



The Integration of Cloud-Based Portfolios and Project-Based Learning to Foster Speaking Performance and 4C Skills in EFL Classroom

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Article Info	Abstract
Received: 2026-05-28 Revised: 2026-06-13 Accepted: 2026-06-10 Keywords: <i>Cloud-based Portfolio;</i> <i>English Speaking Skills;</i> <i>Project-based Learning;</i> <i>4C skills;</i> <i>Student-Centered Learning</i> DOI: 10.24256/ideas.v14i1.10873 Corresponding Author: Ela Kristi Permatasari elapahlevi@umbs.ac.id Pendidikan Bahasa Inggris, Universitas Muhammadiyah Brebes, Brebes Jawa Tengah	<i>The impact of incorporating cloud-based portfolios into Project-Based Learning (PBL) to enhance senior high school students' English-speaking proficiency and 4C skills-critical thinking, creativity, communication, and collaboration is examined in this study. The study, which employed an explanatory sequential mixed-methods design, involved 72 students from two public senior high schools in Central Java, Indonesia. Participants were assigned to the experimental and control groups using purposive sampling. Speaking performance tests were used to get quantitative data during pre-test, Project 1, Project 2, and post-test activities. Questionnaires and semi-structured interviews with English teachers were used to gather qualitative data. According to the results, students in the experimental groups showed progressive improvement in speaking performance across Project 1, Project 2 and Post-test activities. Through group projects, reflective learning, feedback cycles, and genuine speaking exercises, the incorporation of cloud-based portfolios promoted the development of 4C abilities. Students expressed positive attitudes about adopting cloud-based portfolios, particularly when it came to enhancing learner autonomy, motivation, creativity, and communication, according to the questionnaire answers. Additionally, the results of the interviews demonstrated that the integrated instructional model transformed teachers' responsibilities into learning facilitators while boosting students' confidence, engagement, and active participation in speaking activities. A cloud-based e-portfolio template, an analytical rubric for speaking and 4C assessment, and an instructional framework combining PBL with cloud-based portfolios are just a few of the educational outputs that this study created in addition to its empirical findings. The study comes to the conclusion that incorporating cloud-based portfolios into PBL improves speaking development and 21st-century skills in EFL courses.</i>

1. Introduction

Teaching speaking skills in English at the senior high school level continues to be a significant challenge because students have limited opportunities to engage in authentic communication practice. In many classrooms, instruction continues to emphasize grammar and vocabulary through traditional, teacher-centered approaches that provide minimal support for the development of fluency, pronunciation, and speaking confidence (Nasir, 2025; Sukma, 2022; Underwood, 2017). As a result, students often experience difficulties in developing communicative competence and applying English effectively in real-life contexts (Serrania & Mendoza, 2018). In addition, speaking assessment is frequently conducted through isolated, test-oriented activities rather than through continuous and performance-based evaluation, limiting students' opportunities to demonstrate meaningful language use (Rosy et al., 2025).

Beyond linguistic challenges, English language instruction in many EFL classrooms still pays insufficient attention to the development of 21st-century skills, particularly critical thinking, creativity, communication, and collaboration (4Cs) (Dewan & Sharma, 2025; Trilling & Fadel, 2009). These competencies are increasingly recognized as essential for both academic success and future professional demands (Ye & Xu, 2023). However, the lack of systematic integration of the 4Cs in classroom practices often results in passive learning environments where students have limited opportunities to collaborate, solve problems creatively, and engage in meaningful communication (Richards, 2006). This condition indicates a significant pedagogical gap in EFL instruction, highlighting the need for learning approaches that can simultaneously promote speaking proficiency and the development of 21st-century skills.

To address these pedagogical challenges, numerous studies have investigated the implementation of Project-Based Learning (PBL) in EFL contexts, with findings consistently highlighting its positive contribution to students' speaking development and engagement (Guo et al., 2020). A considerable amount of research has explored the effects of Project-Based Learning on language acquisition, consistently showing its effectiveness in improving English speaking skills through meaningful, student-centered activities that encourage motivation and social interaction (Farrell, 2019). (Utami, 2025) for example, claim that PBL promotes creativity, self-directed learning, problem-solving, creativity and communication.

Additional research shows that students who participate in self-reflection using HOTS assessments have enhanced speaking ability and confidence. To be more precise and representative, (Sirisrimangkorn, 2021) investigates the effects of PBL on the speaking abilities of undergraduate EFL learners, with findings showing a notable improvement in students' speaking abilities after PBL implementation. In similar vein, (Benlaghrissi & Ouahidi, 2024) demonstrated how incorporating mobile-assisted project-based learning improved EFL students' speaking abilities, vocabulary growth, learner engagement, and independent learning through technology supported speaking exercises. Even yet, there are still a number of implementation issues with project-based learning, such as time restraints, the difficulty of assessments, and the preparedness of teachers to support student-centered learning environments. One major obstacle is the pedagogical shift from traditional teacher-centeredness to student-driven learning, which necessitates a flexible and forgiving attitude from teachers who must deal with erratic language output patterns unique to project-based needs (Luh et al., 2017).

Additionally, it has been demonstrated that integrating technology and multimedia aids into final presentations enhances autonomous learning and motivation (Mayer, 2002). However, assessment concerns about how to measure multidimensional learning outcomes continue to be a major concern for educators trying to match evaluation strategies with PBL

objectives (Farrell, 2019). As a result, there is a significant methodological gap wherein the precise mechanism through which cloud-based platforms improve speaking and 4C abilities within a Project-Based Learning framework are still not well understood (Kessler, 2017).

The current investigation is based on a number of complementary theoretical stances. First, learning happens through social connection, teamwork, and meaningful engagement with others, according to Social Constructivism (Vygotsky, 1978). This viewpoint backs the use of project-based learning, in which students gain language and information through cooperative problem-solving and real-world communication. Second, according to the philosophy of project-based learning, meaningful projects encourage active learning, learner autonomy, and the application of information in practical settings (Thomas, 2000). Third, Reflective Learning Theory (Schon, 1983) emphasizes the value of ongoing reflection in assisting their development, identifying obstacles to learning, and enhancing future performance. Finally, opinions on technology-enhanced learning contend that digital platforms can support student participation outside of the classroom, interaction, feedback, and documentation of learning processes (Kessler, 2017). When taken as a whole, these viewpoints offer a theoretical framework for comprehending how cloud-based portfolios incorporated into project-based learning may promote the development of speaking abilities, reflective learning, and the acquisition of 21st-century skills.

Reflective learning and project-based activities interact to explain the relationship between the factors this study looked at. Students record speaking performances, get comments from teachers and peers, edit their work, and evaluate their learning progress in a cloud-based portfolio environment. Speaking performance gradually improves as a result of these reflective processes, which help students recognize their strengths and shortcomings. In order to complete the assignment, students must simultaneously exchange ideas, work in groups, come up with original solutions, and critically analyze information. As a result, cloud-based portfolios serve as learning environments that support reflective practice, speaking growth, and the development of critical thinking, creativity, communication, and teamwork skills in addition to being assessment tools.

There are still a number of significant gaps in the body of research, despite the increasing amount of evidence demonstrating the efficacy of project-based learning in enhancing English speaking abilities. The majority of earlier research has mostly concentrated on students' speaking performance, motivation, or engagement while paying little attention to the concurrent development and evaluation of 21st-century skills in integrated EFL learning environments, particularly critical thinking, creativity, communication, and collaboration (4Cs) (Guo et al., 2020). Furthermore, the integration of cloud-based portfolios as an organized educational and assessment tool is still understudied, particularly at the senior high school level in EFL contexts, despite the fact that certain research has examined the use of technology in PBL settings (Kessler, 2017).

Additionally, previous research has rarely examined how cloud-based portfolio integration within project-based learning might concurrently enable reflective learning practices, collaborative learning processes, and continual speaking assessment (Santiuste et al., 2022; Tham & Trinh, 2022). Instead of examining their combined effects on speaking performance and the development of 4C abilities, existing research often looks at either the usage of digital platforms or the implementation of project-based learning alone (Suryani & Argawati, 2023).

Theoretically, this discrepancy is significant since student-centered learning settings heavily rely on reflection, cooperation, and ongoing feedback. Collaboration facilitates the social creation of knowledge, reflection allows students to track and enhance their performance, and ongoing feedback encourages long-term leaning development. Therefore,

it is crucial to comprehend how these components interact in a technology-supported Project-Based Learning environment in order to explain how speaking proficiency and 4C competencies evolve during the learning process as well as to assess whether students' progress. Despite its potential, there is yet no empirical date on how well cloud-based portfolio supported Project-Based Learning can produce real-world learning opportunities that concurrently promote language acquisition and 21st-century skills in secondary EFL classes.

Therefore, this study intends to investigate the degree to which senior high school students' English-speaking performance and their 4C skills – critical thinking, creativity, communication, and collaboration are improved by the integration of cloud-based portfolios within Project-Based Learning, based on the gaps found in earlier research. The study also looks at how project-based activities, reflection, and feedback via cloud-based portfolios help students build their speaking and 4C skills. Consequently, the following research topics are addressed in this study: To what extent does the integration of cloud-based portfolios within Project-Based Learning improve students' English-speaking performance? (2) To what extent does the integration of cloud-based portfolios within Project-Based Learning enhance students' 4C skill (critical thinking, creativity, communication, and collaboration)? (3) How does the integration of cloud-based portfolios within Project-Based Learning facilitate reflective learning, feedback processes, and students' speaking development?

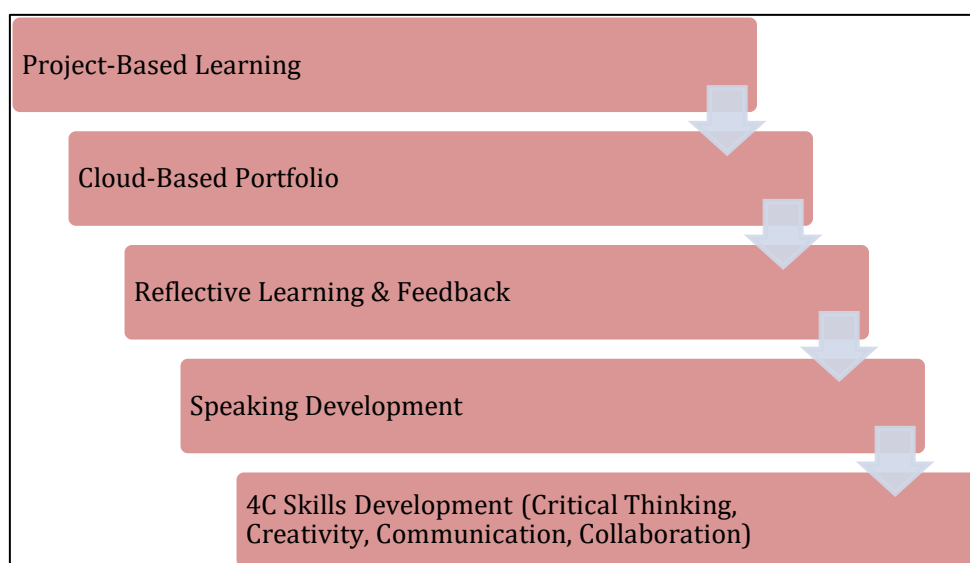


Figure 1. Conceptual Framework of the Study

In addition to addressing these research questions, this study also offers a distinctive contribution to the field of EFL instruction. In order to concurrently support the development of English-speaking proficiency and 21st-century skills in secondary EFL classrooms, this study's innovative integrated instructional approach integrates Project-Based Learning, cloud-based portfolio integration, performance-based assessment, reflective learning practices, and systematic 4C-oriented learning activities within a single instructional framework.

This study specifically examines how collaborative learning, reflective feedback processes, authentic speaking tasks, and digital portfolio documentation contribute to students' speaking development and 4C competencies-critical thinking, creativity, communication, and collaboration-in contrast to earlier research that to earlier research that mainly looked at either technology integration or project-based learning separately. A

cloud-based e-portfolio template, an analytical rubric for speaking and 4C assessment, and an instructional framework intended to assist student-centered speaking instruction in EFL contexts are just a few of the useful pedagogical outputs that this study offers.

2. Method

2.1. Research Design and Approach

The explanatory sequential mixed-methods design used in this study involved the collection and analysis of quantitative data in the first phase and the collection and analysis of qualitative data in the second. Because of this methodology, researchers may more thoroughly explain and elaborate quantitative results using qualitative observations (Creswell, 2022; Mackey & Gass, 2016). In order to assess the impact of incorporating cloud-based portfolios into Project-Based Learning (PBL) on students' English-speaking performance and 4C skills, the quantitative phase was given priority. In order to gain a deeper understanding of students' experiences, perceptions, and learning processes during the intervention's implementation, a qualitative phase was subsequently carried out. A more thorough understanding of how cloud-based portfolio-supported PBL aided students' speaking development and 21st-century abilities was made possible by the merging of quantitative and qualitative findings.

A quasi-experimental design with experimental and control groups was used in the investigation (Creswell & Guetterman, 2019). While the control courses used traditional Project-Based Learning without any technological integration, the experimental classes in both participating institutions received instruction through Project-Based Learning integrated with cloud-based portfolios. All groups were given pre-test and post-test procedures to gauge how the intervention affected the students' speaking abilities and 4C capabilities (Cohen et al., 2018).

2.2. Research Setting and Participants

This study was conducted in two public senior high schools in Central Java, Indonesia, selected for their adoption of the Merdeka Belajar curriculum, adequate technological resources, and support for student-centered learning environments. The schools were situated in Paguyangan, Brebes Regency and Purwokerto, Banyumas Regency. Seventy-two Grade XI students, ages sixteen to seventeen, took part in the study. Purposive sampling was used to choose participants based on their enrollment in the same grade level and their lack of formal prior experience integrating cloud-based portfolios into English learning activities. There were 49 female students and 23 male students among the total participants. SMA N 1 Paguyangan contributed 36 students (9 males and 27 females), whereas SMA N 2 Purwokerto contributed 36 students (14 males and 22 females). According to school academic records and input from English teachers, the participants exhibited relatively equivalent English proficiency levels consistent with those typically expected of Grade XI senior high school learners.

Furthermore, within each participating school, students were randomly assigned to either the experimental or control condition, resulting in two groups of equal size ($n = 18$ per group). Students in the experimental group engaged in Project-Based Learning supported by cloud-based portfolios, whereas those in the control group participated in conventional Project-Based Learning without portfolio integration. To reduce selection bias and create similar baseline conditions between the two groups before the intervention, random assignment was used.

Formal research approval was acquired from the appropriate authorities prior to the study's implementation. In compliance with local administrative requirements regarding

external study, the Banyumas Regency Education Office approved the research activities carried out at SMA N 2 Purwokerto. Additionally, prior to the start of data collection, consent was obtained from the principals of both participating schools. The goal and methods of the study were explained to each participant, and confidentiality was upheld at every stage of the investigation.

2.3.Data Collection Techniques and Research Instruments

Semi-structured interviews, questionnaires, 4C skills evaluations, and speaking performance tests were used to gather data. Pre-test and post-test assessments were used to collect quantitative data before and after the intervention. Students had to do project-related speaking exercises as part of the speaking exams, which were intended to assess their capacity for meaningful English communication. Throughout the project activities, students' critical thinking, creativity, communication, and teamwork were assessed using the 4C assessment tool.

An analytical speaking performance rubric and a 4C skills assessment rubric were the two main research tools used in this study. Students' fluency, pronunciation, grammar, vocabulary, and comprehension were evaluated using the speaking rubric. In the meantime, students' capacity to exhibit critical thinking, produce original ideas, communicate clearly, and work together to complete projects was assessed using the 4C evaluation rubric. The tools were modified from a number of well-known assessment frameworks, including (H. Douglas & Priyanvada, 2019; O'Malley & Pierce, 1996) and (Partnership for 21st Century Learning, 2019). Both tools were altered to fit the goals and circumstances of the current investigation. In addition, a cloud-based e-portfolio template was created to help students record their learning progress, reflective exercises, feedback logs, and project results during the intervention.

Expert judgment was used to determine the analytical rubric's content validity. The rubric's relevance, clarity, representativeness, and usefulness for evaluating students' speaking performance and 4C abilities were assessed by two specialists in English language teaching and educational assessment. The Content Validity Index (CVI), which includes the Scale-Level Content Validity Index (S-CVI/Ave) and Item-Level Content Validity Index (I-CVI), was used in the validation process. Before the rubric was put into use, the experts' input was taken into consideration to enhance descriptor clarity and phrasing uniformity.

Three raters – the lead investigator and two members of the research team were involved in order to establish inter rater reliability and guarantee scoring consistency. Using the analytical rubric, each rater evaluated the students' speaking performances on their own. The intraclass Correlation Coefficient (ICC), which is based on a two-way random-effects model with absolute agreement, was used to assess the level of agreement among raters.

In addition, students in the experimental group were asked to respond to a questionnaire exploring their perceptions of cloud-based portfolio use, opportunities for collaboration, feedback practices, and improvements in speaking performance during Project-Based Learning implementation. Before the instrument was employed for data interpretation, Cronbach's Alpha reliability analysis was used to assess the questionnaire's internal consistency. Moreover, in order to gain a greater understanding of the implementation of cloud-based portfolio-supported PBL, students' classroom involvement, and the difficulties experienced during the learning process, semi-structured interviews with English teachers involved in the study were also carried out. The quantitative results were enhanced and supported by the interview data.

2.4. Research Procedure

The study was carried out over six weeks and involved four primary phases: pre-test administration, intervention delivery, project execution, post-test evaluation. At the outset of the study, all participants completed a speaking pre-test to establish their baseline levels of speaking proficiency. After the pre-test, the control groups got traditional Project-Based Learning without cloud-based portfolio support, while the experimental groups engaged in Project-Based Learning integrated with cloud-based portfolios. Students in both groups finished two speaking assignments (Project 1 and Project 2) during the intervention that were intended to encourage active language use, collaborative learning and genuine communication.

Additionally, students in the experimental groups used cloud-based portfolios to record their learning progress, submit speaking videos, get comments from peers and teachers, reflect on themselves, and edit their project outputs. Throughout the project implementation phase, the portfolio activities were intended to support ongoing evaluation and reflective learning. In order to promote critical thinking, creativity, communication, and teamwork, the learning activities also included methodical 4C oriented assignments. All students took a speaking post-test to assess improvements in speaking performance and the development of 4C skills after completing Projects 1 and 2. Students in the experimental groups then answered a survey about how they felt about using cloud-based portfolios.

In order to gain a deeper understanding of the implementation of cloud-based portfolio supported Project-Based Learning, student involvement, and the perceived influence on speaking development and 4C abilities, semi-structured interviews were also carried out with the participating English teachers. The quantitative results were supplemented and explained by the qualitative findings.

2.5. Data Analysis Technique

The quantitative data obtained from the speaking pre-test, Project 1, Project 2, and post-test assessments were analyzed using both descriptive and statistical techniques. Both the experimental and control groups' speaking performance and the growth of 4C skills were described using descriptive statistics, such as means, standard deviations, score distributions, and score improvement trends. Paired samples t-tests were used to compare pre-test and post-test results' speaking progress within each group. Additionally, each participating school's post-test speaking performance was compared between the experimental and control groups using independent samples t-tests.

An analysis of Covariance (ANCOVA) was used with post-test scores as the dependent variable, group membership as the independent variable, and pre-test scores as the covariate to ascertain the impact of the intervention while accounting for students' starting speaking proficiency. The purpose of these inferential statistical studies was to determine if students' speaking performance changed significantly as a result of the incorporation of cloud-based portfolios into project-based learning.

Thematic analysis was used to examine the qualitative information gathered from student surveys and semi-structured interviews with English teachers. The qualitative analysis concentrated on recurring patterns related to learner autonomy, reflective learning process, collaborative learning experiences, speaking development, feedback mechanisms, and the implementation of 4C-based learning activities through Project-Based Learning supported by cloud-based portfolios.

The quantitative and qualitative results were combined during the interpretation phase after the explanatory sequential mixed-methods design. In order to provide a more thorough understanding of how cloud-based portfolios supported speaking development, reflective learning, and the improvement of 4C skills within Project-Based Learning

environments, the qualitative findings were used to explain, support, and elaborate the quantitative results.

3. Result

The study's conclusions, derived from both quantitative and qualitative data analyses, are presented in this part. Students' improved speaking competence, the development of 4C skills, and statistical analysis of the differences between the experimental and control groups are among the quantifiable findings. Teachers' experiences during the Project-Based Learning intervention and students' opinions of the cloud-based portfolio deployment comprise the qualitative findings. In addition, the instructional products created throughout the research are displayed. In order to provide a thorough picture of how cloud-based portfolios promoted speaking development and the improvement of 21st-century abilities inside Project-Based Learning contexts, the quantitative and qualitative findings are finally combined.

3.1. Students' Speaking Performance Improvement

3.3.1. Descriptive Statistics

Students' speaking performance during the intervention was examined using descriptive statistics. Students' performance on four assessment occasions, the pre-test, Project 1, Project 2, and post-test in the experimental and control groups at the two participating schools was the main focus of the analysis. The distribution of student scores and standard deviations. Table 1 displays the descriptive results. Over the duration of the study, students in both institutions showed a steady growth in their speaking abilities. Nonetheless, compared to the control groups, the experimental groups consistently displayed higher increases in mean scores.

Table 1. Descriptive Statistics of Students' Speaking Performance

School	Group	Pre-test Mean (SD)	Project 1 Mean (SD)	Project 2 Mean (SD)	Post-test Mean (SD)
SMA N 1 Paguyangan	Control	69.44 (5.39)	72.94 (4.14)	75.44 (4.33)	77.22 (5.75)
SMA N 1 Paguyangan	Experimental	70.83 (4.29)	74.28 (4.31)	75.89 (4.56)	84.94 (4.08)
SMA N 2 Purwokerto	Control	75.56 (3.79)	77.20 (4.13)	79.06 (4.04)	81.83 (2.28)
SMA N 2 Purwokerto	Experimental	75.83 (3.54)	81.67 (3.83)	86.28 (3.63)	89.00 (3.09)

The experimental group outperformed the control group in SMA N 1 Paguyangan. While the control group improved from 69.44 (SD = 5.39) to 77.22 (SD = 5.75), the experimental group's mean speaking score increased from 70.83 (SD = 4.29) in the pre-test to 84.94 (SD = 4.08) in the post-test. SMA N 2 Purwokerto showed a similar pattern. While the control group improved from 75.56 (SD = 3.79) to 81.83 (SD = 2.28), the experimental group's mean score increased from 75.83 (SD = 3.54) in the pre-test to 89.00 (SD = 3.09) in the post-test.

Students in the experimental groups showed more significant improvement in speaking performance during the intervention, according to the progression of mean scores across Project 1, Project 2, and post-test evaluations. Additionally, the comparatively low

standard deviation values imply that the improvement was seen by the majority of students rather than just a select few. All things considered; the descriptive statistics offer preliminary proof that the incorporation of cloud-based portfolios into Project-Based Learning was linked to a higher improvement in speaking skill when compared to traditional Project-Based Learning.

3.3.2. Paired Samples *t*-Test Results

Paired-samples *t*-test were used to compare pre-test and post-test results within each group in order to see whether the observed improvement in students' speaking skill was statistically significant. Table 2 displays the outcomes.

All groups' speaking performance improved statistically significantly, according to the analysis ($p < .001$). In SMA N 1 Paguyangan, the experimental group gained 14.11 points ($t = 10.396$, $p < .001$), while the control group showed a significant rise with a mean difference of 7.78 points ($t = 5.102$, $p < .001$). SMA N 2 Purwokerto showed a similar pattern. While the experimental group showed a significantly larger improvement of 13.11 points ($t = 49.147$, $p < .001$), the control group improved by 6.28 points ($t = 14.223$, $p < .001$).

Table 2. Paired Samples *t*-Test Results for Speaking Performance

School	Group	Mean Difference	<i>t</i>	<i>p</i>	Cohen's <i>d</i>	95% CI
SMA N 1 Paguyangan	Control	7.78	5.102	< .001	1.203	[4.56, 10.99]
SMA N 1 Paguyangan	Experimental	14.11	10.396	< .001	2.450	[11.25, 16.97]
SMA N 2 Purwokerto	Control	6.28	14.223	< .001	3.352	[5.35, 7.21]
SMA N 2 Purwokerto	Experimental	13.11	49.147	< .001	11.584	[12.55, 13.67]

The results of the effect size analysis also showed that the experimental group's improvements were significantly greater than those of the control groups. When compared to the control group ($d = 1.203$), the experimental group in SMA N 1 Paguyangan had an extremely large effect size ($d = 2.450$). Similarly, in SMA N 2 Purwokerto, the experimental group outperformed the control group ($d = 3.352$) with an extraordinarily significant effect size ($d = 11.584$).

Overall, the paired-samples *t*-test results offer compelling statistical proof that students' speaking abilities significantly improved during the intervention period, with students who took part in cloud-based portfolio-supported Project-Based Learning showing noticeably larger gains.

3.3.3. Independent Samples *t*-Test Results

Using the post-test speaking scores, independent-samples *t*-tests were used to see if students in the experimental groups performed better than those in the control groups after the conclusion of the intervention. Table 3 displays the findings.

Table 3. Independent Samples t-Test Results on Post-test Speaking Scores

School	Experimental Mean (SD)	Control Mean (SD)	Mean Difference	t	p	Cohen's d
SMA N 1 Paguyangan	84.94 (4.08)	77.22 (5.75)	7.72	4.65	<.001	1.55
SMA N 2 Purwokerto	88.94 (3.09)	81.83 (2.28)	7.11	7.88	<.001	2.63

In both participating schools, the results showed statistically significant differences between the experimental and control groups. Students in the experimental group at SMA N 1 Paguyangan had a substantially higher post-test mean score ($M = 84.94$, $SD = 4.08$) than those in the control group ($M = 77.22$, $SD = 5.75$), $t(34) = 4.65$, $p < .001$. There was a significant effect size ($d = 1.55$) and a mean difference of 7.72 points between the two groups. Similarly, in SMA N 2 Purwokerto, the experimental group's post-test mean score ($M = 88.94$, $SD = 3.09$) was substantially higher than that of the control group ($M = 81.83$, $SD = 2.28$), $t(34) = 7.88$, $p < .001$. The effect size was very large ($d = 2.63$) and the mean difference was 7.11 points.

These results show that students who engaged in Project-Based Learning with cloud-based portfolio support performed significantly better while speaking than students who engaged in traditional Project-Based Learning. The integration of cloud-based portfolios appears to have had a significant impact on students' speaking growth, as seen by the substantial effect sizes seen in both institutions.

3.3.4. ANCOVA Results

Analyses of Covariance (ANCOVA) were used with post-test speaking scores as the dependent variable, instructional group (experimental or control) as the independent variable, and pre-test scores as the covariate to further investigate the efficacy of cloud-based portfolio-supported project-based learning. Table 4 presents the findings.

Table 4. ANCOVA Results for Post-test Speaking Performance Using Pre-test Scores as Covariates

School	Source	F	p	Partial η^2
SMA N 1 Paguyangan	Group	19.89	<.001	.376
	Pre-test	1.81	.188	.052
SMA N 2 Purwokerto	Group	397.59	<.001	.923
	Pre-test	197.39	<.001	.857

After adjusting for students' starting speaking proficiency, the ANCOVA results showed a substantial impact of teaching group in both participating schools. With a substantial effect size (partial $\eta^2 = .376$), the group effect in SMA N 1 Paguyangan was nevertheless statistically significant ($F(1,33) = 19.89$, $p < .001$). Even after adjusting for variation in pre-test performance, this result shows that students who took part in cloud-based portfolio-supported Project-Based Learning had considerably higher post-test speaking scores than those who took part in traditional Project-Based Learning. Similarly, in SMA N 2 Purwokerto, the ANCOVA analysis revealed a very large effect size (partial $\eta^2 = .923$) and a highly significant group effect ($F(1,33) = 397.59$, $p < .001$). These findings imply that the instructional intervention significantly improved students' speaking achievement beyond the impact of their initial speaking proficiency.

When combined, the ANCOVA results offer compelling proof that integrating cloud-based portfolios into Project-Based Learning improved students' speaking abilities. The conclusion that the observed increases were related to the educational intervention rather than just reflecting students' starting ability levels is strengthened by the maintenance of significant group differences after adjusting for pre-test scores.

Overall, when compared to traditional Project-Based Learning, the results of the descriptive statistics, paired-samples t-tests, independent-samples t-tests, and ANCOVA consistently show that the incorporation of cloud-based portfolios within Project-Based Learning contributed to a greater improvement in students' speaking performance.

3.2. Students' Perception toward the Use of Cloud-Based Portfolio and 4C Skill

An online survey was used to find out how students felt about using cloud-based portfolios in English-speaking assignments in order to corroborate the quantitative results. Students' experiences with technology use, speaking development, motivation, and the improvement of 4C abilities during the learning process were all examined in the questionnaire.

The results demonstrated that both institutions' students were already accustomed to using technology in English-language learning activities. In school A, 53% of students said they occasionally utilized technology to learn English, compared to 47% who said they did so frequently. Similarly, 55% of students in School B said they used technology frequently and 45% used it occasionally for English learning activities. All of the students from both schools stated that they had previously utilized cloud-based platforms, but mostly for non-speaking tasks like writing assignments and document submission tasks rather than speaking-based projects. The opinions of students regarding the use of cloud-based portfolios in speaking exercises are compiled in Table 5.

As shown in Table 5, students generally expressed positive perceptions toward the use of cloud-based portfolios within Project-Based Learning. The majority of students concurred that portfolio activities enhanced their speaking abilities, raised their willingness to learn, and promoted more serious speaking practice through recording exercises. Positive perceptions regarding the contribution of cloud-based portfolios to the development of 4C skills were also evident in the responses. A significant number of students concurred that project-based learning fostered critical thinking, creativity, teamwork, and communication. Since students were able to create more imaginative videos, presentations, and other speaking projects, creativity emerged as one of the most favorable elements.

Table 5. Views of Students on Cloud-Based Portfolio Education

Questionnaire Aspect	School A Findings	School B Findings
Ease of portfolio use	Majority neutral (58%)	Majority neutral (60%)
Portfolio helps track speaking progress	Majority neutral (47%) and agree (25%)	Majority neutral (50%) and agree (25%)
Motivation in completing projects	Majority agree (44%)	Majority agree (44%)
Portfolio improves speaking skills	Majority agree (55%)	Majority agree (53%)
Recording speaking increases practice seriousness	Agree (58%) and strongly agree (25%)	Agree (58%) and strongly agree (27%)
Critical thinking improvement	Agree (36%) and strongly agree (31%)	Agree (36%) and strongly agree (34%)

Creativity development	Agree (67%) and strongly agree (33%)	Agree (60%) and strongly agree (40%)
Collaboration improvement	Agree (44%) and strongly agree (23%)	Agree (49%) and strongly agree (26%)
Communication improvement	Agree (42%) and strongly agree (36%)	Agree (42%) and strongly agree (36%)
Overall perception toward cloud-based learning	Agree (50%)	Agree (52%)

Additionally, students believed that working together improved their ability to finish assignments and communicate their thoughts in English. Students stated that recorded speaking performances and cloud-based documentation enabled them to track their learning progress and consider how their speaking has changed over time. Overall, the results of the questionnaire indicate that students saw cloud-based portfolio-supported project-based learning as a beneficial learning strategy that encouraged speaking practice, learning motivation, reflective learning, and the growth of teamwork, communication, critical thinking, and creativity. However, the comparatively large percentage of ambivalent comments about portfolio usability suggest that some students could still need extra help when utilizing cloud-based learning resources.

All of questionnaire answers show a basic trend. Positive answers predominated for questions like speaking improvement, motivation, creativity, teamwork, communication, and critical thinking, whereas students preferred to provide indifferent answers about the technical aspects of portfolio use and progress tracking. This pattern indicates that rather than only seeing cloud-based portfolios as a technology platform, students saw them primarily as a learning support tool.

Moreover, Cronbach's Alpha was used to assess the student perception questionnaire's reliability. The results of the reliability analysis showed that the questionnaire items had good internal consistency, with a Cronbach's Alpha coefficient above 0.80 indicates strong dependability, according to (George & Mallery, 2003; Tavakol & Dennick, 2011). As a result, the questionnaire was deemed sufficiently reliable to gauge how students felt about the use of cloud-based portfolios in project-based learning.

3.3. Teacher Interview Findings

Semi-structured interviews were carried out with English teachers from the two participating schools to gain a deeper understanding of the implementation of Project-Based Learning supported by cloud-based portfolios. The interviews examined teachers' views on students' speaking development, learner autonomy, classroom participation, reflective learning practices, and the cultivation of 4C skills. Analysis of the interview data generated five key themes: (1) challenges in students' initial speaking performance, (2) integration of 4C skills into project-based activities, (3) learner autonomy and reflective learning, (4) the evolving role of teachers, and (5) enhanced student engagement and motivation.

3.3.1. Initial Speaking Challenges

Both instructors clarified that at first, students had trouble speaking English, especially with confidence and vocabulary acquisition. When prompted to speak, students frequently made very brief answers, according to the teacher from School A, and they hardly ever used English actively in class.

"The students' speaking skills were still poor prior to the research. When invited to speak, many of them either remained mute or gave brief answer, and they hardly ever used English in class."

In similar vein, the instructor from School B clarified that even while the students were already conversant in basic English, many of them still lacked confidence when engaging in more lengthy discussions.

"Students' confidence is the main obstacle. Even if they are accustomed to speaking basic English, their vocabulary is still little, so they occasionally worry about making mistakes while speaking in more complicated contexts."

These results show that before to the intervention's implementation, students faced both linguistic and affective obstacles, especially with regard to vocabulary restriction, speaking anxiety, and self-confidence.

3.3.2. Integration of 4C Skills within Project Activities

The results of the interviews also demonstrated that the development of 4C abilities was effectively aided by the use of cloud-based portfolios combined with project-based learning. According to both teachers, project activities promoted critical thinking, active teamwork, idea sharing, and the creation of significant speaking assignments.

One teacher explained:

"Students acquire critical thinking skills during project preparation, creativity in content design, teamwork in group projects, and communication during presentations."

Because they had to organize spoken content, split duties, discuss ideas, and present their work jointly, the teachers saw that students became more actively involved during project completion. These results imply that through real-world project activities, cloud-based portfolio-supported Project-Based Learning gave students the chance to improve their speaking skills while also participating in communication, teamwork, creativity, and critical thinking.

3.3.3. Learner Autonomy and Reflective Learning

Students' learning autonomy and reflective learning methods were the subject of another significant discovery. According to both instructors, the cloud-based portfolio system allowed students to track and assess their personal speaking development on their own.

One teacher said:

"Students gain greater independence through the e-portfolio. They are able to assess their own speaking shortcomings and advancements."

Additionally, the instructors clarified that the portfolio method enabled students to evaluate their prior speaking engagements, pinpoint areas of weakness, and enhance their speaking abilities in upcoming assignments. Students consequently took greater responsibility for their own educational development. These results imply that cloud-based portfolios encouraged self-monitoring and independent learning activities in addition to serving as assessment tools. This result validates the function of cloud-based portfolios as reflective learning tools that allow ongoing self-evaluation, feedback use, and speaking development during the learning process.

3.3.4. Transformation of Teacher's Role

A change in the teacher's position during the learning process was also highlighted by the interview data. Teachers served more as facilitators, directing project activities, keeping an eye on students' progress, and offering ongoing feedback, rather than as the focal point of instruction.

One teacher explained:

"I play more of a facilitator role in the classroom. I provide students project directions and comment on their work. "

This result is a reflection of the use of student-centered learning concepts, where teachers guided and supported students as they actively constructed knowledge and finished speaking assignments. This change reflects the student-centered of project-based learning, where teachers are not the main source of information but rather work as facilitators to promote students' active knowledge production.

3.3.5. Increased Student Engagement and Motivation

Lastly, both educators noted that the use of cloud-based portfolio activities boosted student participation and engagement. When working together on speaking assignments, students were more motivated, engaged, and passionate.

One teacher said:

"I noticed that students were more eager and made an effort to do the assignments as directed. Compared to earlier, they were more active."

The results show that the combination of project-based portfolios produced a more dynamic and interesting learning environment that motivated students to take part in speaking exercises more actively. Group-based project work, continuous feedback, and digital portfolio documentation were found to facilitate higher levels of participation, stronger motivation to learn and increased engagement in speaking tasks.

3.4. Research Outputs: Learning Tools, Assessment Instrument, and Instructional Framework

The implementation of cloud-based portfolio-enhanced Project-Based Learning generated a range of pedagogical outputs aimed at supporting speaking instruction and promoting the development of 4C competencies in EFL settings. These outputs comprised a cloud-based e-portfolio template, an analytical rubric for evaluating speaking and 4C skills, and an instructional framework that combined Project-Based Learning with cloud-based portfolio integration. Their development was informed by established theories of Project-Based Learning, reflective practice, performance assessment, and technology-supported learning, which were incorporated throughout the intervention process.

3.4.1. Cloud-Based E-Portfolio Template

A cloud-based e-portfolio template was developed to support ongoing documentation, reflective practice, and formative assessment during the implementation of Project-Based Learning. The template was grounded in reflective learning principles that promote self-regulation, feedback engagement, and continuous performance improvement. Furthermore, it enabled the systematic, organization and preservation of students' speaking outputs and learning evidence within a unified digital platform.

To make it easier for students to document their speaking projects, reflect, provide comments, and track their progress throughout the learning process, a cloud-based e-portfolio template was created. Personal information, Pre-test paperwork, Project 1,

Project 2, Post-test documentation, and 4C reflection exercises were among the folders that comprised the portfolio. Students were able to systematically upload speaking videos, scripts, peer and teacher evaluations, and reflective learning notes using the portfolio system. Students were able to track their speaking development and get ongoing formative feedback while working on the projects thanks to this arrangement. The structure of the cloud-based e-portfolio template utilized in this investigation is shown in Figure 2.

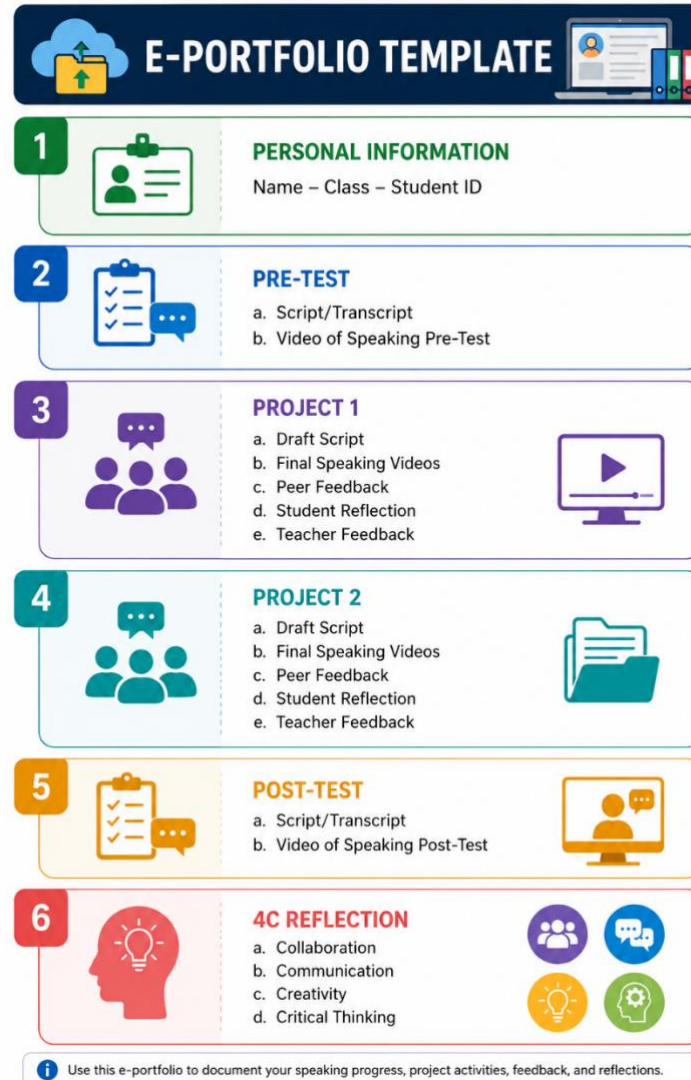


Figure 2. Cloud-based e-portfolio template

3.4.2. Analytic Rubric for Speaking and 4C Skills

An analytical rubric was created to assess students' speaking abilities as well as their growth in critical thinking, creativity, communication, and teamwork during project activities. The development of rubric was informed by established models of speaking assessment and 21st-century skills frameworks, which were adapted to meet the objectives of Project-Based Learning supported by cloud-based portfolios. The instrument was then evaluated by experts in English Language Teaching and educational assessment to verify its content relevance and comprehensibility. The rubric was modified from a number of well-known speaking and authentic assessment frameworks, including (H. Douglas & Priyanvada, 2019; O'Malley & Pierce, 1996) and (Partnership for 21st Century Learning, 2019).

Fluency, pronunciation, grammar, vocabulary, and interaction were all included in the speaking evaluation component. In the meanwhile, the 4C evaluation component assessed students' ability to organize ideas critically, present projects creatively, communicate effectively, and work in groups. By combining linguistic performance evaluation with 21st-century skill evaluation, the analytical rubric supported more systematic and comprehensive assessment procedures. The analytical rubric created for this investigation is shown in Figure 3.

ANALYTICAL RUBRIC FOR SPEAKING AND 4C SKILLS							
ASPECT	PERFORMANCE LEVEL					TOTAL SCORE (0-10)	WEIGHT (%)
	1-2 BEGINNING	3-4 DEVELOPING	5-6 PROFICIENT	7-8 ADVANCED	9-10 EXEMPLARY		
1. FLUENCY Smoothness and flow of speech	Not fluent; frequent long pauses.	Many pauses; speech is choppy.	Fairly fluent; occasional pauses.	Fluent with few pauses; natural flow.	Very fluent; smooth and effortless flow.		10%
2. PRONUNCIATION Accuracy of pronunciation	Unclear; many pronunciation errors.	Many pronunciation errors; difficult to understand.	Sometimes inaccurate pronunciation.	Quite clear; minor pronunciation errors.	Very clear and accurate pronunciation.		10%
3. GRAMMAR Accuracy of grammatical structures	No mastery of grammar; serious errors.	Frequent grammatical errors.	Many grammatical errors.	Few minor grammatical errors.	Almost no grammatical errors.		10%
4. VOCABULARY Range and appropriate use of vocabulary	Almost no vocabulary; very limited use.	Very limited vocabulary.	Limited vocabulary.	Quite varied vocabulary.	Highly varied and appropriate vocabulary.		10%
5. CONTENT Relevance and clarity of ideas	Not relevant to the topic.	Ideas are unclear and difficult to follow.	Ideas are adequate but not fully developed.	Ideas are clear and relevant.	Ideas are very clear, well-developed, and highly relevant.		10%
6. COMMUNICATION Ability to express and respond	Unable to respond; no interaction.	Responds poorly; communication breaks down.	Responds adequately.	Responds well; communicates effectively.	Responds very well; communicates fluently and effectively.		10%
7. CRITICAL THINKING Analysis and reasoning	No reasoning; ideas are weak.	Weak reasoning; limited analysis.	Gives simple reasons.	Provides clear reasons.	Strong analysis and logical reasoning.		10%
8. CREATIVITY Originality and innovation of ideas	No ideas; no originality.	Ordinary ideas; not original.	Adequate ideas; some originality.	Interesting ideas; shows originality.	Very interesting and highly original ideas.		10%
9. COLLABORATION Participation and teamwork	Does not cooperate at all.	Less active; rarely participates.	Fair participation; sometimes helps others.	Active participation; supports team members.	Very active; excellent teamwork and support.		10%
10. STRATEGY Use of strategies (confidence, eye contact, gestures)	Not confident enough; poor eye contact and gestures.	Very nervous; limited eye contact and gestures.	Less confident; some eye contact and gestures.	Quite confident; good eye contact and gestures.	Very confident; excellent eye contact, gestures, and overall presence.		10%
TOTAL SCORE (0-100)							100%

ASSESSMENT SCALE FOR EACH ASPECT	
SCORE	CRITERIA
9-10	Very good
7-8	Good
5-6	Fair
3-4	Poor
1-2	Very poor

FINAL SCORE CALCULATION	
Formula:	
$\text{Final Score} = \frac{\text{Total Score} \times 100}{100}$	
Since there are 10 aspects × maximum score of 10 = 100, then:	
• If the total score = 85 → final score = 85	
• If the total score = 70 → final score = 70	
Therefore, the score is directly converted into a 0-100 scale.	

SCORE INTERPRETATION (OVERALL)	
SCORE RANGE	CATEGORY
86-100	Very good
76-85	Good
66-75	Fair
56-65	Poor
46-55	Very poor

NOTE	
This rubric is designed to assess students' speaking performance and 4C skills comprehensively based on the integration of language competence and 21 st -century skills.	

Figure 3. Analytical Rubric for Speaking and 4C Skills

3.4.3. Instructional Framework Integrating PBL and Cloud-Based Portfolio

The framework was constructed by integrating core concepts from Project-Based Learning, Social Constructivist Theory, Reflective Learning Theory, and Technology-Enhanced Learning. Its purpose was to facilitate authentic learning environments where students co-construct knowledge, participate in reflective practice, benefit from continuous feedback, and record their learning development using cloud-based portfolios. Additionally, an educational framework was created to direct the integration of cloud-based portfolios and Project-based learning in speaking instruction. Topic introduction, project planning, portfolio preparation, project development, feedback and revision, and final reflection comprised the six stages of the framework.

Trough project activities and reflective learning techniques, the framework was created to support student-centered speaking instruction while also encouraging communication, teamwork, creativity, and critical thinking. Throughout the learning cycle, ongoing documenting, feedback, sharing, and performance reflection were made possible by the incorporation of cloud-based portfolios. Students were therefore urged to become more independent and actively involved in the process of learning to speak. The instructional framework created for this project is shown in Figure 4.

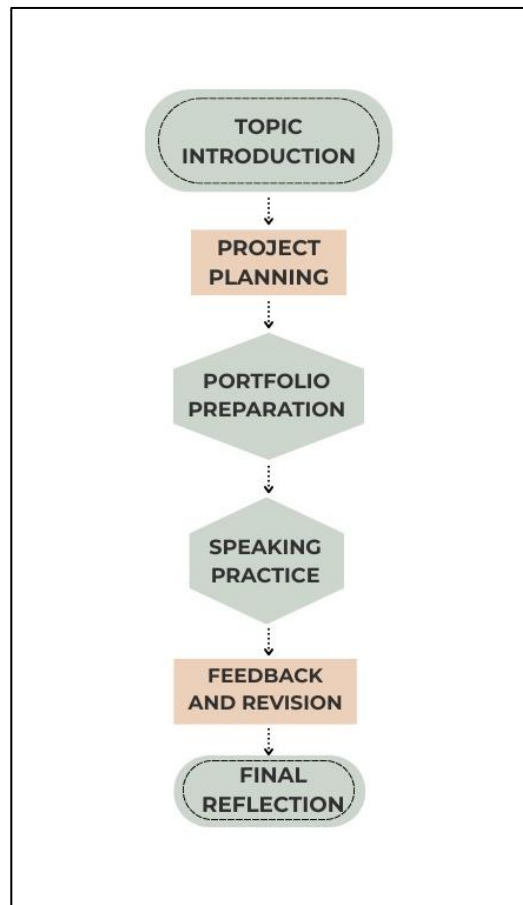


Figure 4. Instructional framework integrating PBL and cloud-based portfolio

The framework demonstrates how project activities, portfolio documentation, reflective learning, and continuous feedback interact to support student learning. By engaging in these interconnected processes, students are expected to improve their speaking abilities while fostering critical thinking, creativity, communication, and collaboration skills. In addition, the framework presents the theoretical pathway linking cloud-based portfolio implementation to speaking improvement and 4C skill development.

3.5. Integration of Quantitative and Qualitative Findings

The integration of quantitative and qualitative results offered a more comprehensive perspective on the contribution of cloud-based portfolio-supported Project-Based Learning to students' speaking development and the enhancement of 4C skills. Rather than serving as independent sources of evidence, both datasets complemented each other and helped explain the processes through which the intervention affected students' learning outcomes.

First, the quantitative findings initially indicated that students in the experimental groups experienced greater improvement in speaking performance than their counterparts in the control groups. Significant gains from pre-test to post-test were identified through paired-samples t-test analyses, and ANCOVA results further confirmed the superiority of the experimental groups after adjusting for differences in initial speaking proficiency. These quantitative outcomes were corroborated by teachers' interview responses, which highlighted increased student confidence, active participation, and greater willingness to communicate in English throughout project activities.

Teachers further reported that students became more engaged in sharing ideas, presenting project products, and participating in collaborative discussions. The convergence of quantitative and qualitative evidence suggests that cloud-based portfolio-

supported Project-Based Learning fostered authentic opportunities for sustained speaking practice and meaningful language interaction.

Second, the combination of questionnaire and interview results highlighted the critical importance of reflective learning in promoting student development. According to quantitative questionnaire data, the majority of students thought cloud-based portfolios were useful for tracking speaking development, increasing motivation, and encouraging more serious engagement in speaking assignments. These opinions were supported by interview data that showed students reviewing previous speaking performances on a frequent basis, identifying shortcomings, and using feedback to better future efforts. According to the findings, reflection served as a mediation technique for cloud-based portfolios, facilitating continual speech improvement.

Third, both quantitative and qualitative results consistently showed that 4C skills were developing positively. Student replies to questionnaires demonstrated positive impressions of gains in critical thinking, creativity, teamwork, and communication. Similarly, teachers said that project activities encouraged students to explore ideas, collaborate to solve difficulties, arrange project content, and effectively explain their work. These findings show that combining cloud-based portfolios and Project-Based Learning resulted in authentic learning experiences that aided not only language development but also the acquisition of critical 21st-century skills.

The integrated findings also contributed to understanding why the experimental groups outperformed the control groups in terms of learning outcomes. While both groups engaged in Project-Based Learning activities, the experimental groups also practiced portfolio documenting, continual feedback, self-reflection, and progress tracking. These new learning processes appear to have increased students' interest, accountability, and self-regulated learning, resulting in more consistent improvement of speaking performance and 4C abilities.

Overall, the integration of quantitative and qualitative findings lends credence to the conclusion that cloud-based portfolio-supported Project-Based Learning fosters speaking development through a combination of authentic project activities, reflective learning, continuous feedback, and collaborative knowledge construction. The data also imply that reflection is a critical mechanism linking cloud-based portfolio use to improvements in speaking proficiency and 4C abilities, confirming the theoretical framework established in this study.

4. Discussion

4.1. Improvement of Students' Speaking Performance

According to the study's findings, students in the experimental groups demonstrated continuous improvement in speaking performance throughout the intervention process. Throughout Project 1, Project 2, and post-test evaluations, the improvement was continuously noted. This finding suggests that through reflective and cooperative learning exercises, cloud-based portfolio-supported project-based learning promoted ongoing speaking practice.

The educational model's reflective and collaborative learning process may have an impact on students' improved speaking abilities. students were able to upload speaking videos, get criticism, edit their performances, and methodically track their own learning process through cloud-based portfolios. Students' fluency, pronunciation, vocabulary usage, and speaking confidence all improved as a result of this method, which promoted repeated speaking practice. According to (H. Douglas & Priyanvada, 2019), the

development of communicative competence in EFL learning situations is supported by ongoing performance practice and authentic speaking assessment.

The findings can also be understood through the lens of Social Constructivism, which emphasizes that learning takes place through social interaction and collaborative knowledge production. Throughout the initiative, students participated in group discussions, peer feedback, and collaborative problem-solving, allowing them to develop speaking skills through meaningful interactions. The cloud-based portfolio aided this process by offering a collaborative digital environment for students to log learning progress, exchange feedback, and reflect on their speaking performance. These learning experiences allowed students to function within their Zone of Proximal Development (ZPD), which enhanced learning through peer and instructor support.

The findings are also consistent with Project-Based Learning theory (Thomas, 2000), which contends that real projects allow learners to actively develop knowledge through meaningful tasks. In the current study, speaking activities were integrated into project completion procedures rather than isolated classroom exercises. As a result, students practiced English for authentic communicative reasons such as project planning, concept negotiation, outcome presentation, and peer criticism. This authentic use of language could explain the remarkable improvement in students' speaking performance.

Additionally, through group speaking exercises and presentations, Project-Based Learning promoted genuine communication. Throughout the project's completion, students engaged in active discussion, problem-solving, and peer interaction. Students' speaking exposure and involvement in relevant communication situations increased as a result of these activities. The results are in line with other research showing that Project-Based Learning enhances students' confidence, speaking fluency, and classroom participation in EFL classes.

4.2. Development of 4C Skills and Reflective Learning

The results also showed that development of 4C skills – communication, teamwork, critical thinking, and creativity was aided by the incorporation of cloud-based portfolios into project-based learning. According to the results of the questionnaire, the majority of students thought that the project activities were beneficial for enhancing critical thinking, creative expression, teamwork, and communication skills. In a similar vein, the results of the interviews showed that during speaking exercises, students become more engaged, introspective, and active.

While group project completion and feedback sharing enhanced collaboration abilities, giving presentations, conversations, and peer interactions developed communication skills. Students' ability to create and deliver speaking presentations utilizing a variety of digital media formats demonstrated creativity. (Lutfiana, 2026) reported similar results, noting that multimodal project activities helped students to creatively blend verbal, visual, auditory, and gestural elements in order to transmit meaning more effectively in English. In the meantime, as students arranged concepts, assessed project results, revised performances, and considered criticism, critical thinking abilities developed. The principles of 21st-century learning, which place an emphasis on incorporating communication, teamwork, creativity, and critical thinking into classroom education, are supported by these findings.

The data indicate that reflective learning was a significant mechanism connecting cloud-based portfolio use to speaking development and 4C skill enhancement. Students had a better understanding of their strengths and limitations through continual documentation, self-assessment, and feedback evaluation, allowing them to make informed changes in future speaking activities. This method is congruent with (Schon, 1983) Reflective Learning

Theory, which claims that learners acquire professional and academic competence by continuous reflection on activity. In the current study, reflection encouraged students to critically analyze their speaking ability, alter project outcomes, and apply constructive criticism, so promoting both language development and higher-order thinking skills.

Learner autonomy and reflective were two more significant findings. Students were able to track their own speaking development, pinpoint areas of difficulty, and assess advancements over time using the cloud-based portfolio system. The results of the interviews also showed that students become more self-reliant and accountable for their own educational progress. According to this research, cloud-based portfolios served as both assessment instruments and reflective learning resources that promoted independent study and ongoing development. This result is consistent with (Permatasari, 2025) findings showing students' interest, motivation, and participation in English learning activities were positively impacted by technology-assisted learning platforms like Quizizz or Wayground. This implies that more interactive, student-centered, and reflective learning environments could be produced by incorporating digital learning platforms into EFL training.

The findings also show that cloud-based portfolios functioned as learning environments that enabled self-regulated learning, rather than just storage tools. The portfolio approach promoted increased learner autonomy by allowing students to review previous performances, track progress, and receive ongoing feedback. This aligns with Technology-Enhanced Learning perspectives, which emphasize the potential for deeper engagement, reflection, and collaborative learning when digital tools are meaningfully integrated into instructional practice (Kessler, 2017).

4.3. Pedagogical Implications of the Integrated Learning Model

The function of the teacher during the learning process was also changed by the adoption of the integrated instructional approach. The results of the interviews showed that rather than serving as the only source of information in the classroom, the instructor served more as a facilitator, a source of feedback, and a learning guide. This illustrates the features of student-centered learning settings, in which students actively contribute to the creation of knowledge through the teamwork introspection, and real-world learning opportunities.

From a theoretical standpoint, the findings show how Project-Based Learning, reflective learning, and technology-enhanced learning may be combined into a unified instructional framework to assist both language acquisition and 21st-century skill development. The study builds on past research that has typically looked at Project-Based Learning or digital learning tools independently by demonstrating how cloud-based portfolios can serve as a reflective mechanism inside Project-Based Learning environments.

From a practical standpoint, the instructional framework proposed in this study may support teachers in developing more structured speaking instruction that incorporates authentic assessment, collaborative learning, continuous feedback, and reflective practice. The framework may be especially beneficial in secondary EFL setting where speaking assessment and 4C skill development are intended to be integrated within a unified instructional approach.

A cloud-based e-portfolio template, an analytical rubric for speaking and 4C assessment, and an instructional framework combining Project-Based Learning with cloud-based portfolios are just a few of the pedagogical outputs this study produced in addition to enhancing students' speaking performance and 4C skills. These results offer useful recommendations for putting technology-assisted speaking training into practice in secondary EFL classrooms. Overall, the results show that integrating project-based learning, cloud-based portfolios, reflective learning, and authentic assessment can result in

a more collaborative, interactive, and student-centered learning environment that promotes the development of 21st-century skills as well as speaking proficiency.

5. Conclusion

This study investigated the extent to which the integration of cloud-based portfolios into Project-Based Learning enhanced senior high school students' English-speaking performance and 4C competencies. The results revealed that students in the experimental groups achieved significant gains in speaking performance throughout the intervention period. Students were given the chance to participate in ongoing speaking practice, reflective learning, group projects, and real-world evaluation through the integration of cloud-based portfolios.

The results also showed that the integrated instructional paradigm encouraged the growth of critical thinking, creativity, teamwork, and communication abilities. Students became more engaged, introspective, cooperative, and self-assured in their ability to communicate in English through project-based speaking exercise. Additionally, by allowing students to track their own learning progress and assess their speaking skill through feedback and revision exercises, cloud-based portfolios promoted learner autonomy. The findings suggest that reflective learning served as an important mechanism through which cloud-based portfolio use contributed to speaking improvement and the enhancement of 4C competencies.

A cloud-based e-portfolio template, an analytical rubric for speaking and 4C evaluation, and an educational framework that combines project-based learning with cloud-based portfolios are just a few of the pedagogical outcomes that this study created. For English teachers looking to use technology-supported and student-centered speaking training in EFL classes, these results could be useful resources.

Overall, the study demonstrates that integration of Project-Based Learning, cloud-based portfolios, reflective learning, and authentic assessment creates a meaningful learning environment that supports both speaking proficiency and 21st-century skill development. The findings further indicate that cloud-based portfolios serve not only as tools for documentation but also as mechanisms for reflective learning that support continuous feedback, learner autonomy, and collaborative knowledge construction. Future studies are encouraged to involve larger samples, extended intervention periods, and a wider range of educational contexts to further explore the long-term effects of this instructional approach.

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7. References

- Benlaghrissi, H., & Ouahidi, L. M. (2024). The impact of mobile-assisted project-based learning on developing EFL students' speaking skills. *Smart Learning Environments*, 11(1). <https://doi.org/10.1186/s40561-024-00303-y>
- Cohen, L., Manion, L., & Morrison, K. (2018). *Research Methods in Education* (Taylor & Francis, Ed.; 8th Editio). Taylor & Francis Group. <http://taylorandfrancis.com>

- Creswell, J. W. (2022). *A Concise Introduction to Mixed Methods Research* (L. Fargotstein & I. Mellem, Eds.; Second Edit, p. 147). Sage Publications, Inc.
- Creswell, J. W., & Guetterman, T. C. (2019). *Educational Research Planning, Conducting, and Evaluating Quantitative and Qualitative Research* (Sixth Edit). Pearson Edition Inc.
- Dewan, M. S., & Sharma, B. D. (2025). Enhancing Oral Communication in English as a Second Language. *Journal of Tikapur Multiple Campus*, 8(February), 18–41.
- Farrell, T. S. C. (2019). 'My Training Has Failed Me': Inconvenient Truths About Second Language Teacher Education (SLTE) Inconvenient Truth # 1: Theory / Practice Gap. *The Electronic Journal for English as a Second Language*, 22(4), 1–16.
- Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures International Journal of Educational Research A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, 102(May), 101586. <https://doi.org/10.1016/j.ijer.2020.101586>
- H. Douglas, B., & Priyanvada, A. (2019). *Language Assessment: Principles and Classroom Practices* (3rd ed.). Pearson Edition Inc.
- Kessler, G. (2017). Technology and the future of language teaching. *American Council on the Teaching of Foreign Languages (ACTFL)*, (November), 205–218. <https://doi.org/10.1111/flan.12318>
- Luh, N., Ning, P., & Putri, S. (2017). Project-based Learning Activities and EFL Students' Productive Skills in English. *Journal of Language Teaching and Research*, 8(6), 1147–1155. <https://doi.org/http://dx.doi.org/10.17507/jltr.0806.16>
- Lutfiana. (2026). Project-Based Short Video Creation for Instagram Reels: Enhancing Multimodal English Production Among EFL Learners. *Journal of World Science*, 5(1), 57–70. <https://doi.org/https://doi.org/10.58344/jws.v5i1.1612>
- Mackey, A., & Gass, S. M. (2016). *Second Language Research Methodology and Design* (Second Edit). Routledge Taylor & Francis Group.
- Mayer, R. E. (2002). Multimedia Learning. *THE PSYCHOLOGY OF LEARNING AND MOTIVATION*, 41.
- Nasir, A. R. (2025). The Effectiveness of Task-Based Language Teaching in Enhancing High School Students' Communicative Competence. *Language Inquiry & Exploration Review*, 2(1), 35–43. <https://doi.org/https://doi.org/10.71435/639192>
- O'Malley, J. M., & Pierce, L. V. (1996). *Authentic Assessment for English Language Learners: Practical Approaches for Teachers*. Addison-Wesley Publishing Company.
- Partnership for 21st Century Learning. (2019). Partnership for 21st Century Learning A Network of Battelle For Kids Frameworks for 21st Century Learning Definitions. In *Framework for 21st century learning*. https://static.battelleforkids.org/documents/p21/P21_Framework_DefinitionsBKF.pdf
- Permatasari, E. K. (2025). Effectiveness of Using the Quizizz Application in Improving Grammar Proficiency. *Al-Mubin: Islamic Scientific Journal*, 8(1), 187–198. <https://doi.org/10.51192/almubin.v8i1.1798>
- Richards, J. C. (2006). *Communicative Language Teaching Today* (First Edit). Cambridge University Press.
- Rosy, F., Husna, N., Kulstun, U., & Farkhan, M. (2025). Assessing the Authenticity and Validity of Tests in CLT-Based English Classrooms in West Java's Formal Education. *IDEAS Journal*, 13(2), 5474–5486. <https://doi.org/10.24256/ideas>
- Santiuste, E. G., Segura, S. G., Garcia, M. A. O., & Alfaya, E. G. (2022). Higher Education Students' Perception of the E-Portfolio as a Tool for Improving Their Employability:

- Weaknesses and Strengths. *MDPI Journal*, 12(321), 1–14.
<https://doi.org/10.3390/educsci12050321>
- Serrania, K. R. A., & Mendoza, R. O. (2018). Strengthening the Oral Communicative Competence of Senior High School Students through Inquiry-Based and Content-Focused Approaches. *AJE*, 4(1), 53–73.
- Sirisrimangkorn, L. (2021). Improving EFL Undergraduate Learners' Speaking Skills Through Project-Based Learning Using Presentation. *AIAC Journal*, 12(3), 65–72.
<https://doi.org/http://dx.doi.org/10.7575/>
- Sukma, F. (2022). THE IMPLEMENTATION OF SELF-REGULATED LEARNING TOWARDS EFL STUDENTS SPEAKING SKILLS: SENIOR HIGH SCHOOL CASE Universitas Negeri Surabaya. *Inspiring: English Education Journal*, 5(2), 117–132.
<https://doi.org/10.35905/inspiring.v5i2.2721>
- Suryani, L., & Argawati, N. O. (2023). Teaching Speaking Through Project-Based Learning With Ict. *Indonesian EFL Journal*, 9(1), 35–42.
<https://doi.org/10.25134/ieflj.v9i1.7134>
- Tham, D. M., & Trinh, N. Le. (2022). an E-Portfolio: a Promising Tool for Promoting Learners' Autonomous Learning Competencies in an Efl Speaking Course. *VNU Journal of Foreign Studies*, 38(6), 148–159. <https://doi.org/10.25073/2525-2445/vnufs.4891>
- Trilling, B., & Fadel, C. (2009). *21st Century Skills Learning for Life in Our Times* (J. Bass, Ed.; First Edit). A Wiley Imprint. www.josseybass.com
- Underwood, P. R. (2017). Challenges and Change : Integrating Grammar Teaching With Communicative Work in Senior High School EFL Classes. *SAGE Open*, 1–15.
<https://doi.org/10.1177/2158244017722185>
- Utami, A. R. (2025). *THE IMPLEMENTATION OF PROJECT-BASED LEARNING BY A TEACHER IN AN EFL CONTEXT THE IMPLEMENTATION OF PROJECT-BASED LEARNING* [Master Degree]. Indonesia University of Education.
- Ye, P., & Xu, X. (2023). A case study of interdisciplinary thematic learning curriculum to cultivate “4C skills.” *Frontiers in Psychology*, 14(March), 1–13.
<https://doi.org/10.3389/fpsyg.2023.1080811>