College Students' Perspectives on and Use of Exam Note Sheets in Intermediate Algebra

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Creating and bringing a sheet of notes to a math exam can help students perform better and feel less anxious, but not all note sheets are equally helpful. This study explores how undergraduate students prepare and use exam note sheets in an intermediate algebra course. We surveyed 119 students about how they created and used their exam note sheet and how they perceived the usefulness of their sheet. We also collected students' note sheets and exam scores. Preliminary analyses revealed that most students spent less than two hours preparing their note sheet. Most students felt the note sheet helped them study for and perform well on the exam and lessened their anxiety. Forthcoming analysis will explore relationships between students' exam performance and features and use of their sheet. Findings can be used to develop guidance for students on how to more effectively prepare and use exam note sheets.

Keywords: Note sheets, crib sheets, support sheets, exam studying, college algebra

Sometimes college instructors allow students to bring an index card or sheet of notes to use on exams (sometimes referred to as a "cheat sheet"). These note sheets can usually include anything students think might be helpful on the exam, such as formulas, definitions, or descriptions of procedures. Instructors often allow this resource because they believe it helps alleviate students' anxiety and because they want students to focus more on conceptualization and problem solving and less on memorizing and procedures (Danielian et al., 2020; de Raat, 2012; Edwards & Loch, 2016). Some studies have shown that students report feeling less anxious or stressed about an exam when they are allowed to bring a note sheet (Danielian et al., 2020; Drake et al., 1998; Erbe, 2007). While some research has found that using note sheets is associated with better exam performance (Larwin et al., 2013), other studies have shown no significant relationship to performance (Hamouda & Shaffer, 2016).

The relationship between a students' exam score and their use of a note sheet may depend on the types of information they include and other characteristics of their note sheets (Song & Thuente, 2015). For example, studies analyzing students' exam note sheets have found that including more example problems (Edwards & Loch, 2015) and creating a more densely packed sheet (Ludorf & Clark, 2014) are associated with lower exam scores, while including a lower number of abstract concepts is associated with higher scores (Danielian & Buswell, 2019).

The benefit of a note sheet may not come simply from having it as a source of information during the exam; the process of creating the note sheet can be a valuable part of the study process. While preparing their note sheet, a student may consider which course concepts are most important, strategize about how to organize the information, and determine which ideas they know by heart and what reminders they might need. A high-quality note sheet that reflects a student's understanding and is tailored to their needs is a product of a thorough study process. For example, de Raadt (2012) suggests that the connection they found between including fewer abstract concepts and performing better on the exam may reflect that students who internalize key concepts develop a deeper understanding of the material and are thus likely to perform well.

In this study, we explore how college students in an intermediate algebra course create and use exam note sheets, as well as their perspectives on the utility of the note sheet. We also consider how various features of students' use of note sheets relate to their exam performance.

Insights gleaned from this research can indicate if and how preparing and using an exam note sheet is helpful to students. Instructors can use this information to develop guidance for students on how to prepare and use an exam note sheet in a way that helps them learn material deeply and perform better on exams.

Background Literature and Research Questions

Much of the existing research on the use of exam note sheets has focused on coding students' note sheets for particular features, such as number of example problems and formulas included, organization, and density (e.g., de Raat, 2012; Ludorf & Clark, 2014; Song & Thuente, 2015). Many of these studies have attempted to identify which features are associated with better performance, by comparing students' note sheets to their exam scores (e.g., Capaldi, 2019; Edwards & Loch, 2015). Most of these studies have used small samples, and many analyses failed to reach statistical significance.

Another approach has been to survey students to explore their perspectives on how they create and use exam note sheets (e.g., Danielian et al., 2020; McCaskey, 2013; Peters, 2024). These surveys have revealed insights into how the note sheet fits into students' larger study process and how they see the benefit of the resource. For example, when asked to rate the extent to which the process of making a note sheet helps them study for exams, undergraduate students in an engineering class gave an average rating of 4.11 out of 5, with 5 indicating that making a note sheet helps a great deal in studying (Peters, 2024). Most students felt that the note sheet was effective in helping them perform on the exam as well (Peters, 2024). In another study conducted in an undergraduate engineering class, students reported that preparing a note sheet helped them summarize, retain, and organize content and allowed them to avoid memorization (Danielian et al., 2020). Students also noted that having a note sheet alleviated their stress about the exam (Danielian et al., 2020). Most survey studies involved small samples, and many did not consider exam performance in their analysis.

More research is needed to investigate the relationships among students' perspectives on and use of note sheets, individual features of the note sheets themselves, and scores from the exam on which they used the note sheet. Exploring these three data sources and relationships among them should provide a deeper understanding of how preparation of a note sheet fits into students' overall study process, and how their use of the resource relates to their exam performance. Additionally, only a few studies have explored the use of note sheets in mathematics courses specifically (Capaldi, 2019; Edwards & Loch, 2015). To build on the existing literature on students' use of exam note sheets, this study investigates the following research questions:

1. In what ways do college students enrolled in an intermediate algebra course create an exam note sheet and use it on an exam?
2. How do students perceive the usefulness of their note sheet as an exam resource?
3. What are common features and properties of the exam note sheets created by the intermediate algebra students?
4. What relationships exist between how a student creates and uses their note sheet, characteristics of the note sheet itself, and their exam performance?

Method

Participants and Context

Participants were 119 undergraduate students enrolled in three sections of an intermediate algebra course at a large research institution located in the mid-Atlantic region of the United

States. Students in this course are allowed to prepare and bring one 8.5" x 11" sheet of notes to use on each exam. This course was chosen for study because instructors have noticed wide variability in what students include on their note sheets and want to better support future students in preparing and using their note sheets.

Ninety-one percent of participants were in their freshmen or sophomore year, and 35% were repeating the course. At least 90% of the participants elected to provided demographic information. Of the students who did, 68% identified as women, 30% as men, and 2% as non-binary. Seventy-three percent of respondents identified as white; 19% as Black/African American; 14% as Latine/Hispanic; 9% as Asian, Pacific Islander, or Desi; and 2% as indigenous/Native American. (Percentages add to more than 100 because participants were allowed to select multiple racial/ethnic identities.) Twenty-nine percent of respondents reported being a first-generation college student.

Data Collection

After the third exam of the Spring 2025 semester, we invited all 187 students enrolled in the course to complete a survey about how they created their note sheet, how they used it on the exam, and how they perceived the usefulness of their sheet. The exam focused on systems of linear equations, understanding and manipulating exponents, simplifying and factoring polynomials and rational expressions, and using the zero product property to solve equations.

Survey questions included a mix of multiple-choice, Likert, and open-response questions. Multiple choice questions asked students about their note sheet creation process (e.g., how long they spent creating their sheet and whether they worked with others), as well as what types of information they included and how they used their note sheet on the exam. Likert questions asked students how useful their note sheet was in helping them study for and perform on the exam and whether having the sheet lessened their anxiety/nervousness about the exam. The open-response questions, several of which were inspired by McCaskey (2013) and Peters (2024), asked students to describe their process for creating their note sheet, how they used it on the exam, and any changes they plan to make when preparing their sheet for the next exam.

Students were offered a small number of course points to incentivize participation. We received 128 responses, but some were not included in the analysis because students either did not complete enough of the survey or did not take the exam. There were 119 usable survey responses, a response rate of 64%. We asked the 119 students for consent to analyze their note sheets and exam scores. Seventy-three students allowed access to their note sheets and 72 to their exam scores. In total, 71 students allowed access to all three data sources.

Data Analysis

Preliminary analyses have been conducted. Specifically, we have analyzed the responses to the 18 multiple-choice and 10 Likert items on the survey. We created frequency tables for responses to each question. To analyze responses to the open-ended survey items, we will use inductive thematic analysis (Braun and Clarke, 2006).

We plan to code students' note sheets according to various features and characteristics of each sheet, inspired by strategies used by Capaldi (2019) and Edwards and Loch (2015). For example, we will count how many example problems and descriptions of procedures are included. In addition, we may categorize students' strategies for organizing the information. We will decide precisely which features to attend to after analyzing the survey responses and exam scores in more depth. Insights gathered from these first two data sources could illuminate which

features of the note sheets may be most beneficial to attend to, which will help target the coding process.

We will use chi-square analysis, ANOVA, and multiple regression to investigate correlations between and among the survey responses, exam scores, and quantifiable note sheet features.

Preliminary Findings

We present preliminary findings from analysis of the multiple-choice and Likert survey items. Of the 119 participants, 105 created a note sheet for the third exam. Of these students, 91% reported spending less than two hours making their sheet, and 54% reported spending less than one hour. About a quarter of students (28%) started making their note sheet on the day of the exam, with another quarter starting the day before, and 48% starting at least two days in advance. Only 13% of students reported working with others when creating their sheet.

Regarding the kinds of information students included on their note sheet, a large majority said they included formulas (89%), example problems (84%), and instructions or steps for solving certain types of problems (78%). Students also reported including definitions (43%), graphs (11%), and supportive notes to themselves, e.g., "You can do it!" (9%).

Participants who created a note sheet were asked how often they used it during the exam. Survey responses indicate that 41% of students used their note sheet three to five times, 29% used their sheet one to two times, and 27% used it more than five times. Only 4% of students reported not using their note sheet at all. Most students reported using their note sheet to look for examples of similar problems (74%), steps for solving certain types of problems (70%), or a formula (66%). Students were less likely to use their sheet to look up a definition or fact (29%) or a graph (6%).

Most students reported perceiving the note sheet as a positive resource. Fifty-two percent strongly agreed and 36% somewhat agreed that the process of creating their note sheet helped them study for the exam. Forty-five percent strongly agreed and 33% somewhat agreed that having a note sheet helped them perform better on the exam. Fifty-two percent strongly agreed and 31% somewhat agreed that having a note sheet helped lessen their anxiety or nervousness about the exam.

A small number of students (n=14, 12% of survey respondents) reported that they did not make a note sheet for the exam. When asked why they chose not to make one, half of these students reported that they felt confident about the material and did not feel the need for a note sheet. Other reasons included forgetting to make a note sheet (29%), not thinking a note sheet would be helpful for the exam content (21%), not having time to make one (21%), being unsure what to put on the note sheet (21%), and finding a note sheet they made for a previous exam unhelpful (14%). (Percentages add to more than 100 because participants were allowed to select multiple reasons.) Of the students who did not create a note sheet, 50% strongly agreed and 36% somewhat agreed that having one would have helped them study for the exam. Fifty-seven percent strongly agreed and 21% somewhat agreed it would have helped them perform better.

Discussion

Survey responses revealed that students spent a minimal amount of time creating their note sheets, with more than half of respondents spending less than an hour, and almost all (91%) spending less than two hours. Most students started making their note sheets close to the exam day, with slightly over half starting the day of or day before the exam. As our analysis proceeds, we plan to investigate if and how these characteristics of students' note sheet creation process relate to their exam performance.

Results indicated that formulas, example problems, and instructions or steps for solving certain types of problems were the top three pieces of information included on note sheets as well as the top three used on the exam. Interestingly, while formulas were the most common type of information students reported including on the note sheets, with 89% of students including them, they were only the third most common type of information used, with only 66% of students looking up a formula on their sheet during the exam. When we analyze the note sheets themselves, we will be able to see which formulas students included, which could reveal insights into why they were not as relevant on the exam as students expected. Students' expectations regarding examples and instructions/steps were more in line with their use: 84% of students reported including example problems, and 74% ended up looking for examples during the exam. Similarly, 78% of students included instructions/steps, and 70% looked for them during the exam. The low percentages of graphs and definitions/facts included likely reflects the fact that the content of the exam focused on simplifying and factoring expressions and solving equations and thus did not call for many definitions, facts, or graphs.

The finding that a majority of students (83%) felt that having a note sheet decreased their anxiety or nervousness about the exam resonates with others who have found that note sheets help students feel less anxious or stressed (Danielian et al., 2020; Drake et al., 1998; Erbe, 2007).

Next Steps

In the next phase of analysis, we will investigate how students' exam performance relates to various aspects of how they created and used their note sheets. We will look for correlations between students' survey responses and their exam scores and plan to report on our findings at the conference. For example, we will analyze whether the amount of time a student spent preparing their note sheet is associated with their exam score. We will also analyze students' responses to the five open-ended survey questions and plan to present salient themes at the conference. For example, we hope to describe students' various strategies for deciding what information to include on their note sheet and how to organize the information. The final phase of analysis will consist of developing a coding scheme for the note sheets themselves, based on salient features identified in earlier phases of analysis. After coding the sheets, we will investigate relationships between features of the note sheets and students' exam scores.

Previous studies have suggested that students need guidance in how to use the note sheet resource effectively (Capaldi, 2019; Edwards and Loch, 2015; Ludorf and Clark, 2015). We hope this analysis will reveal insights that can help researchers and practitioners develop guidance for students on how to create a note sheet that helps them learn the material and succeed on exams.

Questions for the Audience

1. What features would be fruitful to attend to when analyzing students' note sheets?
2. What conceptual or theoretical framings would be useful to consider when interpreting our findings?
3. Based on your teaching experience, what advice would you give students on how to prepare and use their note sheet?

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