Student-Created versus YouTube Videos: Which Type is More Effective in Enhancing Biology Learning in a Virtual Classroom?

Jaybie S. Arzaga
Palawan State University, Puerto Princesa City, Palawan, Philippines

Abstract

The COVID-19 pandemic has led to the adoption of remote online learning in higher education institutions worldwide, including Palawan State University in the Philippines. This study aimed to assess the effectiveness of student-created and downloaded YouTube videos as tools for enhancing learning in a virtual biology classroom. A pretest-posttest control group design was used, with 46 first-year BS Environmental Science students randomly assigned to either the experimental or control group. The experimental group created their own videos on topics such as Plant Cell, Animal Cell, Mitosis, and Meiosis, while the control group watched downloaded YouTube videos. Both groups took a pretest and a posttest covering the same topics before and after the experiment. The study found that both student-created and downloaded YouTube videos were effective in improving academic performance. However, the use of student-created videos had a more positive impact on biology learning outcomes compared to downloaded YouTube videos. These findings suggest that educators should consider incorporating both student-created and downloaded videos into their teaching strategies to enhance student learning outcomes. The use of videos as a teaching tool can be a valuable approach to enhance learning outcomes and engagement in a virtual classroom, particularly when students create their own videos.

Keywords: student-created videos, YouTube videos, online learning, virtual classroom, pretest-posttest control group design, biology.


Introduction

The COVID-19 pandemic resulted in the physical closure of schools and the adoption of online and flexible learning (Avila et al., 2021). The Commission on Higher Education (CHED) in the Philippines introduced reforms in curriculum delivery and directed universities and colleges to build flexible learning systems (Magsambol, 2020). Flexible learning allowed for options in learning pace, location, and mode,
accommodating the unique demands of diverse learners and supporting inclusive and accessible education (Dayagbil et al., 2021). CHED identified three forms of flexible learning: online, offline, and blended, with learners having the choice of how they would continue their studies, where and when they could advance, and how they could comply with standards and demonstrate learning results (Avila et al., 2021).

At the start of the academic year 2020-2021, Palawan State University, a higher education institution in the Philippines, implemented a flexible learning plan in accordance with CHED Advisory No. 7 s. 2020 and CMO No. 4 s. 2020. The university had adopted remote online learning as a means of delivering education to its students. This approach incorporated both synchronous and asynchronous activities, which allowed students to participate in live online classes and complete coursework and assignments on their own time. Additionally, the university had implemented flexible options for students who were unable to participate in online learning, enabling them to complete course requirements at a pace that suited their needs throughout the academic year. By offering a mix of synchronous and asynchronous activities, Palawan State University had provided students with the opportunity to access education despite the challenges posed by the pandemic.

Remote online learning became a common mode of education delivery due to the pandemic, but it was not without its challenges (Li & Lalani, 2020). One of the major concerns was the digital divide, as not all students had access to reliable internet connectivity or the necessary technological devices (Thomas, 2021). This resulted in unequal learning opportunities and hindered the progress of some students. Additionally, students experienced difficulty in managing their time and staying motivated in a remote setting (Sharma & Bumb, 2021). These challenges placed a burden on teachers to think of strategies to address these issues and ensure that all students had equal access to education and opportunities to succeed. Effective strategies included providing alternative learning materials, establishing clear communication channels, and offering flexible schedules to accommodate different learning styles (Liberman et al., 2020). By addressing these challenges and implementing effective strategies, teachers were able to ensure that students received a quality education in a remote online learning environment.

The challenges that students faced during remote online learning brought to light the crucial role that teachers played in developing effective strategies to address these issues. As students navigated the complexities of virtual learning, teachers had to be proactive in identifying and responding to the unique barriers that students encountered in this setting. By recognizing the challenges that students faced and implementing targeted solutions, teachers were able to help ensure that all students had access to high-quality education, regardless of their learning environment. One of the effective strategies was the use of videos in the class to be shown virtually. Video had a variety of uses in higher education, including delivering course content, improving lab functionality, fostering academic integrity, and promoting student success (Ahn & Bir, 2018; Jordan et al., 2015). Web-based videos were easily accessible through platforms such as YouTube and could contain multimedia elements, such as text and hyperlinks, which had been linked to improved learning (Gao et al., 2010). Video blogs, or vlogs, could facilitate reflective thinking among learners (Parkes & Kajder, 2010). Aside from the web-based videos, there were also teacher-created and student-created videos which could boost student learning. Both teachers and students could create videos to engage learners and enhance their understanding of the content (Ahn & Bir, 2018; Campbell & Cox, 2018; Kay, 2012; Olofsson et al., 2011). More
specifically, when the students created videos themselves, they could engage in active and authentic learning, which had been linked to improved academic performance (Freeman et al., 2014). The act of authoring a video could contribute to improved content knowledge and engagement among learners.

Previous studies had explored the effectiveness of student-created videos (Ahn & Bir, 2018; Campbell & Cox, 2018; Jordan et al., 2015, Kay, 2012; Olofsson et al., 2011), and YouTube videos in traditional face-to-face learning settings. However, there was a lack of research on their effectiveness in an online learning environment. This study aimed to address this gap by investigating the efficacy of these teaching tools in a university-level Biology course delivered online. Specifically, the study aimed to compare the academic performance of students who created their own educational videos with those who watched downloaded videos from YouTube. By conducting this comparison, the study sought to determine the most effective teaching tool for enhancing student learning outcomes in an online Biology course.

Methodology

Research Design

The study utilized a pretest-posttest control group design, which involved the random assignment of participants to two groups: the control group and the experimental group. Two intact classes were selected for this purpose. The participants in the experimental group were exposed to the intervention, which involved creating self-made videos, while the control group was tasked to watch downloaded YouTube videos. Before and after the experiment, the participants in both groups were given a pretest and a posttest that covered Biology topics such as Plant Cell, Animal Cell, Mitosis, and Meiosis. The test results were then used to evaluate and compare the achievement levels of the two groups.

Subjects of the Study

The study involved 46 first-year Bachelor of Science in Environmental Science (BSES) students from blocks 1A and 1C who were enrolled in Biology during the first semester of the school year 2020-2021 at the College of Sciences in Palawan State University. Each block consisted of 23 students, with BSES 1A students assigned to the experimental group and BSES 1C students assigned to the control group.

Data Gathering Instrument

The primary tools utilized in this study were the pretest and posttest with 40 test items each designed by the researcher to assess the students' performance in Biology. The test covered topics such as Plant Cell, Animal Cell, Mitosis, and Meiosis. To ensure that the tests adequately represented the subject matter, a table of specifications was prepared. The test underwent content validation, which involved seeking the opinion of three Biology educators with expertise in test construction. The validation process revealed that the test was highly valid, with a rating of 4.15. Additionally, the reliability of the test was assessed using Cronbach's alpha, and the results indicated a high level of internal consistency reliability, with a reliability index of .874, which is considered high for a teacher-made test. Therefore, it can be concluded that the test items formed a scale with high internal consistency reliability.
Procedure
To begin the study, the research objectives were explained to the students, and their voluntary participation was obtained. A pretest was administered to all students to establish a baseline of their knowledge and skills in Biology. An online orientation was conducted for the experimental group to provide guidance on how to create self-made videos. Over a period of three weeks, the Biology lessons were covered online, starting with lectures followed by a video activity. After each lesson, covering topics such as Plant Cell, Animal Cell, Mitosis, and Meiosis, each student in the experimental group was tasked to create a video about the topic, while the students in the control group watched a downloaded video from YouTube. The students in the experimental group were provided with guide questions and marking rubrics to assist them in their assigned tasks, and they were given specific time to work on their videos, with daily monitoring by the teacher. On the final week, the students presented and discussed their video outputs, and on the last day, both the experimental and control groups took a posttest to measure their learning outcomes.

Statistical Treatment
Descriptive statistics, such as mean and standard deviation, were used to determine the achievement level of the students. The independent t-test was employed to determine whether there was a significant difference in the performance of the two groups. These statistical tools were used to accurately analyze and interpret the data gathered during the study.

Results
Control Group’s Pretest and Posttest Performances Taught in Biology with the Use of YouTube Videos
As seen in Table 1, there is a noteworthy increase in scores from the pretest to the posttest, with the mean score for the pretest being 18.17 and the mean score for the posttest being 23.86. This indicates an average gain of 5.69 points, which is statistically significant due to the relatively large sample size of 23 and the low probability of obtaining such a difference through chance alone. The standard deviation for the pretest was 6.83, indicating some variability in the pretest scores, while the standard deviation for the posttest was 8.77, indicating variability in the posttest scores as well.

<p>| Table 1. Control Group’s Pretest and Posttest Performances Taught in Biology with the Use of Youtube Videos |</p>
<table>
<thead>
<tr>
<th>BSES 1C</th>
<th>Mean</th>
<th>N</th>
<th>Standard Deviation</th>
<th>Standard Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>18.17</td>
<td>23</td>
<td>6.83</td>
<td>1.424</td>
</tr>
<tr>
<td>Posttest</td>
<td>23.86</td>
<td>23</td>
<td>8.77</td>
<td>1.830</td>
</tr>
</tbody>
</table>

The standard error of the mean (SEM) for both the pretest and posttest indicates the precision of the sample means as estimates of the population means. A smaller SEM indicates a more accurate estimate of the population mean. In this case, the SEM for the pretest was 1.424 and for the posttest was 1.830. These values suggest that the sample means are reasonably precise estimates of the population means. Generally, the outcomes indicate that the use of Youtube videos was successful in enhancing test performance of the control group, with a significant improvement in scores from the
pretest to the posttest. The findings suggest that incorporating YouTube videos into the learning process can be an effective approach to improve the academic performance of students.

**Experimental Group’s Pretest and Posttest Performances Taught in Biology with the Use of Student-Created Videos**

The pretest and posttest data set shows a significant increase in scores from the pretest to the posttest. The mean score for the pretest was 18.00, while the mean score for the posttest was 32.83, indicating an average gain of 14.83 points. This increase is statistically significant given the relatively large sample size of 23 and the low probability of obtaining such a difference by chance alone. The standard deviation for the pretest was 6.310, which indicates that there was some variability in the pretest scores. The standard deviation for the posttest was 6.401, which indicates that there was also some variability in the posttest scores.

<table>
<thead>
<tr>
<th>BSES 1A</th>
<th>Mean</th>
<th>N</th>
<th>Standard Deviation</th>
<th>Standard Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>18.00</td>
<td>23</td>
<td>6.310</td>
<td>1.316</td>
</tr>
<tr>
<td>Posttest</td>
<td>32.83</td>
<td>23</td>
<td>6.401</td>
<td>1.335</td>
</tr>
</tbody>
</table>

The standard error of the mean (SEM) for both the pretest and posttest indicates the precision of the sample means as estimates of the population means. The smaller the SEM, the more precise the estimate of the population mean. In this case, the SEM for the pretest was 1.316 and for the posttest was 1.335, which suggests that the sample means are reasonably precise estimates of the population means. The results suggest that there was a significant improvement in scores from the pretest to the posttest, which indicates that the intervention, the use of student-created videos, being tested was effective in improving performance on the test. The magnitude of the effect is substantial, with an average gain of almost 15 points.

**Independent Samples Test of the control and experimental group’s posttest performances taught in Biology**

Table 3 shows the results of the independent samples test of the control and experimental group’s posttest performances. The t-value of -3.9543 indicates the difference between the means of the control and experimental groups’ posttest scores is significant. The negative sign indicates that the mean posttest score of the control group is lower than the experimental group’s mean posttest score.

<table>
<thead>
<tr>
<th>BSES 1C &amp; 1A</th>
<th>Posttest 1 &amp; Posttest 2</th>
<th>t-value</th>
<th>p-value</th>
<th>alpha level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-3.9543</td>
<td>.000138</td>
<td>.05</td>
</tr>
</tbody>
</table>

The p-value of .000138 indicates that the probability of obtaining a t-value as extreme as -3.9543 or more extreme, assuming that there is no significant difference between the means of the control and experimental groups, is .000138. Since the p-value is less
than the chosen significance level of .05, it can be concluded that there is a statistically significant difference between the means of the control and experimental groups’ posttest scores. In other words, the results suggest that the experimental group’s posttest scores were significantly higher than the control group’s posttest scores in the virtual classroom setting. This indicates that the use of student-created videos had a more positive impact on biology learning outcomes compared to downloaded YouTube videos.

**Discussion**

The results of the study indicate that students perform well with both student-created (Stanley & Zhang, 2018) and YouTube videos (Lynch, 2020) in the classroom. However, the students performed better with student-created videos compared to downloaded YouTube videos. This finding suggests that student-created videos have a more positive impact on learning outcomes and can enhance student engagement and motivation in the learning process (Greene, 2014). The fact that students performed well with both types of videos is not surprising. YouTube videos have become increasingly popular due to their accessibility, convenience, and wide variety of content available. YouTube offers a vast selection of educational videos, including lectures, tutorials, and animations, which can be used to supplement traditional classroom instruction. Moreover, YouTube videos can provide students with opportunities to learn at their own pace and level, which can enhance their understanding and retention of the subject matter.

However, the fact that students performed better with student-created videos compared to downloaded YouTube videos is an interesting finding. This result could be attributed to several factors. First, student-created videos are tailored to the specific learning objectives and needs of the students, and therefore, may be more relevant and engaging than downloaded YouTube videos. Students who create videos have a better understanding of the subject matter, and the process of creating the video can enhance their learning and retention of the material (Mayer, 2014). Second, student-created videos can provide students with a sense of ownership and responsibility for their learning, which can enhance their motivation and interest in the subject matter (Van Eck, 2010). Students who create videos have control over the content, format, and style of the video, and therefore, can tailor the video to their learning preferences and needs. This sense of ownership can increase students' investment in the learning process and enhance their engagement and motivation. Third, the use of student-created videos can promote active learning and collaboration among students. Students who create videos often work in groups and collaborate to produce the video, which can enhance their communication, teamwork, and problem-solving skills (Losh et al., 2020). Moreover, the process of creating the video can promote critical thinking and reflection, which can enhance students' understanding and retention of the material (Johnson, 2013).

The finding that students perform well with both student-created and YouTube videos is not surprising, given the popularity and accessibility of YouTube videos. However, the fact that students performed better with student-created videos compared to downloaded YouTube videos suggests that student-created videos have a more positive impact on learning outcomes and can enhance student engagement and motivation in the learning process. The use of student-created videos can provide
students with a sense of ownership, promote active learning and collaboration, and enhance critical thinking and reflection.

**Conclusion**

The following statements are based on the results of the study:

1. The use of YouTube videos can be an effective approach to improve the academic performance of students. The significant improvement in scores from the pretest to the posttest suggests that incorporating YouTube videos into the learning process can enhance learning outcomes. The findings highlight the potential benefits of integrating instructional videos into classroom instruction.

2. The use of student-created videos was effective in improving performance on the test. The significant increase in scores from the pretest to the posttest indicates that the intervention, the use of self-created videos, was successful in improving performance on the test. The results suggest that student-created videos can be a valuable tool for enhancing learning outcomes and engagement.

3. The use of student-created videos had a more positive impact on biology learning outcomes compared to downloaded YouTube videos. The significant difference in posttest scores between the control and experimental groups suggests that student-created videos can enhance student learning outcomes and engagement more effectively than downloaded YouTube videos. The findings highlight the potential benefits of incorporating student-created videos into the virtual classroom.

**Recommendations**

Based on the results of the study, the following recommendations are made:

1. Educators may consider incorporating both the student-created videos and YouTube videos into their teaching strategies to enhance student learning outcomes. The findings suggest that the use of student-created and YouTube videos can be an effective approach to improve academic performance. However, they may consider the potential benefits of using student-created videos over downloaded YouTube videos. The findings suggest that student-created videos can have a more positive impact on biology learning outcomes compared to downloaded YouTube videos. Therefore, educators can encourage students to create their own videos instead of relying solely on downloaded resources. This can provide students with a sense of ownership and responsibility for their learning, which can enhance their motivation and interest in the subject matter.

2. Educators should provide guidance and support for students when creating their own videos. Students may need guidance on how to create effective and engaging videos, and educators can provide feedback and support throughout the process. This can help ensure that the videos are relevant to the learning objectives and needs of the students. They may consider using a variety of video types to meet the diverse learning needs of their students. While both YouTube videos and student-created videos can be effective in promoting learning outcomes, some students may prefer one type over the other. Therefore, educators can consider using a mix of video types to cater to the different learning preferences of their students.
3. Further research may explore the effectiveness of video-based learning in different educational contexts. While the current study focused on the virtual biology classroom setting, there may be other educational contexts where video-based learning can be effective. Further research can explore the effectiveness of video-based learning in different subjects, grade levels, and educational settings.

References


