Impact of blended learning instruction in academic performance of grade 10 students in a selected private high school in San Juan City, Philippines

A I Hipol¹², R Cabahug¹ and R Bongon¹

¹ELMD Bro. Andrew Gonzales College of Education, De La Salle University, Philippines
²HS Science Faculty, Xavier School, Philippines

Email: argel_hipol@dlsu.edu.ph

Abstract. The study aimed to determine if blended learning instruction positively affected students’ academic performance in a specific Science topic. Furthermore, it tried to determine if there was a difference in students’ academic performance who were subjected to 20% blended learning instruction and 60% blended learning instruction. The study made use of a pre-test and post-test which were based on standardized tests. After asking permission from Xavier School and upon the approval to conduct the study, the researcher personally conducted the study to a controlled and an experimental group. After which, data were collected, checked and tallied. These were encoded and analyzed using Stata. T-test and ANOVA were used to determine the difference between the pre-test and post-test scores of the two groups. Evaluation of the blended learning lesson plan was also done through Google forms to verify the results. The study revealed that there is a significant difference between the pre-test and post-test scores of the classes. This implied that the BLP helped the students comprehend the lesson. Furthermore, the findings showed that there is a significant difference between the post-test scores of the experimental and controlled group in favor of the experimental group. This implied that 60% blended learning instruction is more effective than 20% blended learning instruction.

1. Introduction

One educator from India said that “teachers will not be replaced by technology, but teachers who do not use technology will be replaced by those who do.” Indeed, the rise of technology as an innate part of globalization has revolutionized the teaching-learning process. It has significantly empowered the learners and broaden their repertoire of learning experiences. Hence, the challenge for teachers to keep up with this paradigm shift remains unabated.

The demand for 21st century teaching approaches continue to escalate as the Department of Education in the Philippines work for the attainment of outcomes-based education — producing graduates who are competitive and equipped with knowledge, skills, and attitudes that will make them productive in the workplaces. Concomitant to this, are instructional approaches and strategies which will allow students to communicate, collaborate, and explore beyond the knowledge that the books and the teachers are able to transfer. It is veering away from the completely traditional approaches of teaching where the only resources available are the teachers, the books, and the chalkboard. Thus, the adoption of blended learning.
Blended learning has been defined in many but similar ways. The Ultranet and Digital Learning Branch of the Department of Education in Melbourne defines it as “the planned implementation of a learning model that integrates student-centered, traditional in-class learning with other flexible learning methodologies using mobile and web-based online (especially collaborative) approaches in order to realize strategic advantages for the education system.” [1] The Glossary of Education Reform (2013) cites that blended learning is “generally applied to the practice of using both online and in-person learning experiences when teaching students.” [6] These definitions suggest that in a blended-learning course, students might attend a class taught by a teacher in a traditional classroom setting, while also independently completing online components of the course outside of the classroom.

For the purpose of our brief experimental study, the blended learning which will be implemented in the experimental group will utilize a combination of traditional and ICT-integrated strategies to teach a lesson in Science. The ICT-integration may either be online or offline which includes multimedia presentations for discussions and activities and as springboards for formative assessments. Whereas, the control or intact group shall not be completely subjected to a traditional approach; twenty percent (20%) of the entire teaching-learning activities will also be ICT-integrated. This is in consideration of the academic culture of the school, where the use of computers and ipads has been deeply and extensively rooted in the teaching-learning process. Some repercussions of a completely traditional approach for the specific school the researchers have chosen might include complaints from parents and an intentional underperformance of students. Hence, the researchers opted to just significantly diminish the amount of time for ICT-integration in the intact group.

It is hoped that the results of this brief experiment would give light to the questions about the assumed contrasting effects of the traditional teaching approach and the blended learning on the academic performance of students, which will be measured in this study through pre-test and post-test.

2. Review of Literature
Blended learning has been interpreted and understood in various ways. It is an educational concept that “first appeared around 2000 . . . associated with simply supplementing traditional classroom learning with self-study e-learning activities . . . Today blended learning can refer to any combination of different methods of learning, different learning environments, different learning styles” [3] It could well be described that the latter use of the term expresses its general meaning while the former is the articulation of the concept in a more specific and restricted sense. Authors, like Singh and Reed, emphasized its general meaning by asserting “blended learning is the transfer of “right” skills to the “right” person at the “right” time by matching the “right” learning technologies with the “right” learning style for the purpose of achieving the learning objectives.”

On the other hand, authors like Horton, Osguthorpe and Graham stressed its strict definition as “combining the strong and advantageous aspects of web-based learning with those of face-to-face learning.” To avoid any confusion in the interchanging use of the term “blended learning,” Brunner proposes that it will be wise to use “hybrid learning” in referring to its restricted application with an emphasis that it has “more online learning and less seat time (when students are seated in a classroom) than a traditional course.” [2]

Aside from maximizing the benefits from traditional and online classes, blended learning also seeks to minimize the disadvantages that arise from the sole use of either traditional or online sessions. Amidst the proliferation of online courses, face to face classes still do not lose its value because they provide venues for immediate and personal teacher-student interactions and responses. Face to face meetings also allow teachers to perform direct supervision and control on learning processes and activities. However, classroom meetings are always limited by time constraints. Hence, learning from such sessions tends to emphasize on the explanation and the clarification of inputs over its reflection and application. To reduce this deficiency, blended learning encourages students not just to study beforehand the topics to be discussed but to browse the course contents and the planned proceedings for the next class. [10] In this manner, students may be able to look up on the topics beforehand and deepen his or her understanding on them afterwards through the internet.
On the other hand, distant online teaching, when it is used well, is found to develop more the “written communication skills of students, whereas the face-to-face experience can give students more practice in speaking and listening skills”. However, the former provides less venues for students to practice their speaking and listening skills. Moreover, Moore states that online courses usually only makes use of one tool of instruction: the computer. Furthermore, Carr as cited by Brunner found out that “dropout rates for online courses are sometimes 10-20 percent higher than for comparable traditional courses.” Nonetheless, three scholars Dziuban, Segment and Villanti as cited by Brunner, in their separate studies, conclude that “hybrid courses improve retention considerably over online courses and have at least equivalent retention to face-to-face courses.” [2]

The higher dropout rates among purely online classes may also be caused by the fear and difficulties encountered by students in online education. Besides, there are also students and even teachers who arrive at discoveries where they realize that they are not suited for purely online educational environments. This is even true if synchronous discussions are integrated in online courses. Listed below are some of the findings why there are lower passing rates for those who only receive synchronous online classes compared to those who receive both synchronous and asynchronous.

1. It “discouraged some participants who were less confident about their technological expertise, their ability to engage actively to synchronous cognitive discourse or the purpose of the web-videoconferences in general”
2. “Offering extra amount of rich communication tools may have drawn students’ attention away from the content and toward the workings of the technology”
3. Wegge found out that, “seeing one’s own image in videoconferencing relates to individual emotional dispositions and can decrease performance.”
4. It is a relief that synchronous online sessions are used less in blended learning (if ever it is used). It is because the use of online platforms outside the classroom are usually reserved for asynchronous discussions and fora. Besides, synchronous classes become redundant and unnecessary when blended classes also make use of face to face sessions. [5]

2.1 Advantages to Students
Students of blended classes have greater access to resources and can receive learning supervision from their teachers whether inside or outside the classroom. This can be done “by creating discussion forums via which they can discuss with each other and with their teachers, interaction can be achieved in online environment”. This may entail more time and sacrifices from teachers though. It is also observed that students’ intellectual capacities and social skills are known and assessed by their teachers from the way they interact in the academic platforms outside the classroom (Brunner, 2006). This gives teachers some hints on how they may enhance their students’ strengths and perform remedies on areas where they are weak.

The use of educational digital applications and networking tools known as Web 2.0 engages students to learn collaboratively through virtual 3D environments, peer networking, social networks, and interactive games. From such platforms, a community of inquiry can be formed where students can serve as collaborators and co-constructors of knowledge. [9] A community of inquiry is established when cognitive, social, and teaching presences are evident among the interaction of students in online educational tasks. Cognitive presence is associated with meaning-making, social presence is found when students interact to form personal relationships among themselves, and teaching presence is the facilitation of the cognitive and social presence to teach other members of the group.

The aforementioned literature is just few of the numerous researches and studies on educational technology that prove its effectiveness in and out of the classroom. It has been shown that given the right orientation and proper methodology, blended learning in the 21st century classrooms can bring significant changes in students’ academic performance.
Our brief experimental study will also attempt to contribute in this body of research as we deliver traditional teaching strategies in one class and a blended learning in another class to a school where students have been enculturated to an extensive ICT-integrated learning environment.

3. Methodology
The researchers gave a pre-test to the students before the actual lesson and gave a post-test after discussing the lesson through EDMODO, an educational application. The questions came from standardized tests. The Pre-test and post-test are appropriate to evaluate if the students understood the topic. Data were checked and tallied. These were encoded and analyzed using Stata. Students also gave evaluation about the lesson through Google forms.

3.1 The Context
Xavier School is known as a premiere institution well-known for its innovative ICT-integrated lessons. Some of their facilities include wide Wi-Fi coverage in each classroom as well an in-house Apple service center. The school implements One2One Program which requires each student from Grades 9 to 12 to have their own Ipad that they can use in their classes. Moreover, the school has a good number of Macbook computers that may be reserved for class activities and discussions. In light of this, the researchers want to find out how technology integration through blended learning instruction helps in improving the students’ academic performance in Science among Grade 10 students.

3.2 Participants
The study was conducted among selected Grade 10 sections. The Grade 10 classes are generally heterogeneous except the first three sections. Sections A, B, and C are known to be the cream classes because most of the students take in advance some Math and Chinese courses. The batch is generally technologically equipped because they have been using Ipad since Grade 9.

3.3 Data Analysis
For the research questions, the T-test and ANOVA were used to determine whether there is a difference in the pre-test and post-test scores of each class as well as the post-test scores of the experimental and the controlled group. The formula is: [4]

\[ SS = \frac{(X - \bar{X})^2}{n} = \frac{\Sigma X^2}{n} - \frac{\Sigma X}{n} \]

where
- \( \Sigma X \) is the sum of the scores or measures
- \( n \) is the number of cases
- \( \Sigma(X-X)^2 \) is the summation of squared scores

P-values represent the degree to which a difference is statistically significant. Values at or below .05 are statistically significant and would be expected to occur by chance at or below 5 percent. [8]

4. Results and Discussion

| Variable   | Test     | Mean   | Standard Deviation | Mean Difference | T value | Sig   |
|------------|----------|--------|--------------------|----------------|---------|-------|
| Grade 10B Students | Pre-test | 4.53   | 1.65               | -3             | -8.29   | 0.00  |
|             | Post-test| 7.53   | 1.63               |                |         |       |
Table 1 presents the difference of the pre-test and post-test scores of 10B. Grade 10B students who studied about protein synthesis had a higher post-test scores \((M = 7.53, SD = 1.65)\) than pre-test scores \((M = 4.53, SD = 1.63)\), \(t(31) = -8.29, p = 0.00\). This means that there is sufficient evidence to prove that the scores of 10B students significantly increased. This may also imply that they were able to grasp the concepts that they are expected to learn.

| Variable   | Test   | Mean   | Standard Deviation | Mean Difference | T value | Sig  |
|------------|--------|--------|--------------------|----------------|---------|------|
| Grade 10G  | Pre-test | 3.94   | 1.82               | -2.18          | -5.19   | 0.00 |
| Students   | Post-test | 6.12   | 2.26               |                |         |      |

Table 2 presents the difference of the pre-test and post-test scores of 10G. Grade 10G students who studied about protein synthesis had a higher post-test scores \((M = 6.12, SD = 1.82)\) than pre-test scores \((M = 3.94, SD = 1.82)\), \(t(31) = -5.19, p = 0.00\). This means that there is sufficient evidence to prove that the scores of 10G students significantly increased. This may also imply that they were able to grasp the concepts that they are expected to learn.

Table 3 presents the difference of the pre-test scores of 10B and 10G. Grade 10B students \((M = 4.53, SD = 1.65)\) and Grade 10G students \((M = 3.88, SD = 1.81)\) who studied about protein synthesis did not differ significantly in their pre-test scores \(t(31) = 1.502, p = 0.143\). This means that there is no sufficient evidence to prove that one of the sections is more knowledgeable about the topic. This would also imply that both of the sections are at par in their level of understanding about the topic.

Table 4 presents the difference of the post-test scores of 10B and 10G. Grade 10B students who studied about protein synthesis using 60% ICT-integrated teaching approach had higher post-test scores \((M = 7.53, SD = 1.63)\) than those students from 10G who studied the same lesson but with only 20% ICT-integration \((M = 6.03, SD = 2.24)\), \(t(31) = 3.276, p = 0.00\). This means that there is sufficient evidence to prove that using 60% blended instruction might have been more effective than 20% blended instruction.

Table 5 presents the difference of the pre-test and post-test scores of 10C. Grade 10C students who studied about protein synthesis had higher post-test scores than those students from 10C who studied the same lesson but with only 20% ICT-integration. This means that there is sufficient evidence to prove that using 60% blended instruction might have been more effective than 20% blended instruction.
Table 5 presents the difference of the pre-test and post-test scores of 10C. Grade 10C students who studied about protein synthesis had a higher post-test scores (M = 7.25, SD = 1.48) than pre-test scores (M = 3.63, SD = 1.81), t(31) = -13.14, p = 0.00. This means that there is sufficient evidence to prove that the scores of 10C students significantly increased. This may also imply that they were able to grasp the concepts that they are expected to learn regarding protein synthesis.

Table 6. Difference of the pre-test and post-test scores of grade 10H (Controlled Group)

| Variable | Test   | Mean | Standard Deviation | Mean Difference | T value | Sig  |
|----------|--------|------|--------------------|----------------|---------|------|
| Grade 10H Students | Pre-test | 3.47 | 1.25               | -2.7           | -6.72   | 0.00 |
|          | Post-test | 6.17 | 2.80               |                |         |      |

Table 6 presents the difference of the pre-test and post-test scores of 10H. Grade 10H students who studied about protein synthesis had a higher post-test scores (M = 6.17, SD = 2.80) than pre-test scores (M = 3.47, SD = 1.25), t(29) = -6.72, p = 0.00. This means that there is sufficient evidence to prove that the scores of 10H students significantly increased. This may also imply that they were able to grasp the concepts that they are expected to learn about protein synthesis.

Table 7. Difference of the pre-test scores of grade of 10C and 10H

| Variable | Test | Mean | Standard Deviation | Mean Difference | T value | Sig  |
|----------|------|------|--------------------|----------------|---------|------|
| Pre-test scores | 10C | 3.63 | 1.83               | 0.17           | 0.37    | 0.71 |
|          | 10H  | 3.47 | 1.25               |                |         |      |

Table 7 presents the difference of the pre-test scores of 10C and 10H. Grade 10C students (M = 3.63, SD = 1.83) and Grade 10H students (M = 3.47, SD = 1.25) who studied about protein synthesis did not differ significantly in their pre-test scores t(29) = 0.37, p = 0.71. This means that there is no sufficient evidence to prove that one of the sections is more knowledgeable about the topic. This would also imply that both of the sections are at the same level of understanding about the topic.

Table 8. Differences of the post-test scores of grade of 10C and 10H

| Variable | Test | Mean | Standard Deviation | Mean Difference | T value | Sig  |
|----------|------|------|--------------------|----------------|---------|------|
| Post-test scores | 10C | 7.20 | 1.52               | 1.03           | 2.53    | 0.02 |
|          | 10H  | 6.17 | 1.80               |                |         |      |

Table 8 presents the difference of the post-test scores of 10C and 10H. Grade 10C students who studied about protein synthesis using 60% ICT-integrated teaching approach had higher post-test scores (M = 7.20, SD = 1.52) than those students from 10H who studied the same lesson but with only 20% ICT-integration (M = 6.17, SD = 1.80), t(29) = 2.53, p = 0.02. This means that there is sufficient evidence to prove that using 60% blended instruction might have been more effective than 20% blended instruction.

Table 9. Difference of the pre-test and post-test scores of grade 10A (Experimental Group)

| Variable | Test   | Mean | Standard Deviation | Mean Difference | T value | Sig  |
|----------|--------|------|--------------------|----------------|---------|------|
| Grade 10A Students | Pre-test | 3.45 | 1.86               | -2.85          | -7.50   | 0.00 |
|          | Post-test | 6.30 | 1.76               |                |         |      |
Table 9 presents the difference of the pre-test and post-test scores of 10A. Grade 10A students who studied about protein synthesis had a higher post-test scores ($M = 6.30$, $SD = 1.76$) than pre-test scores ($M = 3.45$, $SD = 1.86$), $t(32) = -7.50$, $p = 0.00$. This means that there is sufficient evidence to prove that the scores of 10A students significantly increased. This may also imply that they were able to take hold of the concepts that they are expected to learn regarding protein synthesis.

| Variable       | Test | Mean  | Standard Deviation | Mean Difference | T value | Sig  |
|----------------|------|-------|--------------------|-----------------|---------|------|
| Grade 10A Students | Pre-test | 4.03  | 1.64               | -1.17           | -2.67   | 0.01 |
|                 | Post-test | 5.20  | 1.90               |                 |         |      |

Table 10 presents the difference of the pre-test and post-test scores of 10I. Grade 10I students who studied about protein synthesis had a higher post-test scores ($M = 5.20$, $SD = 1.90$) than pre-test scores ($M = 4.03$, $SD = 1.64$), $t(34) = -2.67$, $p = 0.01$. This means that there is sufficient evidence to prove that the scores of 10I students significantly increased. This may also imply that they were able to grasp the concepts that they are expected to learn about protein synthesis.

| Variable     | Test | Mean  | Standard Deviation | Mean Difference | T value | Sig  |
|--------------|------|-------|--------------------|-----------------|---------|------|
| Pre-test scores | 10A | 3.45  | 1.85               | -0.52           | -1.27   | 0.21 |
|              | 10I  | 3.97  | 1.64               |                 |         |      |

Table 11 presents the difference of the pre-test scores of 10A and 10I. Grade 10A students ($M = 3.45$, $SD = 1.85$) and Grade 10I students ($M = 3.97$, $SD = 1.64$) who studied about protein synthesis did not differ significantly in their pre-test scores $t(32) = -1.27$, $p = 0.21$. This means that there is no sufficient evidence to prove that one of the sections is more knowledgeable about the topic. This would also imply that both of the sections are at the same level of understanding about the topic.

| Variable     | Test | Mean  | Standard Deviation | Mean Difference | T value | Sig  |
|--------------|------|-------|--------------------|-----------------|---------|------|
| Post-test scores | 10A | 6.30  | 1.76               | 1.03            | 2.18    | 0.04 |
|              | 10I  | 5.27  | 1.94               |                 |         |      |

Table 12 presents the difference of the post-test scores of 10A and 10I. Grade 10A students who studied about protein synthesis using 60% ICT-integrated teaching approach had higher post-test scores ($M = 6.30$, $SD = 1.76$) than those students who studied the same lesson but with only 20% ICT-integration ($M = 5.27$, $SD = 1.94$), $t(32) = 2.18$, $p = 0.04$. This means that there is sufficient evidence to prove that using 60% blended instruction might have been more effective than 20% blended instruction.

| Variable     | Test | Mean  | Standard Deviation | Mean Difference | T value | Sig  |
|--------------|------|-------|--------------------|-----------------|---------|------|
| Grade 10I Students | Pre-test | 3.42  | 1.93               | -2.31           | -4.76   | 0.00 |
Table 13 presents the difference of the pre-test and post-test scores of 10D. Grade 10D students who studied about protein synthesis had a higher post-test scores (M = 5.72, SD = 2.46) than pre-test scores (M = 3.42, SD = 1.93), t(35) = -4.76, p = 0.00. This means that there is sufficient evidence to prove that the scores of 10D students significantly increased. This may also imply that they were able to learn the concepts that they are expected to learn regarding protein synthesis.

| Variable  | Test     | Mean | Standard Deviation | Mean Difference | T value | Sig  |
|-----------|----------|------|--------------------|-----------------|--------|------|
| Grade 10D | Pre-test | 3.59 | 2.03               | -1.38           | -2.88  | 0.01 |
|           | Post-test| 4.97 | 2.20               |                 |        |      |

Table 14 presents the difference of the pre-test and post-test scores of 10E. Grade 10E students who studied about protein synthesis had a higher post-test scores (M = 4.97, SD = 2.20) than pre-test scores (M = 3.59, SD = 2.03), t(33) = -2.88, p = 0.01. This means that there is sufficient evidence to prove that the scores of 10E students significantly increased. This may also imply that they were able to grasp the concepts that they are expected to learn regarding protein synthesis.

| Variable  | Test     | Mean | Standard Deviation | Mean Difference | T value | Sig  |
|-----------|----------|------|--------------------|-----------------|--------|------|
| Grade 10E | Pre-test | 3.71 | 1.45               | -2.60           | -7.31  | 0.00 |
|           | Post-test| 6.31 | 1.73               |                 |        |      |

Table 15 presents the difference of the pre-test and post-test scores of 10E. Grade 10F students who studied about protein synthesis had a higher post-test scores (M = 6.31, SD = 1.73) than pre-test scores (M = 3.71, SD = 1.45), t(34) = -7.31, p = 0.00. This means that there is sufficient evidence to prove that the scores of 10F students significantly increased. This may also imply that they were able to grasp the concepts that they are expected to learn regarding protein synthesis.

Table 16 shows that there is no significant difference in the pre-test scores among the students from Sections D, E, and F. The F value of 0.24 with the corresponding probability value of 0.79 is not significant at alpha = 0.05. This means that the students did not differ in terms of their pre-test scores when they are grouped based on their sections. Furthermore, post hoc analysis via Bonferroni was executed and it showed that there is no significant difference between the different sections.

| Variable | Sum of Squares | F Value | Sig  |
|----------|----------------|---------|------|
| Pre-test Scores of Sections D, E, F | 339.71 | 0.24 | 0.79 |

Table 17 shows that there is a significant difference in the post-test scores among the students from Sections D, E, and F. The F value of 3.36 with the corresponding probability value of 0.04 is significant at alpha = 0.05. This means that the students differed in terms of their post-test scores when
they are grouped based on their sections. Furthermore, post hoc analysis via Bonferroni was executed and it showed that the significant difference lies between Sections E and F. This further implies that students from Section F got a higher post-test score compared to Section E.

5. Conclusion and Recommendation
5.1 Conclusion
Based on the findings of the study, it can be concluded that in general there is a significant difference between the pre-test and post-test scores of each class, as well as a significant difference between the pre-test score and the post-test scores of the controlled and experimental group.

5.2 Implications and Recommendations
The following are implications and recommendations of the study based from the findings:

Since there is a significant difference for both of the classes which used blended learning at different levels, teachers can provide online interactive activities that would allow the students to understand better the concepts that are discussed in class.

Since there is a significant difference between the post-test scores of the controlled and experimental group, teachers can structure their lesson plans in such a way that students could be given more time to learn independently through interactive and collaborative activities and strategies.

Administrators and subject chairpersons can encourage the teachers to incorporate blended learning in their respective unit plans. Further, they may encourage their teachers to do team teaching. Team teaching in technology integration should be encouraged as to warrant collaboration among teachers. It has been observed that students learn better from teachers who are willing to collaborate and learn from each other. Through team teaching, teachers can share best practices with each other in terms of exhausting the use of technology to the learning advantage of students.

Administrators may want to provide a workshop that will allow the teachers to deepen their understanding about what blended instruction is and how it can be implemented. A sustainable professional development program focusing on ICT-integration in teaching should be put in place. It has been noticed that even if the school has made it part of its culture to use technology in teaching, some teachers limit technology integration in PowerPoint presentations and film clips. Hence, the researchers, recommend a continuous enhancement of teachers’ skills in deepening the use of technology in the classroom become part of in-service trainings and learning sessions.

Since the researcher found limited literature and studies related to blended learning in Xavier School, replication studies on different sets of population such as different science topics or other grade levels may be done. A replication study may also be made by faculty members from other schools to strengthen the results of the study.

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