MEKELLE UNIVERSITY

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DEPARTMENT OF CHEMISTRY

A

Thesis

On

"A Study of the Impact of Feedback-Integrated Continuous Assessment on Grade 12 Students' chemistry achievement: The case of Medhanealem Preparatory School, Addis Ababa, Ethiopia"

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UNDER THE SUPERVISION OF

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"The Impact of Feedback-Integrated Continuous Assessment on Grade 12 students' chemistry achievement: The case of Medhanealem Preparatory School, Addis Ababa, Ethiopia"

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Declaration

I, the undersigned, declare that this thesis entitled **"The Impact of Feedback-Integrated Continuous Assessment on grade 12 students' chemistry achievement: The case of Medhanealem Preparatory School, Addis Ababa, Ethiopia"** is my original work and has not been presented for any other award, and that all sources of materials used in this thesis are duly acknowledged. This thesis was carried out under the supervision of my principal advisor Dr. Meressa.Abrha, Department of Chemistry, College of Natural and Computational Sciences, Mekelle University in the academic year of 2025.

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This thesis has been submitted for examination with my approval as university **advisor/co-advisor**.

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ABSTRACT

Feedback is often overlooked in continuous assessment despite its potential to enhance student outcomes. This study examines the impact of feedback-integrated continuous assessment on Grade 12 students' chemistry achievement at Medhanealem Preparatory School in Addis Ababa. The study involved three groups: two experimental groups (one with feedback-integrated continuous assessment and one with continuous assessment without feedback) and one comparison group (traditional exercises and activities). A mixed-methods approach was used, combining quantitative (quasi-experimental) and qualitative (case study) data. Instruments included pre- and post-achievement tests and semi-structured interviews with teachers from the experimental groups. Data were analyzed using SPSS (version 26), applying One-way and Two-way ANOVA, and Pearson Correlation tests to compare group scores. Post-test results revealed a statistically significant improvement in the experimental groups compared to the comparison group ($p < 0.05$). A significant relationship was also found between continuous assessment scores and post-test outcomes. Qualitative data from interviews and classroom observations highlighted that feedback-integrated continuous assessment positively influenced students' chemistry achievement. The study suggests that incorporating feedback into continuous assessment allows teachers to adapt instruction to better meet individual student needs, ultimately improving learning outcomes. Based on these findings, it is recommended that teachers design feedback-oriented assessments aligned with curriculum objectives and clearly communicate performance expectations to enhance student learning.

Keywords: Feedback, Continuous Assessment, Student Achievement, Medhanealem school, Addis Ababa

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DEDICATION

This study is dedicated to the Almighty GOD who is the owner of my soul, my blessed Redeemer who is the strength of my life, the source of my wisdom and success.

ABBREVIATION AND ACRONYMS

AFL - Assessment for learning

CA - Continuous Assessment

CAs - Continuous Assessments

CAT - Chemistry Achievement Test

ANOVA-Analysis of Variance

FICA-Feedback-Integrated Continuous Assessment

CM-Comparison Methods

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CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Assessment practices in education have evolved significantly in recent decades, shifting from traditional summative evaluations toward more dynamic, formative approaches that emphasize continuous feedback. Globally, research has underscored the importance of formative assessment in enhancing student learning outcomes. For example, Hattie and Timperley (2007) highlight that effective feedback is a powerful tool for improving student achievement across various disciplines. Studies further support this view, demonstrating that timely and specific feedback helps students engage with material, correct misconceptions, and deepen their understanding (Nicol & Macfarlane-Dick, 2006; Shute, 2008). Recent meta-analyses have reinforced these findings, showing that formative assessment strategies positively impact student performance (Baker, 2018; van der Kleij et al., 2019).

In the African context, there has been a growing recognition of the value of formative assessments, with many educational systems moving beyond traditional summative methods. A study by O'Sullivan et al. (2021) across several African countries revealed that formative assessments, including feedback mechanisms, led to improved student motivation and academic performance. These findings are especially important in contexts where summative assessments dominate, as integrating formative approaches has been shown to increase student engagement and promote active learning. Such evidence highlights the potential of continuous assessment in improving student outcomes and addressing diverse learning needs.

However, despite the global and regional progress in adopting formative assessments, many African nations, including Ethiopia, continue to face significant challenges in implementing effective feedback-integrated continuous assessment systems. In Ethiopia, traditional assessment practices largely emphasize final examinations, often at the expense of formative feedback that could support student learning. Hailu and Demissie (2021) note that the Ethiopian secondary education system heavily relies on summative assessments, such as final exams, which leaves little room for ongoing feedback. This limited assessment approach often results in gaps in student understanding, especially in subjects like chemistry, where complex topics require iterative learning and consistent feedback.

In particular, subjects like chemistry present unique challenges due to the abstract and often challenging nature of the content. Topics such as stoichiometry, reaction mechanisms, and equilibrium require scaffolded, iterative learning, where students need continuous opportunities to receive feedback and apply it to deepen their understanding. Summative assessments are insufficient in these areas, as they do not provide the timely feedback necessary for addressing misconceptions or guiding students through the process of mastering complex concepts. Consequently, a shift toward feedback-integrated continuous assessment could significantly enhance students' grasp of these topics.

Building on global and African insights, it is clear that the Ethiopian educational system must adapt its assessment strategies to better support student learning. Research by Taye et al. (2022) suggests that integrating feedback into continuous assessment can improve student performance, particularly for those who may struggle with traditional exam-focused approaches. Feedback-integrated continuous assessment not only helps students refine their understanding of complex subjects like chemistry but also fosters a more positive and engaging learning environment. Additionally, formative assessments have been shown to help bridge the gap between students' perceived and actual performance levels, reducing anxiety and fostering a sense of ownership over learning (Boud & Falchikov, 2007).

Another persistent challenge in Ethiopian education is the gender gap in academic performance. Research indicates that male and female students may respond differently to various assessment methods, which can affect their overall achievement (Kirkup, 2020). Gender differences in learning styles and responses to feedback need to be considered when developing assessment practices. Recent studies, such as those by Kebede and Tadesse (2023), suggest that feedback-integrated continuous assessment could benefit both male and female students, though the nuances of these differences have not been fully explored in the Ethiopian context. For example, Abebe et al. (2023) found that female students tend to perceive feedback as more beneficial when it is constructive and supportive, highlighting the need for tailored feedback strategies that address specific gender-related learning challenges.

At Medhanealem Preparatory School in Addis Ababa, this study aims to address these challenges by investigating the impact of feedback-integrated continuous assessment on Grade 12 chemistry students' achievement, exploring any gender-based differences, and comparing the effectiveness of continuous assessments with final exam results. Additionally, the study seeks to capture students' perspectives on the role of feedback-integrated assessments in shaping their learning experience. Incorporating student voices is essential to understanding the practical implications of this approach and identifying potential barriers to its implementation in Ethiopian schools. Previous research emphasizes the importance of considering student feedback in refining teaching practices and curriculum design, reinforcing the need for educational stakeholders to prioritize students' perspectives in assessment reform efforts (Benson & Palmer, 2020).

This research has significant implications for educators, policymakers, and curriculum developers working to improve educational practices in Ethiopia. By examining the effects of feedback-integrated continuous assessment on student achievement, gender differences, and student perceptions, this study will contribute valuable insights into the development of more effective, responsive, and equitable assessment strategies in secondary education. This aligns with Ethiopia's educational goals, which emphasize improving quality education and ensuring equitable learning opportunities for all students.

In conclusion, as educational systems worldwide continue to explore the potential of feedback-integrated continuous assessment, this study aims to examine its impact on student achievement, gender differences, and student perceptions in the context of chemistry education in Ethiopia. By addressing the challenges and opportunities presented by this approach, the research seeks to foster a more dynamic and supportive learning environment, ultimately enhancing student outcomes and contributing to a more equitable educational system.

1.2 Statement of the Problem

In recent years, the educational landscape in Ethiopia has faced significant challenges, particularly in the area of assessment practices within secondary education. Traditional assessment methods, which have largely focused on summative evaluations such as final examinations, fail to provide meaningful feedback that helps students understand their learning progress or identify areas for improvement. This emphasis on high-stakes testing fosters a culture of rote memorization and limits opportunities for deeper learning and critical thinking. Such shortcomings are particularly evident in subjects like chemistry, where mastering complex concepts and applying them through iterative learning and practice is essential (Hailu & Demissie, 2021; Kebede & Tadesse, 2023).

The absence of formative assessment strategies, especially feedback-integrated continuous assessment, exacerbates the gap in student achievement. Research shows that students who do not receive timely and constructive feedback are less likely to engage with the material, which in turn leads to lower academic performance and increased frustration (Nicol & Macfarlane-Dick, 2006; Shute, 2008). Moreover, the lack of ongoing assessment hinders the development of self-regulated learning skills, which are vital not only for academic success but also for students' long-term personal and professional development (Boud & Falchikov, 2007).

At Medhanealem Preparatory School in Addis Ababa, these challenges are particularly pronounced. For example, a significant portion of Grade 12 chemistry students struggle with fundamental topics such as balancing chemical equations, a concept requiring iterative learning and consistent feedback. This struggle is compounded by the absence of regular formative assessments, which could provide the necessary guidance and support. Without continuous feedback, many students are left with gaps in their understanding, which affect their overall achievement in the subject.

Gender disparities also play a role in these challenges. Preliminary data from Medhanealem Preparatory School suggest that female students often feel unsupported in traditional testing environments, leading to a noticeable performance gap. For example, female students in Grade 12 chemistry have reported a 10-15% lower average score compared to their male counterparts, with many expressing difficulty in coping with the high-pressure environment of summative assessments. Such disparities indicate the need for assessment practices that are sensitive to gender differences and can offer tailored support to all students (Kirkup, 2020; Abebe, Belay, & Tadesse, 2023).

Furthermore, the relationship between continuous assessment and final exam performance remains underexplored in Ethiopia. While formative assessment methods are widely believed to improve student performance, there is a lack of comparative studies that investigate how these methods fare against traditional summative assessments in improving achievement. This knowledge gap limits the understanding of how feedback-integrated continuous assessment could potentially enhance academic performance relative to final exams, particularly in science subjects like chemistry (Taye, Hailu, & Belay, 2022).

The implications of these assessment challenges extend beyond academic achievement. If left unaddressed, the current reliance on summative assessments may undermine Ethiopia's broader educational goals, such as those outlined in the country's Vision 2030, which seeks to produce competent STEM graduates who can contribute to the nation's development. Effective formative assessment strategies, particularly those that integrate feedback, are crucial to realizing these goals, as they foster a more engaged, motivated, and capable student body.

Given these challenges, this study aims to investigate the impact of feedback-integrated continuous assessment on Grade 12 chemistry students at Medhanealem Preparatory School. The research will explore how this approach may differ across gender, comparing its effectiveness with traditional final examinations. The findings will provide valuable insights into the potential benefits of adopting feedback-integrated continuous assessment as a means to improve student outcomes and promote equitable educational practices in Ethiopia.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of this study is to assess the impact of feedback-integrated continuous assessment on student achievement, gender differences, and final exam performance in chemistry. Additionally, the study aims to explore students' perceptions of how feedback-integrated continuous assessment affects their learning and motivation.

1.3.2 Specific Objectives

1. To quantitatively assess the effect of feedback-integrated continuous assessment on student achievement in chemistry across three different intervention groups differentiated by feedback frequency and method.
2. To examine if feedback-integrated continuous assessment results in differences in achievement between male and female students in chemistry.

3. To determine the correlation between students' performance in feedback-integrated continuous assessment and their final exam results in chemistry.

4. To investigate students' perceptions regarding the clarity, timeliness, and usefulness of feedback and how it influences their learning and motivation in chemistry.

1.4 Research Questions

1. How does feedback-integrated continuous assessment impact student achievement across three intervention groups in chemistry, differentiated by feedback frequency and method?

2. Does feedback-integrated continuous assessment lead to gender-based differences in achievement among male and female students in chemistry?

3. Is there a significant correlation between students' performance in feedback-integrated continuous assessment and their final exam results in chemistry?

4. How do students perceive the clarity, timeliness, and usefulness of feedback in enhancing their learning and motivation in chemistry?

1.5 Delimitation of the Study

This study is delimited to Medhanealem Preparatory School in Addis Ababa, Ethiopia, specifically focusing on Grade 12 chemistry students. Medhanealem was chosen due to its unique educational context, which provides a relevant setting to investigate feedback-integrated continuous assessment. While this study is geographically limited to a single school, the insights gained regarding the integration of feedback in assessments can be applied to other secondary schools with similar educational systems, particularly in urban settings.

The study focuses exclusively on the subject of chemistry, as it requires iterative learning processes and concept application that benefit from continuous assessment and feedback. Topics like stoichiometry and chemical reactions, which demand scaffolded learning, are especially well-suited for this form of assessment. Therefore, the findings of this study may not be directly applicable to subjects with different learning dynamics, though the strategies for feedback integration may offer transferable insights to other STEM subjects such as mathematics and physics, which similarly involve complex, cumulative learning.

Participants are confined to Grade 12 students at Medhanealem Preparatory School, as the study aims to assess the effectiveness of feedback-integrated continuous assessment at a critical stage in students' academic development. The study does not include students from other grade levels, as their learning contexts and needs may differ. Additionally, the study is conducted within a single academic year, which may limit the ability to observe long-term impacts on student outcomes.

Finally, the focus of this study is on measuring student achievement through quantitative assessment tools specifically designed for chemistry, primarily using academic performance as a measure. While the study may touch upon qualitative factors, such as student perceptions, it does not delve deeply into other qualitative dimensions like attitudes or emotional responses to assessments. These delimitations ensure a focused investigation of feedback-integrated continuous assessment within a specific academic context, while acknowledging that the broader applicability of the results may require further research in other settings or subjects.

1.6. Significance of the study

The study on the effect of feedback-integrated continuous assessment on chemistry student achievement at Medhanealem Preparatory School holds practical, methodological, and theoretical significance. In terms of practical significance, this study demonstrates how feedback-integrated continuous assessment can enhance students' comprehension and mastery of chemistry concepts. By embedding specific, timely feedback within the assessment process, teachers can address learning gaps as they arise, allowing for more personalized and effective instructional adjustments. This approach supports educators and administrators in fostering a classroom environment where ongoing feedback is central to student growth. Additionally, for policymakers, the study provides evidence-based guidance on integrating feedback-rich assessment strategies within curricula to improve science education outcomes.

Methodologically, the study advances research on assessment practices by focusing specifically on the role of integrated feedback within continuous assessment. It offers a structured approach to evaluating how feedback shapes student achievement, providing a replicable model for future studies. This focus highlights feedback as a quantifiable variable within assessment research, contributing to research standards that emphasize feedback's measurable impact on learning outcomes.

Theoretically, this study enriches educational theories on formative assessment by examining the specific impact of feedback within continuous assessment on student learning and motivation. By investigating how feedback-integrated assessment influences achievement, the study adds depth to theories related to formative assessment, feedback, and student engagement. It positions feedback not merely as a supportive element but as a foundational component of assessment, critical to improving academic performance.

1.7. Limitations of the Study

This study on the effect of feedback-integrated continuous assessment on chemistry student achievement at Medhanealem Preparatory School has several limitations. First, the study is limited to a single school and focuses specifically on chemistry, which may affect the generalizability of the findings. The unique characteristics of Medhanealem Preparatory School, such as its student demographics, resources, and instructional environment, may not represent other schools or educational contexts. Additionally, focusing solely on chemistry may limit the applicability of the findings to other subjects, as different disciplines may respond differently to feedback-integrated continuous assessment.

The sample size and participant selection also limit the study's generalizability. As the study includes only preparatory-level students, the results may not extend to other grade levels or age groups. A larger, more diverse sample could potentially provide more comprehensive insights into the effectiveness of feedback-integrated continuous assessment across varying student populations.

Another limitation is the study's timeframe, as it is conducted within a single academic period. This limited duration may not capture long-term effects of feedback-integrated continuous assessment on student achievement. Longer-term studies could provide additional insights into the lasting impacts of this approach on students' learning outcomes and engagement.

Additionally, the study relies primarily on quantitative measures of student achievement, potentially overlooking qualitative aspects such as changes in students' motivation, engagement, and perceptions of feedback. Including qualitative data could offer a more holistic view of how feedback-integrated continuous assessment affects students' overall learning experiences.

Finally, since the study is conducted within a controlled academic setting, other external factors such as teacher experience, student motivation, and socio-economic influences may impact the findings. Controlling for these factors is challenging, and they may introduce variability in how feedback-integrated continuous assessment impacts student achievement.

1.8. Operational Definition of Terms

Feedback-Integrated Continuous Assessment: A systematic approach to evaluation where students receive ongoing assessments accompanied by constructive feedback. This feedback aims to help students recognize areas for improvement and enhance their understanding over time. In this study, feedback-integrated continuous assessment involves periodic evaluations in chemistry, where feedback is used as a tool to foster deeper learning rather than merely assigning grades.

Student Achievement: The measurable academic performance of students in chemistry, evaluated through their scores in continuous assessments and a final exam. For this study, student achievement reflects the overall mastery of chemistry concepts, as influenced by the feedback and insights provided during the assessment process.

Constructive Feedback: Specific and actionable information provided to students during the learning process, intended to guide improvement and deepen understanding. In this study, constructive feedback is given to students after each assessment activity, aiming to boost their performance and engagement in chemistry.

Gender Differences: Variances in academic performance, engagement, and response to assessment methods between male and female students. In this research, gender differences are explored to determine whether feedback-integrated continuous assessment impacts male and female students differently in terms of learning outcomes in chemistry.

Engagement: The level of interest, participation, and motivation students exhibit toward learning chemistry through continuous assessment. Engagement in this study is assessed by monitoring students' participation in assessment activities and their responsiveness to feedback provided throughout the course.

Self-Regulated Learning: The process by which students monitor, control, and direct their own learning efforts, setting goals and assessing progress. In this study, self-regulated learning refers to the skills students develop through feedback-integrated continuous assessment, enabling them to improve their chemistry understanding independently.

Continuous Assessment: An ongoing process of evaluating student progress through various formative assessments, such as quizzes, practical tasks, and in-class activities, instead of relying solely on final exams. In this study, continuous assessment aims to promote sustained learning in chemistry, as opposed to last-minute exam preparation.

Summative Assessment: A high-stakes evaluation, typically in the form of a final exam, that assesses students' cumulative knowledge at the end of a learning period. In this study, the summative assessment serves as a benchmark to compare the effectiveness of feedback-integrated continuous assessment on students' chemistry achievement.

Achievement Gap: The measurable disparity in academic performance between different groups, such as male and female students. This study examines the achievement gap in chemistry to see if feedback-integrated continuous assessment contributes to narrowing or widening the performance gap across gender.

Learning Outcomes: The knowledge, skills, and competencies students are expected to acquire by the end of the course. For this study, learning outcomes in chemistry are measured by student performance in both continuous assessments and the final exam, aiming to determine how feedback-integrated assessments influence students' overall mastery of the subject.

1.9. Organization of the Study

The report has five chapters. Chapter one outlines the context of the study including the background, statement of the problem, study objectives, research questions, delimitations, significance of the study, limitations and definition of significant terms.

Chapter two reviews literature with regard to the study. It considers views of those who have researched on continuous assessment. It includes the summary of related literature, theoretical framework and the conceptual framework.

Chapter three provides the research design and methodology. It includes; the research design, the Sample and sampling procedures, research instruments, validity of the instruments, reliability of the instruments, data analysis techniques, time frame, financial budget, and ethical considerations.

Chapter four presents' analyses of the data collected and discuss the results. The discussions are based on the research questions touching on all assessment variables mentioned in the study. Finally, chapter five summarizes the findings and indicates recommendations of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction to Feedback-Integrated Continuous Assessment

Feedback-integrated continuous assessment (FICA) is an evolving approach in education that combines the principles of ongoing assessment with targeted feedback to enhance student learning outcomes. Unlike traditional summative assessments, which are often used solely for grading purposes, FICA emphasizes formative assessment practices where feedback is consistently incorporated throughout the learning process. This approach supports not only academic achievement but also the development of students' self-regulation, motivation, and engagement in their learning journeys (Brookhart, 2018; Hattie & Clarke, 2019). In the context of subjects like chemistry, which involve complex problem-solving and critical thinking, FICA offers unique benefits by providing students with immediate insights into their understanding and areas needing improvement (Andrade et al., 2023).

One of the core theoretical foundations for feedback-integrated continuous assessment lies in formative assessment theory, which was notably advanced by Black and Wiliam (2009). They defined formative assessment as a continuous feedback mechanism that enables adjustments in teaching and learning activities to improve student achievement. Recent studies have reaffirmed the importance of feedback in supporting formative assessment, showing that when feedback is given timely and is constructive, it positively impacts students' conceptual understanding, particularly in STEM fields such as chemistry (Anderson et al., 2023; Bennett, 2021). According to Brookhart (2021), feedback integrated within continuous assessment is crucial in providing students with a clear understanding of their progress, which in turn fosters a sense of accountability and encourages self-directed learning.

In practice, FICA provides opportunities for personalized feedback that addresses individual students' learning gaps, enabling teachers to adapt their instruction to meet diverse needs (Fletcher, 2022). Feedback-integrated continuous assessment includes frequent assessment checkpoints, such as quizzes, assignments, and interactive tasks, which serve as a basis for delivering constructive feedback (Shute, 2008). This regularity enables teachers to monitor learning patterns, offer guidance tailored to each student's performance, and help students connect their immediate efforts with long-term learning goals. In subjects like chemistry, where abstract concepts are common, this type of feedback can be particularly valuable, as it enables students to correct misconceptions early and build a stronger foundation in the subject matter (Bennett, 2021).

The effectiveness of FICA has been supported by recent educational research that underscores the benefits of integrated feedback within assessment frameworks. A meta-analysis by Hattie and Timperley (2007) found that feedback is one of the most influential factors affecting student achievement. More recent studies, such as those by Park and Kim (2023), have built on these findings, demonstrating that feedback integrated with continuous assessment helps students become more resilient and engaged in their learning processes. In their study on high school chemistry students, Park and Kim found that students who received consistent, targeted feedback through continuous assessments showed a 15% improvement in their overall performance compared to those who only received feedback at the end of a term. These findings suggest that FICA is not only effective in helping students retain knowledge but also in enhancing their problem-solving skills and fostering a positive learning environment.

In addition to supporting academic achievement, feedback-integrated continuous assessment has been shown to enhance student motivation and engagement. According to Ryan and Deci (2020), feedback plays a vital role in nurturing intrinsic motivation, as it helps students understand the purpose and progress of their learning efforts. Feedback in FICA is formative and forward-focused, emphasizing what students can do to improve, rather than solely pointing out errors. This aspect of feedback encourages a growth mindset, making students more willing to embrace challenges and view mistakes as learning opportunities (Dweck, 2016). For chemistry students, this positive reinforcement can increase persistence in tackling difficult topics, ultimately leading to deeper understanding and academic success.

However, the implementation of FICA does come with certain challenges. Studies indicate that while feedback is critical for continuous assessment, the quality and clarity of feedback can vary significantly, impacting its effectiveness (Andrade et al., 2023). Anderson et al. (2023) emphasize that for FICA to be effective, feedback must be actionable, specific, and aligned with learning objectives. They found that vague or overly general feedback often leads to confusion rather than improvement. Thus, one of the key considerations in FICA is training educators to provide high-quality, targeted feedback that students can readily understand and apply.

2.2. The Role of Feedback in Learning

Feedback is a crucial element in the learning process, often described as the "bridge" that connects assessment with learning improvement (Hattie & Timperley, 2007). In the context of education, feedback is defined as information provided to learners about their performance or understanding, with the aim of guiding them toward a more accurate or refined level of knowledge (Shute, 2008). Effective feedback enables students to identify gaps in their understanding, correct errors, and build upon their existing knowledge, which is particularly valuable in complex subjects like chemistry, where cumulative learning is essential for mastering advanced concepts (Anderson et al., 2023).

At its core, feedback helps make learning an active and self-regulated process. According to Nicol and Macfarlane-Dick (2006), feedback provides students with information that encourages self-assessment and reflection, allowing them to monitor their learning progress. This is especially relevant in formative assessment contexts, where feedback is given continuously throughout the instructional period rather than only at the end of a unit or course. Continuous feedback enables students to recognize and address errors early on, making learning more effective and adaptable. In chemistry education, for instance, timely feedback on foundational concepts such as chemical bonding or reactions helps prevent misconceptions that could otherwise hinder understanding of more advanced topics (Brookhart, 2018).

Feedback’s role extends beyond cognitive support; it also plays a significant role in fostering student motivation and engagement. According to Ryan and Deci’s (2000) Self-Determination Theory, feedback can support students' intrinsic motivation when it is perceived as constructive and aligned with their learning goals. Positive and formative feedback encourages a growth mindset, where students view challenges as opportunities for improvement rather than as fixed limitations (Dweck, 2016). For chemistry students, whose subject often involves complex problem-solving, feedback that reinforces effort and improvement can build resilience, encouraging students to persist even when facing difficult topics (Bennett, 2021).

Research also shows that the quality of feedback is essential to its effectiveness. Hattie and Timperley (2007) argue that feedback must be specific, actionable, and relevant to the student’s current level of understanding. General feedback such as “good job” or “needs improvement” often lacks the clarity that students require to make meaningful progress. Instead, feedback should guide students on what they did well, where they went wrong, and how they can improve (Shute, 2008). For example, in a chemistry assignment involving stoichiometry, feedback that specifies where a student may have miscalculated or misunderstood conversion factors provides clearer direction for improvement.

Moreover, feedback serves as a tool for enhancing student-teacher relationships and creating a supportive learning environment. When feedback is delivered in a supportive and constructive manner, it reinforces a collaborative approach to learning, where students feel supported in their efforts and encouraged to seek help when needed (Hattie & Clarke, 2019). In chemistry labs, for instance, students might feel intimidated by complex procedures, but constructive feedback can ease their anxiety and promote a positive learning experience.

In sum, feedback is integral to learning because it helps students regulate their own learning, reinforces motivation and resilience, and supports a collaborative learning environment. The role of feedback is especially significant in feedback-integrated continuous assessment, where ongoing feedback not only measures learning but also actively contributes to it. For educators, understanding how to provide effective feedback is essential for fostering both academic growth and personal development in students, making feedback a powerful tool in achieving long-term educational outcomes.

2.3. Continuous Assessment and Student Achievement

Continuous assessment (CA) is an educational approach in which students' progress is monitored and evaluated consistently throughout the instructional period. This differs from traditional summative assessments, which are typically administered at the end of a term and offer limited opportunities for students to improve upon their performance based on earlier mistakes. Continuous assessment, by contrast, provides frequent feedback loops, enabling students to adapt their learning strategies, address misconceptions, and build on their understanding over time. This approach has been shown to have a positive impact on student achievement, particularly in subjects that require cumulative knowledge, such as chemistry (Brookhart, 2018; Andrade et al., 2023).

The theoretical foundation for continuous assessment can be traced back to formative assessment theory, which argues that frequent, low-stakes assessments provide critical opportunities for learning adjustments (Black & Wiliam, 2009). Research demonstrates that the effectiveness of continuous assessment lies in its ability to make learning a more active and reflective process. As students receive feedback and reassess their understanding regularly, they develop better self-regulation skills, which are essential for academic success. In subjects like chemistry, where concepts build upon each other, continuous assessment allows students to consolidate foundational knowledge, leading to more robust long-term retention and application of concepts (Andrade & Brookhart, 2020).

Several studies have found significant correlations between continuous assessment and improved student performance across various academic disciplines. In a meta-analysis of formative assessment studies, Hattie (2009) identified continuous assessment as a key factor influencing student achievement, citing an effect size of 0.90, which is considerably high compared to traditional assessment methods. Continuous assessment not only enhances academic achievement but also fosters deeper engagement with the subject matter. For example, when students in a chemistry course are given regular quizzes on reaction mechanisms or molecular structures, they are more likely to revisit and reinforce these concepts than they would if the material were only tested at the end of the term (Shute, 2008).

In addition to supporting academic achievement, continuous assessment has been linked to improvements in student motivation and engagement. Research by Andrade and Cizek (2019) suggests that continuous assessment fosters a growth mindset, helping students to view learning as a process rather than a fixed outcome. This perspective encourages students to embrace challenges and learn from mistakes. In chemistry, where students frequently encounter complex and abstract concepts, the ability to engage persistently with challenging material is crucial for mastery. For instance, continuous assessments that encourage iterative learning, such as problem-based quizzes or lab report evaluations, allow students to learn from errors, gradually improving their understanding and boosting their confidence (Brookhart, 2018).

Another key benefit of continuous assessment is its role in reducing the high-stakes pressure associated with final exams. By spreading assessment throughout the term, continuous assessment lowers the psychological burden on students, making the learning experience less stressful and more supportive of gradual, consistent improvement (Bennett, 2021). This approach aligns with evidence from cognitive psychology, which shows that distributed practice, or learning spaced over time, leads to better retention than massed practice or cramming (Brown et al., 2014). Continuous assessment's incremental approach allows students to develop a deeper, more integrated understanding of the material. This is particularly beneficial in chemistry, where a comprehensive grasp of fundamental concepts is necessary for success in advanced topics.

Despite the evident benefits, continuous assessment does come with some challenges. Educators often report that implementing continuous assessment is time-consuming, particularly in large classrooms where providing individualized feedback can be difficult (Fletcher, 2022). Additionally, there can be inconsistencies in the quality and frequency of feedback, which may affect the effectiveness of continuous assessment. However, recent advances in educational technology, such as digital platforms that automate assessments and track student progress, are helping to address some of these challenges (Anderson et al., 2023).

2.4. Combining Feedback and Continuous Assessment in Chemistry Education

In recent years, combining feedback with continuous assessment has emerged as a highly effective approach in chemistry education, as it supports not only the acquisition of complex knowledge but also the development of critical thinking and problem-solving skills. Chemistry, with its intricate concepts and progressive learning structure, benefits significantly from an assessment system that is both continuous and feedback-rich. Together, feedback and continuous assessment help create an environment where students receive consistent support and guidance, leading to improved learning outcomes and greater engagement in the subject (Andrade et al., 2023; Bennett, 2021).

Continuous assessment in chemistry involves assessing students frequently throughout the course, using various methods such as quizzes, lab activities, and problem-solving exercises. This steady assessment flow helps teachers gauge students' understanding in real-time, allowing them to address misconceptions before they accumulate and hinder future learning (Shute, 2008). By integrating feedback into each of these assessment points, students gain more than a score; they receive actionable guidance on how to correct their errors and refine their understanding. For instance, feedback on a laboratory report could point out specific areas for improvement, such as data interpretation or adherence to scientific protocols, helping students enhance both their theoretical knowledge and practical skills.

Research indicates that feedback-integrated continuous assessment fosters a cycle of self-regulated learning, which is crucial for mastering challenging subjects like chemistry. According to Nicol and Macfarlane-Dick (2006), feedback enables students to reflect on their performance and make adjustments to their study habits and understanding, leading to better academic outcomes. Continuous assessment supports this reflective cycle by providing frequent opportunities for students to receive and act on feedback, rather than waiting until the end of a term when it may be too late to address foundational issues. This iterative process helps students deepen their grasp of core concepts and fosters a growth mindset, making them more resilient in tackling difficult material (Hattie & Clarke, 2019).

Feedback-integrated continuous assessment also positively impacts student motivation and engagement, especially in a demanding subject like chemistry. Feedback that is specific, timely, and constructive encourages students to take an active role in their learning, helping them see assessments as learning opportunities rather than solely as judgment tools. For example, when students receive feedback after an assessment on chemical equations, they can immediately correct any misunderstandings related to balancing equations or reaction mechanisms, which reinforces learning. This approach contrasts with summative assessments that provide little opportunity for corrective action, often leading to fixed mindset beliefs and disengagement (Ryan & Deci, 2020).

Moreover, research in chemistry education suggests that students who receive frequent feedback through continuous assessment experience reduced anxiety and increased confidence. This is especially important in practical components of chemistry, where students may initially feel intimidated by complex procedures and equipment. Constructive feedback during these continuous assessments can help students improve gradually, turning what might have been a stressful experience into a manageable learning process (Brookhart, 2018). For instance, students who receive feedback on their technique in titration labs gain confidence in performing similar experiments in the future, as they understand how to adjust their methods based on prior guidance.

Educators face challenges in implementing feedback-integrated continuous assessment, particularly with respect to time constraints and maintaining feedback quality (Fletcher, 2022). Providing personalized feedback on frequent assessments requires careful planning and often a substantial time investment, which may be difficult in larger classrooms. However, educational technology is helping mitigate these challenges by allowing for automated assessments and digitally delivered feedback, providing more feasible solutions for scaling feedback-integrated continuous assessment. Digital platforms can provide immediate feedback on objective questions, such as multiple-choice quizzes, while teachers can focus on delivering high-quality feedback on more complex, open-ended tasks.

2.5. Feedback-Integrated Continuous Assessment and Gender Differences

Feedback-integrated continuous assessment (FICA) offers a valuable framework for understanding how students of different genders engage with and benefit from feedback in academic contexts. Continuous assessment (CA), which involves frequent evaluation and feedback over the course of a term, is especially effective when combined with structured, specific feedback, allowing students to make immediate adjustments to their learning strategies. Gender differences in response to this feedback can vary, influenced by factors such as learning preferences, self-regulation styles, and attitudes toward feedback, which impact student engagement and academic performance (Brookhart, 2018; Hattie & Timperley, 2007).

Research in educational psychology suggests that gender can influence students' responses to feedback, with variations observed in areas such as confidence levels, feedback interpretation, and motivational responses. For instance, some studies indicate that female students tend to respond more positively to constructive feedback and are more likely to implement specific guidance to improve their performance, while male students may react more defensively to feedback, particularly if it is perceived as negative (Dweck, 2016). In chemistry, where complex problem-solving and error correction are critical, feedback-integrated continuous assessment can support both male and female students in identifying strengths and addressing weaknesses, though their responses to this support may differ.

In terms of academic self-regulation, female students often display a higher degree of self-regulatory behaviors, which make them particularly receptive to continuous feedback and reflection (Zimmerman & Schunk, 2011). This increased receptivity may stem from a stronger tendency among female students to seek guidance and engage with feedback in a constructive manner, viewing it as an opportunity for growth rather than as a critique of ability. This is particularly beneficial in subjects like chemistry, where continuous feedback helps address errors in real-time, fostering incremental learning. Male students, on the other hand, may benefit from feedback that is framed in a way that emphasizes improvement and goal achievement, helping them to view feedback as part of their academic growth rather than a measure of ability (Ryan & Deci, 2000).

Gender differences also extend to how feedback is processed emotionally. Studies have shown that female students are more likely to internalize feedback, using it to refine their approach and deepen their understanding. This can contribute to greater resilience in challenging subjects, where continuous assessment offers frequent opportunities to build competence and confidence (Eccles, 2005). For male students, however, feedback may need to be more focused on encouraging a growth mindset and resilience, particularly when they encounter mistakes. In chemistry education, where challenging topics often require repeated practice, continuous assessment paired with supportive feedback helps mitigate discouragement and fosters persistence across genders, though it may be necessary to tailor feedback approaches to address specific emotional responses (Dweck, 2016).

Recent studies highlight how feedback-integrated continuous assessment can also serve to equalize performance across genders. For example, Hattie and Clarke (2019) found that continuous, feedback-rich assessment reduced achievement gaps in STEM subjects by providing regular, actionable feedback that all students could use to improve. In chemistry, where students may face difficulties in areas such as lab procedures, balancing equations, and reaction mechanisms, continuous assessment allows for iterative learning, enabling both male and female students to refine their skills progressively.

Despite these benefits, implementing feedback-integrated continuous assessment to address gender differences requires a nuanced understanding of how individual students respond to feedback. Educators are encouraged to consider variations in feedback delivery, emphasizing encouragement and constructive guidance for male students, while promoting detailed, actionable feedback that reinforces self-regulation and reflection for female students. Digital platforms and personalized learning tools are emerging as useful resources, allowing feedback to be tailored to individual learning styles and preferences, thus accommodating gender differences more effectively (Fletcher, 2022).

2.6. Continuous Formative Assessment and Continuous Summative Assessment

In education, continuous assessment can take two primary forms: continuous formative assessment and continuous summative assessment. Both approaches aim to evaluate student learning over time, yet they serve different purposes and have distinct impacts on student engagement, motivation, and learning outcomes. In subjects like chemistry, which require both foundational knowledge and application skills, the integration of these two forms of assessment can provide a comprehensive view of students' progress and guide instructional decisions effectively.

2.6.1. Continuous Formative Assessment

Continuous formative assessment is an ongoing evaluation process intended to provide feedback that helps students improve their learning as they progress through a course. The goal of formative assessment is not to assign final grades but to identify students’ strengths and areas where they need support, thereby fostering a supportive learning environment where students feel encouraged to take risks and learn from their mistakes. Through formative assessment, teachers can observe how students approach learning tasks, allowing them to make timely interventions that can prevent misunderstandings from developing further (Black & Wiliam, 2009).

Examples of continuous formative assessment include regular quizzes, in-class activities, interactive discussions, peer assessments, and feedback on assignments or projects. In chemistry, formative assessments might involve quick checks on concepts such as balancing chemical equations or understanding reaction mechanisms, where immediate feedback allows students to adjust their understanding before moving on to more advanced topics. These assessments help build students’ confidence, making complex topics more accessible by breaking down the learning process into manageable steps (Shute, 2008).

The benefits of continuous formative assessment include increased student engagement, improved learning strategies, and enhanced self-regulation. By receiving frequent, low-stakes feedback, students become more proactive in addressing their own learning needs, leading to better long-term retention and academic resilience. This approach aligns with the concept of a growth mindset, where students view their abilities as improvable through effort and learning. In subjects like chemistry, where conceptual clarity is essential for success in subsequent lessons, formative assessments can bridge learning gaps early, supporting cumulative learning (Hattie & Clarke, 2019).

2.6.2. Continuous Summative Assessment

Continuous summative assessment, in contrast, is designed to evaluate student learning at regular intervals with the primary purpose of assigning a final grade or certification of achievement. Unlike formative assessment, summative assessments are typically high-stakes, carrying significant weight in determining students' overall performance. Continuous summative assessment is implemented at multiple points throughout the academic period, rather than relying solely on end-of-term exams, giving educators a broader picture of students' sustained performance over time (Guskey, 2003).

In chemistry, continuous summative assessment might take the form of unit exams, periodic lab evaluations, or graded projects that represent a more comprehensive understanding of the material. By using a series of summative assessments rather than a single final exam, educators can reduce the pressure of high-stakes testing, distribute assessment weight, and offer students multiple opportunities to demonstrate their knowledge. For instance, a chemistry teacher might conduct a graded exam after each major topic, such as atomic structure, stoichiometry, and thermodynamics, allowing for a cumulative view of student understanding.

One of the main advantages of continuous summative assessment is its ability to create a balanced and fair evaluation system that reflects students' growth and consistent effort over time, rather than relying on a single high-stakes test. This approach can be particularly valuable in a subject like chemistry, where ongoing practice and mastery are necessary to develop proficiency. However, continuous summative assessments still carry high stakes and can induce stress in students, potentially affecting their performance if not carefully balanced with supportive feedback (Harlen, 2007).

2.6.3. Combining Continuous Formative and Summative Assessment

In practice, an effective assessment strategy often integrates both continuous formative and summative assessments, allowing educators to support students' learning journey while maintaining accountability. For example, teachers might use formative assessments to guide instructional adjustments and provide students with regular feedback, while summative assessments measure progress toward learning goals at designated intervals. In chemistry, this might look like regular formative quizzes to check for understanding after each lesson and periodic graded exams to assess cumulative knowledge over a series of lessons.

Combining these approaches can promote a more holistic assessment framework, where formative assessments build foundational knowledge and skills that summative assessments then evaluate. This integrated approach enables educators to respond to individual learning needs, reducing the risk of cumulative misconceptions while allowing students to engage in a low-pressure learning environment. For students, it provides a clearer path for improvement, with ongoing feedback shaping their preparation for higher-stakes summative assessments, resulting in greater overall achievement and confidence (Bennett, 2021).

2.7. Challenges and Limitations of Feedback-Integrated Continuous Assessment

Feedback-integrated continuous assessment (FICA) is designed to improve student learning by providing regular, actionable feedback throughout the learning process. This approach enables students to adjust their strategies and deepen their understanding incrementally. However, while FICA offers significant advantages, it also comes with notable challenges and limitations that educators must navigate to implement it effectively. These challenges include time constraints, workload management, maintaining feedback quality, student motivation, and technology limitations.

2.7.1. Time Constraints and Workload Management

One of the most pressing challenges of implementing FICA is the significant time required for teachers to provide individualized feedback on a continuous basis. In larger classes, where the number of assessments and feedback sessions can multiply quickly, managing time effectively becomes challenging. Teachers may find it difficult to consistently offer detailed, personalized feedback for every student due to limited instructional hours and other administrative responsibilities. This is especially relevant in complex subjects like chemistry, where feedback often needs to be specific to individual students' misconceptions or mistakes (Fletcher, 2022). Without enough time to provide high-quality feedback, the effectiveness of FICA diminishes, as generic or delayed feedback may not yield the intended improvements in student understanding and performance.

2.7.2. Maintaining Feedback Quality and Consistency

Another limitation of FICA lies in ensuring that feedback remains high-quality, timely, and relevant to each student's needs. Effective feedback should be clear, specific, and constructive, allowing students to understand their mistakes and make meaningful changes in their learning strategies. However, the pressure of providing continuous feedback can lead to inconsistencies in quality, with some feedback becoming overly general or rushed due to time constraints. In subjects like chemistry, where technical accuracy is crucial, superficial or incomplete feedback may hinder students' learning progress rather than support it (Hattie & Timperley, 2007). Teachers may struggle to maintain a balance between feedback quantity and quality, especially when dealing with diverse student needs and learning paces.

2.7.3. Student Motivation and Engagement

While feedback-integrated continuous assessment is intended to support learning, students may not always respond positively to continuous feedback, particularly if it is perceived as overly critical or overwhelming. For some students, frequent feedback may create stress or anxiety, leading to disengagement rather than improvement. This challenge can be exacerbated when feedback is heavily focused on correcting mistakes without also recognizing successes or encouraging growth. To be effective, feedback needs to be delivered in a way that promotes a growth mindset, encouraging students to view feedback as a tool for improvement rather than as a judgment of their abilities (Dweck, 2016). Motivating students to consistently engage with and act on feedback requires a sensitive approach, where feedback is framed as part of a supportive learning journey rather than a high-stakes evaluation.

2.7.4. Technology Limitations and Accessibility

The use of digital tools and learning platforms can help manage the workload associated with FICA, allowing for automated assessments and immediate feedback on objective questions.

However, relying on technology also introduces limitations related to accessibility, usability, and effectiveness of digital feedback. Not all students have equal access to digital resources, especially in regions with limited infrastructure or where students lack personal devices. Additionally, while automated feedback can be useful for objective assessments, it is often insufficient for more complex, open-ended tasks that require personalized guidance (Brookhart, 2018). This limitation poses a barrier to implementing FICA equitably across diverse student populations, potentially widening achievement gaps rather than closing them.

2.7.5. Limited Professional Development and Support

Effective implementation of FICA requires that educators have the necessary skills to provide constructive, impactful feedback and to integrate continuous assessment into their instructional practices effectively. However, many teachers may lack formal training or resources to implement FICA strategies proficiently. Without adequate professional development, teachers may struggle with techniques for delivering feedback that encourages self-reflection, critical thinking, and resilience in students (Andrade et al., 2023). This gap can lead to inconsistencies in FICA implementation, limiting its potential benefits and creating disparities in how feedback impacts student learning.

2.7.6. Student Dependency on Feedback

Another potential limitation of FICA is that it may inadvertently foster dependency on feedback among students, reducing their ability to self-regulate and critically assess their work. Continuous feedback can become a crutch, where students rely on external input to make corrections rather than developing the skills to evaluate their own progress and identify areas for improvement. In a subject like chemistry, where problem-solving and independent analysis are essential, excessive reliance on feedback may hinder students’ development of self-assessment skills (Zimmerman & Schunk, 2011). Striking a balance between supporting students with feedback and encouraging independent learning is essential for developing self-regulated learners.

2.7.7. Inconsistent Assessment Standards

In FICA, assessments are often integrated into regular classroom activities, which can lead to inconsistencies in assessment standards. Teachers may vary in their grading and feedback practices, resulting in subjective evaluations that are difficult to standardize. This lack of consistency can undermine the credibility of continuous assessments, particularly when students feel that grading criteria are unclear or applied differently across assessments. Maintaining a fair and transparent assessment system within FICA requires clear guidelines and ongoing calibration to ensure that feedback and grades reflect students' true progress (Guskey, 2003).

2.8. Theoretical Framework of the Study

The theoretical framework for the study on feedback-integrated continuous assessment (FICA) in relation to student achievement in chemistry is grounded in several interconnected educational theories, primarily formative assessment theory, feedback theory, and constructivist learning theory. Formative assessment theory emphasizes the importance of ongoing assessments that monitor student learning, providing timely feedback to guide instructional practices and support student progress (Black & Wiliam, 2009). Unlike traditional summative assessments, which evaluate learning at a fixed point, formative assessments enable teachers to identify and address learning gaps as they occur, fostering a more responsive educational environment. This theory underpins FICA's effectiveness in chemistry education by facilitating early intervention and targeted feedback that promote deeper conceptual understanding.

Feedback theory is another critical component of the framework, as it elucidates how effective feedback can bridge the gap between current performance and desired learning outcomes (Hattie & Timperley, 2007). Effective feedback must be specific, actionable, and timely to enhance learning and motivate students. In the context of FICA, feedback serves not only to correct errors but also to reinforce students' efforts and strategies, thereby supporting their academic development. The integration of feedback in continuous assessment encourages students to engage with their learning actively, helping them recognize areas for improvement and adjust their approaches accordingly.

Additionally, constructivist learning theory plays a vital role in this framework, positing that learners construct knowledge through active engagement with content and social interactions (Piaget, 1970; Vygotsky, 1978). FICA aligns with constructivist principles by promoting reflective practices and allowing students to actively participate in their learning journey. This theory highlights the importance of feedback in supporting metacognition, as students reflect on their understanding and make necessary adjustments. Together, these theories illustrate how FICA can enhance student achievement in chemistry by providing a structured approach to learning that incorporates continuous feedback, encourages self-regulation, and fosters a deeper engagement with the subject matter. Ultimately, the integration of these theoretical perspectives provides a robust foundation for exploring the impact of FICA on student outcomes in chemistry education.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Research Design

This study employed a quasi-experimental design with a mixed-methods approach to assess the impact of feedback-integrated continuous assessment on student achievement in chemistry. A quasi-experimental design was selected due to ethical and logistical constraints that prevented random assignment of students to the intervention groups. Specifically, students were already grouped into pre-existing classes, and assigning them randomly to treatment and control groups would have disrupted their normal educational environment. To address this, the study used a combination of quantitative and qualitative methods. The quantitative component involved measuring students' chemistry achievement across three groups: Group 1, which received feedback-integrated continuous assessment; Group 2, which participated in continuous assessment without feedback; and the comparison group, which followed traditional methods, relying on a final exam for evaluation. The pretest-posttest control group design enabled comparisons across the groups, with the comparison group serving as a baseline to evaluate the effects of the feedback-integrated approach. The qualitative aspect aimed to gather in-depth insights into students' and teachers' perceptions and experiences with the feedback process, further complementing the quantitative results by uncovering underlying factors influencing student performance.

3.2 Sample and Sampling Techniques

The study was conducted at Medhanealem Preparatory School during the 2019-2020 academic year, focusing on Grade 12 chemistry students. The student in the sixteen 12^{th} grade of Medhanealem Preparatory School were assigned three section of total sample included 144 students, divided into three groups: Section E (control group), and Sections C and H (treatment groups). The control group consisted of 48 students (20 female and 28 male), and the treatment groups included 96 students (43 female and 53 male). To select participants, stratified random sampling was used, ensuring an equal representation of gender across the treatment and control groups. Although random assignment to groups was not feasible due to the quasi-experimental design, stratified random sampling helped minimize bias in group composition and ensured comparability across sections. Three teachers were purposively selected to implement the intervention based on their qualifications, experience, and familiarity with the chemistry curriculum. Each teacher had at least 10 years of teaching experience and held a Master's degree in Education, ensuring that they were well-qualified to carry out the instructional methods with fidelity. For the qualitative portion of the study, 12 students (6 males and 6 females) were randomly selected from the treatment groups to participate in semi-structured interviews, providing a balanced representation of gender and allowing for a deeper exploration of students' experiences with the feedback-integrated continuous assessment approach.

3.3 Variables of the Study

The study examined several key variables to assess the effects of feedback-integrated continuous assessment on student achievement. The independent variables were the types of assessment used: feedback-integrated continuous assessment (Group 1), continuous assessment without feedback (Group 2), and traditional assessment (the control group). The dependent variable was students' chemistry achievement, as measured by their posttest scores. Gender was included as a moderating variable to examine whether male and female students experienced different outcomes in response to the various assessment types. Previous research has shown that gender can influence achievement in STEM subjects like chemistry, so understanding its potential role in moderating the effect of feedback on student performance was an important aspect of the study (Bowman, et al., 2022). Additionally, the study included an operational definition of feedback-integrated continuous assessment, which was characterized by regular assessments accompanied by timely, constructive feedback. This feedback could take the form of written comments on assignments, verbal feedback during class, or peer feedback, all aimed at reinforcing learning and helping students improve their understanding of chemistry concepts.

3.4 Data Collection Instruments

Data collection in this study was carried out using a combination of quantitative and qualitative instruments to ensure a comprehensive analysis of the impact of feedback-integrated continuous assessment. The primary quantitative tool was a 40-item multiple-choice chemistry achievement test, which was administered both as a pretest and posttest. The test covered key concepts in the chemistry curriculum and was validated through consultations with three experienced chemistry educators, ensuring its content validity. These experts reviewed the test items for alignment with the national chemistry curriculum to ensure the test was an accurate measure of students' understanding. The test was piloted with a small group of students to check for clarity, and some minor revisions were made based on their feedback. The results of the pretest provided baseline data, while the posttest measured learning gains. In addition to the quantitative assessment, semi-structured interviews were conducted with 12 students and 3 teachers to capture their perceptions and experiences of the feedback-integrated continuous assessment process. The interview guide was piloted with a small group to refine questions and ensure clarity. An observation checklist was also used during classroom sessions to document the fidelity of the intervention and monitor student engagement. The checklist included criteria such as the frequency of feedback provided, the level of student participation in assessments, and overall engagement in class activities.

3.5 Procedure for Treatment

The intervention lasted six weeks, with three 45-minute sessions held per week. During this period, the groups followed different instructional procedures. Group 1, the feedback-integrated continuous assessment group, received regular assessments accompanied by constructive feedback. The feedback was designed to guide students in identifying errors and provide strategies for improvement, such as highlighting specific mistakes in problem-solving and offering suggestions for better understanding the material. Group 2, the continuous assessment without feedback group, participated in the same assessments but did not receive any feedback on their performance. The comparison group followed traditional instructional methods, with a focus on lectures and a final exam that served as the primary measure of student achievement. At the end of the six-week intervention, all groups took the same posttest, which was identical to the pretest, to measure any changes in student performance. Following the posttest, interviews were conducted with a selected sample of students and teachers, and classroom observations were analyzed to gain additional qualitative insights into the effects of the feedback-integrated continuous assessment approach on student learning and motivation.

3.6 Validity and Reliability of Instruments

To ensure the validity and reliability of the study's data collection instruments, several steps were taken. The content validity of the chemistry achievement test was established by having it reviewed by three chemistry educators with expertise in the subject. These experts ensured that the test items accurately reflected the core concepts of the chemistry curriculum. Additionally, the interview guide and observation checklist were piloted with a small group of students to check their effectiveness in capturing relevant data. Feedback from the pilot testing led to some adjustments in the wording of interview questions and observation criteria to ensure clarity and focus. The reliability of the chemistry achievement test was confirmed through a test-retest method and internal consistency measures. The Cronbach's alpha for the test was found to be 0.79, indicating moderate to high internal consistency. This coefficient suggests that the test reliably measures student achievement. For the qualitative data, inter-rater reliability was ensured by having multiple researchers independently analyze a subset of the interview and observation data. The level of agreement between researchers was high, ensuring the validity of the qualitative findings.

3.7 Data Analysis

Data analysis in this study involved both statistical and qualitative methods to provide a comprehensive interpretation of the results. The quantitative data were analyzed using One-Way ANOVA to examine whether significant differences existed in the posttest scores among the three groups. This analysis allowed for comparisons between the groups to assess the effect of feedback-integrated continuous assessment on student achievement. Additionally, Two-Way ANOVA was used to explore interactions between assessment methods and gender, providing insights into whether male and female students responded differently to the various assessment methods. Pearson correlation analysis was applied to assess the relationship between pretest and posttest scores, offering further insights into factors influencing student performance. For the qualitative data, thematic analysis was employed to identify recurring themes in the interview transcripts and observation notes. The analysis focused on coding participants' experiences with feedback-integrated continuous assessment, grouping these codes into broader themes that highlighted how feedback affected their learning and motivation. The combination of statistical analysis and thematic analysis provided a robust approach to interpreting both the measurable and subjective dimensions of the intervention.

3.8 Ethical Considerations

Ethical considerations were rigorously followed to ensure the study was conducted in a responsible and respectful manner. Informed consent was obtained from all participants, including parental consent for minor students. Participants were clearly informed about the study's purpose, procedures, and their right to withdraw at any time without facing any negative consequences. Confidentiality was maintained throughout the study by assigning alphanumeric codes to participant data, with a separate, secure key linking the codes to the identities of the participants. All data were stored securely, and access was restricted to the research team. The study adhered to ethical guidelines to protect the rights of participants and ensure the integrity of the research process.

CHAPTER FOUR: RESULTS

4.1. Testing Assumptions

4.1.1. Normality of Data

The researchers aimed to assess the normality of the pre- and post-test chemistry achievement scores in order to determine if parametric tests, which assume normality, could be used in subsequent analyses. The Shapiro-Wilk test was employed to test for normality, and the results showed that the p-values for all groups were greater than the significance level of 0.05, indicating that the data followed a normal distribution. Specifically, the Shapiro-Wilk test yielded p-values of 0.056 for the FICA group, 0.057 for the CA alone group, and 0.054 for the CG group on the pre-test, and p-values of 0.07 for the FICA group, 0.076 for the CA alone group, and 0.076 for the CG group on the post-test. These p-values confirm that the scores for both the pre-test and post-test were normally distributed. Furthermore, the skewness values of the test scores fell within the acceptable range of -1 to 1, further supporting the assumption of normality. As such, parametric tests can be used for subsequent analyses. The normality of the data is also illustrated in Figures 1 and 2, which present the Q-Q plots for the pre-test and post-test scores, showing that the data points closely follow a straight line, confirming the normal distribution. Additionally, Figures 3 and 4 display the box plots for the pre-test and post-test scores, which further confirm the symmetry of the data.

Table 1: Normal distribution analysis study for students' achievement tests among the three groups.

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Skweness	Df	Sig.	Skwness	df	Sig.
Pre-test achievement	FICA	.209	48	.056	.857	48	.067
	CA alone	.245	48	.065	.824	48	.057
	CG	.229	48	.053	.852	48	.054
Post-test achievement	FICA	.139	48	.07	.924	48	.06
	CA alone	.152	48	.076	.916	48	.53
	CG	.226	48	.065	.839	48	.076

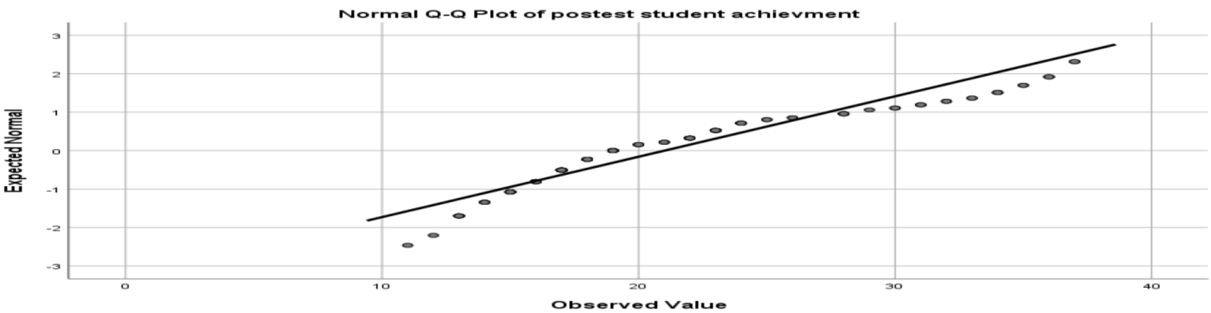

Figure 1: Normal Q-Q Plot of Pre-test Chemistry Achievement Test

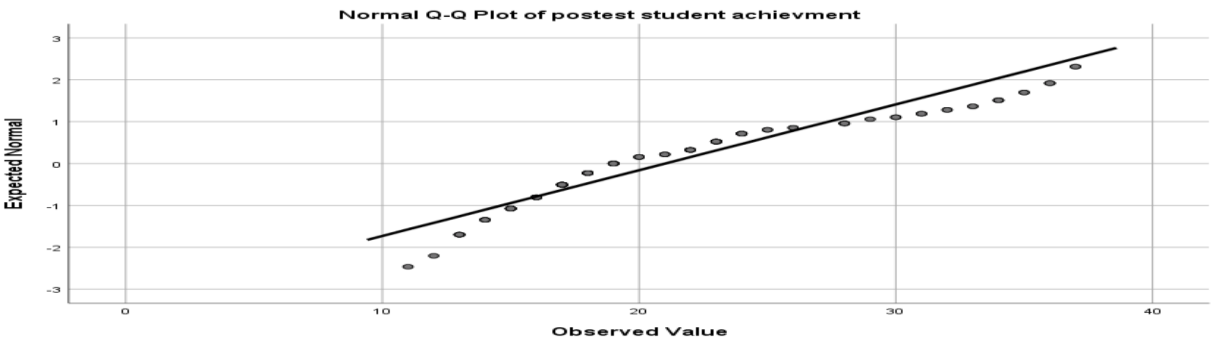

Figure 2: Normal Q-Q Plot of Post-test Chemistry Achievement Test

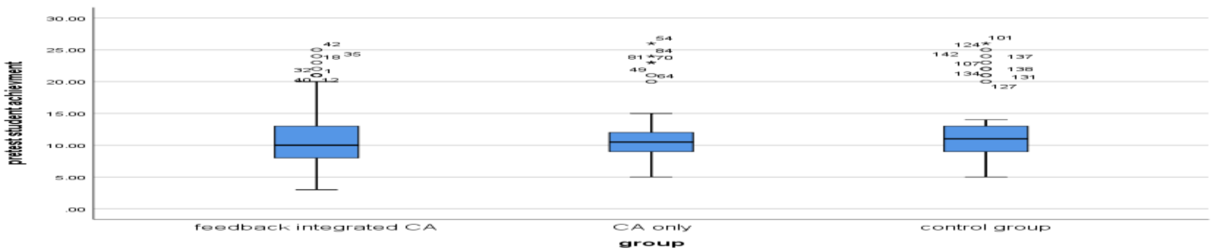

Figure 3: Box Plot of Pre-test chemistry achievement test

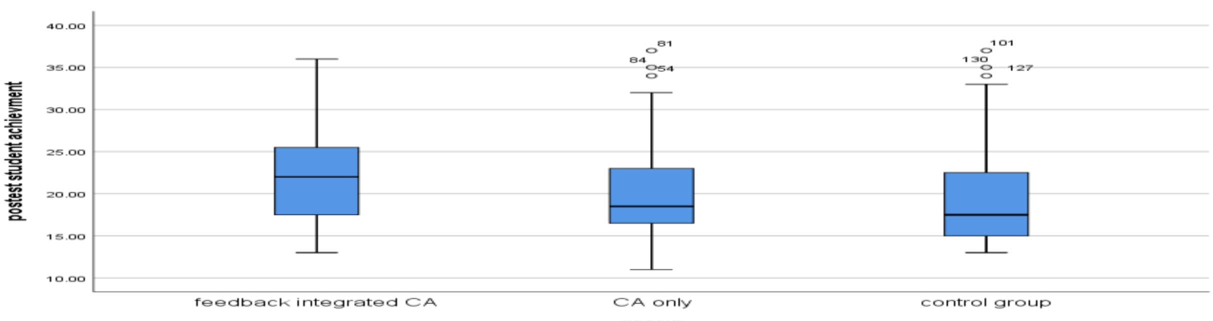

Figure 4: Box Plot of Pre-test chemistry achievement test

4.1.2. Homogeneity of Variance

Homogeneity of variance, a key assumption for the use of parametric tests such as ANOVA, was tested using Levene's test. This assumption ensures that the variance in scores is similar across all groups. The results of Levene's test (Table 2) for the pre-test scores showed a p-value of 0.368, and for the post-test scores, a p-value of 0.855. Both p-values are greater than the significance level of 0.05, indicating that there were no significant differences in variance between the groups. This means that the assumption of homogeneity of variance was satisfied, and the groups can be considered to have equal variances. The satisfaction of this assumption is important as it validates the use of ANOVA in the subsequent analyses, ensuring the reliability and accuracy of the test results.

Table 2: Levene's Test of homogeneity of variances for students' achievement test scores among the three groups.

Dependent variables	Levene Statistic	df1	df2	Sig.
Pre-test achievement test	1.006	2	141	.368
Post-test achievement test	.156	2	141	.855

4.2. Analysis of the pre- test results

Table 3 presents the means and standard deviations for the pre-test chemistry achievement scores across the three groups: Feedback Integrated Continuous Assessment (FICA), Continuous Assessment Alone (CA), and the Comparison Group (CG). The mean score for the FICA group was 11.81 (SD = 5.66), while the CA group scored a mean of 11.42 (SD = 4.95), and the CG group had the highest mean score of 12.10 (SD = 5.66). The overall mean score for all participants was 11.78 (SD = 5.40). Although there were slight variations in the mean scores across the groups, the differences were small, with the CG group performing slightly better on average.

The one-way ANOVA results, summarized in Table 4, indicate that there were no statistically significant differences in the pre-test achievement scores among the three groups, $F(2, 141) = 0.194$, $p = 0.824$, $\eta^2 = 0.03$. The p-value of 0.824 indicates that the differences in scores were not statistically significant, and the effect size ($\eta^2 = 0.03$) suggests that only 3% of the variance in pre-test scores can be attributed to group membership, representing a small effect. This small effect size indicates minimal variation between the groups in their prior knowledge of chemistry. The lack of significant differences in pre-test scores supports the conclusion that the groups were comparable in their chemistry knowledge before the intervention, ensuring that any differences in post-test scores can be attributed to the instructional interventions rather than pre-existing disparities in student knowledge.

In summary, the analysis of pre-test scores confirms that the groups were well-matched in terms of their baseline chemistry achievement, with no significant differences observed. The slight variations in mean scores, including the CG group higher average score, were not sufficient to reach statistical significance. These findings establish a solid baseline for evaluating the effectiveness of the instructional methods used in the study, allowing the researchers to focus on the impact of the interventions on students' post-test performance.

Table 3: Means and standard deviations comparing the three groups on scores of achievement test

Groups	Pre-Achievement test scores		
	N	M	SD
FICA	48	11.81	5.66
CA alone	48	11.42	4.95
CG	48	12.10	5.66
Total	144	11.78	5.40

Table 4: One-way analysis of variance summary table comparing the three groups on scores of Pre-Achievement Test

Source	Df	SS	MS	F	Sig	η^2
Between Groups	11.43	2	5.72	.194	.824	.03
Within Groups	4161.46	141	29.51			
Total	4172.89	143				

4.3. Analysis of the Post-test Results

4.3.1. Effect of FICA on Students' Achievement

Table 5 presents the post-test achievement scores for the three instructional groups: Feedback Integrated Continuous Assessment (FICA), Continuous Assessment Alone (CA), and the Comparison Group (CG). The FICA group achieved a mean score of 25.52 (SD = 4.82), significantly higher than both the CA group, with a mean score of 20.38 (SD = 6.08), and the CG group, which had a mean score of 19.98 (SD = 6.57). The overall mean score for all participants was 21.96 (SD = 6.36), but the FICA group's performance stood out, suggesting that the integration of feedback within continuous assessment strategies may have had a positive impact on students' learning outcomes in chemistry.

The one-way ANOVA results in Table 6 reveal a statistically significant difference in post-test scores among the three groups, $F(2, 141) = 13.32$, $p < .001$, $\eta^2 = 0.16$. The effect size of 0.16 indicates a moderate impact, suggesting that the type of instructional method explained 16% of the variance in students' post-test scores. This substantial effect size highlights the effectiveness of the FICA approach in improving student achievement.

Further analysis using the Tukey HSD post-hoc test, as shown in Table 7, confirmed that the FICA group significantly outperformed both the CA group (Mean Difference = 5.15, $p < .001$) and the CG group (Mean Difference = 5.54, $p < .001$). However, no significant difference was observed between the CA and CG groups (Mean Difference = 0.40, $p = .942$). This finding supports the conclusion that the feedback-integrated approach had a significantly greater impact on students' performance compared to the other two methods.

In summary, these results suggest that the FICA method was significantly more effective than both the CA and CG methods in enhancing students' achievement in chemistry. The absence of significant differences between the CA and CG groups indicates that these instructional approaches were not as effective as FICA in improving student outcomes. These findings emphasize the potential benefits of integrating feedback within the learning process.

Table 5: Means and Standard Deviations of Post-Achievement Test Scores

Groups	Post-achievement scores		
	N	M	SD
FICA	48	25.52	4.82
CA alone	48	20.38	6.08
CG	48	19.98	6.57
Total	144	21.96	6.36

Table 6: One-Way Analysis of Variance (ANOVA) Summary

Source	Df	SS	MS	F	Sig	η^2
Between Groups	2	917.54	458.77	13.32	.000	.16
Within Groups	141	4858.21	34.46			
Total	143	5775.751				

Table 7: Multiple Comparisons Using Tukey HSD

(I) group of students	(J) group of students	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
FICA	CA alone	5.14583*	1.198	.000	2.3077	7.9840
	CG	5.54167*	1.19818	.000	2.7035	8.3798
CA alone	FICA	-5.14583*	1.19818	.000	-7.9840	-2.3077
	CG	.39583	1.19818	.942	-2.4423	3.2340
CG	FICA	-5.54167*	1.19818	.000	-8.3798	-2.7035
	CA alone	-.39583	1.19818	.942	-3.2340	2.4423

*. The mean difference is significant at the 0.05 level.

4.3.2. Effects of FICA on Gender differences

Table 8 provides the means and standard deviations for the post-test scores by gender within each instructional group. In the FICA group, female students (N = 21) achieved a mean score of

25.24 (SD = 4.91), while male students (N = 27) scored slightly higher with a mean of 25.74 (SD = 4.84). In the CA group, female students (N = 22) scored a mean of 20.86 (SD = 7.57), while male students (N = 26) had a mean score of 19.96 (SD = 4.56). In the CG group, female students (N = 20) had a mean score of 19.40 (SD = 5.84), and male students (N = 28) scored a mean of 20.39 (SD = 7.12). Overall, male students outperformed female students in both the FICA and CG groups, while female students outperformed male students in the CA group. These patterns suggest some gender-based differences in achievement, though the overall differences were not substantial.

The two-way ANOVA results, shown in Table 9, further examined the impact of gender and instructional method on achievement test scores. A significant main effect of gender was found, $F(2, 138) = 12.87$, $p < .001$, with a partial eta squared (η^2) of 0.157, meaning that gender accounted for 15.7% of the variance in achievement scores. However, the main effect of instructional group was not significant, $F(1, 138) = 0.040$, $p = .843$, indicating that the type of instructional method did not have a significant impact on students' performance. Additionally, the interaction between gender and instructional group was not significant, $F(2, 138) = 0.33$, $p = .722$, suggesting that the effect of gender on achievement did not differ across instructional methods. The model explained approximately 16.3% of the variance in achievement test scores ($R^2 = 0.163$), with an adjusted R^2 of 0.133, indicating a moderate fit.

In conclusion, the results indicate that gender had a significant effect on achievement scores, with male students generally outperforming female students in the FICA and CG groups, while female students scored slightly higher in the CA group. However, these gender differences were not statistically significant enough to alter the conclusions about the effectiveness of the instructional methods. The lack of significant interaction between gender and instructional method suggests that the impact of gender on achievement was consistent across the three instructional groups. Therefore, while gender differences in achievement were observed, the instructional approach alone did not appear to account for these variations, highlighting the need to consider gender when evaluating student performance, but also suggesting that the method of instruction may not be the sole determinant of achievement.

Table 8: Means and standard deviations for achievement test scores as a function of a gender groups

	Achievement test scores								
	The three levels of group								
	FICA			CA alone			CG		
Gender	N	M	SD	N	M	SD	N	M	SD
F	21	25.24	4.91	22	20.86	7.57	20	19.40	5.84
M	27	25.74	4.84	26	19.96	4.56	28	20.39	7.12
T	48	25.52	4.82	48	20.38	6.08	48	19.98	6.57

Table 9:Two-way ANOVA showing the effects of gender and three level groups on students achievement test scores

Two-way ANOVA results for conceptual test scores						
Predictor	SS	Df	MS	F	P	Partial
Intercept	68103.257	1	68103.26	1944.19	.000	.934
Gender	901.37	2	450.68	12.87	.000	.157
Group	1.39	1	1.39	.040	.843	.000
Gender*group	22.887	2	11.44	.33	.722	.005
Error	4834.03	138	35.03			

a. R-Squared = .163 (Adjusted R-Squared = .133)

4.4. Interpretation of Correlation Findings

The relationship between continuous assessment scores and final examination scores was analyzed using Pearson's product-moment correlation coefficient (r). This method measures the strength and direction of the linear relationship between two quantitative variables.

4.4.1. The Relationship between CA and Post-Test Scores in the FICA Group

In the Feedback Integrated Continuous Assessment (FICA) group, the analysis revealed a strong positive correlation, $r(46) = .829$, $p < .001$. This indicates a highly significant relationship between continuous assessment scores and final post-test scores. Students in this group had an average continuous assessment score of 35.40 out of 40 and an average final post-test score of 22.69 out of 60. The strong correlation suggests that higher continuous assessment scores are associated with higher final post-test scores, indicating that the feedback provided in this assessment format effectively supports student learning in chemistry.

Table 10: Correlation between continuous assessment scores and final post-test scores on FICA group

Assessment modes	N	M	SD	R	Df	Sig.(2-tailed)
Continuous assessment scores	48	35.40	4.40	.829	46	.001
Final post-test scores	48	22.69	6.24			

4.4.2. The Relationship between CA and Post-Test Scores in the CA Alone

In the Continuous Assessment (CA) only group, the correlation was moderate, $r(46) = .429$, $p = .002$. The average continuous assessment score for this group was 43.40 out of 50, while the average final post-test score was 20.40 out of 60. Although this correlation is statistically significant, the moderate strength indicates that continuous assessment scores may not fully reflect students' performance on final examinations. This suggests potential issues with the assessment criteria, such as grade inflation, which could lead to students feeling overconfident and inadequately prepared for their final exams.

In summary, the findings indicate a strong positive relationship between continuous assessment and final examination scores in the FICA group, while a moderate correlation exists in the CA only group. These results highlight the effectiveness of feedback integrated assessments in enhancing student performance, but also point to potential concerns regarding the reliability of continuous assessment scores in the CA only group.

4.5. Analysis of Qualitative Data

To address the fourth research question, a descriptive case study was conducted utilizing two primary data collection methods: semi-structured interviews with participating teachers and classroom observations of three teachers. This mixed-methods approach integrated qualitative data to complement the quantitative findings, allowing for a more comprehensive understanding of the perceptions and practices surrounding continuous assessment.

4.5.1. Coding Process and Formation of Themes

The qualitative data underwent a systematic coding process, where the researcher critically reviewed the interview transcripts and observation notes. Key phrases were highlighted, and codes were assigned to identify emerging themes. This organization facilitated the interpretation of the data, allowing for a clearer presentation of findings related to the research questions.

4.5.2. Interpretation of Interview Data

The analysis of interview data revealed several insights into teachers' perceptions of continuous assessment. Despite challenges such as heavy workloads, large class sizes, and insufficient training, teachers expressed a preference for continuous assessment due to its positive impact on student learning in chemistry. For instance, one teacher noted, "*Despite the many impeding factors... the teachers preferred to practice continuous assessment for it has a salient contribution to the improvement of student learning in the chemistry course*." This sentiment underscores the belief that continuous assessment facilitates remedial instruction and helps track student progress toward learning objectives.

Teachers indicated a preference for both continuous and summative assessment methods, recognizing the distinct roles each plays in the educational process. Continuous assessment was valued for its formative feedback, which aids in improving future performance, while summative assessment was seen as a means to evaluate overall student competence. One teacher articulated this duality, stating, "*Continuous assessment is helpful for giving remedial instruction... while summative helps to check students' competence and attainment of course goals.*"

However, the lack of practical training on implementing continuous assessment was a recurring theme. Many teachers reported receiving theoretical knowledge during their undergraduate studies but lacked guidance on practical application. One teacher remarked, *"I learned about it as a topic in a course... but not how to implement.*" This gap in training highlights a critical area for professional development.

Teachers identified several factors influencing the implementation of continuous assessment, including facilities, learning environments, and personal workload. One teacher noted, "*For reasons of heavy workload, time pressure... and the tendency to believe that the conventional practice... is right.*" This suggests that systemic issues within the educational environment may hinder the effective use of continuous assessment.

Despite these challenges, teachers reported employing various continuous assessment strategies, such as quizzes, group work observations, and feedback on presentations. One teacher described their approach: "*I use questions and answers in the middle of my lectures, incidental quizzes... and individual and group assignment presentations.*" This variety indicates a willingness to engage students actively, despite the constraints they face.

When asked about recommendations for improving continuous assessment practices, teachers emphasized the need for motivation, professional development, and a shift in attitudes toward assessment. They suggested that enhancing awareness and providing training on formative assessment could significantly improve its implementation. One teacher summarized this perspective, stating, "*Continuous assessment is very good for the teaching-learning process... All teachers should apply for quality of learning to occur.*"

4.5.3. Qualitative Results of Classroom Observations

Classroom observations focused on teacher and student interactions, as well as the types of continuous assessments employed. Notably, female students demonstrated higher levels of active participation compared to their male counterparts. Observations revealed that teachers often neglected to introduce lesson objectives and assessment criteria at the beginning of their lessons, which is crucial for setting clear expectations.

During the observed classes, teachers generally adhered to their lesson plans, introducing content and assessment criteria effectively. However, limitations were evident, such as passive student participation and challenges related to classroom size and seating arrangements. The observations indicated that while some students engaged actively, others remained passive, reflecting varying levels of motivation and understanding.

Teachers employed whole-class feedback and self-reflection methods as primary feedback mechanisms, but individual feedback was limited due to the large class sizes. Students were given opportunities to assess their peers' work, yet some exhibited reluctance to participate in this process. This reluctance may stem from a lack of confidence or understanding of the assessment criteria.

Overall, the observations highlighted both the potential and the challenges of implementing continuous assessment in the classroom. While teachers demonstrated a commitment to engaging students through various assessment methods, systemic barriers such as large class sizes and insufficient training hindered the effectiveness of these practices.

In summary, the qualitative analysis reveals a complex landscape regarding the implementation of continuous assessment. Teachers recognize its value in enhancing student learning but face significant challenges that impede its effective use. The findings underscore the need for targeted professional development and systemic changes to support teachers in adopting continuous assessment practices that can lead to improved educational outcomes.

CHAPTER FIVE: DISCUSSION OF FINDINGS

5.1. Assessment Methods

5.1.1. Effectiveness of Feedback-Integrated Continuous Assessment (FICA)

The analysis revealed that students receiving feedback-integrated continuous assessments outperformed those undergoing traditional or continuous assessment-only methods. This finding aligns with Shute's (2008) work, which demonstrated that formative assessments with timely feedback significantly improve student performance. Wiliam (2011) also emphasized the advantages of formative feedback in promoting deeper learning, as it helps students reflect on mistakes and adjust their learning strategies accordingly. The feedback loop in FICA enables students to revise and improve their understanding continuously, something traditional assessments often fail to provide due to their summative nature.

5.1.2. Implications for Educational Systems

Given the significant benefits of FICA, educational systems should prioritize assessment strategies that combine continuous evaluation with timely feedback. This approach can be implemented through digital tools such as automated grading systems, which can provide instant feedback, allowing teachers to offer real-time guidance on student progress. Liu et al. (2021) have highlighted the potential of digital tools in enhancing formative assessments by enabling personalized feedback and reducing teacher workload.

5.2. Gender and Academic Performance

5.2.1. Gender Disparities in Academic Performance

The findings indicated that female students consistently outperformed male students across all assessment types, a trend observed in previous research by Wang et al. (2020), which noted that female students tend to achieve higher academic outcomes. However, unlike the study by Marsh et al. (2021), which suggested that gender influences students' responses to assessment types, the current study found no significant interaction effect between gender and assessment methods. This suggests that both male and female students benefit equally from feedback-integrated continuous assessments.

5.2.2. Implications for Future Research

The absence of an interaction effect between gender and assessment type warrants further exploration. Understanding the factors that contribute to gender differences, such as motivational factors or different study habits, could help tailor interventions to better support male and female students. Future research should investigate how gender-specific approaches to feedback could enhance academic performance.

5.3. Correlation Analysis

5.3.1. Feedback and Academic Performance

The Pearson correlation analysis revealed a strong positive relationship between continuous assessment scores and final exam performance in the FICA group. This supports Hattie and Timperley's (2007) argument that feedback is critical for improving academic performance. The moderate correlation observed in the continuous assessment-only group suggests that feedback plays a crucial role in ensuring that students' ongoing assessments lead to improvements in final exam performance.

5.3.2. Implications for Assessment Practices

The strong correlation between feedback-integrated continuous assessment and final performance emphasizes the need for educators to incorporate feedback into continuous assessment practices. Institutions should consider using digital feedback systems to provide timely, personalized, and constructive feedback that will help students connect their ongoing performance with their final academic outcomes.

5.4. Technology and Feedback

5.4.1. Digital Feedback Tools in Education

The study found that integrating digital tools for feedback delivery could enhance the formative assessment process. Liu et al. (2021) found that digital feedback systems improve the speed and personalization of feedback, providing students with timely responses to help them understand their mistakes. These tools also simplify the data collection process, giving teachers better insights into student progress and informing their instructional practices. The use of technology in feedback delivery can significantly improve the overall effectiveness of formative assessments.

5.4.2. Implications for Future Research and Practice

As digital feedback tools become more common in educational settings, future research should examine their impact on student engagement and academic outcomes. Evaluating the effectiveness of various digital platforms and exploring how they can be optimized for different learning contexts would provide valuable insights into improving feedback mechanisms.

5.5. Discussion of Qualitative Findings

The qualitative findings of the study highlight several important themes related to the implementation and impact of the FICA (Feedback, Instruction, Collaboration, and Continuous Assessment) framework. By organizing the findings into distinct subsections, we delve deeper into the themes of Feedback, Instruction, Collaboration, and Continuous Assessment.

5.5.1. Enhancing Student Learning

Feedback emerged as one of the most crucial elements in improving student learning outcomes. The majority of teachers in the study emphasized the need for timely, specific, and actionable feedback. One teacher shared, “Feedback helps me see where my students are struggling and what they need to work on next.” This statement underscores the centrality of feedback in guiding students through their learning journey.

However, challenges related to providing meaningful feedback were also noted. Many teachers expressed concerns about the time and effort involved in delivering individualized feedback for each student, especially in large classes. As one participant explained, “It’s difficult to give detailed feedback to every student with the limited time I have.” This aligns with the findings of Hattie and Timperley (2007), who highlight that while feedback is essential for improving student performance, its impact is limited if it is not delivered in a timely and structured manner.

5.5.2. Personalizing Teaching through Continuous Assessment

Instructional strategies were found to be closely linked to the data provided through Continuous Assessment (CA). Teachers reported that CA allowed them to identify gaps in student understanding and adjust their teaching accordingly. One teacher noted, “With CA, I can pinpoint exactly where my students are struggling and adapt my lessons on the spot.” This ability to tailor instruction is consistent with Nicol and Macfarlane-Dick's (2006) assertion that formative assessment can enhance instructional quality by providing real-time insights into student progress.

Despite the positive aspects of CA, some educators highlighted challenges with the volume of data that needs to be analyzed. Teachers were concerned about balancing the demands of CA with other instructional responsibilities. As one participant mentioned, “It’s hard to keep up with analyzing all the data and preparing my lessons at the same time.” This concern echoes the limitations outlined by Shute (2008), who notes that while formative assessment can significantly improve instruction, the process of collecting and analyzing data can become overwhelming without proper support and resources.

5.5.3. Fostering Teacher Support and Confidence

Collaboration was identified as a significant factor contributing to the successful implementation of FICA. Many teachers noted that engaging in collaborative activities, such as sharing feedback strategies and assessment techniques, made them feel more confident and supported. One teacher shared, “Collaborating with colleagues has been invaluable. We share strategies for feedback and assessment, and it’s helped me improve my teaching.” The importance of collaboration is also emphasized by Wiliam (2011), who suggests that teacher collaboration leads to improved teaching practices and better student outcomes.

The impact of Professional Learning Communities (PLCs) was also highlighted. Teachers participating in PLCs focusing on FICA principles reported increased confidence and enhanced teaching practices. As one participant noted, “Our PLC meetings have been incredibly useful in helping us refine our feedback techniques and assessment strategies.” This reflects the findings of Liu, Dede, and Hwang (2021), who found that PLCs provide a structured way for teachers to share and refine teaching strategies, leading to more effective classroom practices.

5.5.4. Continuous Assessment

Continuous Assessment (CA) was viewed as a transformative tool for monitoring student progress over time. Teachers appreciated the ability to track student performance in real-time and make adjustments to their instruction. As one teacher remarked, “With CA, I feel more in control of my students’ progress because I’m able to continuously assess their understanding.” This perspective aligns with Adnan and Anwar (2020), who argue that CA enables teachers to make more informed decisions about student learning.

However, concerns about CA becoming overwhelming were also prevalent. Some educators expressed worries about the potential for excessive workload, particularly when managing a large number of assessments. One participant mentioned, “If I’m constantly assessing, I worry that it will take time away from actual teaching.” This concern is in line with the findings of Wiliam (2011), who stresses that while continuous assessment can provide valuable insights, it must be implemented in a way that does not overwhelm teachers or students.

CHAPTER SIX: CONCLUSION, RECOMMENDATION AND IMPLICATION

6.1. Conclusion

The findings of this study underscore the significance of integrating Feedback, Instruction, Collaboration, and Continuous Assessment (FICA and CA) into the Ethiopian education system. Despite the challenges that teachers face, such as limited resources and large class sizes, the potential benefits of these approaches in improving student learning outcomes are clear. By prioritizing FICA and CA, educators can create a more dynamic, engaging, and supportive learning environment that caters to the diverse needs of students. The study's results indicate that effective feedback, personalized instructional strategies, and collaborative teaching practices can drive significant improvements in student engagement and achievement. However, the successful implementation of these strategies hinges on addressing the challenges related to teacher training, resource constraints, and the need for time-efficient practices. Future research should focus on exploring how to overcome these obstacles, particularly through targeted professional development, resource allocation, and policy reforms that support the integration of FICA and CA in classrooms across the country.

6.2. Recommendations

1. Professional Development

To equip teachers with the necessary skills for effectively implementing FICA and CA, it is crucial to develop professional development programs that focus on these principles. Workshops, seminars, and training sessions should provide teachers with practical strategies for delivering feedback, using assessment data to inform instruction, and fostering collaboration among educators. Incorporating case studies from similar educational contexts can help teachers relate to the challenges faced in the Ethiopian setting. Furthermore, mentorship programs should be established to pair experienced teachers with less experienced ones, offering peer support and guidance on implementing FICA and CA practices. These mentorship programs should include regular evaluations to track teacher progress and ensure sustained professional growth.

2. Resource Allocation

Given the limited resources available, the Ethiopian government and educational authorities should prioritize cost-effective solutions to support the integration of FICA and CA. For example, open-source software platforms for assessments and feedback could be introduced as an affordable option for schools. These platforms could be rolled out in phases, starting with a select number of schools, to assess their effectiveness and feasibility. Additionally, it is essential to involve teachers in the development of assessment tools that align with the FICA framework. Collaborative development of these tools ensures that they are practical, culturally relevant, and adaptable to local educational contexts.

3. Collaboration Platforms

Creating formal platforms for teacher collaboration is vital for the successful implementation of FICA and CA. Professional Learning Communities (PLCs) can serve as a space for educators to regularly meet, share resources, discuss challenges, and develop strategies to improve teaching practices. PLCs can include peer reviews of lesson plans, collaborative problem-solving sessions, and workshops focused on FICA principles. Moreover, when face-to-face meetings are not feasible, digital platforms should be considered for facilitating collaboration between schools in different regions. These online platforms can provide a space for teachers to exchange best practices, resources, and successful strategies, overcoming logistical challenges and ensuring continued professional engagement.

4. Student-Centered Assessment Practices

To foster a more engaging and effective learning environment, educators should adopt formative assessment strategies that allow for real-time feedback and student involvement in the learning process. Techniques like think-pair-share or quick quizzes enable teachers to gauge student understanding and provide immediate feedback, which helps students engage more actively with their learning. Additionally, gathering student input through surveys or reflective journals can help students set learning goals and reflect on their academic progress. This process of involving students in their own assessment promotes self-regulation, increases motivation, and enhances overall academic performance.

6.3. Implications

1. Enhanced Teacher Collaboration

The study emphasizes the importance of collaboration among teachers, and the findings suggest that such collaboration can significantly improve instructional practices. For example, when teachers share lesson plans and strategies, they reduce preparation time and improve the delivery of content. Collaborative activities, such as peer reviews or joint lesson planning, can strengthen the teaching community, promote the sharing of best practices, and lead to better educational outcomes for students. By working together, educators can support one another in overcoming challenges, ultimately creating a more cohesive and effective educational environment.

2. Alignment with National Educational Goals

The integration of FICA and CA directly aligns with Ethiopia's national educational goals, particularly those focused on improving literacy, numeracy, and overall academic performance. By incorporating continuous feedback and assessment into the teaching process, FICA and CA support these goals by promoting ongoing student engagement, personalized learning, and the development of critical skills. As Ethiopia continues to invest in educational reform, the adoption of FICA and CA principles can serve as a foundational strategy for enhancing the quality of education and improving student outcomes nationwide.

3. Long-Term Educational Reform

The successful implementation of FICA and CA can play a critical role in driving long-term educational reform in Ethiopia. The shift towards continuous assessment, feedback, and collaborative teaching can transform traditional, rote learning practices into more dynamic, student-centered approaches. However, to ensure the success of these reforms, they must be phased in gradually. Piloting FICA and CA in select schools will provide valuable insights into the challenges and benefits of these approaches, allowing for necessary adjustments before nationwide implementation. Over time, these reforms will help prepare students for the challenges of the 21st century, equipping them with the skills needed to compete in a rapidly evolving global job market.

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APPENDIX

Appendix 1: Achievement Test

Medhanealem Preparatory School
Department of Natural Science
Chemistry Grade 11 Mid-Exam

Instruction: There are 40 multiple choice questions. Each question has one correct answer. Select the correct answer and write it on the space provided.

______1. The derived quantity among the following is

A. Current B. Length C. Volume D. Time

______2. The volume of an irregular object is 460μL. This volume in cm^3 is:

A. 0.046 B. 0.46 C. 4.6 D. 46

______3. Which of the following branch of chemistry is usually concerned with quality control in such fields as foods, pharmaceuticals and safe water?

A. Physical chemistry C. Biochemistry

B. Analytical chemistry D. Inorganic chemistry

______4. The true value of the density of water is 1.0g/mL at 4^0C and 1atmosphere. Student X and Y determined the density of water at the same conditions and obtained the following value in g/ml

Student	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Average
X	0.91	0.92	0.90	0.88	0.89	0.91	0.90
Y	1.10	0.99	1.01	0.97	0.91	1.03	1.00

Which of the following is **not true** about measurements made by students X and Y?

A. Student X has made precise measurement

B. Student Y has made accurate measurement

C. The uncertainty of student X is less than student Y

D. The errors reported by student X are random errors

______5.The correctly reported difference of 17.6732 and 7.19 will have a significant figure equal to

A. 3 B. 4 C. 5 D. 6

______6. All of the following are measuring equipment in the laboratory. EXCEPT

A. Pipettes B. burettes C. iron stand D. balance

______7. The tentative explanation of an observation is

A. Theory C. Hypothesis

B. Law D. Observation

______8. Five coins were dropped into a graduated cylinder containing 20.20 mL of water. The volume of the water increased to 20.30 mL. A single coin had a mass of 0.99 g. What is the identity of the metal used for the coins?

Density of aluminum = 2.7 g/mL density of copper = 9.09 g/mL

Density of zinc = 7.1 g/mL density of silver = 10 g/mL

A. Aluminum B. zinc C. copper D. silver

_____9. What is the Kelvin scale (K) corresponding to the temperature readings when degree Celsius (^{0}C) is identical to Fahrenheit (^{0}F)?

A. 0K B. 37K C. 233K D. 273K

______10. According to Bohr's atomic model

A. Electron in an atom of hydrogen can have only certain allowable energy levels
B. Electron has particle as well as wave character
C. Atomic spectrum of an element should contain only five lines
D. It was successful in accounting for the spectral lines of multi-electrons atoms

______11. Which of the following **cannot** be used to define the electron configuration of an atom or ion?

A. Aufbau principle C. Hund's rule

B. Heisenberg's principle D. Pauli's exclusion principle

______12. The threshold frequency of a metal is 1 x $10^{14}s^{-1}$. The ratio of the maximum kinetic energies of the photoelectrons when the metal is irradiated with a radiation of frequencies 1.5 x $10^{14}s^{-1}$and 2.0 x 10^{14} s^{-1} respectively would be

A. 1 : 2   B. 2 : 1   C. 2 : 3   D. 3 : 2

______13. Given periodic properties:

I. Ionization energy   II. Atomic size   III. Metallic character

Which of the following generally increase down a give group in the modern periodic table?

A. I only   B. I and III   C. II and III   D. I, II, III

______14. Which of the following electromagnetic radiation has the longest wavelength?

A. Ultraviolet   B. Infrared   C. X-ray   D. Microwave

______15. Which of the following is **true** about isotopes of an element?

A. They have different valence electron configuration

B. They have same mass number

C. They have different neutron number

D. They have same atomic number

______16. Which of the following ion/atom has the highest number of unpaired electrons?

A. ${}_{25}Mn$ B. ${}_{24}Cr^{3+}$ C. ${}_{29}Cu$ D. ${}_{26}Fe^{2}$

______17. Which electronic transition in hydrogen atom is accompanied by minimum absorption of energy?

A. n = 4 to n = 5   C. n = 1 to n = 2

B. n = 3 to n =4   D. n = 2 to n = 3

______18. The maximum number of electrons when n = 4 and m_1=-1 is

A. 8   B. 16   C. 6   D. 32

______19. The four quantum numbers for the valence electron of rubidium are

A. 5, 0, 1, $\frac{1}{2}$ C. 4, 0, 0,$\frac{-1}{2}$

B. 5, 0, 0,$\frac{1}{2}$ D. 4, 0, 1, $\frac{-1}{2}$

______20. Which of the following would produce a line spectrum rather than a continuous spectrum?

A. Excited hydrogen atom   C. A normal filament light bulb

B. Sunlight   D. A yellow sodium street light

______21. The group and period of an element with atomic number 24 respectively are:

A. VB, 4   B. IVB, 4   C. VIB, 4   D. VIIB, 4

______22. If E is the kinetic energy of the particle then which of the following expressions is correct for de Broglie wavelength of the particle?

A. $\lambda = \frac{h}{2mE}$

C. $\lambda = \sqrt{\frac{h}{2mE}}$

B. $\lambda = \frac{h}{\sqrt{2mE}}$

D. $\lambda = \frac{\sqrt{2mE}}{h}$

______23. Given the reaction: $^{238}_{92}U \rightarrow X + ^{234}_{90}Th$, X is

A. Alpha particle

C. Gamma ray

B. Beta particle

D. X –ray

______24.All of the following **are wrong** about the properties of ionic compounds except:

A. They conduct electricity in molten state

B. They are usually soluble in water

C. They are aggregations of atoms

D. They have high melting point

______25. Which of the following compounds has both ionic and covalent bonds?

A. $CaCl_2$

C. NCl_3

B. $NaNO_3$

D. NaCl

______26. All of the following species have resonance structure except:

A. SO_3

C. CO_3^{2-}

B. NO_2^-

D. H_2O

______27. The type of bond formed when both shared electrons are contributed from one atom is:

A. Ionic bond

C. Covalent bond

B. Coordinate covalent bond

D. Hydrogen bond

______28. Which of the following molecules has the same molecular shape and electron pair arrangement?

A. H_2O

C. AlH_3

B. CH_3^-

D. NH_3

______29. Which of the following **is true** about metallic bond?

A. As number of valence electrons increase strength of metallic bond decreases

B. As size of metal increases, strength of metallic bond increases

C. Metallic bond is responsible for the physical properties of metals

D. In metallic bond, there is transfer of electrons.

______30. What type of hybridization is used by sulfur in SF_2?

A. sp^3 C. sp^3d^2

B. sp^3d D. sp^2

______31. Which one of the following is the most stable?

A. O_2 B. O^+_2 C. O^-_2 D. O^{2-}_2

______32. Which of the following is an example of molecular crystal?

A. Ag C. SiO_2

B. NaCl D. $C_{12}H_{22}O_{11}$

______33. Which of the following ionic compound has the largest lattice energy?

A. MgF_2 B. CaF_2 C. NaF D. KF

______34. How many sigma and pi (**π**) bonds are present in toluene ($C_6H_5CH_3$)?

A. 3**π**and 8 sigma bonds C. 3 **π**and 10 sigma bonds

B. 3 **π**and 15 sigma bonds D. 6 **π**and 3 sigma bonds

_______35. A crystal does not conduct electricity, yet its melt and aqueous solution do. It is hard, brittle and melts at a high temperature. What type of crystal is it?

A. A molecular crystal C. A metallic crystal

B. A covalent (network) crystal D. An ionic crystal

_____36. Two elements W and X are found in group IIA and VA respectively. The formula of the ionic compound formed between W and X is

A. WX B. W_3X_2 C. W_5X_2 D. W_2X_3

______37. The kinds of orbitals that overlap to form the carbon –carbon bond in CH_3CN molecule is:

A. $sp^2 – sp$ C. $sp^2 – sp^2$

B. $sp^3 – sp$ D. $sp^3 – sp^2$

______38. Which set contains only covalently bonded molecules?

A. BCl_3, $SiCl_4$, PCl_3 C. I_2, H_2S, NaI

B. NH_4Br, N_2H_4, HBr D. Al, O_3, $AsCl_3$

______39. Which term describes the units that make up compounds with covalent bonds?

A. ions B. acids C. salts D. molecules

______40. The order of O-O bond length in O_2, H_2O_2, and O_3 is

A. $O_2 > H_2O_2 > O_3$

B. $H_2O_2 > O_3 > O_2$

C. $O_3 > H_2O_2 > O_2$

D. $O_2 > H_2O_2 > O_3$

Appendix 2: Interview and Observation Checklist

(i) Interview

Interview guide

Dear Respondent,

My name is Biruk Gemechu! I am a postgraduate student at Mekele University, conducting a research thesis with topic: ***Impact of Feedback-Integrated Continuous Assessment on grade 12 students' chemistry achievement: The case of Medhanealem Preparatory School, Addis Ababa, Ethiopia***. The purpose of the research is to investigate whether and to what extent feedback integrated continuous assessment influenced the natural science learners' chemistry achievement and for partial fulfilment of the requirements for Master of science degree in Chemistry. This interview is, therefore, designed to collect the necessary primary data for the purpose mentioned above.

Thank you for your time!!

Background

1. Tell me about your background and work experience?

Subject specific Interview Questions:

1. Can you describe your experience with feedback-integrated continuous assessment compared to continuous assessment without feedback?
2. How did the inclusion of feedback impact your teaching and students' learning?
3. What challenges did you encounter while implementing feedback-integrated continuous assessment, and how did you address them? Were there any notable differences in student engagement or performance?
4. In what ways did you adjust your instructional strategies based on the feedback received through the feedback-integrated continuous assessment?
5. Were there specific examples where feedback led to significant changes in your teaching approach?

6. How did students respond to the feedback provided in the feedback-integrated continuous assessment group compared to the continuous assessment without feedback group? Did you notice any differences in their motivation or learning outcomes?
7. Finally, reflecting on both treatment groups, what recommendations would you offer to other educators who are considering implementing feedback-integrated continuous assessment or continuous assessment without feedback in their classrooms.

(ii) Observation Checklist

Classroom Observation Checklist
Observer Name: ________
Date: ________
Class/Subject: ________
Teacher Name: ________
Observation Time: ________

1. Teaching Practices

Feedback-Integrated Continuous Assessment:
Feedback Delivery:
  A. Is feedback provided to students during the lesson?
  B. Are multiple forms of feedback used (e.g., verbal, written, digital)?
  C. Are students given opportunities to discuss or seek clarification on the feedback?
- Instructional Adjustments:
  A. Are there observable changes in instructional strategies based on feedback received?
  B. Are any lesson modifications or new activities introduced in response to feedback?
Continuous Assessment without Feedback:
- Feedback Absence:
  A. Is there a lack of direct feedback provided to students during the lesson?
  B. Does the teacher rely solely on general assessment without specific feedback?

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2. Student Engagement and Interaction

Feedback-Integrated Continuous Assessment:
- Response to Feedback:
  A. Are students actively engaging with the feedback provided?
  B. Do students show motivation to improve based on the feedback?
  C. Are there visible changes in student work or behavior following feedback?
Continuous Assessment without Feedback:
- Engagement Levels:
  A. Are students less engaged or motivated in the absence of feedback?
  B. Is there a noticeable difference in student participation compared to feedback-integrated approaches?

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3. Student Performance and Learning Outcomes
Feedback-Integrated Continuous Assessment:
- Performance Improvement:
  A. Are there observable improvements in student performance or understanding?
  B. Can specific examples of enhanced work quality following feedback be identified?
Continuous Assessment without Feedback:
- Performance Monitoring:
  A. Are there any gaps or stagnation in student performance observable without feedback?
  B. Is student learning consistent, or are there signs of struggle due to the lack of feedback?

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4. Classroom Environment
Feedback-Integrated Continuous Assessment:
- Feedback Resources:
  A. Are resources or materials related to feedback visibly present in the classroom?
  B. Is the environment set up to facilitate feedback discussions (e.g., feedback boards, suggestion boxes)?
Continuous Assessment without Feedback:
- Resource Availability:
  A. Is there a noticeable absence of feedback-related resources or tools?

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5. Interaction Patterns
Feedback-Integrated Continuous Assessment:
- Teacher-Student Interaction:
  A. Are teacher-student interactions frequent and focused on discussing feedback?
  B. How is feedback communicated and engaged with during these interactions?
Continuous Assessment without Feedback:
- Interaction Nature:
  A. Are teacher-student interactions less centered around assessment outcomes?
  B. Is there reduced communication about student performance or progress?
Additional Observations:
- General Classroom Atmosphere:
____
- Notable Incidents or Examples:

____
____

Overall Impression:
A. Does the classroom environment support effective feedback practices?
B. Are there observable differences in teaching effectiveness and student outcomes between the two assessment approaches?
Notes/Comments:
____
____
____