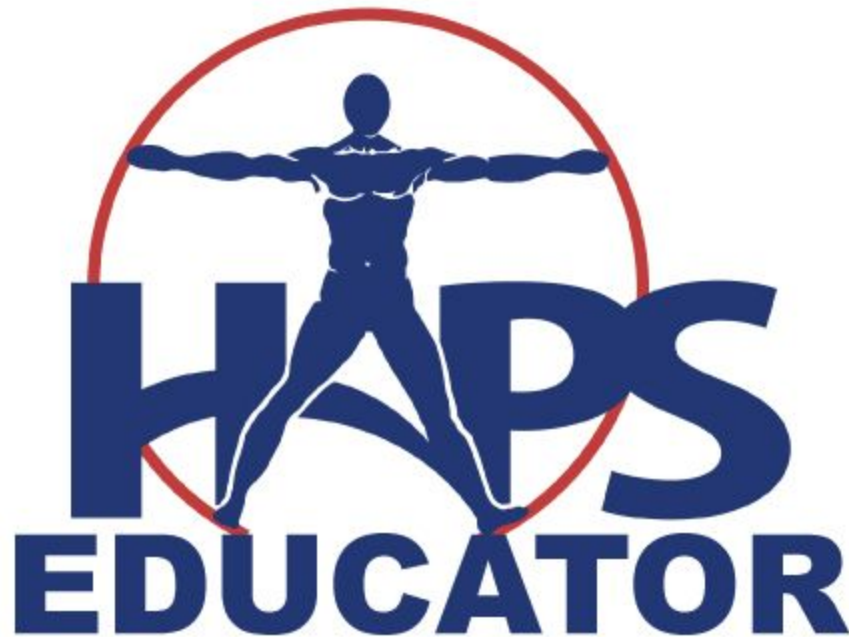


**Does the Quality of Student Crib Cards Influence Anatomy and Physiology Exam Performance?**

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# Does the Quality of Student Crib Cards Influence Anatomy and Physiology Exam Performance?

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## Abstract

This study examined the relationship between quality of student prepared crib cards and exam scores in Anatomy and Physiology I and II. We hypothesized that students with better quality crib cards would have higher exam scores. Measured crib card attributes were: number of sections, number of colors used, and amount of the card utilized. Two hundred fifty four crib cards from 118 students who took four exams in undergraduate Anatomy and Physiology I and II courses were analyzed. We found correlations between the amount of the crib card used and exam scores, and between the numbers of colors used on the crib card and exam scores. There was no correlation between the number of sections used on the crib card and exam scores. These results could be used to help students make better crib cards for Anatomy and Physiology exams. doi: 10.21692/haps.2018.005

**Key words:** undergraduate education, crib cards, cheat sheets, note cards, Anatomy and Physiology

## Introduction

Some previous research studies demonstrated that the use of crib cards was successful in aiding students in their exams and showed a positive correlation between the use of crib cards and exam scores. (Dickson and Baur 2008, Drake *et al.* 1998, Gharib *et al.* 2012, McCaskey 2006, Raadt, 2012, Skidmore and Aagaard 2003, Visco *et al.* 2014, Whitley 1996). These studies compared exam results of students who used crib cards to exam results of students who were not allowed to use crib cards. Gharib *et al.* (2012) showed that those students who used crib cards did better on exams than those who did not use crib cards and that open book exams provided the biggest improvement in exam score. Skidmore and Aagaard (2004) found that the use of cheat sheets yielded improvement in exam performance and students who used cheat sheets did better on their exams than their non-using counterparts. Visco *et al.* (2014) found that the actual making of crib cards aided students in exam performance. They examined cards from ten engineering students and found that the making of the crib card improved exam performance as compared to when no crib card was made. Raadt (2012) found that students who prepared and used a cheat-sheet did significantly better on exams than those who did not. McCaskey (2006) found that the actual construction of the crib card or cribbing sheet and the content of the sheet improved exam performance but warned that other factors such as the amount of office hours attended also affected the results.

Conversely, other previous research studies found that crib cards were not useful to students. Dickson and Miller 2015, Erbe 2007, Hindman 1980, Trigwell 1987, and Whitley 1996) found that in undergraduate psychology courses there was no correlation between the ability to use a crib card and

exam performance. Erbe (2007) found that there was a slight correlation between using a crib card and improved exam performance but after further analysis she concluded that the actual preparation of the crib card accounted for the improvement in exam scores when comparing pretest and posttest learning. She found that making the card contributed to the learning, not necessarily use of the card during the exam.

Crib cards may be useful in decreasing student anxiety during exams (Butler and Crouch 2011, Dickson and Baur 2008, Drake *et al.* 1998, and Trigwell 1987). These studies concluded that students were less anxious when they had a crib card versus when they did not, and when they had access to the crib cards they did better on the exam. Unfortunately Dickson and Bauer (2008) were not able to differentiate whether or not the card directly improved exam performance or if the improved exam performance was due to the decreased anxiety that occurred when students used crib cards.

Dickson and Baur (2008) theorized that students did not study as much as they did before or would have done before because students viewed the cheat sheet as a “crutch”. They found that students spent time making the cheat sheet and because they had the cheat sheet they did not do further studying, or spent half their usual time studying. For example, students stated that if they would usually study for five hours for an exam, when allowed to use the cheat sheets they only studied for two and a half hours.

Burns (2014) asked students to tally the number of times they used their crib cards during the exams. She found a negative correlation between the number of times students used their

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crib cards and their exam scores. Moderate and low achieving students increased their dependency on their crib cards throughout the semester.

The hypothesis of this study was that the quality of the crib cards would correlate with student exam scores. Students who used critical thinking skills to select more important information and effectively organize it for retrieval during exams would have higher exam scores. If supported, this hypothesis could help explain the contradictions between those previously mentioned studies that found improvements in student performance using crib cards and those that showed no improvement.

**Methods**

Students from four Anatomy and Physiology classes were invited to participate in the study. One hundred and eighteen students participated with some students enrolled in both Anatomy and Physiology I and Anatomy and Physiology II. Composition of the classes was predominantly freshman (77%), followed by sophomores (18%), juniors (4%), and seniors (2%). The students' majors were Exercise Science (34%), Nursing (33%), Athletic Training (18%), Biotechnology (6%), Liberal Studies (5%), and other majors: Education, Bioengineering, Physical Education and Psychology (4%).

Students followed directions for creating the crib cards that included: card size of three by five inches, hand written on one side only, student's name on the back of the card, and no drawing or figures on the card. The students took exams utilizing their own crib cards. Exams consisted of multiple choice questions, short answer responses, open ending questions and diagram labeling questions. Each of the four classes had cards from two exams and a final. A total of six exams were analyzed. All participants signed an

informed consent document for the use of their crib cards and exam scores. The cards were coded numerically to assure confidentiality. Data were stored on password protected computers. The Endicott College Institutional Review Board approved this study, IRB #200019 RO.

Two hundred and fifty four crib cards were collected from the 118 students. The cards were analyzed for content and organization by examining: the number of colors on the card, the amount of the notecard that was filled, and how many sections were created on the card. Each card was given a numerical rating on a scale of 1-4, whereby "1" indicated that the card was one fourth full and "4" indicated that the entire card was filled (see Figure 1 for sample crib cards). The number of colors used on the cards was also scored. For example, if a card contained red, blue and yellow ink it would get a designation of three in that category (see Figure 2 for sample crib cards). The number of sections created on the card was also evaluated. For example if someone had vocabulary words as well as bullet points they were awarded a "two" in the number of categories evaluation. If a person had a chart, bullet points and vocabulary words they would be given a three in category evaluation. Some examples of categories were: vocabulary words, bullet points, charts, and content categories such as "skin" and "bones" (see Figure 3 for sample crib cards). Analysis of crib cards was done prior to comparing card attributes to exam scores.

All data were recorded on excel spreadsheets. The excel Pearson Product Moment Correlation Coefficient was used to compare crib card attributes to exam scores. We chose a level of significance value,  $p < .05$ . We calculated critical correlation value using 252 degrees of freedom ( $n=254, n-2=$ degrees of freedom) for a two-tailed test.

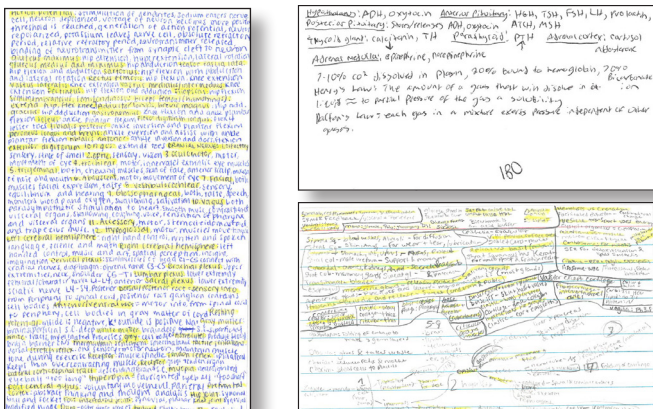


Figure 1. Sample Crib Cards: Amount of the card used.

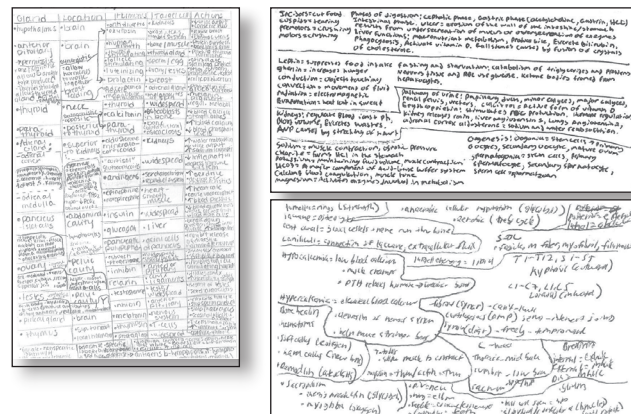


Figure 2. Sample Crib Cards: Sectioning of Card.

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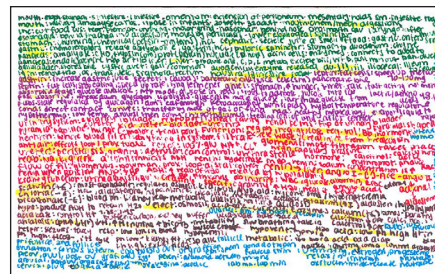
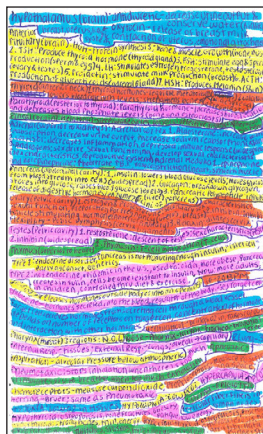


Figure 3. Sample Crib Cards: Use of Color

### Results

Results varied for the three crib card attributes we examined. The critical correlation value for a significance of  $p < .05$  and using  $n-2$ , or 252 degrees of freedom for a two tailed test was  $r = 0.12$ . We found correlations between the amount of the card used and exam scores, and between the use of color and exam scores. There was no correlation between the number of sections used and exam scores.

Table 1: Results of Pearson Product Moment Correlations for Attributes of Crib Cards

|                     | r value for the two variables | p value        | Degrees of freedom | Critical correlation value |
|---------------------|-------------------------------|----------------|--------------------|----------------------------|
| Amount of card used | 0.30                          | $p = 0.00001$  | 252                | $r = .12$                  |
| Use of Color        | 0.21                          | $p = 0.000757$ | 252                | $r = .12$                  |
| Number of Sections  | 0.07                          | $p = .266363$  | 252                | $r = .12$                  |

The strongest correlation we found was between the amount of the crib card used and exam scores. There was an r-value of 0.30 with  $p = 0.00001$ . This suggests that students who take the time and effort to utilize more space on the crib card and include more information had better exam scores. The scatter plot (see Figure 4 for the graph) shows that the relationship.

A weaker but still significant relationship existed between the number of colors used on the crib card and exam scores. There was an r-value of 0.21 with  $p = 0.000757$ . This suggests that students who organized their material on the crib card by using more colors of pencil or ink had better exam scores. The scatter plot (see Figure 5 for the graph) shows that the relationship.

There was no correlation between the number of sections created and exam scores. The r value of  $r = .07$  with  $p = 0.266363$  was not significant given the critical correlation r value of  $r = .12$ . The scatter plot (see Figure 6 for the graph) shows a scattered distribution of exam scores.

We noticed a trend with exam card attributes whereby most students (77%) who had more than one crib card, tended to improve the quality of their crib card over time. For example, a student who used only one color on their crib card for the first exam often used two or three colors on subsequent crib card construction.

### Discussion

We hypothesized that students who spent more time creating and organizing their crib cards would have better exam scores than students who had poorly constructed crib cards. Our hypothesis was supported for students who utilized more space on their crib cards and students who used more colors to organize their crib cards. The hypothesis was rejected for students who created more section on their crib cards. This information could be used to help students make crib cards that will be more effective in achieving better exam scores.

Our results may help explain contradictions in the literature regarding the crib card effectiveness. While some studies found improvements in student performance using crib

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cards (Dickson and Baur 2008, Drake *et al.* 1998, Erbe 2007, Gharib *et al.* 2012, McCaskey 2012, Raadt, 2012, Skidmore and Aagaard 2003, Visco *et al.* 2007, Whitley 1996) other studies showed no such improvement (Dickson and Miller 2015, Hindman 1980, Trigwell 1987, and Whitley 1996). Perhaps, some of those different findings could be explained if the quality of student crib cards was examined. If most students who were included in a study produced high quality crib cards, then those studies may have shown improvements in performance, while studies where most students produced poor quality crib cards may not have demonstrated improved exam performance. However, there may be other explanations for the differences in the literature regarding the usefulness of crib cards. For example, we are not aware of any previous studies that were done on students in Anatomy and Physiology courses. Furthermore, some studies used a sample size of less than 50 students or anecdotal reports. (Burns 2014, Dickson and Baur 2008, Erbe 2007, and McCaskey 2012)

**Table 2:** Related Literature Subject Area and Sample Size

| Authors                       | Subject Area                              | Number of subjects | Publication Year |
|-------------------------------|---|--------------------|------------------|
| Burns                         | Statistics                                | 43                 | 2014             |
| Butler                        | Statistics                                | 284                | 2011             |
| Dick                          | Psychology: Child and Adolescent Behavior | 54                 | 2015             |
| Dickson, K. L., &             | Psychology                                |                    | 2008             |
| Gharib                        | Introductory Psychology, Statistics       | 297                | 2012             |
| Hindman, C.D.                 | Abnormal Psychology                       | 52                 | 1980             |
| McCaskey                      | Physics                                   | 20                 | 2012             |
| Raadt, M                      | Programming                               | 72                 | 2012             |
| Skidmore, R. L., & Aagaard, L | Teacher Education Training                | 141                | 2004             |
| Visco                         | Chemical Engineering                      | 10                 | 2007             |
| Whitley, B.E.                 | Social Psychology                         | 136                | 1996             |

## Limitations

A limitation to our study is the variability in the student's ability to prepare crib cards. Some students may have had experience constructing crib cards in prior courses before taking Anatomy and Physiology I and II. Also, as we noted in our results, students tended to improve the quality of crib cards over time. The number of crib cards per student varied from two to six. Some students participated in the crib card study in only Anatomy and Physiology I but were in sections with other professors for Anatomy and Physiology II or vice versa. Therefore, some students had more opportunity to practice making crib cards. A further limitation was the variability among the six exams. While all exams included

diagrams, short answer, and multiple-choice questions, the percentage of each type of question and length of each exam varied. Further, we had a few crib cards that were not usable, for example when a student forgot to put a name on the back of the card.

Follow up studies might examine the creative process by which students construct crib cards. How much time do students put into creating crib cards? Do they mostly work alone or with study partners? Results of future studies could assist students to sort and prioritize the increasing body of knowledge that pertains to Human Anatomy and Physiology.

## About the Authors

Joyce A Shaw, DPT, CPT, CSCS, SFSC is a Professor of Biology and has been teaching Anatomy and Physiology at Endicott College since 1999. Dr. Shaw is a licensed Physical Therapist, strength and conditioning specialist and a certified senior fitness consultant. She publishes and presents in the areas of fitness and science education.

Melissa G Almeida was a junior nursing student at Endicott College. She is a member of Phi Sigma and the National Biological Sciences Honor Society. She is planning to pursue a graduate degree in nursing education.

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