

Learning by Speaking Science: The Effect of Student-Generative Reflective Vodcast in Science Achievement

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ABSTRACT

This study investigated how student-generated reflective vodcasts impact science achievement compared to traditional instructional methods. Using a quasi-experimental, non-equivalent control group design, the research involved 62 first-year Bachelor of Information Technology students in a Science, Technology, and Society course. One group engaged with reflective vodcasting, while the control group followed conventional instruction. A researcher-developed 30-item science achievement test provided the data through pretest and posttest administration. Although both groups showed improvement, the vodcast group achieved a significantly higher mean gain. Statistical analysis confirmed that both groups started at a similar baseline, making the posttest differences a clear indicator of the intervention's success. These findings suggest that creating reflective multimedia encourages students to move beyond rote memorization toward active knowledge construction and higher-order thinking. Ultimately, the results highlight vodcasting as a practical, innovative tool for fostering meaningful engagement in science education.

Keywords: student-generative vodcast, reflective learning, science achievement, quasi-experimental design, technology-enhanced learning

INTRODUCTION

Science education is essential for helping learners navigate a world driven by rapid technological advancement. Rather than simply acquiring facts, students must develop the ability to construct knowledge actively (OECD, 2019). This shift aligns with constructivist principles, which suggest that meaningful learning thrives on social interaction and engagement rather than the passive reception of information (Bruner, 1961; Vygotsky, 1978).

Despite these theoretical foundations, many science classrooms still rely on teacher-centered lectures and rote memorization. This reliance on passive instruction often stifles student engagement and academic performance (Freeman et al., 2014). When students act only as recipients of information, they lose vital opportunities to develop metacognitive skills and deep conceptual understanding (Alessa & Hussein, 2023).

Reflective learning offers a path forward by transforming raw experience into meaningful knowledge (Dewey, 1933). By fostering metacognition—an awareness of one's own thinking processes—reflection allows students to regulate and improve their own performance (Flavell, 1979; Zimmerman, 2002). This cyclical process of experience and reflection is a cornerstone of cognitive growth (Kolb, 1984), and empirical evidence confirms that such practices directly boost achievement in science (Al-Rawahi & Al-Balushi, 2015; Serra et al., 2023).

Technology enhances this process by providing multimedia environments where students can organize and process information (Mayer, 2020). Digital tools, specifically student-generated vodcasts, require learners to articulate their understanding clearly, which promotes both cognitive and communicative development (Kay, 2012; McLoughlin et al., 2007). When students create their own materials, they take ownership of their learning, leading to higher motivation and better critical thinking skills (Alwafi, 2023; Coppola & Pontrello, 2020).

While research has explored student-generated materials, reflection, and video instruction independently, few studies have examined their combined impact through a quasi-experimental lens. This study addresses that gap by investigating how reflective vodcasts influence the science achievement of first-year Bachelor of Information Technology students. By comparing pretest and posttest scores between experimental and control groups, the research aims to determine if this integrated approach significantly improves academic performance in the Science, Technology, and Society course.

METHODOLOGY

Research Design

The research followed a quasi-experimental design, specifically utilizing a non-equivalent control group pretest–posttest framework. This approach was chosen because it allows for rigorous evaluation within authentic classroom environments where random assignment is often impractical (Creswell & Creswell, 2018). By working with intact classes, the study maintained a natural educational setting while still providing the structure necessary to measure the intervention's impact.

The study involved two existing classes, designated as either the experimental or the control group. Before the intervention began, both groups completed a pretest to ensure they started at a similar academic baseline. The experimental group then integrated student-generated reflective vodcasts into their learning, while the control group continued with conventional instruction. Once the intervention was complete, a posttest was administered to both groups. Comparing these final scores against the initial pretest data allowed for a clear assessment of how the vodcasting strategy influenced academic achievement.

The design of the study presented by Campbell and Stanley (1963) is illustrated as follows:

$$\begin{array}{l} \text{Experimental} \quad O_1 - X - O_2 \\ \text{Control} \quad \quad O_3 \quad \quad O_4 \end{array}$$

Where:

O_1 = Pretest for experimental group

X = Student-generated reflective vodcast intervention

O_2 = Posttest for experimental group

O_3 = Pretest for control group

O_4 = Posttest for control group

Participants and Sampling

The study involved 62 first-year Bachelor of Information Technology (BSIT) students enrolled in the Science, Technology, and Society course during the second semester of the 2025–2026 academic year. These students were organized into two groups: Section A (31 students) served as the experimental group, while Section B (31 students) acted as the control group. All participants were officially enrolled and maintained regular attendance throughout the study, ensuring consistent exposure to the instructional methods.

Participants were selected through purposive sampling based on specific criteria, including course enrollment, attendance reliability, and participation in the assigned instructional interventions. Utilizing intact classes helped preserve the ecological validity of the study, as this approach maintained the natural classroom environment and avoided disrupting the college's existing schedule. This strategy ensured that the findings reflect the practical realities of a typical higher education setting.

Research Setting

The study was conducted at the Cotabato Foundation College of Science and Technology (CFCST), a state-supported higher education institution located in Barangay Doroluman Arakan, Cotabato, Philippines (7°20'48"N 125°05'38"E). The institution offers undergraduate programs in science, education, and technology,

providing an appropriate context for investigating technology-integrated instructional strategies in higher education.

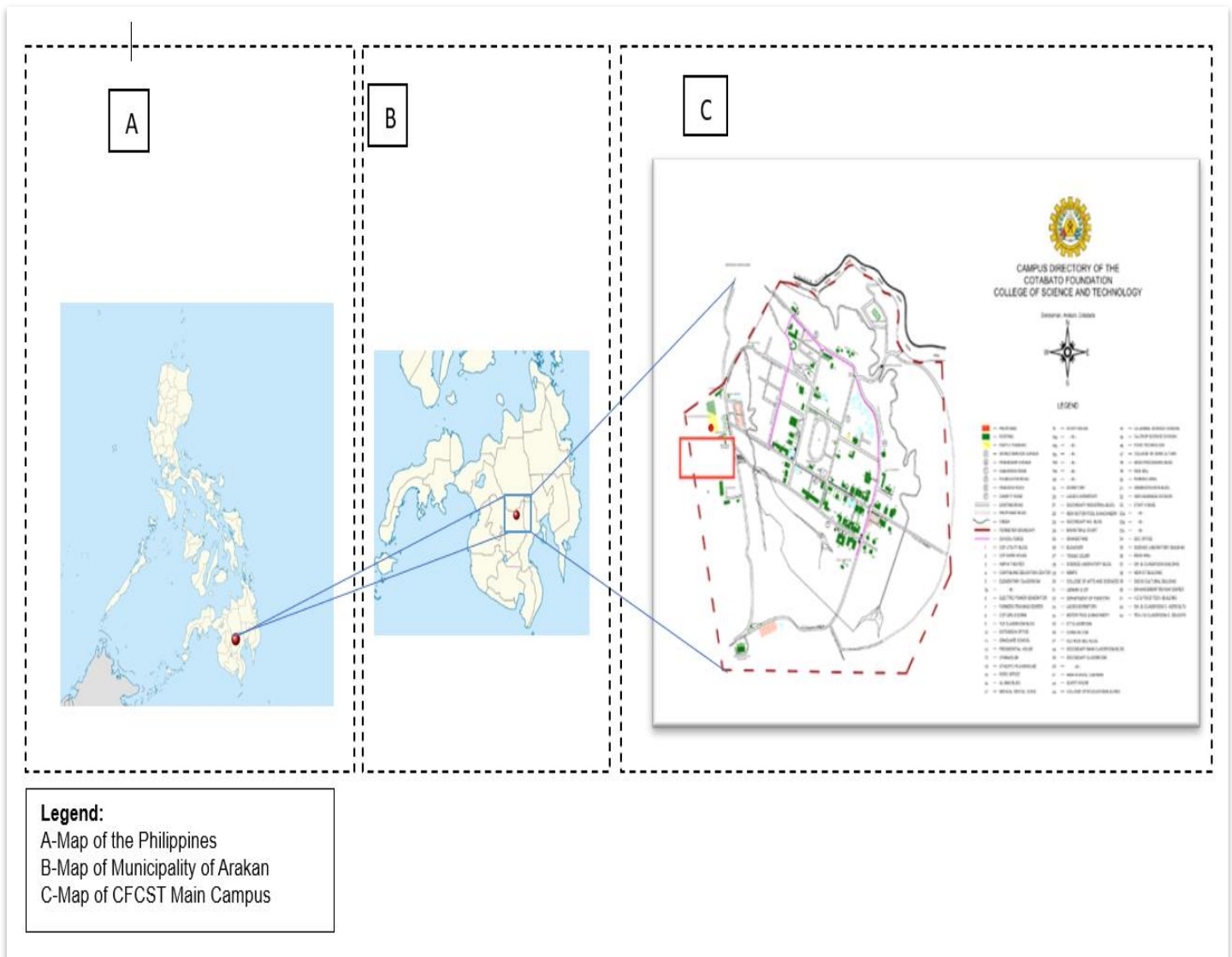


Figure 1. Location of the Cotabato Foundation College of Science and Technology Main Campus

Instrumentation and Validation

The primary data collection tool was a science achievement test specifically developed to align with the course's learning outcomes. This 30-item multiple-choice instrument focused on the relationship between "Biodiversity and the Healthy Society" and measured both students' conceptual understanding and their cognitive mastery of the material. To ensure the test was comprehensive and fair, a Table of Specifications (TOS) guided its construction, providing a balanced representation of various content domains and cognitive levels.

To establish content validity, three experts in science education and assessment reviewed the instrument. Their evaluation ensured that every item remained relevant to the learning competencies, maintained clarity, and offered an appropriate level of difficulty. This expert feedback was crucial in refining the test before it reached the participants.

The final stage of development involved pilot testing the instrument with a group of students similar to the study participants. This phase allowed for a detailed item analysis to determine difficulty and discrimination indices. Based on these results, the test underwent further revisions to improve its overall quality and reliability, ensuring it would provide an accurate measure of student progress.

Intervention Procedure

The intervention took place over two weeks, spanning three sessions per week. This process unfolded in three distinct phases: pre-intervention, intervention, and post-intervention.

During the initial phase, administrative approvals were finalized, and students received a full briefing on the study's objectives before taking the pretest to establish their baseline knowledge. In the intervention phase, the experimental group moved away from traditional formats to engage in student-generated reflective vodcasting. These students produced short video podcasts to explain scientific concepts and articulate their personal learning reflections. Structured criteria guided the creation of these vodcasts to ensure they remained focused on the core learning objectives. Meanwhile, the control group followed a conventional instructional path involving standard lectures and classroom activities. Finally, both groups completed a posttest to capture the changes in achievement resulting from these different approaches.

Data Analysis

Descriptive statistics, such as mean and standard deviation, provided a clear summary of the students' performance levels. To provide these numbers with an academic context, the scores were interpreted using criterion-referenced standards adapted from Bloom's Mastery Learning framework.

To determine the true impact of the vodcasting strategy, inferential statistics played a key role. Paired samples t-tests and independent sample t-tests allowed for a comparison of within-group progress from pretest to posttest. All statistical tests were conducted at a 0.05 level of significance to ensure the reliability and validity of the findings.

Ethical Considerations

Maintaining high ethical standards was a priority throughout the research process. Participation remained entirely voluntary, and every student provided informed consent before the study began. To encourage honest participation and reduce anxiety, students were explicitly assured that their involvement or lack thereof would have no impact on their official academic standing. Confidentiality and anonymity remained strictly protected, with all collected data used solely for this research.

RESULTS AND DISCUSSION

Pretest Achievement of Participants

Before the introduction of the reflective vodcasts, both groups demonstrated nearly identical levels of science achievement. As shown in Table 1, the experimental group earned a mean score of 16.00 (SD = 3.27), while the control group followed closely with a mean of 16.48 (SD = 3.60).

This minimal gap confirms that both sets of students started with a similar foundation of prior knowledge. In quasi-experimental research, establishing this "baseline equivalence" is a critical step; it ensures that any later improvements can be linked directly to the teaching method rather than to initial differences in student ability (Creswell & Creswell, 2018).

At a descriptive level, both groups fell into the "Good" category, reflecting a moderate existing grasp of the course material. The similarity in their standard deviations also points to a consistent spread of performance across both classrooms.

By confirming that the groups were homogeneous at the start, the study creates a valid and fair foundation for measuring the intervention's success. This balanced starting point mirrors findings by Stajić (2025), where groups showed not only similar average scores but also a comparable distribution of achievement levels before any new strategies were applied.

Table 1. Level of students’ science achievement in the experimental group and control group before the implementation of student-generated reflective video podcasts.

Pretest Score					
Group	Mean	N	Std. Deviation	Minimum	Maximum
Experimental	16.00	31	3.266	10	21
Control	16.48	31	3.595	8	24
Total	16.24	62	3.415	8	24

Posttest Achievement of Participants

After the intervention, both groups showed clear progress in their science achievement, as detailed in Table 2. However, the degree of that growth varied significantly. The students who created their own reflective vodcasts reached a substantially higher mean score ($M = 25.71$, $SD = 3.05$) than those in the control group ($M = 20.16$, $SD = 2.33$). These figures suggest that while traditional teaching methods certainly supported learning, the vodcast-based approach was notably more effective in driving academic gains.

The descriptive ratings further illustrate this gap. The experimental group moved up to an "Excellent" level of achievement, while the control group reached a "Very Good" level. This jump in performance implies that the process of producing reflective video content helped students more deeply engage with the material and better articulate complex scientific ideas (Khomyshak, 2024). Additionally, the higher maximum scores recorded in the experimental group reinforce the idea that this intervention helps students reach a greater level of mastery over the course content.

Table 2. Level of students’ science achievement in the experimental and control groups after the implementation of instructional activities

Posttest Score					
Group	Mean	N	Std. Deviation	Minimum	Maximum
Experimental	25.71	31	3.046	19	30
Control	20.16	31	2.325	15	25
Total	22.94	62	3.879	15	30

Pretest–Posttest Comparison in the Experimental Group

The students in the experimental group showed a remarkable shift in their science achievement after producing their reflective vodcasts. As detailed in Table 3, their average scores climbed from a pretest mean of 16.00 ($SD = 3.27$) to a posttest mean of 25.71 ($SD = 3.05$).

This resulted in a substantial mean gain of 9.71 points. The statistical analysis ($t = 14.476$, $df = 30$, $p < .05$) confirms that this increase was significant, providing strong evidence that the vodcasting strategy directly influenced student success.

This significant growth suggests that the intervention did more than just help students memorize facts; it fostered a deeper conceptual grasp of the material. By actively creating content and reflecting on their progress, students were able to internalize scientific principles more effectively. These results align with the experiential learning theories of Kolb (1984), which argue that knowledge is best built through meaningful, hands-on engagement.

In addition, Morisson et al. (2024) found that Video-Based Learning (VBL) significantly enhances student engagement, understanding, and motivation by providing interactive, flexible, and multimedia-rich learning experiences, though its effectiveness depends on proper implementation. Furthermore, the use of reflective processes likely boosted students' metacognitive skills, their ability to monitor and sharpen their own understanding, consistent with the frameworks proposed by Zimmerman (2002) and Mayer (2020).

Table 3. Comparison of Pretest and posttest achievement scores of students in the experimental group

Variables	Mean	SD	Mean Difference	t-value	df	Sig. (2-tailed)	Decision
Pretest	16.00	3.266					
Posttest	25.71	3.046	9.71	14.476	30	0.000	Reject H ₀

Pretest–Posttest Comparison in the Control Group

The control group in Table 4 also demonstrated a statistically significant improvement in achievement following conventional instruction. The mean score increased from 16.42 (SD = 3.47) to 20.16 (SD = 2.33), yielding a mean gain of 3.74. The computed t-value ($t = 4.840$, $df = 30$, $p < 0.05$) indicates a significant difference, leading to the rejection of the null hypothesis.

The findings indicate that the use of conventional teaching methods contributed to an improvement in students’ science achievement. However, the relatively smaller mean gain suggests that while traditional instruction is effective for structured content delivery and foundational knowledge acquisition, it may be limited in promoting deeper learning. This is consistent with existing literature, which explains that teacher-centered approaches often position students as passive recipients of knowledge, thereby restricting opportunities for critical thinking, active engagement, and reflection (Alessa & Hussein, 2023; Freeman et al., 2014). Moreover, the absence of structured reflective activities in conventional instruction may hinder students from developing a deeper understanding, as reflective writing has been shown to enhance critical thinking, metacognitive skills, and meaningful learning (McGuire et al., 2009; Chang, 2019; Machost & Stains, 2023). Without proper guidance, students may also struggle to engage in effective reflection, resulting in superficial learning (Chan & Lee, 2021).

Table 4. Comparison of Pretest and posttest achievement scores of students in the control group

Variables	Mean	SD	Mean Difference	t-value	Df	Sig. (2-tailed)	Decision
Pretest	16.42	3.472					
Posttest	20.16	2.325	3.74	4.840	30	0.000	Reject H ₀

Comparison Between Experimental and Control Groups

The comparison between the two groups provides compelling evidence for the effectiveness of the intervention. At the outset of the study, the experimental group ($M = 16.00$, $SD = 3.27$) and the control group ($M = 16.48$, $SD = 3.60$) demonstrated comparable levels of achievement. Statistical analysis confirmed that no significant difference existed between the groups ($t(60) = -0.555$, $p = .581$), establishing baseline equivalence. This similarity ensures that any observed differences in posttest performance can be attributed to the instructional intervention rather than pre-existing disparities in ability.

Following the intervention, a substantial difference emerged. The experimental group ($M = 25.71$, $SD = 3.05$) significantly outperformed the control group ($M = 20.16$, $SD = 2.33$), with results indicating a statistically significant difference ($t(60) = 8.061$, $p < .05$). This finding provides strong evidence that student-generated reflective vodcasting is more effective than conventional instruction in enhancing science achievement.

This significant difference led to the rejection of the null hypothesis, suggesting that the student-generated reflective vodcasts were more effective than conventional teaching in boosting science achievement. These findings highlight how shifting toward student-centered, reflective strategies can spark deeper engagement and higher academic performance. While traditional methods are useful for delivering structured content, they can sometimes limit the active involvement necessary for mastery (Alessa & Hussein, 2023; Freeman et al., 2014). In contrast, by integrating reflection into the learning process, students were able to move beyond passive listening to active knowledge construction, ultimately leading to superior academic results. Similar findings are also observed from the study of Litchfield et al. (2010), which revealed that vodcast assignment fostered strong peer learning and professional skills, achieving high engagement and significantly improving students’ awareness of IT careers and multimedia communication abilities.

Table 5. Comparison of Pretest and Posttest Achievement Scores Between Experimental and Control Groups

Test	Group	Mean	SD	Mean Difference	t-value	df	Sig. (2-tailed)	Decision
Pretest	Experimental	16.00	3.266					
	Control	16.48	3.595	-0.48	-0.555	60	0.581	Not Reject H ₀
Posttest	Experimental	25.71	3.046					
	Control	20.16	2.325	5.55	8.061	60	0.000	Reject H ₀

Despite the significant findings of this study, several limitations must be acknowledged. The sample size was relatively small (n = 62), which may limit the generalizability of the results to broader populations. Additionally, the use of purposive sampling and intact classes may have introduced selection bias, as random assignment was not feasible in the educational setting. Furthermore, the intervention was conducted over a short duration of two weeks, which may not sufficiently capture the long-term effects of reflective vodcasting on knowledge retention and skill development.

CONCLUSION AND RECOMMENDATION

Conclusion

This study examined the effect of student-generated reflective vodcasts on science achievement compared to conventional teaching methods. Although both groups demonstrated improvement, the experimental group achieved significantly higher gains, confirming the effectiveness of the vodcasting intervention. Given that both groups started with comparable pretest scores, the observed differences in posttest performance can be attributed to the integration of reflective vodcasting.

The findings provide strong empirical support for the use of student-centered, technology-enhanced strategies in science education. By engaging in the creation of reflective video content, students developed deeper conceptual understanding and higher-order thinking skills. These results affirm that learning is more effective when students actively construct knowledge rather than passively receive information. Overall, the study highlights the value of integrating reflection and multimedia tools to promote meaningful and lasting learning.

Implications

The results of this study carry significant theoretical, pedagogical, and practical implications. Theoretically, the findings reinforce constructivist and experiential learning perspectives by emphasizing the central role of reflection in knowledge construction. Pedagogically, the use of student-generated reflective vodcasts demonstrates a powerful approach to enhancing student engagement, critical thinking, and conceptual understanding in science. Practically, the study suggests that integrating multimedia tools into instruction can improve academic performance and learner participation. At the institutional level, the findings imply the need for policies and support systems that promote technology-integrated and student-centered teaching practices.

Recommendations

Based on the findings, it is recommended that science educators integrate student-generated reflective vodcasts into instruction, supported by clear guidelines, scaffolding, and assessment criteria. Educational institutions should strengthen technology integration by providing adequate resources and continuous professional development for teachers. Curriculum developers are encouraged to embed reflective digital tasks within science programs to foster higher-order thinking and communication skills.

Future research may consider involving larger and more diverse samples across multiple institutions to enhance the generalizability of findings. Where feasible, randomized controlled trials could be implemented to reduce selection bias and strengthen causal inference. Moreover, extending the duration of the intervention would provide deeper insights into the long-term impact of student-generated reflective vodcasting on students' knowledge retention and skill development.

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