Presented at the DLSU Research Congress 2019
De La Salle University, Manila, Philippines
June 19 to 21, 2019

Effects of Block Scheduling on Grade 12 STEM Students' Academic Performance in General Physics 1

Marjorie A. Nariz, Lydia S. Roleda
De La Salle University
**Corresponding Author: lydia.roleda@dlsu.edu.ph*

Abstract: Block scheduling is a system for scheduling classes characterized by longer hours but less frequent sessions in a week. Literature supported its effectiveness in enhancing students' academic performance since this schedule allows students to focus on fewer subjects each day. However, local studies supporting this is lacking. This study investigates the effects of block scheduling in the academic performance of students in General Physics 1. A hybrid block schedule was used to compare performances of two batches of Grade 12 STEM students. One batch received instruction under the traditional four one-hour-per-day sessions while the other, two two-hour-per-day sessions. For comparison, the participants from both batches were paired based on their Grade 11 GWA and grades in Mathematics, and scores in the Diagnostic Test in General Physics 1. Using t-test, it was found that students who received instruction under the block schedule scored significantly higher than the previous batch who were taught under the traditional schedule, with the means 31 and 28 out of 50 (p < .05).

Key Words: block schedule; traditional schedule; academic performance; physics

1. INTRODUCTION

The Philippines did a major overhaul in its educational system by adapting to the globally patronized K to 12 curricula according to ICEF Monitor article entitled *"Philippines Creates Opportunities in Overhaul of K-12 Education System"*. The K to12 Basic Education Program aims to provide every Filipino with the essential education he or she needs to compete in the global market. The goal of the new curriculum was to give Filipino students *extended time* to master skills and concepts so that they are prepared for their tertiary education.

Based on the anecdotal evidences collected from the participating school, most students believed that low mastery in the subject matter was rooted from an insufficient time of instruction inside the class. Students believed that extended discussions and lectures will be helpful to students who want to understand the topics in General Physics 1. Students felt that the time allotted for the discussion of General Physics 1 is not sufficient for them to understand and master the topics under the course. Rayburn & Rayburn (1999) also believed that grasping the knowledge to solve more complicated and longer problem takes longer *time*.

However, the concern for a longer period was not observed in the current class schedule used by senior high school students. No matter how complex or simple the subject is, all classes are

having equal learning time. In the Philippines, subjects in the basic education are taught four (4) times a week, 50-60 minutes per class period. In the senior high school, the students share the same experience. Students are traveling to the six-, seven- and an eight-period day is exposed to six to seven pieces of unconnected curriculum each day. They rarely, if ever, have sufficient time to study exhaustively. (Canady, R et al., 1995).

Additionally, traditional schedule provides hectic, impersonal, inefficient instructional environment that offers inadequate time in probing deeper ideas and discourages varied learning activities (Irmsher, 1996). In addition, many faculties felt that 50-minute classes three times a week do not allow for the same amount of teaching time since the first minutes of every class were used for settling and making class announcements (Schultz & Sharp, 2006).

Senior High Schools who offer Academic Track-STEM Strand also offer General Physics 1 and 2 for the entire school year. General Physics 1 is offered for two quarters during the first semester, and General Physics 2 is offered on the 3rd and 4th quarters during the second semester. Each subject is being taught four times a week, 40 hours per quarter or 80 hours per semester. In principle, senior high school physics share the same difficulty level similar to those in college as referred to the contents, topics, and the depth of the discussion to be tackled. However, physics in college are taught using block schedule; this means that students meet with their professors once or twice in a week (two or three hours per meeting). Students have longer class durations but less frequent than the traditional schedule.

1.1 Purpose and rationale

There are anecdotes about teachers lamenting that having a 60-minute class period was not enough to finish topic/s intended for the day. Or, it almost impossible to accomplish laboratory experiments or outdoor activities in one meeting. Most of the time, lectures, outdoor activities, and laboratory experiments are continued onto the next meeting. Problems arise when students forget to bring again the materials needed for the experiment, or students lose their experiment sheets. Worse, the students might be able to attend the following session due to sickness or some school activities.

With these in mind, it is believed that adopting the block schedule to the senior high school class for Grade 12 General Physics 1 class would provide students their needed longer time per activity, whether it is during lecture or laboratory.

1.2 *Context*

According to Al-Huneidi, A., & Schreurs, J. (2013), Constructivism theory is based on the idea that people construct their knowledge through their own personal experiences and that it prepares students for problem solving in complex environment.

A change in the school schedule offers potential for real reform to capitalize on these core creeds of constructivism. A block schedule could provide for extended learning periods leading to greater interaction and fewer interruptions (Roberts, 2016). Moreover, in a constructivist classroom, both teacher and students think of knowledge not as chunk of information and facts to be memorized, but as a dynamic, ever-changing view of the world we live in and the ability to successfully stretch and explore that view. However, processing complex information, enhancing critical thinking and problem-solving skills, and assessing their own understanding and learning would require longer working time since students need to digest and process the information, they acquire from their classroom experiences. This suggests that longer time is necessary to maximize the effect of constructivist model in the classroom.

Adopting block scheduling in the class system would lengthen the class meetings to two hours. The increase in time per meeting is believed to allow ample time for doing laboratory experiments and for providing students exercises that will help enhance their Higher Order Thinking Skills (HOTS).

2. METHODOLOGY

This study used a Quasi-experimental research design to acquire and interpret data gathered from its participants. The study aims to determine the significant effects of using block scheduling in enhancing Grade 12 STEM students' academic performance in General Physics 1.

The experimental group for this study were Grade 12 students from Batch 2019 and Grade 12 students from Batch 2018 served as the control group of the study. Batch 2018 students received the one-hour, four-times-a-week traditional schedule while Batch 2019 students took the two-hour, twice-a-week block schedule for General Physics 1.

Data were gathered after the researcher made sure that sample students from Batch 2018 and sample students from Batch 2019 had an approximately equal academic performance in terms of their general academic performance mathematical ability and background knowledge in General Physics 1 before block scheduling was applied. Student academic ability and performance from both batches were paired based on the students' Grade-Weighted Average (GWA). Students from both batches were ranked from highest to lowest GWA. Students from both batches with the same GWA were grouped together to be paired according to their Grade 11 Mathematics (Pre-Calculus and Calculus) grades. To ensure that students' performance and knowledge in General Physics for students from both batches were the same before the intervention was applied, the scores in the diagnostic test in General Physics 1 were compared. If the two students have a similar score or close scores in the pairing processes, the two students are assumed to be a *perfect pair*.

After students from both batches were perfectly paired, the researcher then compared their grades in the first quarter in General Physics 1 to determine if there were significant changes in their academic performance. The quarter grades were obtained from the students' Written Work (25%), Performance Task (45%), and Quarterly Exam (30%). The written work was comprised of quizzes, long tests and home works scores while Performance Task was comprised of students' portfolio, outdoor and indoor physics experiments and the quarterly exam. The quarterly exam was comprised of test questions aligned with all the required competencies in General Physics 1 and was already used in the previous school year (SY 2017-2018). The researcher used Paired t Test in determining whether the use of block scheduling in General Physics made significant difference in enhancing students' academic performance in the subject compared to the use of traditional schedule.

All students were given a human informed consent form and the researcher informed the participants about the nature, objectives, risks and confidentiality of the information they provided for this study. Students who were 18 years old and above were asked to accomplish a consent form and students below 18 years old were asked to accomplish a consent form and an assent form.

3. RESULTS AND DISCUSSION

3.1 Story and Outcomes

In Figure I the first quarter grades in General Physics 1 of the two groups (N=30 for each group) of Grade 12 STEM students showed relatively higher first quarter grades of students under the block scheduling as compared to the grades under the traditional schedule. Under the traditional schedule, most students received a grade of 85, the lowest grade was 80 and the highest was 89. On the other hand, students under the block schedule received grades ranging from 86 to 92.

The quarter grades were computed based from students' written works – 25% (quizzes, long tests, seatworks and assignments), performance tasks– 45% (indoor and outdoor experiments/activities, projects, and quarterly examination – 30%.

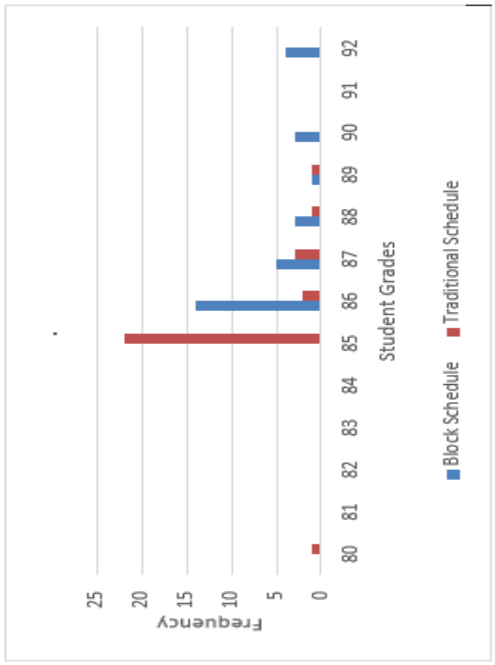

Figure 1: *Quarter grades of Grade 12 STEM Students in Block Schedule versus Traditional schedule*

Table I presents the data analysis of the sample means of the two groups of students under the *traditional schedule* and under the *block schedule*. The data suggested that block scheduling received a higher mean compared to traditional schedule (M_{block} = 87.7; M_{trad} = 85.3). Paired t-test was run to test the significance of the difference between the two means. The confidence level was set to 95% (alpha = 0.05) and the degrees of freedom was 29 for N=30.

TABLE I: *Excel Data Analysis Using Paired T test for Sample of Two Means*

	Traditional	*Block Schedule*
Mean	85.333333333	87.66666667
Variance	2.091954023	4.643678161
Observations	30	30
Pearson Correlation	0.324531080	
Hypothesized Mean Difference	0.000000000	
df	29	
t Stat	-5.887150124	
P(T<=t) one-tail	0.000001086	
t Critical one-tail	1.699127027	
P(T<=t) two-tail	0.000002172	
t Critical two-tail	2.045229642	

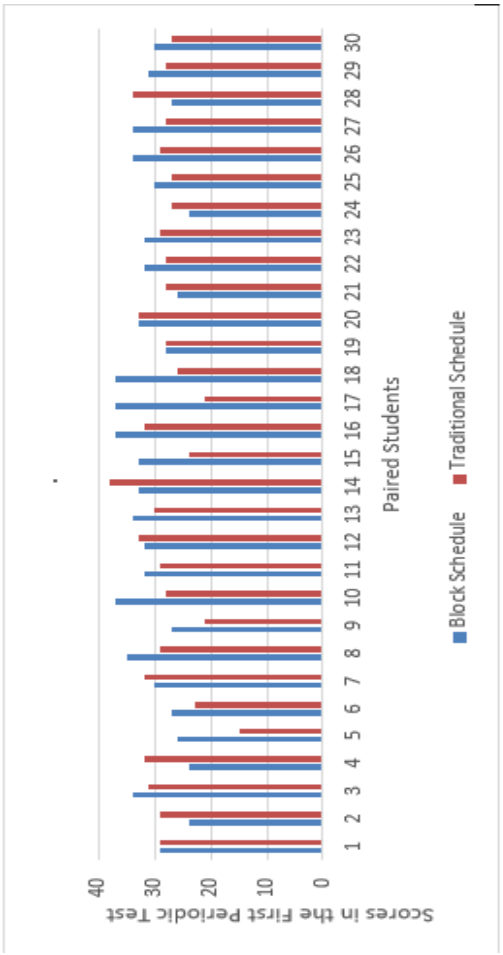

Figure 2: *Quarter test scores of Grade 12 STEM Students under the Block Schedule versus Traditional schedule*

Figure 2 shows the quarter test scores of students under both schedules. There were 19 students who scored higher under the block schedule, 8 students scored higher under the traditional schedule and 3 students received the same score. Out of 50 items, the highest score for block scheduling was 37 and the lowest score was 24 while in the traditional schedule the highest score was 34 and the lowest score was 15. The mean of the scores under the block schedule was 30.97 and its SD = 4.038 while the mean of scores under the traditional schedule was 28.27 and SD = 4.417.

The computed t stat value was smaller than the p value for one-tail and two-tail. Moreover, the t stat value was smaller than the t critical value. The result yielded implied that there is a significant different between the mean physics grades of the students under the traditional schedule and block schedule.

In order to corroborate the initial findings on the effects of block scheduling on the academic performance of students in terms of grades, focus group discussions were conducted on selected student participants.

The interviews revealed that positive feelings and views towards block scheduling were manifested among students. Some of the student responses were: *"the new schedule gave me more time to prepare"*, *"there was more time doing the activities under the block scheduling"*, and *"it gave me more time to ready myself for the next lesson"*.

3.2 Self-reflection and learning

Initially, the participants found the two-hour session for General Physics 1 to be too long. In fact, the teacher-researcher was afraid that this intervention might lead to more bored students in the physics class. However, after implementing the block schedule for the first quarter of the first semester of the current school year (about 3 ½ months), the students gave positive feedback on the new schedule. They shared that the block schedule allowed them enough time to accomplish their tasks in class. Moreover, on the side of the teacher, the block schedule was appreciated because of the reduced amount of classroom and teaching preparations.

4. CONCLUSIONS

Statistical test results showed that the different paired means were significant thus indicates that the use of block scheduling in improving students' academic performance as observed through their first quarter grades.

In general, many students believed that block scheduling provide opportunities for them to enhance their academic performance in General Physics 1 and, therefore, should support to the use of block scheduling in the subject. Some students said that

Overall, the results showed that block scheduling provided positive effects to both teachers and students in terms of the number of activities accomplished, amount of preparation and its effectiveness in aiding student learning.

This study further recommends the use of block scheduling in senior high school especially in teaching General Physics and also recommends the full implementation of the new schedule in the senior high school to realize its full effect on the academic performances and classroom behavior of the students in this level.

5. ACKNOWLEDGMENTS

The authors would like to acknowledge the administrators and students of a government school in Las Piñas City, who offered their precious time and support throughout the conduct of this study.

6. REFERENCES

Al-Huneidi, A., & Schreurs, J. (2011, September). Constructivism based blended learning in higher education. In *World Summit on Knowledge Society* (pp. 581-591). Springer, Berlin, Heidelberg.

Canady, R. L., & Rettig, M. D. (1995). *Block scheduling: A catalyst for change in high schools* (Vol. 5). Eye on Education.

Farbman, D. (2011). Learning Time in America: Trends to Reform the American School Calendar--A Snapshot of Federal, State, and Local Action. *Education Commission of the States (NJ3)*.

Rayburn, L. G., & Rayburn, J. M. (1999). Impact of course length and homework assignments on student performance. *Journal of Education for Business*, *74*(6), 325-331.

Salvaterra, M., Lare, D., Gnall, J., & Adams, D. (1999). Block scheduling: students' perceptions of readiness for college math, science, and foreign language. *American Secondary Education*, *27*(4), 13-21.