Student-Generated Videos Using Green Screen Technology in a Biology Class

Donnalyn Blacer-Bacolod

***Abstract*—This study explores the effectiveness, learning benefits, and positive and negative experiences of using student-generated videos as an approach to project-based learning in a biology class. Ninety-two Grade 11 students were chosen through matched pairing of characteristics and had participated in this mixed-method research. Students in the experimental group made video projects using the Green Screen by Do Ink application. The effectiveness of the intervention was determined through posttest assessments of the experimental and comparison groups. A postexposure self-report survey was also administered to understand the learning benefits and experiences of the students who made the video projects. The results of this initial study show that the student-generated video project has statistical and practical effects in the study of animal physiology lessons. Its utilization significantly improved the students' test scores. Likewise, they appreciate the cognitive, technical, and life skill contributions of using it, although there are minimal demotivating experiences. This study contributes to the literature in student-generated video and project-based blended learning.**

***Index Terms*—Academic performance, chroma key technology, project-based learning, student-made videos.**

I. Introduction

The increased availability and affordability of new technologies allow an innovative revolution in different sectors of society. As supported by [1], the emergence of low-priced cameras and mobile editing platforms has led to new video applications in the industry, including schools. In the educational environment, the use of video has become a vital part [2], such as part of traditional courses, as the core of many blended courses and as a primary content distribution method for an online course in higher education [3]. Videos may serve as effective means of improving student learning in biology class because they are engaging [4] and useful in visualizing abstract concepts that they often encountered in many courses in biology [5].

Miner and Stefaniak categorized educational videos into those generated by teachers to provide input and actively received by the students and those created by students to demonstrate their knowledge of the topics discussed [6]. In the separate studies of [7] and [8], they observe that many of the educational videos created are for passive and responsive simulation of lectures. Examples of digital materials produced by teachers to complement class contents were podcasts, vodcasts, and short videos [9]. However, students expect more educational activities related to technology apart from watching lectures or video clips. Hence, student-generated videos can address the need for such a "learning with technology" problem.

Student-generated videos have several benefits supporting active learning, engagement, motivation, and skills development. Student-generated content promotes reflective learning [10], active participation, and creativity [11]. Moreover, Stanley and Zhang [12] stated that student podcasting and video creation enhance online learning and engagement. Student-generated videos promote critical thinking, research skills, and digital literacy [13], [14] which all support the development of 21st-century skills among students. Twenty-first-century learning necessitates the acquisition of 21st-century skills such as collaboration, digital literacy, critical thinking, and problem solving [15] in the early levels of formal education so that students will be prepared to continue their education anywhere in the world and gain the confidence they need to successfully transition into the worlds of work and civic participation [16]. Moreover, students are motivated to research more on their chosen topic for them to ensure accurate information [17]. It creates a deepening of students' scientific inquiry skills during video production [18]. Creating learning videos helps facilitate learning by letting students look for more information and develop their vocabulary outside the classroom [9]. Hawley and Allan reported that student video creation offers the opportunity to improve digital and communication skills and enrich their learning in a fun, motivational, and fulfilling manner [19].

One way to produce student-generated videos is through project-based activity. Project-based learning offers practical and significant learning experiences for students. This analysis is consistent with the reports of [20] and [21] that tell project-based learning has a positive effect on the learning attitude of students in science. Project-based learning provides opportunities for students to create their videos to assist them in their learning process while thinking that the videos can have future purposes. It gives students a sense of ownership compared with receiving teacher-centered materials. Project-based learning underlines reflective thinking, contextualization, and personalized learning. Case studies suggested that the incorporation of the video making of university students into project-based learning [22] facilitated effective learning and, in particular, it is interactive, context based, and has innovative features [23]. In engineering education, deep learning of science facts is facilitated, and imagination is stimulated when students are encouraged to plan out their assignments with video [24]. Students learn more when they are required to do a project. Participating in the project encourages them to attain higher

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levels of cross-curricular skills and better academic performance relative to their nonparticipating peers [25], [26].

In the past, only photographers and videographers commonly used green screen technology [27]. They often used it in video editing to create a more cinematic and creative video production. The availability of cameras and editing platforms in mobile devices had led to new applications of green screen technology in educational settings. Currently, students and teachers can use this technology for meaningful and enjoyable learning experiences. Green screen technology has been used in the curricula of technology [28] and engineering [29] in higher education. In the study of [30], they used green screen technology as a teacher-made video for a blended course in drug literature evaluation. Presently, green screen technology can also be incorporated in making both teacher- and student-generated videos that can serve as a teaching–learning material or student project.

There are no studies on student-generated videos using green screen technology in the high school biology course despite the practical application and widespread use of green screen technology in the industry and higher education. This gap in literature opens new opportunities to explore this topic. Hence, this current study aimed to determine the effectiveness of the intervention, the learning benefits, and the meaningful experiences of the students in making a student-generated video project through the use of green screen technology in animal physiology lessons. Being an emerging innovation in the education field, green screen technology can be used in the creation of student-generated video projects. Student-generated video projects can provide opportunities to engage 21st-century students in a blended classroom and enhance their learning process.

The use of green screen technology in student-generated video project creation allows students to present the concepts they acquired in a meaningful and creative way. Green Screen by Do Ink, Green Screen Movie FX Studio, and Hands-On Green Screen are simple Macintosh green screen applications that can be used by students on their mobile phones or tablet device. Green Screen Pro, Chromavid, and Chroma Key Touchup are other choices of green screen applications for android users [31]. To create a project using green screen technology, students stand in front of a video camera with a green screen background of any colored cloth (but not skin-toned color) hanging sturdy on a wall. Once they finished recording their video, they can change their background layout according to their desired imported still or motion pictures from the internet using their chosen application. The resulting video can look unique, creative, and realistic with less effort and cost.

This study aimed to explore the effectiveness of a student-generated video project using green screen technology in increasing student outcomes in biology and to determine the learning benefits and experiences that students acquire from making it. The research questions addressed in this study were as follows: 1) Does the integration of a student-generated video project through green screen technology help improve test scores? 2) What learning benefits and experiences can students get from making a student-generated video project?

II. Materials and Methods

This study used a mixed-method type of research with concurrent triangulation design to determine the effectiveness of the intervention in increasing student outcomes through posttest assessments (quantitative strand) and to explore the learning benefits and experiences of using the student-generated video project as perceived by the students through postexposure self-report survey questionnaire (qualitative strand).

Twenty-five-item multiple-choice questions relevant to animal physiology were used in the pretest to determine their prior knowledge of the concepts and to establish that the two groups matched. Conducting a test–retest reliability test to 45 randomly selected nonparticipating Grade 11 students ensured the reliability of the test. The pretest and the posttest used parallel questions to lessen the threat to external validity. For the qualitative data, the researcher used a questionnaire with two open-ended questions to determine the perceptions of the students about the learning benefits and experiences of doing the student-generated video projects. Their perspective provided a better understanding of the continued success of using a student-generated project-based video activity in biology.

Ninety-two Grade 11 students participated in this study, with 46 students in each group. The experimental group did a student-generated video project using green screen technology, whereas the comparison group performed a nontechnology project like a portfolio. The academic performance (GPA in the first semester), the composition of gender, number of students, teacher handling the subject, academic course topic, number of students who have a mobile device, and academic schedule were considered comparable in both Grade 11 class sections.

The students were informed about the aims and intentions of the study as well as their voluntary participation. There was also a short orientation on how to create a project using the Green Screen by Do Ink application (as preferred by the participants) to help them familiarize the technology they will use for this experiment. Initially, they took a pretest to determine their knowledge level before the experimentation. During the treatment, the content area specified for the animal physiology lessons were covered within the 2-week activity. At first, there was a face-to-face lecture. After that, students formed groups that had 5 members. However, because they are 46 in their class section, there would be a group consisting of 6 members. A total of 9 groups were organized for each of the experimental and comparison groups.

The experimental group made a green screen video project (5-min duration) about the content matter as part of their learning process, whereas the comparison group made a portfolio. Guide questions and marking rubrics were given to students for them to know the content and grading system of their assigned projects. They were provided with a green cloth and were allowed to download still or motion pictures from the internet or create their own. Students were given one day to work in the library, two days to work in the computer

hub, and the rest of the days in the classroom. The teacher and the researcher did daily monitoring of accomplishments. On the seventh to ninth day, face-to-face learning was conducted for them to present and discuss their outputs. On the 10th day of the experimental period, both groups answered a posttest. However, only the experimental group completed a postexposure self-report survey regarding the learning benefits and experiences of using green screen technology in the classroom.

The 25-item questionnaire in the pretest and posttest was analyzed using the mean percentage and standard deviation to describe the test scores of the students in both groups. This present study utilized a paired sample *t*-test to know whether a significant difference exists in the pretest and posttest results of both groups. With that statistical test, the effectiveness of the video project to increase student outcomes was determined. Conversely, frequency count was employed to tally the perceptions about the learning benefits and experiences of using green screen technology.

III. Results

The first research question asked, "Does the integration of student-generated video project through green screen technology help improve test scores?" Results reveal that the mean percentage scores of the comparison and experimental groups in the pretest are 56.35 (SD = 7.39) and 53.65 (SD = 7.94), respectively. The mean percentage scores of both experimental and control groups are described as "did not meet the expectation" (Table I). On average, the comparison group has higher performance than the experimental group. The mean percentage scores in the pretest were normally distributed, as assessed using Shapiro–Wilk's test ($p > 0.05$). The result shows that these scores do not differ significantly, with $t(45) = 1.64$, $p > 0.05$, implying that both groups have similar performance at the beginning.

Following the experiment, a posttest was administered to the two groups. Results of their posttest indicate that the mean percentage score of the experimental group is "outstanding" (M = 86.96%, SD = 7.18), whereas the comparison group's is just "very satisfactory" (M = 80.00%, SD = 7.25). Again, the Shapiro–Wilk test was used to ensure that the posttest scores were normally distributed for each group ($p > 0.05$). Results show that the students who participated in the student-generated video project scored significantly better than those who made a portfolio project, with $t(45) = -4.20$, $p < 0.05$.

TABLE I: The Test Performances of Students

	Pretest		Posttest	
	Mean	SD	Mean	SD
Comparison	56.35	7.39	80.00	7.25
Experimental	53.65	7.94	86.96	7.18

Scaling: 0.00–59.99 = Did not meet expectations. 60.00–67.99 = Fairly satisfactory. 68.00–75.99 = Satisfactory. 76.00–83.99 = Very satisfactory. 84.00–100.00 = Outstanding.

It is safe to assume that the student-generated video project using the green screen project was successful in improving their test scores in the said lessons as no other intervention was conducted. The substantial improvement in the experimental group's posttest scores, compared to the comparison group's scores, may primarily be attributed to the benefit of the video project because there was no other intervention used in the study. However, this study does not claim that student-generated video project is better than other forms of learning. To further understand the effect of the student-generated video project to the students, a postexposure survey questionnaire was given to them.

The second research question was "What learning benefits and experiences can students get from making student-generated video project?" The open-ended questions raised to them were as follows: 1) What are the learning benefits of making the student-generated video project using green screen technology? 2) What are the experiences that you gained from doing the activity? How does your experience help in your learning process?

The content analysis of the written responses for the learning benefits and positive experiences reveals six themes: authentic learning experience, cognitive gains, collaborative engagement, development of self-confidence, practical technical skills, and opportunity to be creative. Conversely, three themes emerge for the negative experiences of using green screen technology as a student-generated video project: time constraints and unfamiliarity, being technologically unenthusiastic and challenges in video preparation.

A. Learning Benefits and Positive Experiences

Theme 1. Authentic Learning Experience

Many of the students (n = 10) commented that making the green screen student-generated project is more enjoyable, genuine, and engaging than any other kind of presentation.

Sample comments:

"It's more fun to make videos using Green Screen Technology."

"It's enjoyable than [to make] PowerPoint or do role-playing."

"I like it more compare[d] to the usual task given to us."

A limited number of students ($n = 5$) said that the use of a project-based student-generated video promotes reflective learning and allows dynamic learning to happen.

Sample comments:

"Because of this [kind of activity], I think we can reflect or think about what we have learned."

"This activity encourages the deepening of lessons because we have to internalize the concepts we need to present in the video."

"Aside from the lessons taught by the teacher, this activity gave us a useful learning because we are encouraged to study online."

There are four students who mentioned that this activity promotes personalized learning and encourages self-learning. To quote one of their answers: "While enjoying taking videos, I can learn more knowledge aside from what I learned from the teacher because I can listen to my classmates" part, and I can still search the internet for whatever information I want to add."

Theme 2. Cognitive Gains

Eleven out of 46 students reported that the

student-generated video project helped them remember the conceptual lessons. Four of them indicated that they gained a better understanding after doing the project. Typical comments from the response papers are as follows:

"… because we need to make a script for the recording, each of us should study the lesson well enough, or else we might deliver a wrong concept."

"Unlike of usual reporting where we just usually copy PPT slides or concepts, in here, we need to make sure we know what we are saying."

"We share[d] our ideas for making the green screen project and by that, we understand and remember it much."

"I remembered the lessons because of doing the project, unlike if I just listened to the [Teacher's] lecture or I do reportorial, because in reportorial, what I usually do is copy from the internet and write in Manila paper"

Meanwhile, three of the students in the experimental group stated that making this project using green screen technology had improved their study habits. Sample comments are as follows:

"I put more effort to study the content to be included in our video."

"Instead of doing other things, I searched on Google and YouTube to prepare for the video."

A few students (n = 3) commented that it increased their preparedness in taking tests, and they have lesser test anxiety. They said, "Since we are the ones who did the video, I became confident for the exam" and "doing it, made me prepared as if I have reviewed my lessons."

Theme 3. Collaborative Engagement

As reported by some students (*n* = 7), the green screen technology project had made learning more meaningful by promoting social interaction among them:

"Doing this became useful for me because my group mates helped me understand the lesson better."

"I enjoyed making the project because we can work with one another, doing what we have decided."

"By simply doing the project, we have given more chance to interact with our classmates unlike for reportorial, others became dependent on the leader most of the time."

Theme 4. Development of Self-confidence

The student-generated video project is helpful in the development of self-confidence. According to a few students (*n* = 4), doing the project eliminated their timidity and anxiety in front of the camera resulting in increase of self-confidence. Sample comments include the following:

"I felt nervous. I was afraid to face the camera but because of this, I enhanced my self-confidence."

"I was not used to speaking in front of the camera, but this one helped me to be at eased and be confident."

Theme 5. Practical Technical Skills

There were students (n = 11) who mentioned about the practical application of technology as a positive experience. Students consider learning additional skills concerning technology as beneficial to them at present. Sample comments are as follows:

"I'm sure I can use this skill. It's good to know another skill like this."

"Now I can create my movie, I think I can use this in doing projects in other subjects."

"Since doing short films are required in most of our subjects, we can use this new technique to have a creative and cinematic output."

Theme 6. Opportunity to be Creative

Some of the respondents (*n* = 7) enjoyed the use of green screen technology because they can express their creativity. Sample quotes include the following:

"It's a new way for the students to express their creativity."

"Making this project is enjoyable. It's a creative way to explain or tackle the different topics using Green Screen Technology, and it will also help to express my creativity."

B. Negative Experiences in Using Green Screen Technology in Student-Generated Video Projects

Theme 1. Time Constraints and Unfamiliarity

Nine of the respondents complained about the time consumed in making the video project. They said it consumed more time to accomplish it because they are not yet familiar with the green screen technology application and there are many procedures to follow. Sample comments are as follows:

"Overall, doing the project is time-consuming, from the planning, execution up to the video editing, compared to the usual preparation for reporting."

"Since we were not yet familiar with this, it took us more time."

"We want to make a quality video, but we have to study first the procedure, we are not yet familiar to it."

Theme 2. Technologically Unenthusiastic

Few students (*n* = 5) reported that they are demotivated to learn new technological skills. They are reluctant to learn because they are not confident when it comes to operating technological tools.

Sample comments included are:

"I don't like it because I'm slow to learn"

"I have difficult[y] understanding procedures that's why I don't prefer it."

"I'm afraid to use a new mobile application because my cellphone is not that good."

Two of the students said that they are simply uninterested to learn green screen technology because they are not into technology. They said that "new adjustments are needed in order to learn that green screen app" and "it's a hassle to use because it's better to use the usual things."

Theme 3. Challenge in Video Preparation

One of the difficulties reported by the respondents was about preparing and editing the video. According to four of them, they must retake their video several times because of some errors. Sample comments include the following:

"The difficulties that I encountered in doing green screen projects are retaking videos due to mispronunciation of words."

"There are some bloopers that's why it took us more time to video."

In contrast, some students (n = 4) said that editing the video was a bit difficult for them.

Sample comments are as follows:

"… because I'm not a pro when it comes to editing video using green screen …"

"… I don't know how to edit the video …"

Two students commented that they have no problem in doing the green screen project. One of the students commented, "nothing, really. One should just learn how to do it correctly."

The remaining students had no comment about the difficulties encountered in doing the green screen video project.

IV. Discussion

The availability and affordability of technologies have created potential tools that can cater to the students' needs and enrich their learning experiences in the 21st century. Classroom learning becomes fun, engaging, and interactive with these devices. The student-generated video with the aid of green screen technology in a project-based blended learning approach offers various learning benefits and meaningful experiences in a high school biology classroom.

The pretest results of the study groups indicate their similar outcomes before the experimentation. Conversely, the posttest results reveal that the experimental group has significantly higher test performance than the comparison group because of the integration of a student-generated video project. The notable increase in the scores of those in the experimental group supports the claim of [32] that the use of technology in the classroom can increase the students' academic performance. It also agrees to the research of [33] that the usage of technology is associated with academic achievement. Likewise, the integration of technology in the classroom helps the students to develop higher-order thinking skills [34] such as analysis, evaluation, and synthesis. In particular, the use of videos may be an effective way to enhance student learning in biology class [4] because they help visualize complex ideas frequently present in many biology courses [5]. It improves the scientific inquiry of students during video development [18].

Student-generated videos and project-based learning activity provide students with real and meaningful opportunities to learn independently and collaboratively. Miner and Stefaniak have shown that e-learning is successful when independent learning, especially in the video form, is allowed [6]. The use of technology is more meaningful because there is an opportunity to collaborate with peers and classmates while doing a project. Stanley and Zhang reported that podcasting and video production strengthen online learning and interaction [12]. It has a positive effect when students have meaningful experience through cooperation with peers [35]. The student-generated video project has also improved the engagement and cooperation of students in the classroom. For [36], technology integration fosters student participation in the classroom. Keengwe et al. proposes related findings to improve interaction and engagement across a technological-rich learning environment [37].

Student-generated videos and project-based learning activity have positive effects on the skills and attitudes of learners. Hawley and Allen recognized the opportunity for student video creation to develop multimedia and communication skills and enhance their learning in a constructive, encouraging, and satisfying manner [19]. Incorporating the green screen video project into the lessons posed opportunities to hone the creativity of the students, to instill a positive outlook for the integration of technology in their academic learning, and to develop other technological skills. It aligns with the assertion of [38] that when students believe that technological tools like multimedia video presentations can enhance their learning, it may influence their study positively. Martin-Dunlop et al. and Howland et al. demonstrated that project-based learning favorably affects students" learning attitude in science [20], [21]. The use of a student-generated video project in this study afforded the students to develop their 21st-century skills, such as collaboration, digital skills, and critical thinking [15], which education should develop among students to help them once they embark in the real world [16].

However, the use of a student-generated video project posed some disadvantages too. Out of the comments of the students, it can be drawn that incorporating new technology into learning is not easy. Proper time allocation is necessary to avoid additional burden to students. Likewise, educators who are planning to introduce a new technology should see to it that they have the skills to manipulate it; otherwise, they cannot teach the students the proper procedures. These barriers are the same barriers identified by [39], [40], and [41]. They said that a lack of time and knowledge to use technology is one of the obstacles that prevent the success of using it in the classroom. Such a problem can lead to unwanted increase in cognitive load as described by [42] that while being immersed in a virtual world during the learning task can create a unique experience compared with other traditional media, the use of technology (e.g. use of VR) can also deplete learners' cognitive resources resulting to decreased learning. Rather than assisting in the learning process, technology use impedes it and increases students' cognitive load.

Some students remarked that the introduction of student-generated video project using green screen technology entails a shift in learning for which not all students are ready. It parallels the study of [43] that fast learners appear to be better prepared when it comes to the use of technology. They are more willing to incorporate technology in the learning process and find it user-friendly. In contrast, slow learners seem to have difficulty changing their learning habits and have low technology acceptability. Likewise, several studies explain the connection between attitude and technology use. According to the findings, having positive attitudes can motivate students to use computers and other information technologies, whereas having negative attitudes can cause students to avoid these technologies. It is easier to be familiar with technology if students have positive attitudes [44]. Doing a video requires some preparations, starting from the planning up to the execution and final editing. With that, educators must consider the skills of students needed for this task. When it comes to editing, not all students are familiar and good at it. It would be helpful if students can practice beforehand. Although learners were born into a technologically rich country, they might not be skillful technology users [45].

The overarching goal of the student-generated video using green screen technology is to help in the learning process.

The analysis revealed that it contributes to the improved test scores of the students who used it. They also reported positive feedbacks that contributed to their meaningful learning experiences such as authentic learning experiences, cognitive gains, collaborative engagement, development of self-confidence, practical technical skills, and opportunity to be creative. Time constraints and unfamiliarity, being technologically unenthusiastic and the challenges in video preparation are some of the negative experiences enumerated by the students.

V. Conclusions and Recommendations

The use of a student-generated video project in a biology course has viable effects in student outcomes and learning experiences. Overall, the students were positive about the student-generated video project, which is reflected in their response that it helped them acquire conceptual knowledge, technological abilities, and life skills, which are important components of 21st-century learning. Although few demotivating factors arise, this study has provided additional learning benefits and meaningful experiences to the students in the form of student-generated video project activity. Likewise, this study helps to bridge the gap between the use of technology in the classroom and the trends in technological society at present. This current study contributes to substantial examples of student-generated video projects and project-based learning pedagogy that teachers and researchers can explore. Student-generated video project using green screen technology is still a burgeoning practice in the field of education.

However, there were some limitations in the execution of this study. First, there was a limited sample size to collect the data. Adding more participants will help obtain a more reliable result. Second, the teachers' perceptions were not included in the study; hence exploring their perceptions will provide more information about the effectiveness of the intervention. Third, the novelty effect of emerging technologies on students was unexplored. It is recommended to add some questions about technology novelty and do a Focus Group Interview to help interpret students' perspectives. Fourth, a single topic was used in the study. Incorporating additional topics will help to ensure that the intervention is successful. Fifth, increasing study time is vital. The veracity of diagnosis can be calculated over longer times. Aside from the above-stated limitations and recommendations, the researcher suggests conducting more studies to exploit the capacity for better learning results in student-generated video projects using green screen technology.

Conflict of Interest

The author declares no conflict of interest.

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