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Introducing Google Sites and Quizlet Flashcards into an Anatomy & Physiology Lab to Improve Grades: A Four Year Study

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ABSTRACT: *The problem in the U.S. is lack of qualified registered nurses and nurses in general which makes it tough for employers to fill positions. The main reason for lack of qualified applicants is due to students having trouble making a grade of A or B in anatomy and physiology (A&P) lectures and labs. College instructors need to improve teaching methods in order to improve student comprehension, memory, and final grades. The objective of this study was to determine if introducing instructor created Quizlet flashcards, YouTube videos, and Google Sites significantly improve student's face-to-face A&P I lab grades? The first two years of this four year study, students did not have access to instructor created Quizlet flashcards, YouTube videos, and Google Sites. The last two years students were supplied with these three learning tools. Study results indicated there was a significant difference, t(787) = 3.188, p = .002, and showed that the odds of making grades of A or B in the treatment group was 1.33 times higher than in the unexposed group of students (OR=1.334; 95% CI, 1.002–1.777), indicating that adding Quizlet flashcards, YouTube videos, and Google Sites significantly improved student's grades. Hopefully, results from this study will encourage other A&P lab instructors to convert their face-to-face labs into virtual classrooms because blending in Quizlet flashcards, YouTube videos, and Google Sites significantly improves final lab grades in college A&P labs. Data from this study indicated that student's memory, appetite for self-pace, and motivation significantly improved with these added learning tools.*

KEYWORDS: *Computer-mediated communication, Evaluation methodologies, Improving classroom teaching, Interactive learning environments*

I. INTRODUCTION

Anatomy and physiology (A&P) labs have a long history at universities and colleges in the United States as being a tough course and several studies have shown that nursing students are often anxious about studying anatomy and physiology [1]. Nursing programs use A&P courses as prerequisites to test the memory and ability of students to study long hours [1]. Students who want study, have poor memories, are illiterate, and have low cognitive abilities will not become adequate licensed medical practitioners. It is the college instructor's sworn duty to keep this type of student away from future patients before harm is done. These labs study human histology, structures, organs, and systems of not just humans but also other similar mammals. The vocabulary is difficult to understand and memorize because biology still uses Latin to identify every aspect of the course. Most students who register for A&P want to become healthcare practitioners, kinesiology majors, or need a science course for their major [2]. There are about 700,000 persons employed as licensed practical nurses and licensed vocational nurses in the U.S. and its projected that 581,500 new registered nurses (RN) jobs will be created through the year 2018 [3]. The lack of RNs and nurses in general makes it tough for employers to fill positions. One of the main reasons for lack of qualified applicants is due students having trouble making a grade of A or B in A&P lectures and labs [4, 5]. How can college instructors help improve student memory and help them make high grades in A&P where students can be accepted into their chosen healthcare program?

1. Blinding in Google Sites in Face-to-Face A&P Labs: Google Sites is a free tool that comes with a Google account and allows an instructor to design and create a website [6]. This website is a structured wiki creation tool and the goal is for any student to be able use this team-oriented site where they can collaborate and share files to improve their lab grades [7].

The instructor can attach PowerPoint lab notes, educational YouTube videos, instructor produced YouTube videos, and Quizlet flashcards to the new website to encourage students to use several senses in order to improve memory and literacy [8]. People better retain information if reading, hearing, doing, seeing, and saying are all used during each study period [8]. Google Sites converts PowerPoints to Google Slides for free, that way students do not have to purchase Microsoft Office or download PowerPoint Viewer form the Microsoft Download Center.

2. Blinding in Quizlet Flashcards in Face-to-Face A&P Labs: Quizlet is a free online learning tool that enables instructors to create flashcards, tests, and study games, which students can then access [9]. Quizlet content is organized into flashcards, quizzes, a test with multiple-choice and true/false questions, written and matching questions, and "match" and "race" games. Students can see how their performance in various study modes stacks up against others and try to beat the leading scores [10]. Quizlet flashcards can play audio that reads to college students who have literacy problems coming out of high schools which really seems to improve memory, understanding of main terms, and complex physiology [11].

3. Research Question: Does introducing instructor created Quizlet flashcards, YouTube videos, and Google Sites significantly improve student's anatomy and physiology I lab grades? It has been reported previously that nursing students traditionally experience difficulties with the science subjects in nursing curricula [4, 12]. It would be relevant to any college instructor, student, journal readers, and wider audiences to learn how to better educate these new college students in the 21st century. These college students have an array of technology to study with including online computing, cellphones, and social networking.

II. MATERIAL AND METHODS

4. Participants: Students in this four-year study were recruited from a community college in Southeast Texas. The college is a member of The Texas State University System, accredited by the Southern Association of Colleges and Schools (SACS), and a comprehensive public two-year college offering instruction leading to associate degrees and a variety of certificates. The college is an open-access, meaning any student with a high school degree including a General Educational Development (GED) certificate holder is welcome. Students were recruited from 53 face-to-face 2401 A&P I labs from June 1, 2011 to May 6, 2015. A total of 1,006 students participated in this study which included students from all four semesters (fall, spring, summer I, summer II). The only course prerequisite was passing a "basic skills competency in reading and writing" test produced by the state of Texas. Given the open-access system, many students enter these first A&P lab courses as unprepared students with limited reading comprehension, writing, and cognitive skills. Students included both genders and were racially and culturally diverse. Students in this study who attended this community college represent the typical community college enrollment in the U.S. with about 40% full-time and 60% part-time, 60% female and 40% male, and the typical enrollment by ethnicity [13]. Spicific age and race of the students were not repoted during this study and every student's grades were keeped private via Texas state law. However, student population appeared to be similar during the four year period with most students being young and recently arriving from high school.

5. Measures and Procedures ----First Two Years of the Study: June 2011 to May 2013 : A&P lab students were given their lab notes via Blackboard Inc. which is an online e-Education platform used to communicate to students. The lab notes were PowerPoint slides derived from the lab manual and created by the lab instructor. Students were told to understand all red terms in the PowerPoint slides and then mark red terms in the lab manual and read to comprehend. The four main lab practical exams and pop tests were created from these red terms found in the PowerPoints and lab manual. The four practical exams during the semester included a 25 question colored packet derived from the lab manual and the PowerPoints. The four practical exams also included stations in the front of the lab which included identifying specimens and models. All four students at a table received similar but not identical practical exams. In these first two years, students were not supplied with instructor created Quizlet flashcards, YouTube videos, nor Google Sites. These students were measured by their average lab grades for the two year period.

6. Measures and Procedures ---- Last Two Years of the Study: June 2013 to May 2015 : A&P lab students were given the same lab notes via Blackboard as students from the first two years of this study. In addition, these students had access to instructor created Quizlet flashcards, YouTube videos, and Google Sites. Quizlet flashcards were created by the lab instructor and were composed of all the important red terms from the language of anatomy in the lab manual and PowerPoints. Google Sites was created to give students access to YouTube videos that were related to most of the major topics. The Google Sites also included access to Quizlet flashcards and the lab

PowerPoint notes converted to Google Slides. These students could also access Quizlet flashcards and Google Sites outside of Blackboard via separate uniform resource locator (URL) address. The same lab instructor taught all the A&P labs the entire four years of this study. The Ph.D. lab instructor was experienced at teaching A&P labs at the start of this study. He was previously trained in teaching these labs for three years at Lamar University as a graduate teaching assistant. The same four lab practical exams were identical during the entire study, also the front lab stations were kept similar during the entire study period. No extra credit nor any type of curving of grades were introduced into this study. These students were measured by their average lab grades for the two year period.

7. Data analysis All statistical analysis in this study was performed by the software package Sigma Stat for Windows, Version 3.10. An unpaired t-test was performed to study the influence of student characteristics on their learning paths and learning strategies. This statistical test was used to indicate if blinding in Quizlet flashcards, YouTube videos, and Google Sites does significantly make a difference in student's final A&P lab grades. A level of .05 was adopted to test for significance [14]. The formula for final lab grades was kept constant for the entire study: (Average of the pop tests) + (Four practical exams) divided by five with two of student's lowest pop tests dropped. Many researchers advocate alternatives in future research that should significantly increase focus on the effect size, such as odds ratio (OR), to the extent that reporting them should be 'mandatory' [15, 16]. Calculating and reporting of effect sizes is now required by the American Psychological Association (APA 6th edition), following the report of the 1999 APA Task Force on Statistical Inference, stating that effect sizes for primary outcomes should always be reported [17]. An OR and 95% confidence intervals (CI) was calculated on: (a) # of students exposed to Quizlet, YouTube videos, and Google Sites who made grade of A or B; (b) # of students exposed to Quizlet, YouTube videos, and Google Sites who made grade of C, D, or F; (c) # of students unexposed to Quizlet, YouTube videos, and Google Sites who made grade of A or B; and (d) # of students unexposed to Quizlet, YouTube videos, and Google Sites who made grade of C, D, or F.

III. RESULTS

8. First Two Years : Total number of lab students the first two years was 442 and their average final lab grades being (M = 72.9, SD = 15.1). Students that dropped (officially or unofficially) were not graded in this study. The percentage of student's dropouts in this group was 22.0%. In the state of Texas, students who attend state colleges are allowed six drops for their college careers with students receiving a grade of "Q" if they drop before the first deadline. If students drop after the second deadline, they receive a "Q" only if they have at least a passing grade of D. A grade of "Q" does not influence their grade point average (GPA). Table 1 shows that 163 students made the desired grades of A or B with 13.1% making A and 23.7% making B. Fig. 1 shows a histogram of the distribution of student's numerical data from the first two years and the data appears to be normally distributed.

Table 1: Total number of student's grades before and after introducing virtual learning tools.

First Two Years	Grades	Last Two Years	Grades
Number of A's (90-100)	58	Number of A's (90-100)	50
Number of B's (80-89.9)	105	Number of B's (80-89.9)	102
Number of C's (70-79.9)	101	Number of C's (70-79.9)	102
Number of D's (60-69.9)	98	Number of D's (60-69.9)	45
Number of F's (0-59.9)	80	Number of F's (0-59.9)	45
Number of Drops	125	Number of Drops	95

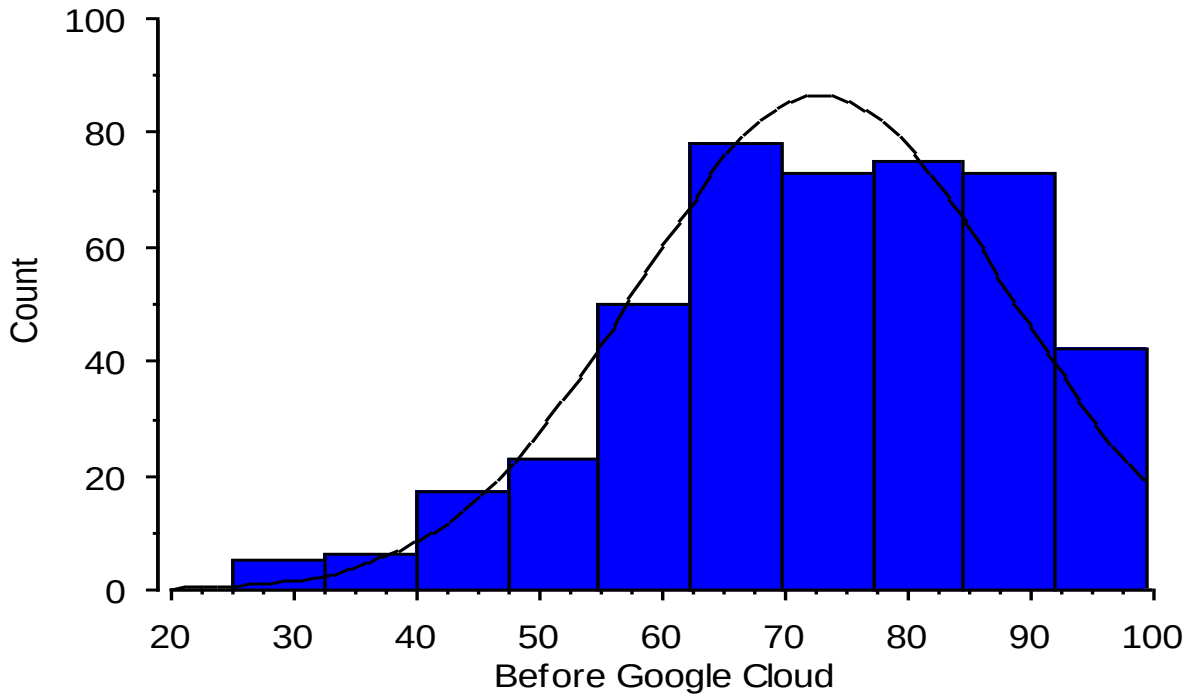

Fig. 1: Histogram showing range of 442 student's grades before Quizlet flashcards, YouTube videos, and Google Sites were blended into A&P labs vs. count of students with mean grade of (M = 72.9, SD = 15.1).

9. Last Two Years: Total number of lab students the last two years was 347 and their average final lab grades being (M = 76.2, SD = 13.4). There were 95 less lab students in the last two years of this study due to a decreasing enrollment problem. The percentage of student's dropouts in this group was 21.5%. Table 1 shows that 152 students made the desired grades of A or B with 14.4% making A and 29.4% making B. Fig. 2 shows a histogram of the distribution of student's numerical data from the last two years and the data also appears to be normally distributed.

10. Testing for Significance: There was a significant difference, $t(787) = 3.188$, $p = .002$, with the before and after groups indicating that adding Quizlet flashcards, YouTube videos, and Google Sites significantly improved student's grades. Power of performed test with alpha = 0.050 was 0.875. Most researchers assess the power of their tests using power = 0.80 as a standard for adequacy, which indicates sample size was more than adequate for this study [18]. Effect size results (OR) showed that the odds of making grades of A or B in the treatment group was 1.33 times higher than in the unexposed group of students that did not have access to Quizlet flashcards, YouTube videos, and Google Sites (OR=1.334; 95% CI, 1.002–1.777). In this study, 95% CI were used, so the study was statistically significant ($p < .05$) because the 95% CI excludes the null value of 1.0 [19].

IV. DISCUSSION

In this study, there was a significant difference with the before and after groups indicating that adding Quizlet flashcards, YouTube videos, instructor created YouTube videos, and Google Sites significantly improved student's grades. However, both groups mean grade scores were still below the pass rate of A or B grade. These results indicate that to better

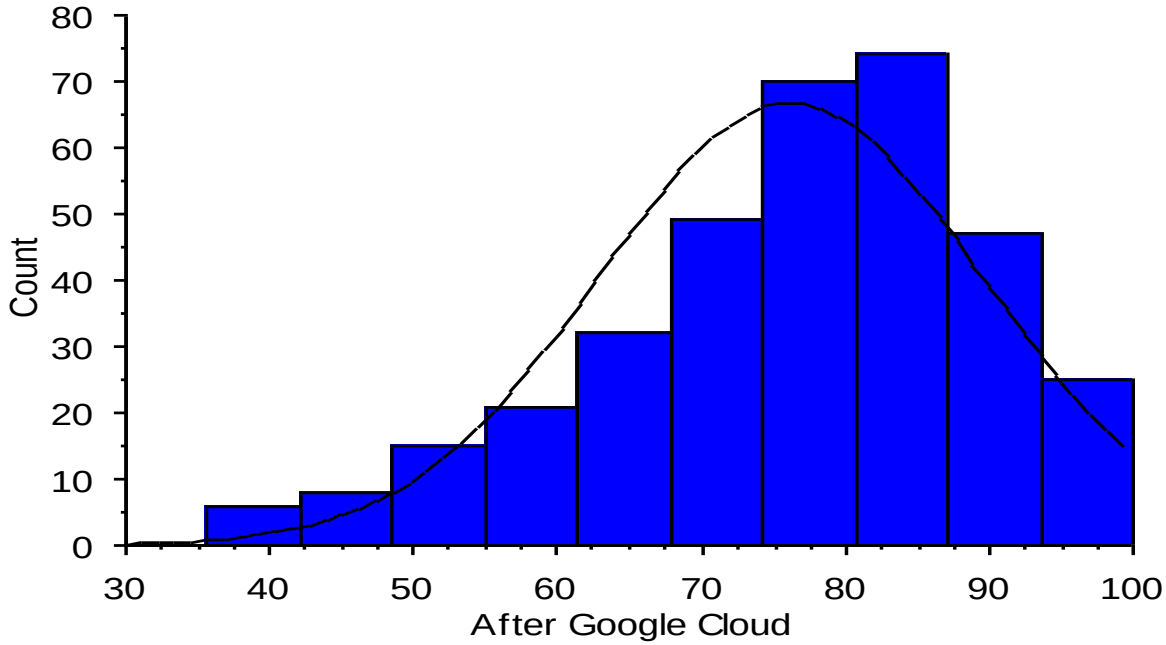

Fig. 2. Histogram showing range of 347 student's grades after Quizlet flashcards, YouTube videos, and Google Sites were blended into A&P labs vs. count of students with mean grade of (*M* = 76.2, *SD* = 13.4).

facilitate the learning process, the college instructor should focus on increasing students' motivation to learn by using several teaching strategies [20]. Students should use several of their senses to memorize and learn. It has been shown that students retain: (1) 10% of what is read; (2) 20% of what is heard; (3) 30% of what they see; (4) 50% of what they hear and see; (5) 70% of what they say; and (6) 90% of what they do and say [8]. Quizlet flashcards enable students to read, hear audio of what is read, speak terms out loud, and enable them to be active rather than passive in their learning methods. Instructional YouTube videos that are easily accessed from Google Sites better enable students to read, hear, and see important structures and function of the human body. Face-to-face lecturing, use of videos, flashcards, and discussion rather than just lecture enhances learning when information is repeated several times in a variety of ways [8]. Student learning is more likely to occur if information is applied to more than one setting or situation [8]. Students probably significantly improved their lab grades with Quizlet flashcards because it takes several hours to make their own flashcards on index cards. Students saved valuable time and spent more time actually studying the hundreds of terms, structures, models, and photographic information needed for each major lab practical. Educational researchers have repeatedly claimed the superiority of flashcards over wordlists or the advantage of computers over the paper-and-pencil approach to learning [21]. The most important aspect of flash carding is the ability to shuffle the terms in a random sequence where students want learn in a repeated order. Most instructor's exams should be randomly created with no order of subject matter. With one click of the shuffle icon, Quizlet randomly shuffles all terms in the set automatically. Students can also study Quizlet flashcards in mobile applications on their Androids and cellphones which gives them access to notes any time and place. This application is fun and interactive and provides an interesting way to learn. The advantages of online flashcards are instant dictionary reference, interactive pronunciation and statistics [22]. Statistics give a summary of how many attempts a student takes to get a correct answer, and statistics page allows the student to save the words they got wrong so that they can review those words at a later time [22].

YouTube videos makes it possible for college instructors to capitalize on student's appetite for self-paced, visually stimulating learning, and incorporating these videos into science lessons can energized teaching and help motivate students [23]. Many students claim they are visual learners and these readily available videos on a specific subject better help them improve memory and understand complex physiological concepts. Unlike an entire class viewing a film or DVD, integration of these video's content allows students to work at their own pace, allows students to watch, review, pause, and research in real time, and also encourages interactive participation [23].

V. CONCLUSION

The best way to teach college-level A&P lab students is to make the classroom an active learning environment where students actively participate in lab and discussions and have hands-on experiences [24]. Instructional technology tools are used to increase student performance by promoting the active learning process and shift students from traditional methods of just listening and taking notes [25]. Given that Internet-based and mobile technologies now pervade life in the U.S., they could be seen as highly relevant tools for education [26]. This study was the first to test the effectiveness of blending in Quizlet flashcards, YouTube videos, and Google Sites into face-to-face A&P labs for the purpose of improving student's grades. Hopefully this study will encourage other A&P lab instructors to convert their face-to-face labs into virtual classrooms because blending in Quizlet, videos, and Google Sites appears to significantly improve final lab grades. Data from this study indicated that student's memory, appetite for self-pace, and motivation significantly improved with these added learning tools via significantly improving grades.

The findings of this study should be interpreted taking into account several project limitations. First, although the study had a large sample size (N = 1,006) and targeted two different course periods, there was an uneven sample distribution across classes. The sample was heavily represented by an uneven number of students due to the larger class sizes and greater number of sections taught in the first two years. This inequity across courses probably reduced statistical power for this study analyses although a power of >.8 was achieved. Future studies should target larger samples of students taking A&P lab courses to address this possibility. Second, the sample of students all came from the same college and as such, it is unknown if one can extrapolate these results to other populations of students at different community colleges and universities. Finally, in the unpaired t-test, equal variances and normality assumptions were borderline and significant results were in question for this test.

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