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Preface

This e-book describes the research papers presented at the International Conference on Emerging Computational Technologies (ICECoT 2021), organised by Faculty of Computer and Mathematical Sciences (FSKM), UiTM Cawangan Melaka. The main discussions of the conference is on the technological advances that help shape the skills that are required to cope with the Fourth Industrial Revolution (IR 4.0). Considering that this is our first attempt at organising a conference, we are therefore greatly honoured that the Universitas Negeri Semarang (UNNES), Indonesia, Mahasarakham University (MSU), Thailand and University of Hail (UoH), Saudi Arabia have all agreed to become our partners by contributing several reseach papers as well as providing reviewers to assess the quality of the papers.

Out of the numerous research works that had been submitted and reviewed, the Editorial Board have selected 22 papers to be published in the e-book. The discussions of these papers pertain to the use of technologies within the broad spectrum of Computer Science, Computer Networking, Multimedia, Information Systems Engineering, Mathematical Sciences and Educational Technology. It is hoped that the research findings that are shared in this e-book can benefit those who are interested in the various areas of computational technologies; such as graduate students, researchers, academicians and the industrial players, to name a few.

As the Project Manager, I would like to thank all of the committee members from the bottom of my heart for their tireless efforts in ensuring the success of ICECoT 2021. Without their continual support and excellent teamwork, this conference would not have come to fruition. In fact, holding this major event has been a good learning experience for us all, and I sincerely believe that our future conferences will become more outstanding if the same spirit is maintained.

Dr. Noor Aishikin Adam

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Investigating The Relationship Between Student Engagement and Learning Outcomes via Flash Card Technology in Saudi Arabia

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Abstract—Purpose: This investigation attempts to discover if student demographics and student engagement relate to learning outcomes. In higher education research, one of the key concerns is the relationship of student engagement and learning outcomes. The findings can contribute to identify the factors that relate to desirable learning outcomes and the ways to enhance student engagement. **Method:** This exploratory study examines three undergraduate information systems courses with and without flashcards to learn keywords. A survey acquires data on student demographics and student engagement (study habit, study preference, study source, and learning style). The desirable learning outcomes include academic achievement (course final exam grade), personal achievement (self-esteem), and cognitive skills (knowledge and comprehension). **Results:** In total, 103 female students participate in this study. The results indicate student demographics and student engagement relate to the desirable learning outcomes.

Keywords—*desirable learning outcomes, flashcard, learning styles student demographics, student engagement, study habit, study preferences, study sources*

I. INTRODUCTION

Despite its subjectivity, many scholars show their interests regarding the topic of student engagement. Student engagement often refers the amount of concentration or attention that students can gain in a class session. In other words, it is a situation to verify whether students are able to comprehend the content given by educators. To maximize the level of attention, educators introduce various methods either face-to-face or online, such as using an interactive teaching aid. In higher education, usually a learning outcome is the proof or evidence to verify the level of engagement. The outcomes of the engagement are usually measured by several methods, such as exams, discussion, and assignments. However, there are also factors that may influence learning outcome such as a learning style, teaching techniques, learning content, students and instructors' behavior.

The objective of the study is to present an exploratory investigation on the relationship of student engagement to the desirable learning outcomes of students in higher education. We provide an evidence for the relationship based on the questionnaire result. Instead of using a large content in the class, students are exposed with the key terms via flash cards to help students retain more terminology related to the course

in class. The students' comprehension level are tested by requiring them to list and explain the meaning of each keyword or terminology.

By combining three different courses, the study covers over a 12-week duration. At the beginning of the study, students' demographics, study habit, and learning style were collected. In the first six weeks, the usual teaching and learning style were tested. The course instructors discussed the materials after completion. In the next six weeks, the study included an interference (using flash cards) to support the different teaching and learning styles. The goal is to examine whether there is any impact on the students' engagement with the targeted outcomes. The findings suggest that the students' engagement improved significantly. The study proposes an empirical evidence to support the relationship between student engagement and learning outcomes. This study also contributes to support future research especially to the literature on student engagement and desirable learning outcomes.

II. LITERATURE REVIEW

Educational institutions generally strive to nurture and enhance the abilities of students to improve desirable learning outcomes of academic and non-academic performances such as abilities and competencies, self-esteem, satisfaction, and better grades [1]. Bloom's Taxonomy [2] is one of the most familiar taxonomies for identifying the quality of learning outcomes in terms of lower-order (knowledge, comprehension, application) and higher-order (analysing, synthesis, and evaluation) thinking skills.

Student demographic is one of the key factors to learning outcomes [3], [4] and to undergraduate academic achievement. Other factors to learning outcomes include student attendance [5], and the environments for a better learning such as learning spaces [6]. Since the 1980s, an extensive research literature evolves on how to improve student success in the context of outcomes such as retention, completion and employability, how to engage students with their studies, and what the institutions and educators can do to enhance student engagement.

Student engagement involves not only the students, educators, administrators, but also location, structures, culture, technologies, building and equipment [7]. Student

engagement is one of the influencing factors on learning outcomes. The research approaches to student engagement varies. Trowler [1] suggests that student engagement seeks to optimize student experience (time, resources, relationships and communications with their tutors, peers and the organization), enhance learning outcomes, nurture student performances, and reputation of the institution. Kahu [8] conceptualizes the effects of student engagement to be academic achievement, academic retention, well-being, and personal growth. Ashwin [9] agrees that engagement helps students improve learning outcomes. Holmes [10] shows that engagement relates to non-academic learning outcomes such as student satisfaction and student experience. Qiu [11] proves that student engagement positively correlates with learning effectiveness. Student engagement has several dimensions including study habits [3], [5], [10], [12], [13], [14] and learning styles [4], [14], [15].

Usually, when an instructor concludes a topic or a course, the instructor conducts an evaluation through quizzes, tests, or exams. Although the classes have similar conditions for the group of students (same institution, same college, same pre-requisites, similar age, and even the same instructor), the results reveal that not all the students attain satisfactory learning outcome. One of the reasons for this is the student's study habit. Chilca [13] and Alzahrani [3] confirm that study habit relates to academic performance. Study habit refers to the activity carried out by learners during the learning process of improving knowledge [16]. The study habits or strategies that students use to learn, such as paying attention in class, being on time, taking good notes, completing homework in a timely manner, and reading the study material before a lecture, that are likely to impact their performances [17]. Study habit or way of study could be systematic or disorderly, efficient or unproductive. This literally means that "good" study habit could produce positive academic performance, and poor outcome for "bad" study habit [18]. Nonis and Hudson [17] stress that good study habits can make study time effective for students. Study habit is effective if the student excels or ineffective study habit if the student gets poor grades. Ebbeler [19] conducts a study on flipped classroom and discovers that students in the traditional class like the lectures, and students in the flipped class lack readiness for the new mode of study. They verbally report liking the flipped class but few of them watch the lectures at home. Similarly, Burke [12] postulates that students in the flipped class have higher student engagement than those in the traditional class. However, 42% of the students indicate emphatically engaged, 6% respond "no" and 52% "sometimes". These results indicate that students put in less study effort outside the class; and reinforces the decline of student study time [20].

There may be multiple reasons for the unexpected results such as that each student has different study preferences, different study sources, or that they have different ways to prepare for a test or exam. Alzahrani [3] reveal that 82% of the students with high Grade Point Average (GPA) prefer to study alone. This outcome might be due to cultural differences. In terms of the study source, [3] conclude that students with high or low GPA, either male or female spend only the time required to meet the minimum requirements. This means that they express surface learning; study from lecture handouts, memorize information needed for assessments, and deliberately follow the course requirements [21]. To encourage students to prepare for effective study

time, they need to understand not only what, why, and how to study, but also *how* to self-direct their learning [22]. Almusharraf [23] discloses that learner autonomy (or allowing learners to self-select method of learning) plays a critical role in enhancing vocabulary development. Shah and Barkas [5] link online activities to academic performance.

Therefore, it is clear that each student has different levels of engagement to study due to differences in study habit, study preference, and study source. The other dimension of student engagement is the learning style. According [24], learning style is "the complex manner in which, and conditions under which, learners most effectively perceive, process, store, and recall what they attempt to learn". Learning style refers to how the students learn and process information. Fleming [25] outlines Visual, Aural, Read/Write, Kinesthetic (VARK) learning styles. Visual learners learn with graphs, charts and diagrams; aural learners focus on listening; read/write learners rely on prints; and kinesthetic learners understand through examples and applications [26]. Oxford [27] explains that auditory learners "enjoy oral-aural learning channels and like to engage in discussions and group work. While visual learners "prefer visual channels of bulletin boards and videos. They read a lot that requires concentration and time spent alone". Kinsella [28] says tactile learners "use one's hands through manipulation or resources such as writing, drawing, building a model, or conducting a lab experiment". While kinesthetic learners "imply total physical involvement such as field trip". Reid [29] compares group learners who "learns more effectively through working with others", and individual learners who "learn more effectively through working alone". Further studies associate learning styles with the Myers-Briggs Type Indicator (MBTI) [30] dimensions of extraversion or introversion, sensing or intuition, thinking or feeling, and judging or perceiving. Jensen [31] relates MBTI type and learning style. Lawrence [32] summarizes learning preferences that involves the MBTI. In brief, extraversion student learns best in discussions and working with a group, while introversion student prefers to work individually. Sensing student values practical knowledge and excels at memorizing facts, while intuition student quickly gets insight but careless about details. Thinking student has an analytical mind and learns best with logical rationale, while feeling student has the human angle rationale and learns best through personal relationships such as teachers. Judging student works in orderly way and gauge learning by the completion of tasks, while perceiving student tends to be flexible and care less about deadlines and the completion of tasks.

Past studies assert that learning style enhances learning experiences and outcomes. Trowler [1] attests that diverse learning styles are one of the antecedents of student learning. Magulod [14] finds learning styles have significant relationship with academic performance. Chan [33] look at the effective learning styles of top achieving university students who choose sensing for individual assignments; extraversion and feeling for group assignments. These findings provide important evidence that top students have their own learning styles for academic performance. Vaishnav and Chirayu [34] indicate kinesthetic as the highest form of learning style. Espinoza [35] highlights that student ages 18 and 24 predominate the aural learning style, 19-23 lead read/write learning style, and students age 25-26 use kinesthetic. However, not every learning strategy or study habit produces useful results in terms of academic

achievement [17]. Awang, [15] affirm no significant relationship between VARK learning styles and academic results. Lee and Mao [36] describe student preference for “learn by doing”. Malacapay [4] advises that learning style does not influence or driven by demographics or academic achievement. Educators have to realize that learning acquisition varies. The learning materials, instructions, and activities should allow the visual, auditory, and kinesthetic learners to explore the contents of the lessons from different methods and tasks. Such instructional materials should not only be on the content but also in the process, and output of the lessons. The implications can guide instructors to plan and deliver suitable instructional interventions. One of the instructional interventions is by using flash cards.

Flash cards (also known as word cards) are a set of cards where the information that divided into a small “chunk” for the learners with its meaning [37]. Flash card learning is a common strategy well known for being effective and efficient for learning and memorization [38]. Learning through flashcard can make the learning subjects easy to understand and memorable for a longer period [37]. As an effective memory-aid tool, the flashcard approach was developed to improve the teaching and learning process for all ages [39]. Many educators have looked into the use of flashcards to help students learn [38], [39], [40].

The use of technology for educational purposes by college students is increasing [40]. E-flashcards combined the concept of flashcards with technology to aid in the learning process. For example, scholars [39] suggested that E-flashcards are an excellent tool for learning mathematics. It addresses students' enthusiasm in using computer technology in the classroom. Furthermore, it promotes self-learning and reduce time consuming. Similarly, one study looks at the influence of new vocabulary teaching techniques including a flash card games [41]. Their evidence shows that students who were taught using the new techniques including flash card performed better on vocabulary tests compared to conventional way. These techniques prove to improve students' vocabulary acquisition. E-flashcards supported by tools such as MsPowerpoint, Flashcards Deluxe App [38] is becoming a popular choice and mobile technologies like tablets [40] might be especially advantageous. The E-flashcard has an unlimited amount of space to store any useful information for users [40]. According to Sage [40], there is a small but growing body of literature devoted to digital flashcards and the need to explore this concept specifically in Saudi Arabia is essential.

The study may give impact to the current situation in the country. Saudi Arabia has launched the Vision 2030, which urgently needs educational reforms as their main initiative. Three important areas in education reforms are curriculum development, higher education developments, and the development of vital and valuable skills required for the labor market. One of the criticisms is mainly the medium of instruction, majority of University limited to Arabic Language. Lacking in English language may undermine the Saudi Education System. For instance, students may find great difficulties to continue their study to a higher level because of the language barrier [42]. Evidence of the learning barriers is demonstrated in the previous study that students may find it difficult to cope with the presented text [43]. It is proposed that classrooms be provided with cutting-edge technology features such as the Internet and interactive

whiteboards, to improve the learning environment in the classroom [42].

III. METHOD

This study explores the desirable learning outcomes of female students at the university; and attempts to uncover if student demographics and student engagement relate to academic and personal achievements.

- The first research question for this study, does student demographics relate to learning outcomes?
- The second research question for this study, does student engagement relates to learning outcomes?

To answer the two research questions, this study locates at the College of Business Administration (female campus), University of Hail in Saudi Arabia. The instructional methods to deliver the curriculum combine the traditional face-to-face classes, practical computing lab activities, electronic learning, and self-directed learning. The participants are students of three Management Information Systems courses including Fundamentals of E-Commerce, Business Data Management, and Project Management System Applications. Three different instructors teach these courses. This study occurs over a 12-week duration. Upon commencement of the study, the students complete a questionnaire on student demographics, study habit, and learning style. The first six weeks of this study covers twelve classes of each course.

During this time, the students engage in the usual teaching and learning styles. The course instructors upload the course materials on the learning management system, and the students download the materials as handouts for the class/lab activities as well as for self-directed learning. In class, the course instructors present and discuss the course materials. In the next six weeks, the study covers twelve more classes of each course. This time the students engage in a different teaching and learning styles. The course instructors upload new presentation slides that incorporate Gagne's [44], [45] instructional design, and digital flashcards for the students to learn keywords for each topic. In class, the instructors present and discuss the new slides that include ‘memory recall’ exercises and the flashcards. As an extension to the usual self-directed learning exercise, the students use the flashcards to learn keywords, concepts, and definitions at their own time and pace. During the course of this study, at the end of each topic the students complete a test on knowledge and comprehension of Bloom's Taxonomy [2]. The knowledge level tests on specific information from the topic. For this study, the students *list* the keywords or terminologies that they can remember from the topic covered. At the comprehension level, students interpret the facts by *explaining* the meaning of each keyword or terminology.

IV. RESULTS

A. Student Demographics

Based on the survey at the start of this study, the students provide information on demographics, study habit, and learning style. Student demographics include their age, year registered at the university, and the latest Cumulative Grade Points Average (CGPA).

In total, the three Management Information System courses comprise of 114 students, but only 103 questionnaires are complete. Overall, they are accessible, homogeneous, and share similar characteristics. All of them

are females, less than 25 years old, and they are in the prior to 2017 cohort. The majority or 73.17% have intermediate CGPA between 2.0 and 3.7.

B. Student Demographics and Learning Outcomes

All the students in this study are less than 25 years old and registers before 2017. This study takes the CGPA to represent student demographics. At the end of the semester, students sit for the final examination of the three courses in this study. The intermediate CGPA (2.0 to 3.7) with the majority or 43.90% get course grade 'A' (mean (μ) = 17.89%, standard deviation (σ) = 22.66%); 58.54% with high-level self-esteem (μ =24.39%, σ =29.67%); 21.95% get knowledge grade 'C' (μ =8.94%, σ =11.53%); and 56.10% with high comprehension level (μ =25.20%, σ =26.76%). Using p-value of less than 0.05, the CGPA is statistically significant to course grade ($p=0.031$, chi-square (χ^2) = 13.873); self-esteem ($p=0.043$, $\chi^2=9.843$); knowledge ($p=0.022$, $\chi^2=17.887$); and comprehension ($p=0.035$, $\chi^2=10.313$).

C. Student Engagement and Learning Outcomes

In this study, student engagement comprises of study habit, study preference, study source, and learning style. The study habit focuses on the frequency of reading course materials, and the readiness prior to a test or examination. For the frequency, students decide on the number of times they read the course material between "at least once", "two or three times", and "more than three times". In terms of readiness, students convey how they feel about taking a test with the options of "nervous but I try my best", "I am not ready", and "Scared. I do not want to fail". In terms of the study habit prior to a test or examination, the students primarily opt for reading the course materials two to three times and try to do their best despite feeling nervous. In total, 19.51% of those with 2-3 frequency, and 34.15% who feel nervous, get course grade 'A' (μ =14.63%, f =11.12%). The same frequency-nervous option (39.02% and 41.46%) relates to high self-esteem (μ =25.20%, f =13.77%); 14.63% and 21.95% get grade 'C' for knowledge (μ =8.94%, f =7.82%); 31.71% and 51.22% have high comprehension (μ =23.58%, f =15.86%). Using the p-value of less than 0.05, the study habit is statistically significant to course grade ($p=0.044$, $\chi^2=25.449$); self-esteem ($p=0.025$, $\chi^2=20.471$); knowledge ($p=0.005$, $\chi^2=39.926$); and comprehension ($p=0.043$, $\chi^2=18.768$).

In addition to the study habit, study preference and study source are also part of student engagement in this study. The study preference considers study alone and discuss with others. The study source includes the learning management system (LMS) at the university and the Internet. In the questionnaire, the students rank their study preference and study source from a scale of one (lowest) to seven (highest).

In terms of study preference, 14.63% study alone, they equally use the LMS and the Internet as the study source and achieve course grade 'A' (μ =9.76%, f =3.45%). Further, those who study alone (26.83%) and use the LMS (17.07%), have high self-esteem (μ =18.29%, f =7.04%). While those who study alone (9.76%) and use the LMS (9.76%), achieve grade 'C' (μ =7.93%, f =2.34%) for knowledge. However, for high level of comprehension (μ =12.80%, f =5.03%), study alone and discuss with others are equally split at 17.07%, and LMS is the study source (9.76%).

Using the p-value of less than 0.05, the preference and study source are statistically significant to course grade ($p=0.043$, $\chi^2=17.365$); self-esteem ($p=0.040$, $\chi^2=13.180$); knowledge ($p=0.022$, $\chi^2=23.771$); and comprehension ($p=0.039$, $\chi^2=13.245$).

In this section, the analysis so far covers student engagement in terms of study habit, study preference, and study source. In this study, learning style is part of student engagement through multimedia, class participation, writing own notes, and practical or lab activities. The students rank their learning style from a scale of one (lowest) to seven (highest).

In terms of the top three rank of learning style, course grade, self-esteem, knowledge, and comprehension, both class participation (21.95%) and practical or lab activities (21.95%) achieve course grade 'A' (μ =15.85%, f =7.32%), and these two-learning style (34.15% and 36.59% respectively) attain high self-esteem (μ =26.83%, f =12.11%). In terms of knowledge and comprehension, the learning style with practical activities (19.51% and 31.71% respectively) attain knowledge grade 'C' (μ =10.37%, f =8.06%) and high comprehension level (μ =21.34%, f =11.68%). Using the p-value of less than 0.05, learning style is statistically significant to course grade ($p=0.013$, $\chi^2=20.846$); self-esteem ($p=0.003$, $\chi^2=20.055$); knowledge ($p=0.029$, $\chi^2=22.815$); and comprehension ($p=0.021$, $\chi^2=14.891$).

In terms of the Chi-square and p-value of all the relevant variables and using the p-value of less than 0.05, student demographics are statistically significant to all the learning outcomes namely exam grades ($p=0.038$, $\chi^2=13.329$); self-esteem ($p=0.001$, $\chi^2=18.931$); knowledge ($p=0.027$, $\chi^2=17.328$); and comprehension ($p=0.012$, $\chi^2=12.807$).

The findings also reveal that using the p-value of less than 0.05, student engagement is statistically significant to all the learning outcomes. Study habit (reading frequency and exam readiness) relates to grades ($p=0.033$, $\chi^2=8.710$); self-esteem ($p=0.024$, $\chi^2=7.482$); knowledge ($p=0.032$, $\chi^2=10.569$); and comprehension ($p=0.030$, $\chi^2=7.024$). Study preference and study source relate to exam grades ($p=0.008$, $\chi^2=11.887$); self-esteem ($p=0.025$, $\chi^2=7.409$); knowledge ($p=0.016$, $\chi^2=12.144$); and comprehension ($p=0.044$, $\chi^2=6.234$). Lastly, learning style relates to exam grades ($p=0.001$, $\chi^2=28.913$); self-esteem ($p=0.006$, $\chi^2=18.295$); knowledge ($p=0.002$, $\chi^2=31.634$); and comprehension ($p=0.034$, $\chi^2=13.656$).

V. DISCUSSION

This study seeks to investigate two research questions.

Research Question 1: Does student demographics relate to learning outcomes?

Overall, all the respondents are homogeneous with similar characteristics. All of them are females, less than 25 years old, and they are in the prior to 2017 cohort. The majority with intermediate CGPA (2.0 and 3.7). Thus, CGPA represents student demographics in this study. The results indicate that majority of the students with intermediate CGPA get course grade 'A'; high-level self-esteem; get knowledge grade 'C'; and high comprehension level. Further, the Chi-square tests emphasizes student demographics are statistically significant to all learning outcomes. Thus, the

findings show that student demographics (CGPA) relate to learning outcomes.

Research Question 2: Does student engagement relate to learning outcomes?

This study examines student engagement in the contexts of study habit, study preference, study source, and learning style. In terms of study habit, the results indicate that those who read the course materials two to three times, and who feel nervous, get course grade 'A'. This result supports [46] of which, the majority of female students experience some level of anxiety ranging from mild to severe; however, they are able to do well in the exam. The same frequency-nervous option relates to high self-esteem; grade 'C' for knowledge; and high comprehension. These results agree with previous studies that study habits do influence academic performance [3], [13], [14].

In terms of the top three rank of study preference and study source, the results indicate that they prefer to study alone, they equally use the LMS and the Internet as the study source, and achieve course grade 'A', high self-esteem, grade 'C' for knowledge, and high level of comprehension. It is generally agreed by previous studies that each student has different study preferences, different study sources, or that they have different ways to prepare for a test or exam.

In terms of learning style, the results of the top three ranking indicate that both class participation and practical or lab activities achieve course grade 'A', and these two learning styles attain high self-esteem. In terms of knowledge and comprehension, the learning style with practical activities attain knowledge grade 'C', and high comprehension level. These results agree with the findings by [35] in which most students aged 25-26 use the kinesthetic learning style.

Thus, these findings show that student engagement relates to learning outcomes.

VI. CONCLUSION

This study concludes that desirable learning outcomes relate to student demographics and student engagement. Findings from this study reinforce known study habit, study preference, study source, and learning styles that affect learning outcomes; and the results also provide insights to further motivating less-achieving students. As implications of the results, this study recommends the followings for higher education institutions (HEI).

Foremost recommendation, student demographics (in the context of CGPA) relate to desirable learning outcomes; and student engagement (in the contexts of study habit, study preference, study source, learning style) relate to desirable learning outcomes. HEI can enhance student engagement by encouraging good study habit such as frequency of reading the course materials, and thereby improve on the readiness to face examinations. To this end, get students to attend special tutorials or workshops to acquire skills on time management, managing test anxiety, develop reading and writing interests and skills. HEI can further enhance student engagement by enabling students to adopt good study preference (study alone and group study), and by offering students a combination of study sources (own notes, course materials, LMS, and the Internet) that can improve their learning outcomes. HEI also need to find ways to utilize electronic material to encourage student engagement with their studies. In addition, student engagement is important in the light of evidence that many

university students lack skills for effective study. Effective learning skills could be fostered when embedded in content learning. By embedding specific skills development within discipline units, the relevance of such skills is made more explicit since it is directly linked to the acquisition of content knowledge. HEI can enhance student engagement by exposing students to a variety of learning styles that relate to good learning outcomes. It is important to know learning styles according to the required academic training of the students, so the courses in the curriculum use teaching techniques, evaluation systems, and activities that help to train competent students. To this end, provide students with suitable learning environment and spaces for students to maximize their learning opportunities.

The present study has limitations. First, modest scope; only three Management Information System (MIS) courses in one female-only campus of a public higher education institution. Gender segregation is practiced in the Kingdom that have separate campuses for men and women. The male campus may have different learning strategies conducted by their instructors; hence, it is excluded from this study at this stage. Second limitation, assessment of the factors is of possible association, not causation. Third, short duration of study. At least two more semesters for the same courses are necessary to collect adequate data. Further studies with male and female respondents, larger samples and more variables to be included. Ethnicity of the respondents may be considered since cultural differences may affect study habit and learning style. Other limitations include the absence of control group. This study necessitate replication with other cohorts, other units and across disciplines.

Future studies should utilize quantitative and qualitative approaches to assess student engagement (study habit, study preference, study source, and learning style); and to analyze student engagement in relation to teaching strategies. Further studies on other factors that influence academic performance (environmental, physical, emotional); use multiple learning styles; allow the visual, auditory, and kinesthetic learners to explore the contents of the lessons from different methods. Such instructional materials should not only be on the content but also in the process, and output/product of the lessons. Research should explore the possible reason for the factual recall results pertains to measurement. This study utilizes Gagne's memory-recall method that requires students to write the key terms (Bloom's knowledge) and explain the meanings (Bloom's comprehension) in their own words. While it is not always clear how previous research evaluated the recall of factual knowledge, if the technique relied on multiple choice questions or some other method, the measurement technique itself is the reason for the disparity in results. This is also a good area for future study.

For the current study, the findings provide useful and important implications on the association between student demographics, student engagement, and learning outcomes. These findings could also support future research on student engagement and desirable learning outcomes.

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