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Correlation of First-Year Medical Students' Performance in Case-Based Small-Group Discussions with Overall Academic Performance in the Department of Medical Physiology

Rose Anna R. Banal[1]

[1] Pamantasan ng Lungsod ng Maynila, Manila, Philippines

Correspondence: Rose Anna R. Banal, Pamantasan ng Lungsod ng Maynila, Manila, Philippines.

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Abstract

Case-based small-group discussions (SGDs) are one of the teaching strategies used in the Department of Medical Physiology of the Pamantasan ng Lungsod ng Maynila College of Medicine. The purpose of this study was to investigate the relationship between the first-year medical students' grades in SGDs and their academic performance measured at the end of each shifting period and the end of the course. All 135 students were assessed and graded during clinical case SGDs. Correlational analyses indicate a significant relationship between the SGD grades and the students' grades in the written examination, shifting period medical physiology grades, and final medical physiology grades. SGDs are linked to improved academic performance, but further studies are needed to investigate other predictors of students' learning in medical physiology.

Keywords: case-based small group discussion; medical physiology

1. Introduction

Studies in medical school require an excessive amount of factual-based and procedural-based learning, by which students feel frequently overwhelmed and stressed because of the amount of information the institution obliges them to learn. Various instructional methods are used for teaching first-year medical students, and lectures have been, and continue to be, the most common instructional format used in the college classroom (Lammers & Murphy, 2002). However, the traditional lecture format lacks many of the components of effective instruction, such as frequent and immediate feedback on responses, self-pacing, and reinforcers of accurate responding (Fredrick & Hummel, 2004). The monotony and passive nature of lectures may actually reduce students' cognitive skills because they are rarely given the opportunity to process the information presented to them (King, 1993; Shakarian, 1995).

Traditional lecture methods have also been blamed for producing doctors with poor critical thinking and problem-solving skills (Dyke et al., 2001). It is necessary for medical schools and institutions to incorporate interactive approaches, such as small-group discussions (SGDs), to enable students to understand the required basic medical concepts quickly (Flosason, 2011). SGDs are advantageous because they motivate students to be involved in discussion and improve memory retention. Medical physiological concepts can be learned and applied more effectively when the traditional lecture method is supplemented by clinical cases and when students actively participate (Latif, 2014).

SGDs and clinical case-based learning also develop students' critical thinking (evaluation, analysis, and interpretation of information), problem-solving, and decision-making skills (Mahdil et al., 2020). Clinical case studies can convert passive traditional lectures into active mental activities, which is crucial in the learning process (Meyers & Jones, 1993). Thus, clinical case-based SGDs provide a unique environment to achieve high standards in medical education. The combination of traditional lecture methods and SGDs helps students understand material and perform better on examinations (Hadimani, 2014).

In Pamantasan ng Lungsod ng Maynila (PLM) College of Medicine, the Medical Physiology course for first-year medical students is an annual subject class divided into four shifting periods. Students' learning was measured via each shifting period's medical physiology grade. The criteria for this shifting grade includes their class standing (short quizzes), laboratory grade, case grade, and written shifting examination scores. Overall physiology learning was assessed via a final written examination at the end of the academic year. The final

medical physiology grade is the average of all the shifting grades and the final exam score.

The Department of Medical Physiology employs clinical case-based teaching through SGDs, wherein the students apply their knowledge of physiology in determining the pathophysiology of various clinical cases. The SGD performance forms part of the students' case grade for each shifting period. The department observed that SGDs increase student interest and motivation, ability to work in a team, and retention of knowledge and skills. They also enhance the application of concepts and improve self-directed learning. It is critical to understand how SGDs affect physiology students' overall learning.

We designed this study to determine the relationship between SGD performance and the overall academic performance among first-year medical students in the Department of Medical Physiology. Given the overwhelming advantages of SGDs in the learning of medical physiology students, this study would help students improve their involvement during SGDs, motivate them to study well, and increase their commitment to lifelong learning.

2. Methods

The goal for this correlational study was to identify the relationship between students' performance in SGDs and their performance on the Medical Physiology written examination, the shifting grade, and the final grade. A total of 135 PLM first-year medical students of the academic year 2018–2019 were subjects in this study. The students' performances in SGDs were reported as a percentage and were based on the following criteria: their active participation in the discussion, concept map output in the pathophysiology of the case, and score in the short quiz given after the group discussion.

For the correlation of SGD performance with shifting examination (SE) performance, the average of all SGD scores in the percentage for that specific shifting period was calculated for each student. The obtained mean SGD grade for every shifting period (e.g., SGD I for first shifting period, SGD II for second shifting period) were collated for correlation analysis with the corresponding shifting examination score (e.g., SE I for the first shifting period, SE II for second shifting period). The SGD performance grade for every shifting period was also correlated with the corresponding shifting grade (SG). The SGD grade in all four shifting periods was averaged (SGDAv) and correlated with the average of all shifting examinations (SEAv) and shifting grades (SGAv). Correlation analyses were also conducted for SGDAv and both the final examination (FE) and the final physiology grade (FG).

All scores were entered as percentages of a 100-point scale into Microsoft Excel documents for purposes of organizing different sources into a single document; analysis was done in SPSS version 25.0. Pearson product-moment correlation coefficient (Pearson's r) was used for all correlation analyses. Regression analyses were also done to evaluate how SGD performance predicted examination scores and the physiology grade of students. Results were deemed significant if the p value was < 0.05.

3. Results

Central to this study is the relationship between SGD performance and written examination scores. The correlation between the SGD scores and the SE scores for each shifting periods is presented in Table 1. In all the shifting examinations, there is a positive correlation between the two variables. The SGD average grade of all the students in the four shifting periods also showed a significant positive correlation with the averaged shifting examination and final examination score ($p = 0.000$).

Table 1. Correlation between SGD Performance and written examination grade

	Pearson's *r*	*p* value
SE I	0.27	0.002
SE II	0.39	0.000
SE III	0.34	0.000
SE IV	0.20	0.000
SEAv	0.53	0.000
FE	0.42	0.000

The scatterplot of SGDAv performance and mean shifting examination score (Figure 1) shows a linear and increasing relationship. The same is observed in SGD performance and final examination score (Figure 2). This means those who perform well in the SGD typically earn passing scores in the written examination.

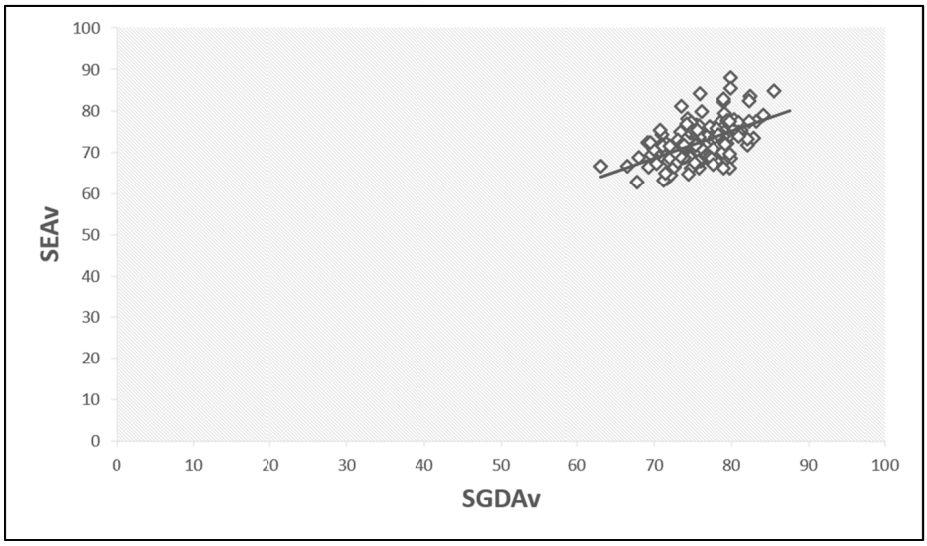

Figure 1. Scatterplot of SGD performance and shifting examination in four shifting periods

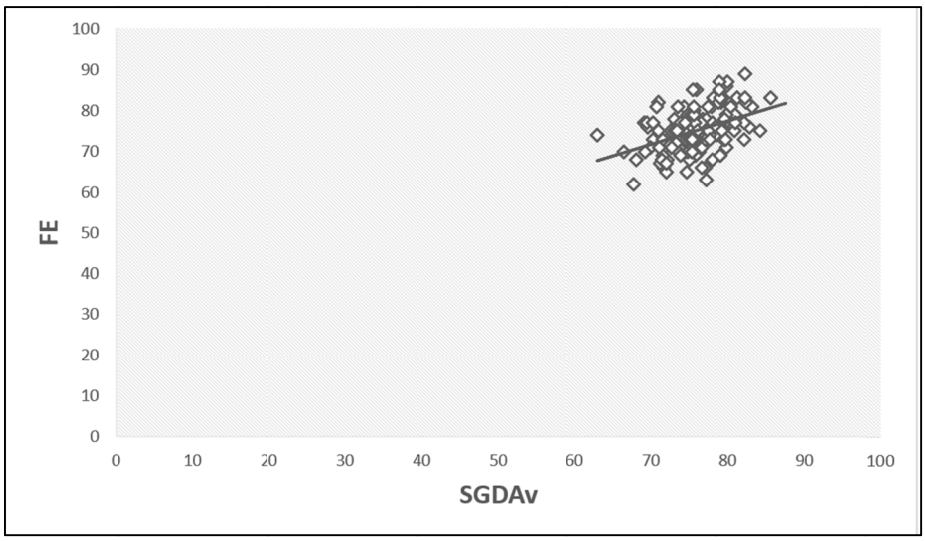

Figure 2. Scatterplot of SGD performance and final examination

Regression analysis was also done on the performance of the students in SGDs and their scores in the final written examination. The significant p-value ($p = 0.000$) strongly suggests that SGD performance is a good predictor of the final examination grade.

Table 2. Linear regression coefficients of SGD performance and final exam score

	Unstandardized Coefficients		t	Sig
	B	Std. Error		
Constant	31.42	8.172	3.845	0.000
SGDAv	.577	0.108	5.353	0.000

Table 3 presents the correlation between SGD performance and the students' shifting grades and final grades. It also shows a positive correlation. The relationship between these variables is stronger than the correlation between the SGD performance and written examinations. The scatterplot also depicts the linear relationship (Figures 3 and 4).

Table 3. Correlation between SGD performance and shifting/final grade

	Pearson's *r*	*p* value
SG I	0.47	0.000
SG II	0.63	0.000
SG III	0.55	0.000
SG IV	0.50	0.000
SGAv	0.66	0.000
FG	0.64	0.000

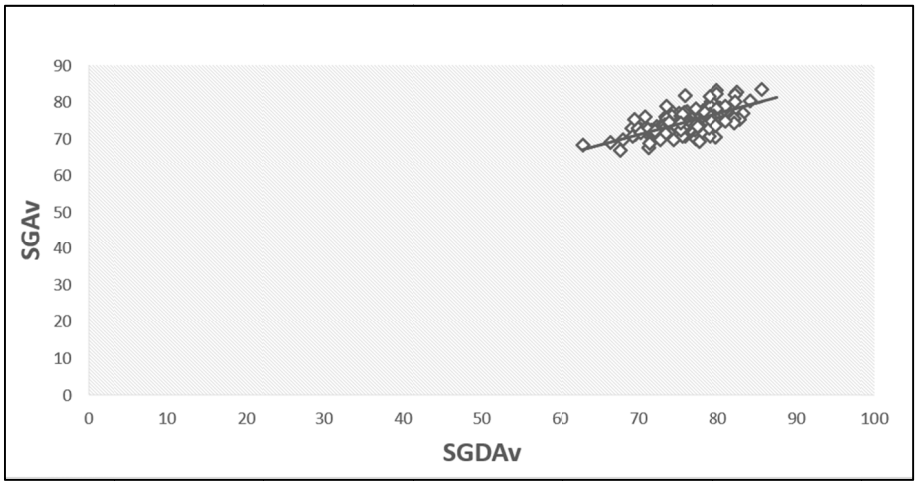

Figure 3. Scatterplot of SGD performance and shifting grade

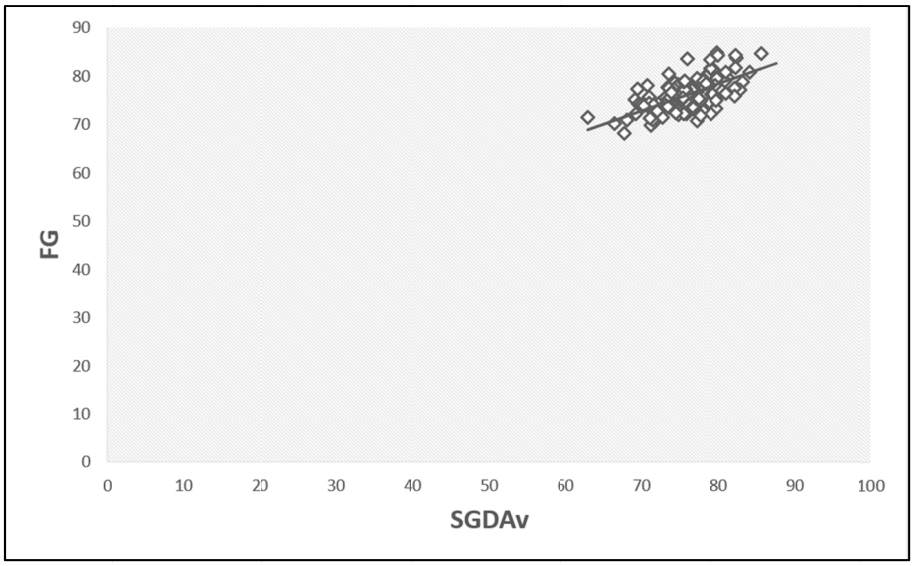

Figure 4. Scatterplot of SGD performance and final grade

Regression analysis was also done to determine how SGD performance predicts the final physiology grade of the students (Table 4). Results showed that for every additional point in SGD score, the final grade is expected to increase by half a point (β coefficient = 0.556). This only means that SGD performance is an accurate predictor of the final grade.

Table 4. Linear regression coefficients of SGD performance and final grade

	Unstandardized Coefficients		t	Sig
	B	Std. Error		
Constant	33.58	4.458	7.533	0.000
SGDAv	.56	0.059	9.534	0.000

4. Discussion

A medical doctor is expected to be skilled in self-directed learning and to be equipped for a lifetime of clinical practice. This is why there is a movement for competency-based education to be reinvented into problem-based learning (PBL). PBL is a popular, innovative, and effective learning approach conceived and implemented in education to enhance students' application of knowledge, higher-order thinking, and self-directed learning skills (Hung, 2009). Small-group teaching plays a vital role in problem-based learning in that it provides a conducive, collaborative learning environment, resulting in better cognitive outcomes (McLean et al., 2006). In the past decade, the medical curriculum has evolved into a form of outcome-based education. Outcome-based education (OBE) is a performance-based approach that has been described as results-oriented thinking (Harden & Laidlaw, 2012). It requires learning outcomes of what is expected at the end of the course, and the curriculum must be based on these outcomes. Similar to problem-based learning, OBE employs small-group activities as one of several educational strategies used to promote student learning.

The Department of Medical Physiology uses a hybrid model of several distinct teaching methods, wherein students have the opportunity to participate in active learning. These methods include didactic lectures, laboratory practicals, and small-group learning. Small-group learning is used for laboratory conferences and clinical case discussions. A faculty member facilitates each group. The facilitator's role of encouraging active and purposeful participation of group members enhances student learning (Burgess et al., 2020). In a study by Holland (2018), medical students discussed cases in small-group tutorials rather than studying case-based eLearning resources because SGDs give them the opportunity to discuss the case with their facilitators.

The department had been using SGDs as a teaching method for several years before the popularization of outcome-based education. This group learning method is used to supplement the traditional lectures the department offers on the different topics in medical physiology. This type of education aims to reinforce active learning, which improves the retention of physiological concepts and develops higher critical thinking skills among students. This will also serve as a stable and strong foundation for other medical courses as the students move forward in higher learning and will equip them with proper knowledge and skills essential to when they become clinicians.

The department has polished its method of conducting group discussions, with students being graded both individually and as a group. We have observed that SGDs are an effective tool in teaching the course and that students who perform well during group discussions also perform well during examinations. This study validated this observation using empirical data. From the results above, it is shown that the group discussion grade is moderately and positively correlated with the examination scores for all shifting examinations. In a study by Wahid (2009), a significant correlation between group discussion scores and theoretical test scores was also established among second-year medical students who took a cardiovascular module. Several studies on small-group teaching in medical education also showed the effectiveness of this learning activity in improving students' academic performance (Arja et al., 2020; Powell et al., 2019). In a meta-analysis of 12 RCTs in pediatric medical education in China, results showed that the PBL teaching model significantly increased theoretical knowledge scores, skill scores, and case analysis scores compared with those using the lecture-based learning teaching model alone (Ma & Lu, 2019).

Students also have positive perceptions toward small-group effectiveness, particularly in learning experience and teamwork (Sahu et al., 2018). They learn how to apply the principles of basic medical sciences to clinical medicine, which motivates them for further learning (Hadimani, 2014; Naveed et al., 2017; Semin, 2020). Case-based learning is also effective in enabling the acquisition of clinical reasoning skills, which improves students' clinical competency (Weidenbusch et al., 2019).

Using SGD as a teaching method in problem-based learning models is also highly predictive of performance on medical licensure examinations. Students who received PBL curricula have better outcomes on the United States Medical Licensing Examination (USMLE) or the exam given by the National Board of Medical Examiners (NBME) than those who received lecture-based curricula (Cendan et al., 2011; Hoffman et al., 2006; Thomas et al., 2009). In Japan, the academic achievement scores in basic and clinical science and the National Medical

Licensing Examination pass rates during the two periods pre- and post-PBL were compared, with results suggesting that PBL is equal to or superior to the traditional methods used to develop cognitive ability (Niwa et al., 2016).

The present study shows a significant correlation between SGD grades and examination performance of first-year medical students. This suggests that small-group learning is a valuable cognitive learning experience and should be incorporated into medical curriculum. As a method of self-directed learning in the field of medicine, it increases the students' ability to actively learn and improves their confidence and independence in their learning. It is a valuable tool in ensuring that students will retain the motivation needed for lifelong learning after becoming practicing clinicians.

5. Conclusion and Recommendations

SGDs in medical physiology are linked to improved performance on examinations designed to directly assess successful learning. They are also strongly predictive of students' final grades. This study supports widespread implementation of small-group learning and problem-based learning. To further evaluate how SGDs affect students' learning abilities, controlled trials should be conducted to establish the causal relationship between small-group learning and academic performance in the local setting as well as the performance of medical graduates on licensure examinations. Additionally, its impact on further training of medical graduates and its utility to practicing clinicians should be assessed. Last, studies should be conducted on the effectiveness of small-group learning in outcome-based curricula as opposed to problem-based curricula.

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