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Using YouTube video projects to develop creativity and communication in biology learning at SMAN 2 Lambandia

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ABSTRACT

Producing a biology video requires students to document a practical activity and communicate its purpose, procedure, and findings to an audience. This study examined creativity and communication in student video projects shared through YouTube during pandemic-related distance learning at SMAN 2 Lambandia. Twenty-two science students from the 2019 entry cohort completed three project assessments across the second semester of 2020/2021 and both semesters of 2021/2022. The projects addressed respiration, plant growth and development, and conventional biotechnology using a STEM-oriented project-based learning approach. Video products were evaluated with four-point observation rubrics and summarized descriptively. Reported overall scores were 74 for creativity and 70 for communication, both within the study's good category. Scores for all seven assessed dimensions increased across the three projects. However, the submission register contains 13, 20, and 22 links, corresponding to 59.09%, 90.91%, and 100% of participants; the first proportion differs from the narrative's 64%. The record also combines pretest-posttest and one-shot design labels without presenting an independent baseline assessment. The results therefore describe a pattern of improving assessed video products rather than a controlled estimate of the effect of YouTube. The approach provided opportunities for repeated production, clearer scientific explanation, and digital participation. Interpretation remains limited by unclear scoring denominators, group production, unavailable individual ratings, and differences between project topics.

Keywords: YouTube; student-generated video; creativity; communication; biology education; project-based learning

INTRODUCTION

Distance learning changed how students documented practical biology activities and submitted their work. At SMAN 2 Lambandia, students initially sent text, photographs, documents, and videos to their teacher through WhatsApp. The teacher reported difficulties with large video files, limited phone storage, unstable internet access, and incomplete or compressed submissions. These were local implementation problems, rather than evidence that a particular communication platform was inherently unsuitable. Pandemic research emphasizes the importance of teaching arrangements and institutional readiness when educational activity moves online (Kaden, 2020; König et al., 2020).

The content of the submitted videos also created assessment difficulties. Some recordings lacked student identification, had inconsistent orientation, contained inaudible speech, or moved

too quickly for the teacher to follow. Background music sometimes competed with the explanation. Typographical errors and unsuitable wording made the intended message less clear. A change in the submission channel could address file sharing, but students also needed guidance in planning and explaining a scientific activity. A school-level review of emergency remote teaching similarly identifies variation in access and implementation conditions (Al Mazrooei et al., 2022).

The intervention combined STEM-oriented project-based learning with the production and sharing of biology videos through YouTube. Students were expected to become producers of educational content and to organize evidence from practical work into an intelligible account. Literature on project-based learning provides a rationale for an extended task with a tangible product and opportunities for revision (Bell, 2010; Kokotsaki et al., 2016). Reviews of YouTube and student-generated video show that educational use includes both viewing resources and making resources, which place different demands on learners (Balıkçı & Karataş, 2024; Snelson, 2011).

Creativity and communication were treated as separate outcomes. A visually elaborate video may communicate a biological explanation poorly, while a simple recording may convey an accurate and coherent explanation. Definitions of creativity emphasize both novelty and appropriateness, and accounts of everyday classroom creativity recognize development within a particular learning task (Kaufman & Beghetto, 2009; Runco & Jaeger, 2012). This distinction matters because the present rubric includes technical video features as well as originality.

The study asks how the recorded creativity and communication scores varied across three biology projects and what practical strengths and difficulties were observed. Its contribution is a classroom account of student production under constrained distance-learning conditions. It does not isolate the contribution of YouTube from the project structure, STEM orientation, teacher guidance, or repeated practice.

LITERATURE REVIEW

Creativity in educational products

Creativity can be understood as generating an outcome that is both original and useful within a task. Divergent thinking offers one historical route for considering fluency, flexibility, elaboration, and originality, but these dimensions do not automatically validate every assessment bearing those labels (Guilford, 1950; Runco & Jaeger, 2012). In video assessment, a distinction is needed between producing a file, generating several ideas, and constructing a scientifically

appropriate explanation. The ability to complete a product is meaningful, although it is not equivalent to the number of ideas generated.

Classroom creativity also involves students' interpretation of new material and the development of personally meaningful ideas. The mini-c account and four-c model provide ways to recognize this development without claiming professional creative achievement (Beghetto & Kaufman, 2007; Kaufman & Beghetto, 2009). For biology videos, a student's choice of an explanatory sequence or a clear visual demonstration can be valuable even when the underlying practical task is shared by classmates.

Assessment requires attention to the product and the judgment process. Amabile's consensual assessment approach illustrates the role of informed judgment, whereas reviews of creativity training and creative learning environments emphasize the surrounding instruction (Amabile, 1982; Davies et al., 2013; Scott et al., 2004). The present study uses a teacher-applied rubric rather than a validated consensual assessment procedure. Its originality ratings should therefore be interpreted within that classroom scoring arrangement.

Project-based learning and STEM integration

Project-based learning organizes activity around a sustained task and an outcome that students develop. Reviews associate its implementation with attention to task design, support, and assessment, rather than the mere existence of a final product (Bell, 2010; Kokotsaki et al., 2016). A meta-analysis comparing project-based and classroom-based learning provides broader evidence of potential academic benefits, although its educational settings and outcomes differ from those of this school (Chen & Yang, 2019). It cannot be used to infer an effect size for these biology projects.

Integrated STEM education seeks meaningful connections among disciplinary knowledge and practice. Frameworks emphasize that integration should be visible in the problem and in students' use of knowledge, rather than established only by naming four disciplines (English, 2016; Kelley & Knowles, 2016). Teacher preparation and professional support are also relevant to implementation (Shernoff et al., 2017). Here, the instruction was described as PjBL-STEM, but detailed plans showing the contribution of each STEM component are unavailable. This description is retained as an instructional orientation.

Video creation as a learning task

Digital storytelling and student-generated video require decisions about content, sequence, visual evidence, and audience. Research on digital storytelling reports applications to motivation, problem solving, and learning, while emphasizing that outcomes depend on the instructional task (Hung et al., 2012; Robin, 2008; Yang & Wu, 2012). Biology practical videos are not necessarily stories in a narrative sense; the relevant connection is students' organization of multimodal material to convey a coherent explanation.

Video production can support authentic work when students use recordings to represent an activity that has a clear purpose and audience. Studies of digital video and student-produced online videos illustrate these possibilities (Kearney & Schuck, 2006; Stanley & Zhang, 2018). Learning-by-teaching research provides a related explanation for the value of preparing an explanation for another person (Hoogerheide et al., 2016). These sources offer plausible mechanisms, but the study did not independently assess audience learning or compare creating a video with writing a report.

Multimedia clarity and communication

Useful educational video depends on intelligible speech, purposeful images, and a manageable flow of information. Guidance on educational video and multimedia instruction recommends controlling unnecessary processing demands and connecting representations with the intended concept (Brame, 2016; Clark & Mayer, 2016; Mayer et al., 2020). The teacher's concerns about overlapping music, blurred images, excessive text, and very small lettering are therefore pedagogical concerns as well as production concerns.

Research syntheses on multimedia design and distracting details caution against adding attractive features without a clear instructional function (Noetel et al., 2022; Sundararajan & Adesope, 2020). A soundtrack or animated text may support an explanation, but it may also compete with it. Cognitive load theory provides a reason to examine what students and viewers must process at a given moment (Sweller, 2020). Consequently, elaboration should reward useful explanatory detail, rather than the number of effects included.

Preparing a video explanation can be a generative activity because students select and reorganize material. Research on generative learning also shows why visible activity cannot be assumed to establish understanding (Brod, 2021; Fiorella, 2023; Skulmowski, 2024). Communication assessment should distinguish the quality of the explanation from the mere

completion of editing and uploading. Here, introduction, content delivery, and language were the recorded communication dimensions.

Guidance and feedback

Teacher competence includes selecting technology for a learning purpose and connecting it with assessment. Research on digital competence and teachers' perceptions of technology integration supports this broader view (Akram et al., 2022; Falloon, 2020). Planning expertise and readiness for online instruction also matter when a task combines practical work, digital production, and remote submission (Backfisch et al., 2020; S. K. Howard et al., 2021). Using a familiar service does not remove the need for explicit directions.

Feedback and peer assessment can provide opportunities to improve an explanation, while writing-to-learn research suggests that a script or short explanatory text may support scientific communication (Double et al., 2020; Graham et al., 2020; Wisniewski et al., 2020). These are potential extensions of the approach, not procedures assumed to have been implemented systematically. Motivation research further supports assessing students' interest separately from the quality of their work (J. L. Howard et al., 2021; Ryan & Deci, 2020).

METHODS

Design, setting, and participants

The study involved 22 science students in the 2019 entry cohort at SMAN 2 Lambandia. The first project was assessed in the second semester of 2020/2021, when students were in Grade XI. The second and third assessments occurred in the first and second semesters of 2021/2022. All three used the same broad instructional approach and assessment dimensions but covered different biology topics.

The methodological description combines a one-group pretest-posttest label with the notation X-O for a one-shot case study. The presented results, however, comprise three assessments of products made after instruction, without a separate untreated pretest. Accordingly, the analysis is a descriptive account of repeated project assessments. There was no control group or random assignment. The first project is not treated as a conventional pre-intervention baseline.

Project activities

The projects concerned measuring vital lung capacity within respiration, producing liquid organic fertilizer and examining its effectiveness within plant growth and development, and

preparing a conventional biotechnology product. The products were documented in videos uploaded by students, with links sent to the teacher. Practical activity was conducted in groups, while videos could differ in editing choices, music, backgrounds, captions, and sequencing. The record does not establish how group contributions were separated for individual assessment.

Project instructions, production duration, device allocation, upload settings, and teacher feedback schedules were not specified sufficiently to reproduce the intervention in full. YouTube served as a publication and sharing channel for the submitted videos. Neither platform copyright processing nor acceptance of an upload was treated as proof of originality. No new assessment of current link availability was undertaken for this analysis.

Instruments and scoring

Data came from video observation sheets for creativity and communication, documentation, and field notes. Each assessed aspect was rated on a four-point scale: 4 very good, 3 good, 2 moderate, and 1 poor. The ratings were converted to a 0-100 reporting scale, although the detailed conversion formula, item weights, treatment of non-submissions, and denominator for each project were not explained.

Creativity comprised fluency, flexibility, elaboration, and originality. The operational descriptions linked these dimensions to product completion, camera and audio handling, addition and organization of assets, and the student's own work. Communication comprised introduction, content delivery, and language. The reporting bands were 81-100 very good, 61-80 good, 41-60 moderate, 21-40 poor, and 0-20 very poor. These are the study's categories, not externally validated proficiency standards.

Descriptive analysis

Project scores and rounded means were retained as reported. Submission counts were calculated from non-empty entries in the 22-student link register, using 22 as the denominator. Differences between the register and the narrative were documented separately. Individual score distributions, agreement between raters, and instrument reliability were unavailable; therefore, no significance test or standardized effect size was calculated.

RESULTS AND DISCUSSION

Participation and submission records

Table 1. Documented video submissions across three biology projects (N = 22)

Project	Documented links	Recalculated (%)	Narrative (%)
1: Respiration	13	59.09	64
2: Plant growth	20	90.91	91
3: Biotechnology	22	100.00	100

Source: Student link register and reported submission narrative. Percentages use 22 students as the denominator; a missing link does not establish that no video was produced.

The link register contains 13 entries in Project 1, 20 in Project 2, and 22 in Project 3. Their proportions are 59.09%, 90.91%, and 100%. The accompanying narrative reports 64%, 91%, and 100%; the first figure cannot be reconciled with the visible register. A missing entry does not necessarily prove that no video was produced, but it prevents a complete audit of submission using this table alone.

By the third project, each participant had a documented link. This is evidence of recorded submission coverage, rather than evidence that every student achieved the same creative or communicative proficiency. Progress may reflect growing familiarity with production and submission, teacher support, or differences between tasks. Literature on student-generated video provides a rationale for repeated production, but it does not establish which explanation accounts for this classroom pattern (Balıkçı & Karataş, 2024; Stanley & Zhang, 2018).

Recorded creativity scores

Table 2. Reported creativity scores across three video projects

Dimension	Project 1	Project 2	Project 3	Reported mean
Fluency	45	91	100	79
Flexibility	43	81	91	72
Elaboration	36	78	94	72
Originality	43	82	90	72

Source: Creativity observation table. Scores use the reported 0–100 scale. The reported overall creativity score is 74; individual ratings and precise aggregation rules were unavailable.

All four creativity dimensions increased across the three projects. Fluency rose from 45 to 91 and 100; flexibility from 43 to 81 and 91; elaboration from 36 to 78 and 94; and originality from 43 to 82 and 90. The rounded dimension means were 79, 72, 72, and 72. Their arithmetic average is 73.75, consistent with the reported overall value of 74 after rounding.

The operational meaning of fluency requires particular care because it was associated with making the final video. The value of 100 in Project 3 may therefore relate partly to completion rather than divergent ideation. Flexibility likewise included camera focus and audible speech. These technical capacities support production, but their labels overlap only partly with conventional creativity constructs (Guilford, 1950; Runco & Jaeger, 2012). The results support improvement in the assessed product dimensions, with limited grounds for generalizing to creative thinking outside the task.

Field notes described additions such as captions, personal photographs, transitions, backgrounds, and changes in playback speed. Group members could record similar practical content while choosing different presentation assets. This indicates variation in production decisions. It does not establish originality through an independent plagiarism assessment, and successful uploading cannot validate authorship. Assessment of scientific usefulness alongside novelty would strengthen the interpretation (Amabile, 1982; Kaufman & Beghetto, 2009).

Recorded communication scores

Table 3. Reported communication scores across three video projects

Dimension	Project 1	Project 2	Project 3	Reported mean
Introduction	34	76	88	66
Content delivery	43	82	95	73
Language	44	79	94	72

Source: Communication observation table. The reported overall score is 70. The average of all nine displayed scores is 70.56; the aggregation cannot be reconstructed fully without underlying ratings and weights.

Introduction increased from 34 to 76 and 88; content delivery from 43 to 82 and 95; and language from 44 to 79 and 94. Their reported rounded means were 66, 73, and 72. The reported overall communication score was 70. Averaging the rounded dimension means gives 70.33; averaging all nine displayed project-dimension scores gives 70.56. Without underlying ratings and weights, the precise overall aggregation cannot be reconstructed.

The teacher reported opening and closing greetings, clearer identification of the subject, content aligned with the assigned biology topic, and Indonesian wording that was easier for an audience to understand. These observations support discussion of communication within the submitted products. They do not establish general oral proficiency, audience comprehension, or accuracy on an independent biology test. Video and multimedia research supports assessing such outcomes separately (Brame, 2016; Mayer et al., 2020).

Implementation strengths and difficulties

Reported difficulties included unavailable videos, unstable uploading conditions, blurred images, overlapping music, typographical errors, small text, and text-heavy screens. Students' explanations linked some unavailable videos to network instability, but these accounts do not conclusively identify the technical cause. Where comment functions were disabled, public feedback through the video page was unavailable; the record does not quantify the effect on teacher feedback.

The learning opportunity lay in requiring students to make their practical work understandable to another person. A script, a visible demonstration, and an explanation of the result could each support that aim. The findings are compatible with generative learning and learning-by-teaching accounts, while remaining insufficient to test either mechanism directly (Fiorella, 2023; Hoogerheide et al., 2016). More elaborate editing should not be encouraged at the expense of readable evidence and coherent explanation (Sundararajan & Adesope, 2020).

Limitations and implications

The same cohort was assessed repeatedly, but different topics and incomplete early submission records complicate comparisons. It is unclear whether absent products received zero ratings or were excluded. Missing individual ratings, unspecified conversion rules, group production, and unreported rater agreement constrain the interpretation. The study also lacks an independent pretest, a comparison condition, and a measure of biological understanding apart from product ratings.

For subsequent classroom use, a shared rubric should separate scientific accuracy, clarity, production quality, and originality. Draft review could be conducted before publication, using teacher feedback or structured peer assessment (Double et al., 2020; Wisniewski et al., 2020). A short written explanation may clarify the reasoning to be represented in the video (Graham et al., 2020). Assessment records should identify which students and products contribute to each mean so that participation and quality can be analyzed separately.

CONCLUSION AND RECOMMENDATIONS

Across three biology projects involving 22 science students, reported creativity and communication scores increased in each assessed dimension. The overall reported values were 74 and 70, both categorized as good. Submission coverage reached 22 documented links in the third

project. The discrepancy in first-project coverage and the unspecified score aggregation require clarification before precise improvement claims can be made.

YouTube-supported video production offered a practical setting for documenting biology activities and practicing explanation. The evidence supports this classroom description, with improvement attributed to the instructional experience as a whole rather than to the sharing platform alone. Future implementation should retain individual ratings, record non-submissions explicitly, clarify group contributions, and assess scientific explanation alongside video design. A comparative design and consistent tasks would be needed to estimate effectiveness more directly.

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