This was done in order to understand the students that were making the posts and to see if there is a relationship between qualities of the students and posts made. For each student, the quantity of each posting category for the early and late data was recorded and linked to the survey data. This provided a profile for each consenting student as well as their quantity and frequency of posts and each post category. Student discussions from ZOOM were examined early and late in the semester for both classes in the fall semester of 2020. A sample of student discussion can be seen in Appendix B. The early data for GROUP 01 was examined for the assignment from Oct. 10-15, 2020 and the assignment from Oct. 4-17, 2020 was used as early semester data for GROUP 02. These dates were chosen because they were within the first few weeks of the semester while not being the date the first assignment was given so students had a chance to get slightly acquainted with the ZOOM assignment and format. The late discussion posts for GROUP 01 were made from Nov. 14-17, 2020 and the late discussion posts for GROUP 02 were made from Nov. 7-19, 2020. These dates were chosen because these were the dates some of the last ZOOM assignments for the courses were due. At this time in the semester, students have completed these assignments several times and are more accustomed to the assignment format and medium

of communication. Students have also had time to get to know other students better and grow as physicists and a problem-solvers.

Data from the two classes, GROUP 01 and GROUP 02 was coded based on the content of the posts into the categories: solution, math, physics, surface/procedural, conceptual, assignment-related, affirming, image, and external. The frequency of these post types was calculated and the mean frequency for each post type per student was analyzed using appropriate statistical tests. The analysis examined the mean post frequency for each post type for: GROUP 01 vs. GROUP 02 posts; early semester vs. late semester posts; and frequency of posts types based on student characteristics such as GPA, preference of individual or group work, and experience with discussion boards. Mean frequency per student was chosen as the unit of analysis when examining student post types because it allowed for t-tests to be run to compare two groups (GROUP 01 vs. GROUP 02 and early vs. late) and for ANOVAs to be run to compare three or more groups when examining student characteristics. To learn if the two classes, GROUP 01 and GROUP 02, had similar or different frequencies of post types, pairwise t-tests were run for physics, solution, surface/procedural, conceptual, assignment-related, and affirming posts, as well as post frequency. A pairwise t-test is a statistical analysis test that determines if the means between two groups are significantly different or could be due to random chance. Math, image, unproductive, and external posts were not analyzed due to the difficulty in interpreting image posts as well as the scarcity of math, unproductive, and external posts.

To see if experience with discussion boards factored into the types of posts that students made, a t-test was conducted. Using the survey data collected from consenting students, each student was categorized into either having used discussion boards in a class or not having used discussion boards in a class. The t-test examined whether this experience factored into students' making solution, physics, assignment-related, conceptual, surface/procedural, and affirming posts, as well as the number of posts made. This process was done for both GROUP 01 and 310 as well as for the early and late posts for each class.

RESULTS AND ANALYSIS

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The goal of this research is to learn about student discussion and problem solving through an online medium, in this case a discussion board tool called ZOOM. Students are assigned physics problems to discuss and solve through ZOOM and must work together and collaborate in order to accomplish this task. For this study two courses were examined: GROUP 01, which is an introductory calculus-based mechanics course, and GROUP 02, which is an upper division undergraduate mechanics course. Both courses are taught by the same instructor who uses ZOOM the same way. To guide this study three research questions were posed:

• How does student discussion in an online discussion board differ between GROUP 01 and GROUP 02?

• How does student discussion in an online discussion board change over the course of a semester?

• What factors could affect how students use an online discussion board (GPA, discussion board experience, etc.)?

To answer research question one, a t-test was conducted to compare the early data for GROUP 01 and GROUP 02 and the late data for GROUP 01 and GROUP 02. A t-test was also done to compare the early and late posting data for both GROUP 01 and GROUP 02 to answer research question two. To answer research question three, the survey data and early and late posting data was compared using an ANOVA for both classes.

To learn more about the student body of GROUP 01 and GROUP 02, a survey was

distributed to the students in both classes to complete. This survey provided the researcher with some background knowledge of the students as well as a general profile of the two groups of students. Tables 3-5 detail the survey responses made by students to give a general profile of both classes. Table 3 shows the self-reported GPA of student in GROUP 01 and GROUP 02. Table 1 shows the preference of individual work, group work, or no preference for students in GROUP 01 and GROUP 02. Table 5 describes other characteristics of student in GROUP 01 and GROUP 02.

TABLE 3. Survey Responses of GROUP 01 and GROUP 02 for GPA

Survey Response	GROUP 01 (N = 74)	GROUP 02 (N = 42)
GPA < 2.0	0.0%	0.0%
GPA 2.0-2.5	4.0%	9.5%
GPA 2.5-3.0	18%	36.1%
GPA 3.0-3.5	40.2%	35.1%
GPA 3.5-4.0	22.3%	14.3%
Unreported GPA	9.0%	0.0%

CONCLUSION

Analysis suggests that there was an increase in assignment-related posts as well as post frequency in GROUP 01. Students in GROUP 01 may become more accustomed to ZOOM and the discussion roles, which may have contributed to the increase in assignment-related posts. The increase in post frequency could reflect that students in GROUP 01 may be more familiar with the tool and be more willing or able to use it both to communicate with others and learn and discuss the assignment at hand. These GROUP 01 students may also want to discuss the assigned problems more compared to GROUP 02 students. It is important to note that a portion of students' grades in both courses based on ZOOM participation. While the exact algorithm for each week's ZOOM score is not known by the students, many students may believe that more participation means more points. Another possibility for the increase in post frequency could be related to grades. Students in GROUP 01 may be more concerned with grades than GROUP 02 students since it is a preliminary class before acceptance into some majors. Additionally, there is a much larger portion of GROUP 01 students that are non-physics majors so they may be more concerned about grades than overall learning. Some of these students may be taking GROUP 01 because it is a prerequisite or requirement of their major and want to pass or get a good grade rather than because they have an interest in learning the subject.

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