Instructor and Student Perceptions of the Authorized, Self-prepared Reference Sheet for Examinations

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Abstract

This paper presents results from a quantitative analysis investigating instructor and student perceptions of the authorized, self-prepared examination reference sheets, commonly known by students as an authorized “cheat-sheet”. In this study, student-prepared “cheat-sheets” are evaluated and scored according to five dimensions measuring their organization, completeness, readability, usability, and density. Scores are paired with results from an end of semester survey aimed at understanding student perceptions of the reference sheet benefit to outcome, as well as the estimated time investment made in the preparation. While the results suggest most students embrace the use of a “cheat-sheet”, some students choose not to invest time in preparing their “cheat-sheet” for a variety of reasons and strategies, which correspondingly demonstrate a range of outcomes. The factors for these decisions are discussed and outcomes are reported.

1 Introduction

Over many years researchers, largely in the field of psychology, have studied the benefits of using reference materials in the examination setting with respect to performance, knowledge acquisition and knowledge retention [1-4]. Although some researcher findings have not been supportive [5-7], a general consensus has not been formed on the practice due in large part to the differing examination formats, topics and contexts. As a result, course instructors are often left to debate whether the allowance of self-made reference materials during examinations improves student preparation and knowledge acquisition, resulting in better test outcomes. Principle courses of a quantitative nature, such as engineering economy, often permit the use of a reference during examination. Several studies have cited benefits from the approach such as reduced test anxiety [8-10], encouraged preparation [11], and discouraged cheating [12]. As a result, instructors frequently permit students to use resources, such as: (1) the text book, to encourage use of long-term reference; (2) the class notes, to encourage good note taking and class attendance; (3) a notecard, to encourage focused study and prioritization of important topics; (4) an instructor-prepared formula reference sheet; or (5) a student-prepared “cheat-sheet”, to encourage thorough review and organization of the material. While these approaches have become commonplace in courses, little investigation has been conducted to evaluate how students utilize these resources, the impact on test preparation and the resulting benefits.

This work will present results from a quantitative analysis investigating instructor and student perceptions of the authorized, self-prepared examination reference sheets, commonly known by students as the authorized “cheat-sheet”. In this study, student-prepared “cheat-sheets” are evaluated and scored according to five dimensions measuring their organization, completeness, readability, usability, and density. Scores are paired with results from an end of semester survey aimed at understanding student perceptions of the reference sheet benefit to outcome, as well as the estimated time investment made in the preparation. While the results suggest most students embrace the use of a “cheat-sheet”, some students choose not to invest time in preparing a high quality “cheat-sheet” for a variety of reasons and strategies, which correspondingly demonstrate a range of outcomes. The factors for these decisions are discussed and outcomes are reported.

2 Research methodology

The approach consisted of collecting data from one section of an engineering economy course with 34 students enrolled at regional state university. Students enrolled in the course were junior and senior-level undergraduate engineering students. The course instructor had previously taught the course over prior four semester offerings. Data collected and used in the study included: (1) a student survey regarding reference aid preparation and perceptions; (2) student self-created, authorized quick reference "cheat-sheets"; and (3) final examination performance outcomes.

The comprehensive final examination included approximately 30% new material that students previously had not been tested on. The examination format consisted of 20 multiple-choice questions, some requiring computation, and 8 multipart problems to complete. Examination time was restricted to a 150-minute period. Students were permitted to use a self-created, handwritten, double-sided 8½ x 11-inch authorized quick reference sheet, otherwise known as the cheat-sheet. Prior to starting the examination, students were asked to complete a one-page survey to gather information about their perceptions of the study preparations and cheat-sheet reference. At the conclusion of the examination, the instructor collected all materials including the student's cheat-sheet reference.

Student Survey

Prior to beginning the final examination students were asked to complete a brief survey to collect information about their perceptions of using an authorized cheat-sheet reference and to better understand their preparation efforts for the final examination. The results are used to develop insight with respect to four questions: (1) what reference aid would they have preferred if given a choice; (2) how did they go about their study preparation with use of the cheat-sheet option; (3) what did they think the benefit would be in using a cheat-sheet; and, (4) how do they think others will behave relative to academic integrity if a cheat-sheet were not allowed. The following detailed questions were posed in the survey.

Questions Q1 through Q7 were used to evaluate study preparation given the authorized cheat-sheet option was available. Responses include: (a) always, (b) sometimes, and (c) rarely.

1. I plan adequate study time for each exam.
2. I keep my course materials organized and in a logical order.
3. I study with a group from my class.
4. I prepare potential test questions from themes, central topics, old exams, syllabi, and information emphasized by the professor.
5. I include creating my authorized cheat-sheet as part of my study process.
6. Creating the cheat-sheet assisted me in organizing the material to study.
7. I allocated enough time to prepare my cheat-sheet with the information I thought useful.

Additional questions were included on the survey to ascertain the level of study preparation effort made. Responses were numerical values.

8. How many hours did you spend preparing your final exam cheat-sheet reference?
9. How many hours did you spend preparing for your final exam in total?

Questions Q10 and Q11 were used to evaluate whether students had trouble locating information on their cheat-sheets during exams, and how they utilized available cheat-sheet space. Responses include: (a) always, (b) sometimes, and (c) rarely.

10. I have difficulty locating and retrieving information from my cheat sheets during exams.
11. I utilize all the allowable space on my cheat sheet, whether I need it or not.

Questions Q12 through Q15 were used to evaluate the perceived benefits of being allowed an authorized cheat-sheet option, and the perceived behavior of others if the cheat-sheet option were removed. Responses include: (a) most definitely, (b) somewhat, and (c) no difference.

12. Being allowed to use a cheat sheet, I feel less stressed about taking an exam.
13. Being allowed to use a cheat sheet, I feel that my exam result will be better.
14. Not being allowed to use a cheat sheet, I feel a classmate may be tempted to cheat.
15. Not being allowed to use a cheat-sheet, I feel pressure from others to assist in cheating.

In order to associate the survey results with performance outcomes students were asked to volunteer identifying information provided they were comfortable in doing-so; otherwise, students could return the survey anonymously. Survey responses were then coded and recorded. Results and analysis are presented in the section for results.

Reference Evaluation

Developing a scoring criterion to evaluate the cheat-sheet reference required understanding the quantitative nature and examination format. To start, forty authorized cheat-sheet references from a previous semester's engineering economy course were evaluated to identify the unique characteristics and features. Like many other studies [13-17], characteristics and features such as density and organization were readily apparent. In total, five characteristics were identified for use in the scoring criterion: (1) density; (2) organization; (3) readability; (4) number of formulas; and (5) number of examples.

In Table 1 the scoring criterion around these characteristics is fully detailed. For the feature "density", the use of available space is evaluated according to a Likert scale (1-3), where moderately or very dense is preferred. For the feature "organization", the use of organization structure, references, color and highlighting are evaluated according to a Likert scale (1-3), where organized or well organized is preferred. For the feature "readability", the use of font size, clarity, and legibility are evaluated according to a Likert scale (1-3), where readable and clearly readable is preferred. For the feature "number of formulas", the presence of an excessive number of formulas, or well above average in number, is considered an undesirable characteristic and thus subject to penalty (0, -1, -2). The rational is that the presence of core formulas should be adequate and extensive formula permutations introduces confusion. For the feature "number of examples", the presence of an excessive number of examples, or well above average in

number, is considered an undesirable characteristic and thus subject to penalty (0, -1, -2). The rational is that the presence of a simple example can be helpful to reflect the concept, however, multiple permutations indicate lack of understanding fundamental concepts. Students not creating a cheat-sheet or failing to bring it for use in the exam received a score of zero. To compute a representative composite an additive scoring approach was used. Using this criterion each cheat-sheet was evaluated by two reviewers.

Figure 1 provides an illustration of two different authorized cheat-sheet examples used in a midterm examination. The cheat-sheet appearing on the left received the scores: density 2, organization 2, readability 3, formulas 0, and examples -1. This received a total score of 6. By comparison, the cheat-sheet appearing on the right received the scores: density 1, organization 1, readability 2, formulas 0, and examples 0. This received a total score of 4.

Table 1: Detail description of cheat-sheet quality feature, scoring, and criteria

Feature	Score	Criteria Description
Density	1	Very sparse
	2	Moderately dense
	3	Very dense
Organization	1	Poorly organized
	2	Organized
	3	Well organized
Readability	1	Barely readable
	2	Readable
	3	Clearly readable
Number of Formulas	0	Average number of formulas
	-1	Above average number of formulas
	-2	Excessive number of formulas
Number of Examples	0	Average number of examples
	-1	Above average number of examples
	-2	Excessive number of examples

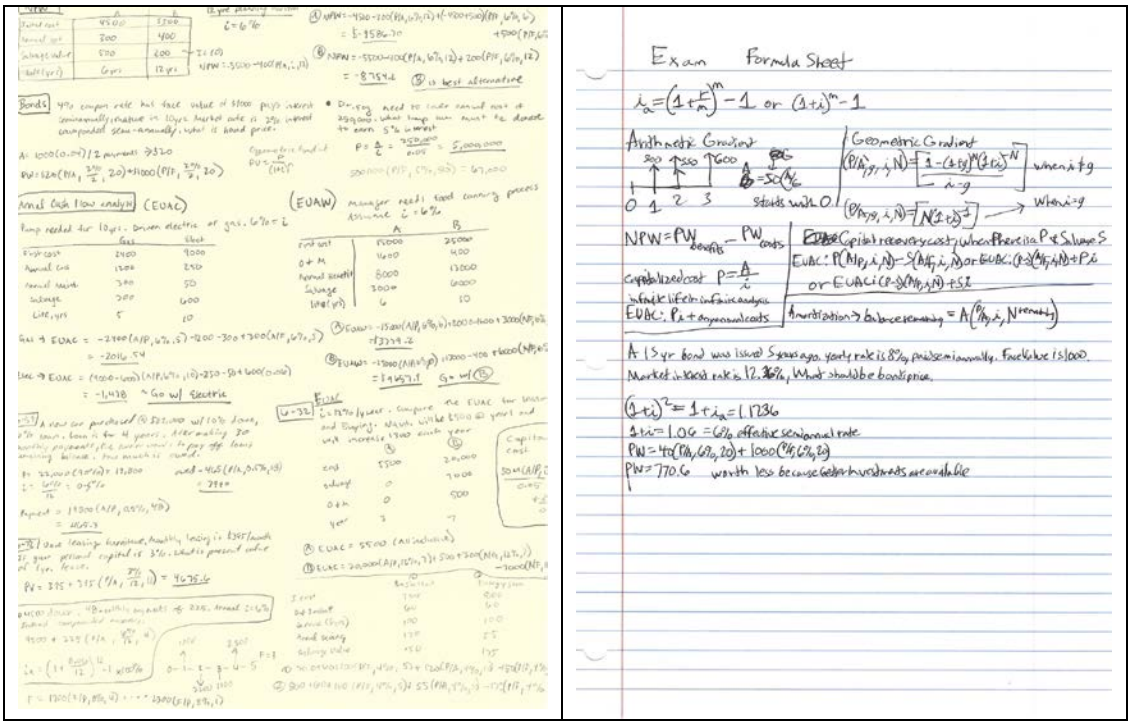

Figure 1: Comparison of example student cheat-sheets from a midterm examination

Exam Performance

By allowing the use a quick reference aid in an examination it is expected that students will take time to carefully review, organize, and construct a quality cheat-sheet and develop a better understanding of the material. As a result, it is expected that students will perform better on the examination. To evaluate whether the perception is correct, students are categorized into one of two groups based on their final examination performance. Using an approach like Song [13], if a student's examination score was at least at or above the median final examination score for the class, they are categorized in the higher performing student (HPS) group. If a student's examination score was below the median final examination, they are categorized in the lower performing student (LPS) group. Conveniently this results in two similar sized groups useful for performing statistical tests.

3 Results

The results are organized into four categories. First, results from the pre-examination survey are discussed. Second, results comparing the cheat-sheet quality and examination performance are presented. Third, results comparing the groupings of student examination performance are presented for cheat-sheet quality and preparation time. Fourth, results comparing the student preference groups are presented for cheat-sheet quality and preparation time.

Student Survey

Results from the pre-examination survey reveal when presented with an option of selecting an open book, open note, or quick reference cheat-sheet students overwhelmingly prefer the cheat-sheet option (61%). Figure 2 illustrates the student preference breakdown with 61% for the cheat-sheet option, 32% for the open note option, and only 7% for the open book option.

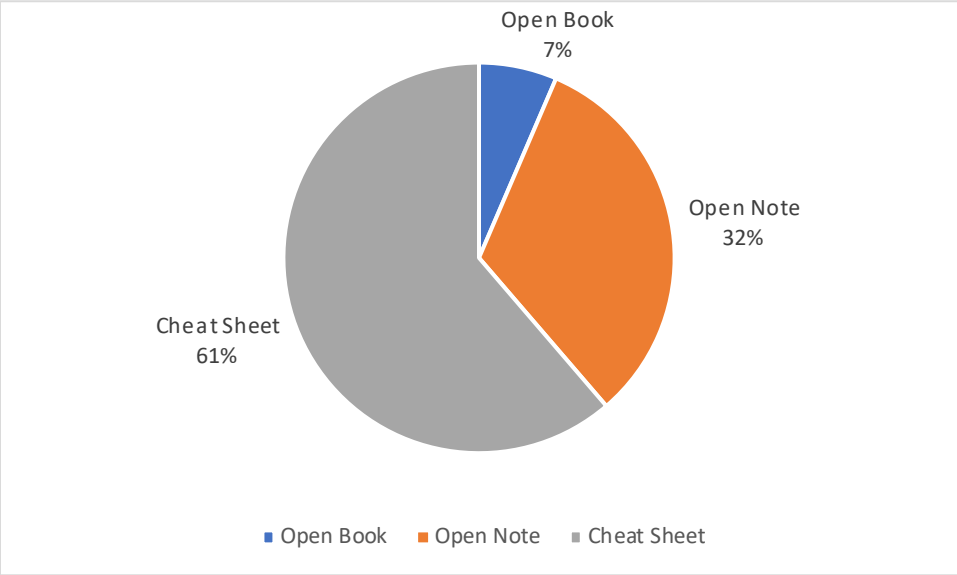

Figure 2: Results of survey for student preferred examination reference aid

When speaking with students about their preferences, those preferring the open-book or open-note option frequently mention wanting to use references they already have, and they dislike having to construct their own reference cheat-sheet since it required time. By comparison, students that preferred the cheat-sheet option felt that it was more efficient to have a single reference with all the information consolidated. Students felt an open-book format was least preferred since examination time is wasted hunting for answers that may not exist. Additionally, several students expressed support for the cheat-sheet format given it forced them to review and organize the material ahead of time. While the survey did not examine test-taking strategy, some insights are gained through many of the responses that follow.

Figure 3 presents the survey results for questions 1 through 7, which addressed student preparation when allowed the authorized cheat-sheet reference. Responses to the questions are limited to ‘always’, ‘sometimes’, and ‘rarely’. The first four questions focus on general study practice: (Q1) The results found students in large part tend to plan adequate study time for an examination, and (Q2) they tend to keep course materials well organized and in logical order. (Q3) The results indicate 48% of students ‘sometimes’ study in a group and 42% of students ‘rarely’ do study in a group. (Q4) The results found 48% of students ‘always’ and 45% of

students ‘sometimes’ prepare for an examination based on themes, central topics, old exams, and information the instructor emphasized.

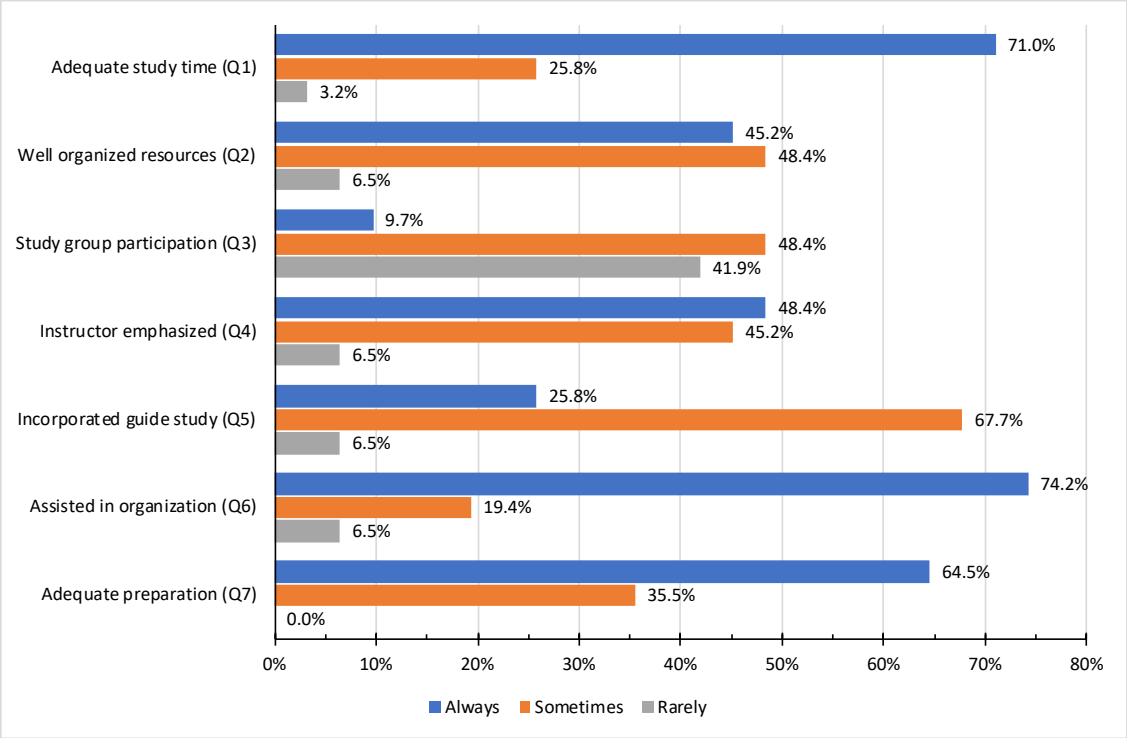

Figure 3: Survey results for student study preparation with cheat-sheet reference

Questions 5 through 7 are more specific to understand how students integrate development of the cheat-sheet into the study preparation: (Q5) The results indicate 68% of students ‘sometimes’ and 26% of students ‘always’ include creating their cheat-sheet as an integral part of their study process. (Q6) The results show 74% of students ‘always’ and 19% of students ‘sometimes’ find creating the cheat-sheet assists them in organizing the material to study. Lastly, (Q7) results found 65% of students ‘always’ and 35% of students ‘sometimes’ allocated enough time in preparing their cheat-sheet to be useful.

Figure 4 presents the survey results for questions 12 through 15, which are specific to understanding student perceptions of benefits and disbenefits: (Q12) The results found students reported feeling less stressed by when allowed use of a cheat-sheet, where 68% reported ‘most definitely’, 32% reported ‘somewhat’, and 0% reported ‘no difference’. (Q13) The results show students reported feeling their exam result would be better when allowed use of a cheat-sheet, where 74% reported ‘most definitely’, 26% reported ‘somewhat’, and 0% reported ‘no difference’. These results are rather strong in their support for allowing a cheat-sheet from a student’s perspective.

Additionally, the survey results capture the student perception of the disbenefits, specifically related to academic integrity, by not allowing a cheat-sheet reference. (Q14) The results found students believe without a cheat-sheet reference a classmate might be tempted to violate the academic integrity policy, where 6% reported 'most definitely', 45% reported 'somewhat', and 48% reported 'no difference'. (Q15) The results indicate students believe without a cheat-sheet reference they might feel pressure from others to assist in a violation of the academic integrity policy, where 6% reported 'most definitely', 10% reported 'somewhat', and 84% reported 'no difference'. Students were not asked about their own academic integrity under such conditions. While students perceive that academic integrity issues may increase without the cheat-sheet, they tend to believe the pressure on them to participate in such activity will be minimal.

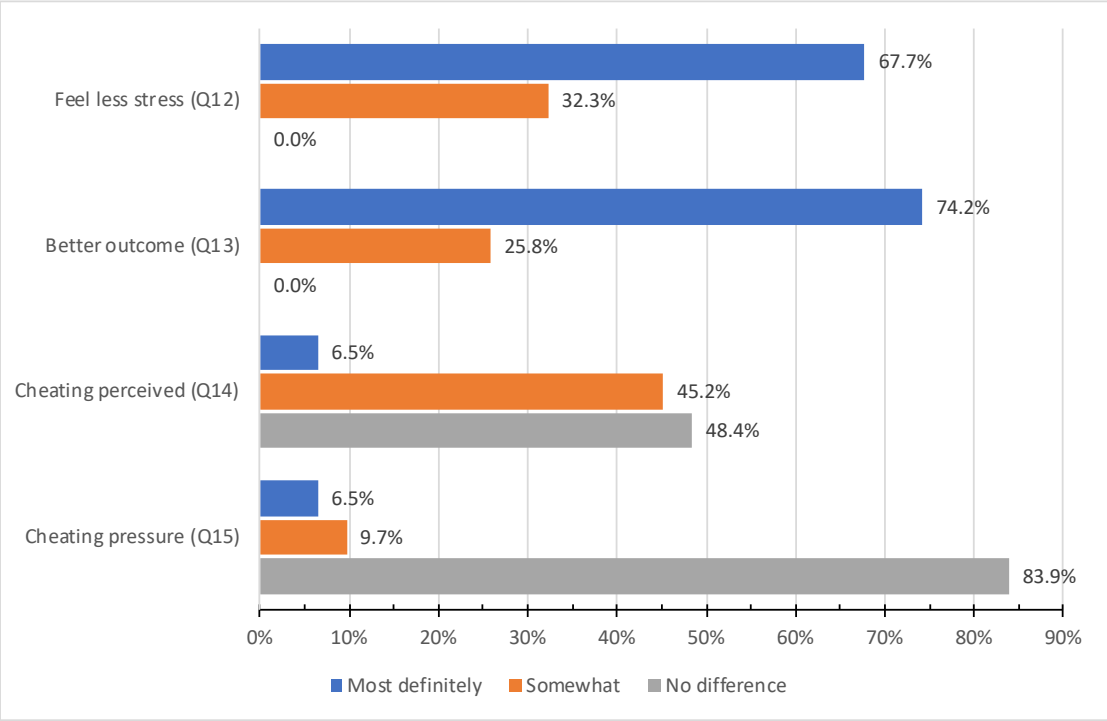

Figure 4: Survey results for student perceptions of benefits and disbenefits

Exam Performance

Many instructors believe that if a student spends adequate time in preparation and develops a strong knowledge of the material, they will be able to produce a relatively high-quality quick reference sheet. The expected result from this activity would be higher examination scores. Using the cheat-sheet score and examination performance paired data this belief can be examined. Figure 5 shows the relationship between student examination performance and the authorized cheat-sheet quality score of the 34 students using ordinary least squared regression. The computed Pearson's correlation coefficient is 0.5607, indicating a positive linear relationship, with a one-sided P-value of 0.0006. A simple linear regression finds $R^2 = 0.3351$

and adjusted $R^2 = 0.3144$, indicating a weak relationship where other factors are likely contributing more to examination results. Additionally, Table 2 presents results from the simple linear regression which finds the constant and slope elements to be significant. Nonetheless, the results provide enough motivation to explore further. Two comparisons are investigated in this study utilizing the survey results, cheat-sheet scoring, and exam performance data.

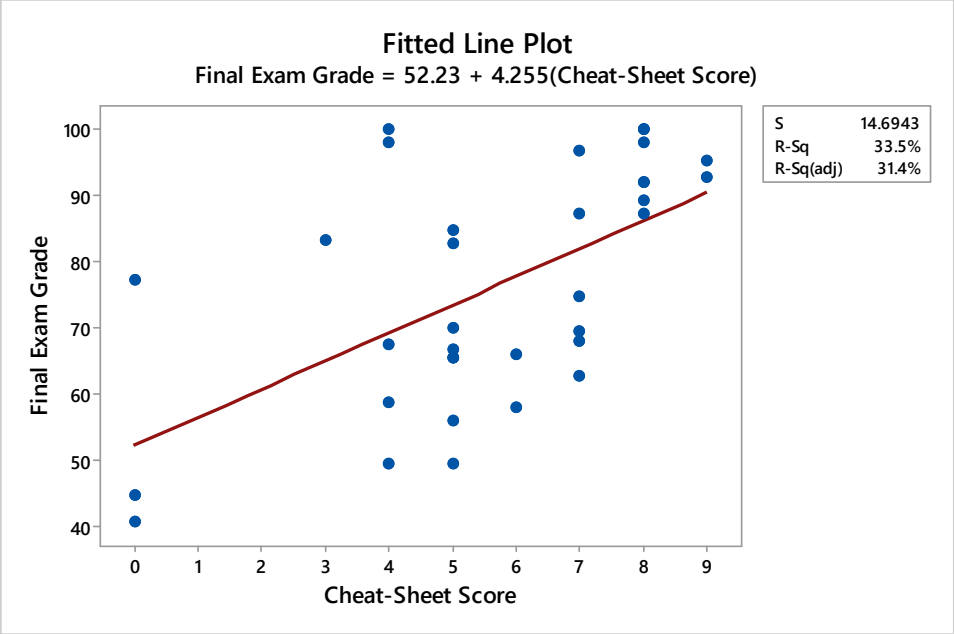

Figure 5: Simple regression analysis for student grade and cheat-sheet quality score outcomes from the final examination (*n*=34)

Table 2: Simple regression analysis results for student grade and cheat-sheet quality score outcomes from the final examination (*n*=34)

Constant	52.233***
	(6.468)
Cheat-Sheet Score	4.255***
	(1.060)
R-squared	0.335
Number of Observations	34

Standard errors are reported in paratheses.
*,**,*** indicates significance at the 90%, 95%, and 99% level, respectively.

Performance Group Comparison

One major question to explore is whether differences exist between the higher performing student (HPS) group and the lower performing student (LPS) group with respect to the cheat-sheet quality scores and invested preparation time.

The following hypothesis is tested:

- H_0: HPS and LPS groups produce cheat-sheets of equal quality.
- H_A: HPS and LPS groups produce cheat-sheets of different quality.

As presented in Table 3, the mean for the HPS group appears to be higher than the mean for the LPS group. In fact, the means are determined not to be equal according to a statistical test for the difference in means assuming unequal variances. Thus, members of the HPS group appeared to produce higher quality cheat-sheets than the LPS group.

Table 3: Comparison of the HPS and LPS groups' cheat-sheet quality

	Cheat-Sheet Score						
	HPS Group			LPS Group			P-value
Examination	Mean	(SD)	n	Mean	(SD)	n	(two-sided)
Final	6.2353	(5.3162)	17	4.9118	(4.3199)	17	0.0883

Figure 6 shows the student reported preparation time for the cheat-sheet and examination for the two performance groups. Contrary to expectations, the HPS group, which produced the higher quality cheat-sheets, reported spending less time than the LPS group in developing their reference and studying for the examination. This suggests the LPS group members may be spending more preparation time to address knowledge deficiencies.

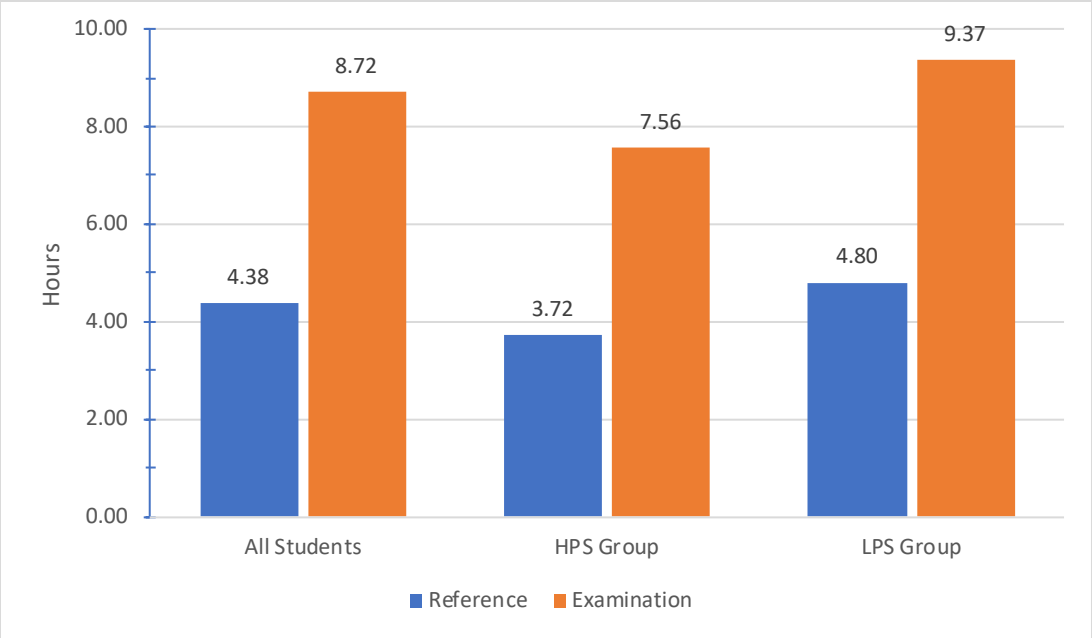

Figure 6: Survey results reported by students for estimated preparation time

Table 4 presents the student reported preparation time for the cheat-sheet reference and examination by performance group. As shown, the results from two hypotheses are included.

The following hypothesis is tested for evaluating cheat-sheets:

- H_0: HPS and LPS groups expend similar amounts of time producing cheat-sheet references
- H_A: LPS group expend more time producing cheat-sheet references

Using a statistical test for the difference in means with unequal variances, the result is unable to conclude the means are not equal using a one-side test. The result suggests members of the HPS and LPS groups expend similar amounts of time to produce their cheat-sheets.

The following hypothesis is tested for evaluating total study time:

- H_0: HPS and LPS groups expend similar amounts of time preparing for the examination.
- H_A: LPS group expend more time preparing for the examination.

Using a statistical test for the difference in means with unequal variances, the result is unable to conclude the means are not equal using a one-side test. The result suggests members of the HPS and LPS groups expend similar amounts of time to prepare for their examination.

Table 4: Preparation time allocated by HPS and LPS groups

	Preparation Time (hours)						
	HPS Group			LPS Group			P-value
Preparation	Mean	(SD)	n	Mean	(SD)	n	(one-sided)
Cheat-sheet	3.7188	(6.2656)	16	4.8012	(16.2857)	15	0.1331
Examination	7.5625	(9.0625)	16	9.3723	(35.4024)	15	0.0880

Preference Group Comparison

Another major question to explore is whether differences exist between the group preferring a cheat-sheet reference and the group preferring an alternative reference, specifically with respect to the cheat-sheet quality scores and invested preparation time.

Investigating the preferences held by the HPS and LPS performance groups revealed a distinct non-uniformity. Figure 7 graphically illustrates by performance group the preference for using a cheat-sheet reference or an alternative reference, which included open-note or open-book options. Results indicate the HPS group strongly prefers the cheat-sheet reference option (13 of 16 students); whereas, the LPS group strongly prefers the alternative option (10 of 15 students). This observation suggests students may produce high quality cheat-sheets given the option aligns with their preference group rather than their performance group.

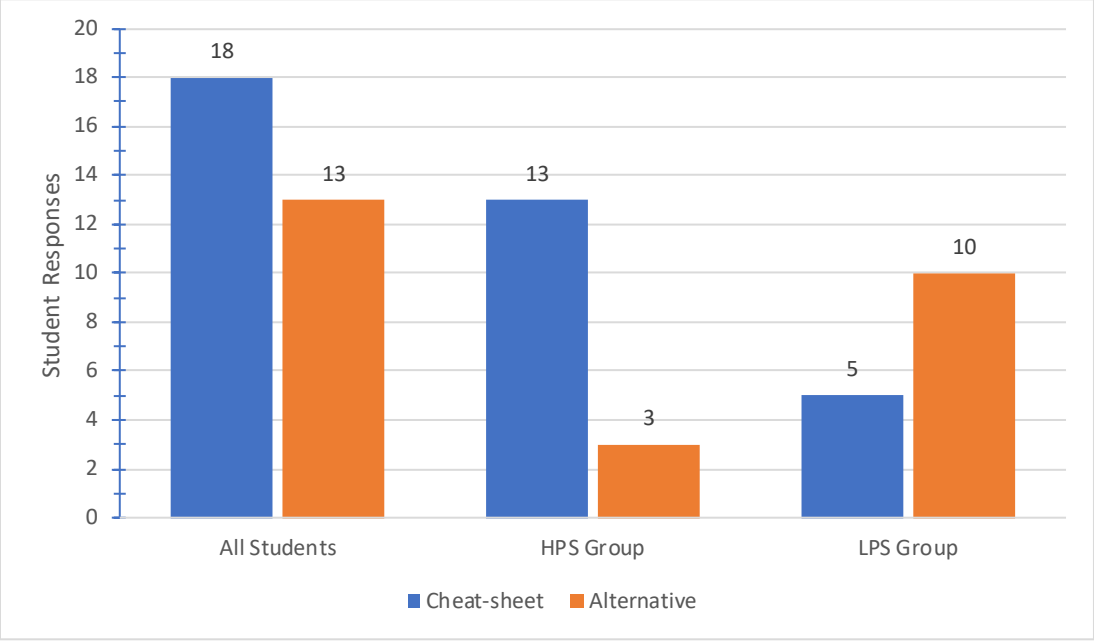

Figure 7: Survey results for student preferred examination reference

In Table 5 the proportion of the HPS and LPS performance groups preferring the authorized cheat-sheet option are shown. The proportional of the HPS group that prefers the cheat-sheet (0.8125) is observed to be significantly higher than the proportional of the LPS group that prefers the cheat-sheet (0.3333). A statistical test examining the difference finds the proportions to be not equal (P-value 0.0034). Based on the result, the reminder of this section explores cheat-sheet quality and preparation time by preference group.

Table 5: Proportional difference between HPS and LPS groups preferring cheat-sheets

	Proportion of Responses		Z-Score	P-Value	Difference (95% CI)		
Outcome	HPS Group	LPS Group	Value	(two-sided)	Difference	Lower CI	Upper CI
Prefers Cheat-sheet	0.8125	0.3333	2.7019	0.0034	0.4792	0.1734	0.7849

In Table 6 the differences between the group preferring the cheat-sheet option and group preferring the alternative are shown. The mean quality score for the cheat-sheet preferring group appears higher than the mean quality score for the alternative preferring group. This is tested using the following hypothesis:

- H_0: The 'cheat-sheet' and 'alternative' preferring groups produce equal quality references.
- H_A: The 'cheat-sheet' preferring group produces references of higher quality.

A statistical test for the difference in means, with unequal variances, finds that the means are unequal using a one-side test. This indicates the cheat-sheet preferring group produces higher scoring quality cheat-sheets.

Table 6: Cheat-sheet quality scores based on preference group

	Cheat-Sheet Score						
	Prefers Cheat-Sheet			Prefers Alternative			P-value
Examination	Mean	(SD)	n	Mean	(SD)	n	(one-sided)
Final	6.5000	(2.5294)	18	5.5769	(1.4519)	13	0.0382

Figure 8 illustrates the preparation time spent by students for creating the cheat-sheet reference, and the total time spent in examination preparation. The figure shows the cheat-sheet preferring group on average spends more time both in developing the reference and examination preparation, than the alternative preferring group.

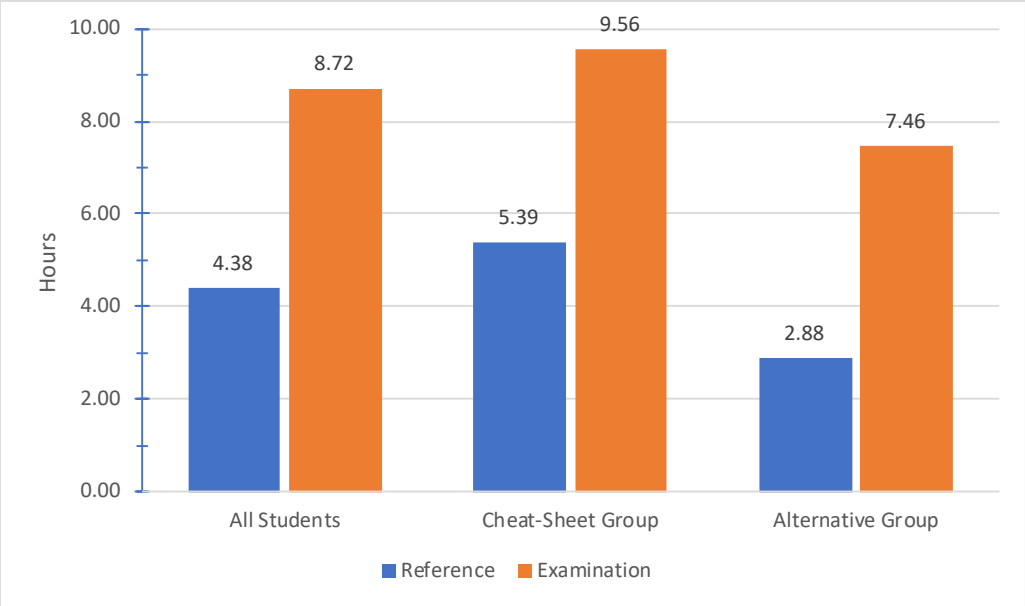

Figure 8: Survey results reported by students for estimated preparation time

In Table 7 the student reported preparation time for the cheat-sheet reference and examination by preference group is presented. The table also reports the P-values (one-sided) used to test two hypotheses for the groups.

The following hypothesis is used to evaluate the time to produce the cheat-sheet reference:

- H_0: The 'cheat-sheet' and 'alternative' preferring groups expend equal time producing cheat-sheet references.
- H_A: The 'cheat-sheet' preferring group expends more time producing cheat-sheet references.

Using a statistical test for the difference in means with unequal variances the result indicates the means are not equal using a one-side test. Results suggest members of the 'cheat-sheet' preferring group expend more time than the 'alternative' preferring group. This would indicate that those preferring alternative options for a reference aid will likely not allocate as much time to developing a quality cheat-sheet.

The following hypothesis is tested for evaluating total examination preparation time:

- H_0: The 'cheat-sheet' and 'alternative' preferring groups expend equal time preparing for the examination.
- H_A: The 'cheat-sheet' preferring group expends more time preparing for the examination.

Using a statistical test for the difference in means with unequal variances the result is unable to conclude whether the means are unequal using a one-side test. The result suggests members of the 'cheat-sheet' and 'alternatives' preferring groups expend similar amounts of time preparing for the examination. This indicates that regardless of their preferred reference aid students will likely allocate a similar amount of time in study preparation.

Table 7: Preparation time allocated by preference group

	Preparation Time (hours)						
	Prefers Cheat-Sheet			Prefers Alternative			P-value
Preparation	Mean	(SD)	n	Mean	(SD)	n	(one-sided)
Cheat-sheet	5.3889	(14.1340)	18	2.8750	(3.1875)	13	0.0106
Examination	9.5556	(20.6144)	18	7.4583	(23.6117)	13	0.1233

4 Conclusion

This paper presented the results of a quantitative analysis for a small sample size study investigating instructor and student perceptions of the authorized, quick reference "cheat-sheet" used in the final examination setting. The analysis makes use of an end of course student survey given to understand student perceptions and study behavior, the evaluation of collected cheat-sheets according to the defined scoring criteria, and the final examination performance outcomes. A weak positive correlation was found between cheat-sheet reference scores and examination performance outcomes, which indicates that as cheat-sheet quality scores improve the examination performance outcomes generally improve. The finding supports a belief held by many instructors that a such a relationship exists and provides some justification for the practice. More importantly, the study investigated how differently organized groups of students perceived the use of the authorized cheat-sheet and whether these groups equally benefitted using the reference. Using statistical analysis, two comparative studies were performed to evaluate cheat-sheet scores, cheat-sheet preparation time, and examination preparation time.

In the first comparison students were organized into groups according to their final examination performance outcome as determined relative to the class median final examination score. Students with above the median scores were assigned to the higher performing student (HPS) group, and those below the median scores were assigned the lower performing student (LPS) group. Analysis of these two groups found the HPS group had significantly higher cheat-sheet scores than the LPS group, which is consistent with the positive relationship between cheat-sheet quality scores and examination performance outcomes. While many instructors might speculate that students in the HPS group may have spent more time than students in the LPS group in preparing their cheat-sheet, findings from the survey results for the estimated time allocated to cheat-sheet preparation were not significantly different. Surprisingly, the mean estimated time for the LPS group appeared to be slightly greater than for the HPS group. In fact, the estimated time for overall examination preparation was statistically higher for the LPS group than the HPS group. The findings indicate that students in the LPS group may be applying as much time and effort, if not more, than students in the HPS group, however, they received poorer outcomes. Although not studied, one explanation could be in part due to insufficient completion or mastery of the preparatory work, such as readings and assignments, which leaves a tremendous burden for final exam preparation.

In the second comparison students were organized into groups according to their preferred examination reference option. One group consisted of the students preferring use of the cheat-sheet reference, and another group consisted of the students preferring use of the open-book or the open-note reference option. In general, the cheat-sheet quality scores were found to be statistically higher for students in the group preferring the cheat-sheet reference when compared with the group that did not. This finding was somewhat intuitive given it is unlikely for some students to invest in a study format they would not normally gravitate toward. Additionally, the estimated preparation time spent developing the cheat-sheet reference was found to be statistically different between the two preference groups. Notably, the group preferring the cheat-sheet spent nearly twice the amount of time as the group not preferring the cheat-sheet in developing the reference – a much greater difference than anticipated. Conversely, the estimated preparation time spent overall for the final examination was not found to be statistically different between the two preference groups. These findings suggest that although the two preference groups may behave much differently with respect to their time allocation for preparation and study activities, they still devote similar amounts of time toward the examination preparation overall. However, examination performance outcomes were significantly different. Overall, the group preferring the cheat-sheet reference performed significantly better. Supporting this finding, students scoring at or above the final exam median strongly favored (81%) use of the cheat-sheet option; whereas, students scoring below the final exam median strongly favored (67%) use of the open-text or open-note options. Further study is needed to understand the differences in the study strategies of the two groups.

While this study provides many insightful findings, many questions regarding the study strategies used by students in conjunction with the authorized, quick reference cheat-sheet remain unexplored. Future studies may want to build upon these findings by investigating what additional factors differentiate student preferences and performance. To do so, the study sample size must be significantly increased to accommodate a broader set of outcomes and classifications. This may also require understanding more about underlying student motivation and test taking strategies, as well as developing a measurement instrument.

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