

PEER ASSESSMENT FRAMEWORK TO SUPPORT GROUP-BASED ASSESSMENT IN E-LEARNING ENVIRONMENT FOR HIGHER INSTITUTIONS OF LEARNING

BY

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AUGUST, 2025

DECLARATION

I declare that I am the author of this work and that any assistance I received in its preparation is fully acknowledged and disclosed in this paper. I have also cited any sources from which I used data, or ideas, either quoted directly or paraphrased. I also certify that this research thesis was prepared by me for the partial fulfillment of the requirements of a Doctorate of Philosophy in Computing by Research at Mbarara University of Science and Technology.

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APPROVAL

We approve that the research work culminating in this Thesis titled "Peer Assessment Framework to Support Group-based Assessment in E-learning Environment for Higher Institutions of Learning" is done under our guidance and supervision.

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...

DEDICATION

This work is dedicated to my dear wife Mrs. Ruth Komuhangi Kalema; and to my mother, Mrs. Jovlet Tukahirwa; and my lovely daughters Nissi Kirabo and Shalom Mukisa; and my sister Sarah Nakanda for their love and support, and pushing me hard and standing tall and straight every day.

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ABBREVIATIONS AND ACRONYMS

BSU	:	Bishop Stuart University
CMS		Course Management System
CVI	:	Content Validity Index
DOI	:	Diffusion of Innovation
ICT	:	Information and Communication Technology
IT	:	Information Technology
KB	:	Kabale University
LMS	:	Learning Management System
MOODLE		Modular Object-Oriented Dynamic Learning Environment
OPRA	:	Online Peer Review and Assessment
PA	:	Peer Assessment
REC	:	Research Ethics Committee
SEM	:	Structural Equation Modeling
SPSS	:	Statistical Package for Social Science
TOE	:	Technology, Organization and Environment
TPB	:	Theory of Planned Behaviour
TRA	:	Theory of Reasoned Action
TRAM	:	Technology Readiness and Acceptance Model
UNCST	:	Uganda National Council for Science and Technology

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ABSTRACT

Online learning in higher education faces challenges in fostering meaningful student interactions, particularly in group-based assessments. Key issues include coordinating group participation, uneven student engagement, difficulty measuring individual contributions, high failure rates due to lack of material engagement, unclear instructions, and poor group relationships. Peer assessment is an effective approach to support group work but existing frameworks, primarily developed outside Uganda, have limitations. These include inadequate support for managing group assessments, addressing bias and fairness, providing effective feedback, and integrating with online learning platforms. These shortcomings hinder student engagement, feedback quality, and collaborative learning outcomes. This study proposes a new peer assessment framework to address these issues, enhance group-based assessments, and improve student interactions in online learning environments. The study applied case study design and human-centered design approaches closely examine the data collected. The framework was evaluated using DeLone and Maclean model questionnaire on experts and to achieve the objectives, employed a mixed-methods research approach. The study revealed key obstacles faced by participants while conducting group-based assessment online and include; Technical problems were the most significant issue, affecting 62.8% of respondents, emphasizing the need for reliable technology. Communication tool limitations were reported by 23.5%, indicating that existing platforms may not fully support effective feedback and interaction. Additionally, 13.7% of students struggled with group coordination, often due to scheduling conflicts, fairness concerns, or differing communication styles. In conclusion this study contributes to the growing body of research The study highlights challenges in Uganda's higher education institutions with group-based assessments in online learning, including low student engagement, difficulty measuring individual contributions, and high failure rates due to limited interaction with course materials. A new peer assessment framework was designed to address these issues, tailored to Uganda's online learning context, with improved management tools, bias mitigation, and enhanced feedback mechanisms. The study recommends adopting a tailored peer assessment framework in Uganda's higher education to enhance group-based assessments by improving management, fairness, feedback, and collaboration, with suggestions for training, scalable integration, and future research on its adaptability and AI augmentation.

CHAPTER ONE
INTRODUCTION

1.0 Introduction

This chapter introduces the background of the study detailing the statement of the problem, our research objectives, the significance of the study, and the scope of the study.

1.1 Background to the study

The high rate of population growth in Uganda has increased the demand for higher education. The demand is not proportionate to the number of higher education institutions and corresponding infrastructure in Uganda (Mayende *et al.*, 2015). Online learning can cater to the increasing demand for higher education, the students do study autonomously from their workplaces or homes online. Despite using this learning model, online learning practitioners use learning group activities such as student group-based assessments to enhance collaborative and cooperative learning. In online learning, student activities can be achieved if learners are compelled to come together and virtually connect with other members to learn collaboratively (Alcarria *et al.*, 2018).

In the assessments, students are required to work in groups that are incorporated at different levels of higher education to enhance learning and there is evidence to suggest that students' perception of peer assessment can have an impact on their learning and work. One approach to incorporating assessment into the learning process is to move away from focusing primarily on summative assessment, which occurs at the end of a course and is often teacher-led, and instead prioritize formative assessment according to Sridharan and Boud, (2019). Formative assessment happens continuously throughout the course, it encourages students to engage in the subject matter, which helps them become familiar with the information they are attempting to learn.

Studies also indicate that formative assessment is particularly effective in online courses, as it not only evaluates and supports learners, but also collects feedback that can be used to enhance the quality of the course. (Demir, 2018; Demosthenous, Panaoura, & Eteokleous, 2020) These studies further emphasize that incorporating formative assessment into online courses can provide valuable insights and promote continuous improvement.

Using supportive tools, teachers can effectively track and evaluate students' progress in formative assessment, which is closely linked to the learning process and includes various learning activities that enable teachers to assess students' academic progress through multiple evaluations that take into account contextual factors, allowing for a comprehensive evaluation

of different aspects of the learner rather than just their knowledge. In doing so, teachers can provide a more holistic evaluation that considers the broader context of a student's learning journey according to (Jaime *et al.*, 2016)

The main purpose of groupbased assessment is to develop a collaborative skill which is a highly sought-after skill by most employers around the world (McKenzie, Pelliccione, & Parker, 2008; Kearney, 2013; Limpanuparb *et al.*, 2021). However, working in a group does not always ensure that all participants cooperate and collaborate effectively toward accomplishing a shared goal, especially in higher education, because, both the students and teachers encounter challenges in succeeding with the group work and therefore, receive negative experiences.

There is a great need for frameworks comprised of key principles and approaches supporting effective formative assessment and, more specifically group assessment and feedback that leverage the functionalities of technology in collaborative online environments.

Even though, collaborative learning pivots on the belief that knowledge is socially constructed, each learner has control over his/her learning. The increase of ICT in teaching and learning has created new possibilities for supporting collaborative and cooperative learning in distance learning (Muyinda, Mayende, and Kizito, 2015), as we define Collaborative learning as instructional methods that encourage students to work together to find a common solution for a given task and occurs where there are interactions.

Collaborative group assessments can increase the productivity and performance of individual students by deepening their understanding of the subject area. Anderson(2016) in his online learning framework argues that for meaningful learning to happen, there must be student-teacher; student-student, and student-content interactions (Mota *et al.*, 2019). Collaborative group activities are essential to encourage information sharing, knowledge acquisition, and skill development (Surahman *et al.*, 2019).

This set-up of formative assessment approach for peer assessment can enhance interactions in online learning peer groups hence leading to meaningful learning.

Peer assessment can be a valuable learning tool in the education sector because it supports students in acquiring skills that are essential in their professional working lives. It is also a potentially promising pedagogical approach for enhancing e-learning and supporting the student in self-regulated learning. In contrast, Instructors still have the traditional approach to the evaluation of their students' assessments and most of these approaches exclude the opinion of the student's peers (Chai, Tay and Lim, 2015).

Peer assessment can be conducted in the context of individual or group assessments, with the latter taking on three possible forms: intragroup, where each member of the group evaluates

the performance or contribution of other group members towards the shared product; intergroup, where one or more members from one group assess the performance or product of another group; and extra group, where individuals who are not members of a group evaluate the performance or product of one of the groups (Kritikos *et al.*, 2011; Kritikos Ph.D. *et al.*, 2011; Saputra, Mertasana & Rahardjo, 2020).

In this learner-centered method, the role of a teacher has become more of a mentor or a guide who facilitates this self-motivated process of learning and supports the active process of knowledge discovery and developing skills for future employability.

Different scholars argue that a person's learning may be enhanced through engagement or interactions with others, and peer assessment has been widely used as a formative assessment that enhances learning and critical thinking (Chai, Tay, and Lim, 2015; Surahman *et al.*, 2019; Chen *et al.*, 2020). Therefore, effective ways of engaging learners online can offer possibilities for enhanced interactions among students.

In a survey report on employment skills of youth graduates carried out by Makerere University Uganda team rated teamwork and critical thinking as the top two skills required by employers (MUK 2018), and therefore concluded that group work assessment is unarguably one of the important assessment strategies for the 21st-century curriculum that prepare students for the future workforce.

Learners who accepted this process of evaluation believed that the quality of their work improved as a result of the peer assessment, despite a possible socio-emotional discomfort. The correlation between students' assessment grades (peer assessment) and teacher42 assessment has been inconclusive. For instance, Sadler and Good (2006) found that when grading themselves, lower-performing students tended to inflate their low scores. However, many studies show a significant correlation between peer assessment scores and teacher centered assessment scores (Alias et al., 2015; Mehrdad, et al. 2012). On the other hand, some international studies found that a well-organized and systematic peer assessment can provide reliability and validity to the assessment process (Falchikov, 2000; Sande & Llorent, 2014).

Peer assessment can be highly context-specific (Winstone, 2020). Nevertheless, promising results referring to formative assessment strategies in digital formative assessment were reported in studies conducted in various countries. For example, the research of Petrovic, Pale, and Jeren with undergraduate engineering students in Croatia found that the participants used the available online formative assessments by choice and that elaborated feedback aided by digital formative assessment led to better exam results (Petrovi´c, 2017).

In South Africa, a study on peer assessment conducted by Baleni concluded that effective digital formative assessment encouraged student-centered learning through formative feedback and enriched learners' commitment (Baleni. 2015)(Paterson and Prideaux, 2020; Assia and Samira, 2023a, 2023b).

Some peer assessment schemes have been reported in the literature (Chen & Lou, 2004), all wrapping an organized system where students rate their own and peers' contributions, and the average ratings are consequently used to moderate team marks to reflect individual differences. The schemes differ from each other and emphasize different goals. However, in almost all of them, a mathematical formula is used to calculate mark-weighting factors.

(Williamson and Paulsen - Becejac, 2018) mentioned that paper-based peer assessment has fewer advantages than online peer assessment, in other words, application of technology makes the evaluators comment freely without any restriction of time and location, also providing a chance for direct connection between them. This, in the current 21st century, use of technology is very rapid. On the Internet, social networking sites are most visited from all around the world, especially by the young generation.

Several scholars recognized that immersing students in higher-order thinking helped boost their skills and judgment and suggested a reciprocal peer assessment method to aid the students in cultivating the marking criteria and educate themselves by examining their peers' works and observing the peer assessment method closely as it is believed to have an impact on personal feedback and interactive course-work, along with being expandable. Thus online peer assessment has determined adequate feedback within a short period as compared to the traditional methods, and hence several online peer review and assessment (OPRA) have been escalated to enable the automation of peer assessment and augment the procedure(Gweon *et al.*, 2011; Saraç and Karakelle, 2012; Williamson and Paulsen - Becejac, 2018).

Adachi *et al.* (2017) emphasized the benefits of peer assessment through an interview process in academics which strongly revealed that peer assessment is a powerful tool in constructing a student's mind positively and showed evidence that peer feedback enhanced student learning and proved the effectiveness by integrating peer assessment with technology i.e. via learning management systems and social media platforms.

Within a peer assessment process, learners can take on two different roles: that of the assessor or the assessee. Research suggests that learners tend to prefer the role of the assessor and find it to be more valuable. Additionally, studies have shown that learners benefit more from being assessors than they do from being assessed. Providing feedback and comments is considered

to be a more effective approach for assessors than simply assigning a numerical score or grade. (Tillema, et al., 2011).

Incorporating collaborative learning through peer assessment is essential for student interactions, but implementing it in an e-learning environment can be challenging for teachers. In this study we utilized Moodle, an LMS (learning management system) platform, to facilitate the implementation of learning activities and assessment and ensure equitable access to quality learning design for all students and teachers. Moodle is a flexible and user-friendly open-source learning management system that offers robust support for the governance and security of the learning environment. It has a wealth of useful documentation and is developed according to IMS/SCORM standards. With a vast array of modules and plugins, Moodle provides support for a diverse range of learning activities and assessment formats (Saputra, Mertasana, & Rahardjo, 2020).

Using peer assessment can improve interactions in group-based assessment in the online learning environment for Universities. Most group-based assessment frameworks (Alcarria *et al.*, 2018) are not based on learning outcomes and interactions but on grading criteria and assessment rubrics of students.

Conceptual tools and frameworks to date in the literature have lacked clear model support and high-level guides for educators as to how they can plan their lectures effectively based on digital formative assessment (Saputra, Mertasana, & Rahardjo, 2020). Thus, frameworks are needed to help educators engage in pedagogical planning for their unique classroom environments. This study attempted to address this gap and help educators intentionally use digital tools and formative assessment strategies to improve interaction and promote effective group-based assessments in online environments.

1.2 Problem statement

In higher education, online learning environments present unique challenges for promoting meaningful interactions among students in universities.

There are several challenges in Uganda's higher institutions of learning and these include; co-locating students and participation of each group member in the group assessment (Swan, 2017; Donelan and Kear, 2024) low and uneven participation by students in the group assessment where 20–35% of students are often non-participants (Mayende *et al.*, 2015) , and their names are attached to the activity. Also, there are high failure rates at the end of the final summative assessment say exam since many students do not engage with the course materials to do the group assessment, and measuring individual contributions may be difficult and time-

consuming for lecturers and, a lack of clarity and preparation for students, and poor relationships.

Peer assessment is recognized as an effective way to support group-based assessments (Nguyen, 2017; Sridharan and Boud, 2019; Limpanuparb *et al.*, 2021).However the current frameworks for peer assessment in online learning environments developed in other countries and none in Uganda have limitations that hinder their ability to effectively support group-based assessments and improve interactions among students.

These limitations include; inadequate support for the coordination and management of group-based assessments which was discovered in the framework for assessment for learning framework with peer assessment for group work and also lacks mechanisms for dealing with bias and fairness issues in peer assessment (Moccozet and Tardy, 2015), and a limited ability to provide students with effective feedback to improve their learning outcomes which was another challenge in these frameworks, and finally, there is a need for frameworks that can effectively integrate with the existing online learning environment. As a result, students may not be able to fully engage in the peer assessment process, and the quality of feedback and interactions may suffer, leading to reduced learning outcomes and lower levels of engagement in collaborative activities. Therefore, this study designed a new peer assessment framework that will overcome some of these limitations and provide a more effective way to support group-based assessments and improve interactions in online learning environments.

1.3 Objectives

1.3.1 General Objective

The purpose of this study was to support interactions for group-based assessment in the online learning environment for higher institutions of learning by designing a peer assessment framework.

1.3.2 Specific Objectives

(i) To assess the current group-based assessment frameworks used in higher institutions of learning and gather requirements for Peer assessment framework.

(ii) To design a peer assessment framework for group-based assessment based on the requirements gathered in (i) above.

(iii) To evaluate the designed peer assessment framework using the DeLone and McLean model.

1.4 Research Questions

(i) What are the requirements for addressing the challenges faced by existing frameworks for group-based assessments in the online learning environment for learners?

(ii) What are the techniques and requirements used in the design of a peer assessment framework for group-based?

(iii) What impact does the designed peer assessment framework for group-based have on improving interactions in an online learning environment for University students.

1.5 Significance

Collaborative learning hinges on the belief that knowledge is socially constructed although each learner has control over his/her learning. The proliferation of ICT in teaching and learning has created new possibilities for supporting collaborative and cooperative learning in distance learning (Bhagat, K.K., 2017). Learning groups have been preferred for propelling interaction and learning. Vygotsky, (2020), argues that a person's learning may be enhanced through engagement with others. Because many distance learners are working adults who, are not co-located, computer-supported collaborative learning can offer possibilities for effective online learning groups. However, motivating and sustaining effective student interactions is not easy to achieve. That requires planning, coordination, and implementation of curriculum, pedagogy, and technology (Ismail, M.A, 2019).

In addition, the study encourages educators to use LMS tools in the design and implementation of learning activities in an eLearning environment in higher education, where the traditional methods of learning and assessment are still popular and the study also aims to stimulate the use of classes that focuses on improving the skills of teamwork, cooperation and exchange between the participating learners.

The results of the study are useful and contributes to the emerging knowledge on peer assessment-based group assessment to different stakeholders in the education sector as students, Lecturers, university management, and researchers understand and appreciate the use of the designed framework.

1.6 Scope of the Study

1.6.1 Physical Scope

This research focused on the assignment modes of assessment in universities. The study covers academic staff (teachers) and students from the selected universities. The study population

entails all Students and their teaching staff in Information Technology courses in two selected Universities case of South Western Uganda Chartered Universities that use Moodle as their Learning Management System (LMS) and those are; Kabale University, and Bishop Stuart University, and students in the second and final year study periods. The population of these selected participants have enough skills in the implementation of the study.

1.6.2 Technical Scope

The study resulted in the design of a framework for effective peer assessment for group-based assessment to enhance interactions in an online learning environment for Universities.

1.6.3 Time scope

This research study about peer assessment framework to support group-based assessments in an online learning environment for Universities for students was for a period of three years from 2022 to 2025.

1.6.4 Content Scope

The group assessments took on the form of intragroup, where each member of the group evaluates the performance or contribution of other group members towards the shared assessment and a framework was developed and evaluated using DeLone and Maclean model questionnaire on expert evaluation with constructs that play significant role as a direct determinant between use and user perceived satisfaction like, Technical System Quality, System Quality, Service Quality, and Content & Information Quality

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter covers the existing frameworks of group-based assessment, the key concepts, and the methods of assessment concerning the online learning environment for learners.

2.1 Overview of Assessment Methods in Higher Institutions of Learning

Assessment refers to the wide variety of methods or tools that educators use to evaluate, measure, and document the academic readiness, learning progress, skill acquisition, or educational needs of students(Rawlusyk, 2018). Assessment has great significant effects on student learning because as we know assessment and learning are closely related. Assessment plays an important role in the quality of learning and influences how students perceive learning(Ijeoma B. Anumaka, 2013; Matovu and Zubairi, 2015; Pereira, Flores, and Niklasson, 2016).

One reason is for student learning and the second is for certification, which entails the evaluation of student achievement

2.1.1 Summative Assessment method

Summative assessment is used for examining student achievement and occurs at the end of a course or phase of instruction. Most researchers say that common methods used for summative assessment include unit tests, exams, and final presentations or projects(Khaled and Khatib, 2020; Darabi Bazvand and Rasooli, 2022). However, the timing of these practices makes it hard to modify student learning. Therefore, they are used only to determine grades. And because of this, summative assessment is referred to as an assessment of learning(Rawlusyk, 2018).

2.1.1.1 Examinations and Tests

Scholars stated that higher education instructors primarily assess student learning through exams and tests. According to (Pereira, Assunção Flores and Barros, 2017),testing represents a behaviorist model, which is teacher-centered and not learner-centered. Learners perform a passive role as they react to the environmental conditions presented to them. However, Researchers question whether examinations and tests promote student learning(Rust, 2002; Brookhart, 2009).

Carless et.al (2015), noted that examinations hinder the thoughtful planning of information that requires ongoing drafting and re-drafting.

(Pereira, Assunção Flores and Barros, 2017) pointed out that testing promotes memorization rather than understanding and applying knowledge. These drawbacks of examinations may cause the neglect of skills such as problem-solving and critical thinking needed in today's world.

2.1.2 Formative Assessment method

Formative assessment occurs continuously throughout the course, it encourages students to engage in the subject matter, which helps them become familiar with the information they are attempting to learn. Researchers recommend that for effective formative assessment to happen, active participation of the student and teacher must occur. When students are actively engaged in the tasks, it leads to deeper thinking and long-term retention of learned concepts (Brookhart, 2009; Rawlusyk, 2018; Wanner and Palmer, 2018). Improvements in learners' performances are achieved through supportive feedback from various assessment tasks.

Learner-centered methods lead to the development of autonomy, a sense of responsibility, and reflection and influence how students look at their learning. Learner-centered practices enhance the development of the skills needed for real life, ensuring that the success criteria for education and teaching are the same as those used in practice (Morris, Perry and Wardle, 2021; Sudakova *et al.*, 2022).

Learner-centered practices such as self-and peer assessment enhance students' autonomy, self-confidence, and reflection allowing the development of skills and promoting deep learning (Navaridas-Nalda, González-Marcos and Alba-Elías, 2020) .

Formative assessment is highly effective in online courses as it not only evaluates and encourages learners but also gathers feedback from them, which can be used to enhance the quality of the course.

2.1.2.1 Self-assessment Method

A central value of self-assessment is the development of metacognition.

Metacognition is described as the ability of learners to gain knowledge about their learning and is identified as a significant factor affecting learning. Additionally, self-assessment can

empower students as it encourages self-monitoring. However, the power given to learners must focus on sustaining self-reflective abilities(Mota *et al.*, 2019).

2.1.2.2 Peer Assessment Method

Peer assessment also teaches learners how to handle criticism and be responsible When judging others' work. Another benefit of peer assessment is that the competencies learned, provide a foundation for performing self-assessment(Wanner and Palmer, 2018; Li *et al.*, 2020).

Computer-mediated peer assessment is also associated with greater learning gains than paper-based peer assessment. (Wanner and Palmer, 2018; Li *et al.*, 2020) confirm that paper-based peer assessment has fewer advantages than online peer assessment where the application of technology makes the assessors comment freely without any restriction of time and location, and also provides a chance for direct connection between them.

Peer assessment is a promising approach to engage learners in the assessment process and easily integrate into the learning activities. In higher education, peer assessment involves students applying criteria and standards to evaluate the work of their peers and can be either formative or summative, providing qualitative feedback related to the grading criteria used rather than solely focusing on the numerical grade. (Kearney, 2013)

In summative assessment, peers are required to assign a grade or assist in assigning a grade, while in formative assessment, they are expected to offer feedback and comments. It is also possible to merge both approaches to provide both feedback and grades.

According to Limpanuparb *et al.*, (2021), Peer assessment can also prove advantageous to teaching staff as it reduces their workload, offers fresh perspectives on student learning processes, fosters critical thinking skills through interactions with other group members, and encourages staff members to be more transparent about assessment objectives and grading criteria.

2.2 Computer Supported Collaborative Learning Theory (CSCL).

Computer Supported Collaborative Learning Theory is a pedagogical approach that fosters collaborative learning through social interaction in e-learning environments, utilizing computers or internet-based environments(Lin and Lin, 2019; Janssen and Kirschner, 2020). Computer-supported collaborative learning (CSCL) with its mechanisms has been widely adopted because it can enhance online collaborative learning effectiveness.

For a peer assessment framework in group assessments, CSCL enables learners to work collaboratively, share knowledge, and provide mutual feedback, supported by technology in synchronous or asynchronous formats. By leveraging digital tools, CSCL enhances peer assessment by promoting collective understanding, moving beyond traditional individual evaluation models to create dynamic, technology-supported group assessment experiences(Pareto and Willermark, 2022). Collaborative learning entails groups of learners cooperating to address a challenge, accomplish a task, or develop a product. Its primary aim is to foster the collective creation of shared knowledge among group members.

Computer-Supported Collaborative Learning (CSCL) enhances group learning by leveraging information and communication technologies (ICTs) to facilitate knowledge sharing and co-construction. For a peer assessment framework in group assessments within e-learning environments, CSCL employs digital tools to streamline collaborative feedback, supporting synchronous or asynchronous interactions(Morris, Perry and Wardle, 2021). It can be implemented in online, distance, or blended learning settings to foster effective group assessment and collective knowledge-building.

According to (Ouyang, Xu and Cukurova, 2023), online collaborative processes promote knowledge creation and conceptual transformation. In the context of a peer assessment framework for group assessments in e-learning, collaborative learning fosters deeper understanding, critical and reflective thinking, shared knowledge, and sustained retention of content. It enhances learners' communication skills and competencies through interactions designed to complete collaborative assessment tasks.

Integrating Computer-Supported Collaborative Learning (CSCL) and team-based activities into e-learning frameworks for peer assessment in group assessments creates enhanced opportunities for learner engagement, communication skill development, and active learning. CSCL promotes active learning strategies, boosting motivation and persistence while cultivating critical thinking skills(Petersen *et al.*, 2023). It empowers learners by involving them in dynamic, collaborative experiences, encouraging shared efforts with peers and fostering responsibility for their own learning within group assessment environments. Active learning nurtures critical thinking and reflective learning behaviors, transforming surface learning into deep learning. By shifting responsibility to learners, CSCL supports the creation of learner-led activities that enhance social interaction and collaboration in e-learning settings(Kirschner *et al.*, 2018; Janssen and Kirschner, 2020).

This study is also based on Computer supported collaborative learning theory, also known as cooperative learning(Daribi Bazvand and Rasooli, 2022) defined collaborative learning as a scenario in which two or more individuals learn or make an effort to learn together. The theory emphasizes the significance of social interaction, teamwork, and mutual support in the learning process and suggests that learning is enhanced when individuals work together to achieve a common goal or objective. Additionally, collaborative learning can be summarized as a situation in which individuals are expected to interact with each other, which can stimulate the learning process. In a learning setting, the objective of collaborative learning must be transparent, and students should derive benefits from it and provide feedback on their involvement.

Collaborative learning pivots on the belief that knowledge is socially constructed although each learner has control over his/her learning and the author argues that a person's learning may be enhanced through engagement with others(Melnyk, 2022).

The online learning environment uses two major ways of communication: synchronous and asynchronous. In the circumstance of collaborative assignment activities, both synchronous and asynchronous methods are used. Some students prefer the face-to-face processes in the virtual environment and those prefer to communicate more with the written word than the spoken word(Rosa, Coutinho, and Flores, 2016).

In synchronous learning, both the teacher and the students communicate at the same time, in the same or different geographic locations. Most times the appropriate technological tools are employed such as chat rooms, and videoconferencing tools.

The use of online tools, such as the big blue button, allows the use of asynchronous processes in the case of collaborative activities such as group assignments.

There is always the need to keep in mind that the teaching and learning processes have to be based on constructivism and each asynchronous or synchronous technique needs to respect the inter-individual differences concerning the different cognitive styles and learning styles(Palacios *et al.*, 2022; Sudakova *et al.*, 2022). Collaborative work and assignments have to offer time and tools according to those differences to enable each one to work productively. Technology-based methods of learning provide many opportunities for constructivist teaching as they offer a highly interactive medium of learning that can be customized to meet the student's individual needs. However, most times students encounter difficulties during a collaborative online assignment or activity due to their lack of experiences during their earlier school years or studies(Higgins *et al.*, 2017).

2.2.0 Theoretical Review

In recent years, there has been widespread acknowledgment of information Communication technology (ICT) as a crucial instrument for strengthening a country's economic competitiveness. It is now widely recognized that ICT plays a substantial role in enhancing the efficiency of Higher institutions of learning. The full impact of ICT can only be achieved when it is extensively adopted and utilized(Michael Edoru and Sanni Adebayo, 2019). Consequently, it is essential to understand the factors influencing ICT adoption and the theoretical frameworks that have been developed to address this adoption.

It's important to note that many of these theories and models in information systems (IS) adoption have been employed to gain insight into the mechanisms behind the utilization of technologies. They aim to predict the extent of adoption within an institution, facilitating the integration of information and communications technology (ICT) into operations to improve efficiency and effectiveness.

Among the models considered are the Unified Theory of Acceptance and Use of Technology (UTAUT) and the DeLone and McLean model.

Unified Theory of acceptance and use of technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a widely utilized model for understanding the adoption of information systems innovation. Introduced by Venkatesh et al. in 2003, the UTAUT model integrates several influential theories, including the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Motivational Model, the Theory of Planned Behavior (TPB), the combination of TAM and TPB, the model of Personal Computer Utilization, the Innovation Diffusion Theory, and the Social Cognitive Theory.

According to Alowayr (Alowayr, 2022) empirically tested over ten models in an attempt to develop a model that integrates elements across the twelve models. Based on their work in a variety of settings they produced a set of hypotheses to explore and explain the variables which impinge on acceptance and use. These are related to the effect of gender, age, and experience on performance expectancy and effort expectancy. The authors also showed the influence of attitude and social factors on behavioral intention. UTAUT model was found to outperform each of the single models with four core determinants of intention and usage, and up to four moderators of key relationships.

Conti et.al (Han and Conti, 2020) developed a new tool named the HANCON model, which was developed by merging and extending the constructs of two solid and proven models the Unified Theory of Acceptance and Use of Technology (UTAUT)model.

The model was successfully used to examine the factors that influence the decision to use a telepresence robot as an instrument in educational practice and after used to evaluate the acceptability of 112 pre-service teachers after the actual use of a telepresence robot in an education setting. Results after the analysis demonstrated a positive attitude towards the use of telepresence robots in a school setting and confirm the applicability of the model in an educational context.

According to Chan et.al (2010), UTAUT is designated for the mandatory use of information systems or technology. Where technology used in a mandatory environment aims at supporting the users in doing their work in the organization to increase work performance. A user who uses technology in the workplace will expect that the usage will increase his/her job performance. Performance expectation is a variable in UTAUT that aims to capture the extent to which a person believes that the technology will increase his/her job performance.

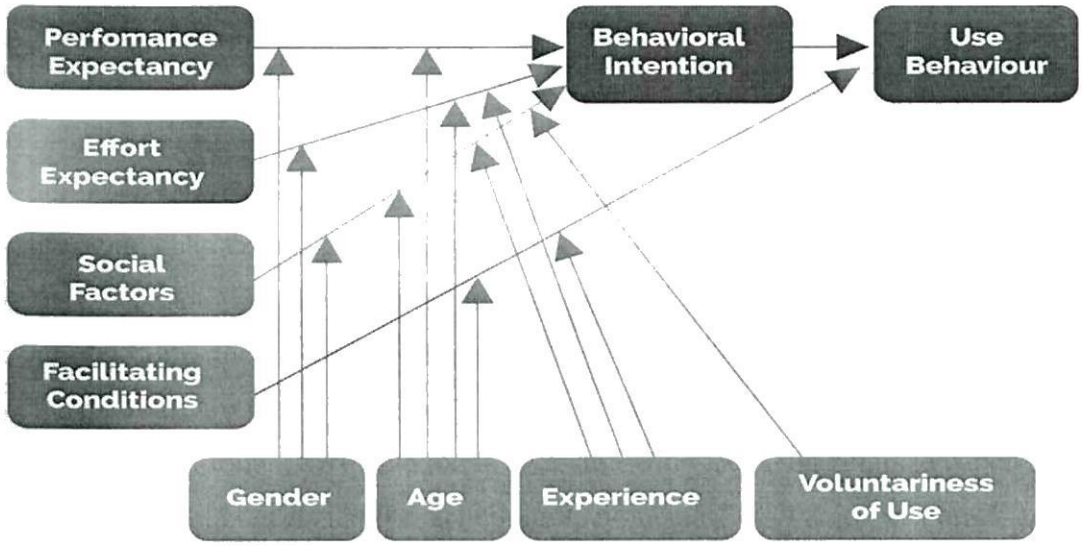


Figure 1: the UTAUT model adopted from (venkatesh et al., 2003)

UTAUT has its limitations, notably the exclusion of significant behavioral factors such as self-efficacy and anxiety, which numerous studies have demonstrated to be relevant to the acceptance of innovations and technology. Given that the primary objective of the research is to ascertain the effectiveness of the developed peer assessment framework for group-based assessment in enhancing interactions in the online learning environment for university students,

UTAUT falls short. This is because it solely focuses on understanding the behavior of participants towards the technology, neglecting other pertinent factors.

DeLone and McLean model

According to different researchers, the model offers six interrelated constructs of information systems success measures, that is, the quality dimensions (in-formation, system, and service quality) which could affect subsequent use or intention to use and user satisfaction(Mudzana and Maharaj, 2015) that is most widely used to assess information system success benefits tagged as net benefits will be achieved as a result of use and/or user satisfaction(Ojo, 2017). These net benefits could consequently affect user satisfaction and continued use of the system. The model is largely accepted in the information systems field.

DeLone and McLean (2003) built their framework upon three parts of instruments to measure information system success, which respectively are instruments for measuring technical success, semantic success, and effectiveness success. Technical success is measured through "system quality." System quality concerns the technical factors of the system. Semantic success is measured through "information quality," and effectiveness success is measured through "use, user satisfaction. Service quality is based on service quality for the antecedent of intention to use and user satisfaction, and net benefits based on the view that impact could be positive or negative.

The authors stated that the addition of intention to use into the DeLone–McLean model is based on the premise that before a user uses the system, their attitude shows the intention for using the system, while variable use itself is the behavior. After using the system, the user will feel satisfied with the system (measure as "user satisfaction") and produce intention to use, then followed by actual use, and actual use will bring user satisfaction.

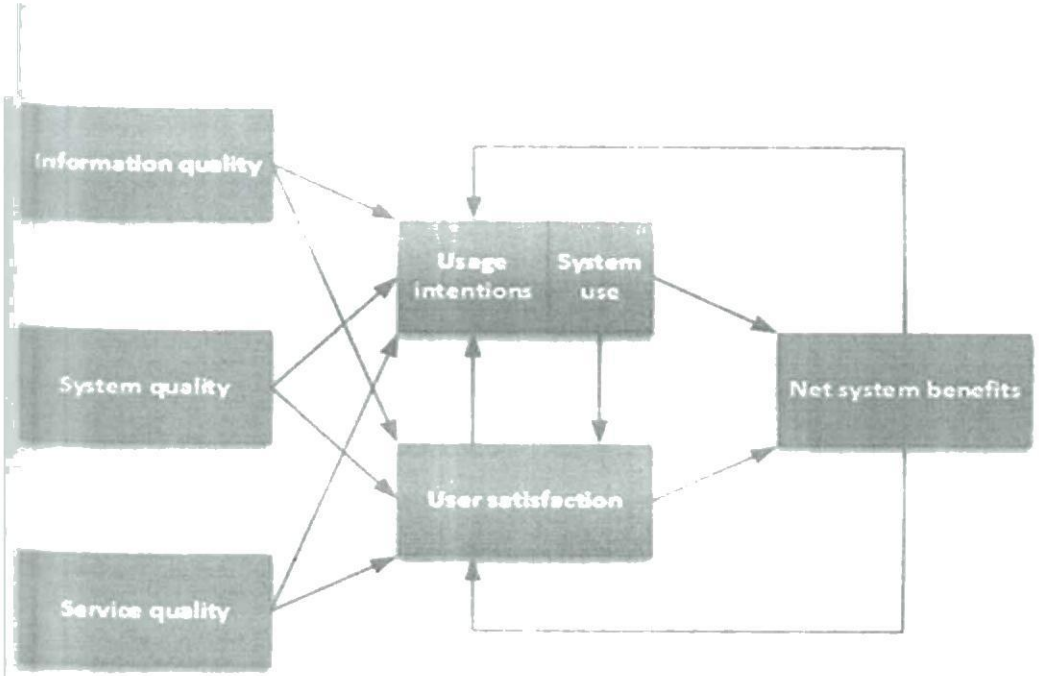


Figure 2: DeLone and McLean Model

The DeLone and McLean model has been applied to assess the effectiveness of e-learning systems and their adoption, such as in Nigerian universities where the model identified the success factors contributing to the acceptance of an e-learning platform named Canvas by university students.

2.2.1 Moodle for E-Learning Environment

E-learning is a process of learning in an electronic method through an Internet network or the Intranet with the use of a management system for education. This process has two approaches that are Asynchronous and Synchronous(Hermansyah, Nurhairunnisah, and Dwi Lestari, 2022).

The asynchronous approach is enabled by media such as e-mail and discussion boards which support work relations among students or learners and with tutors, even when members cannot be online at the same time. It is flexible e-learning where many persons take online courses because of their asynchronous nature, combining education with work, family, and other commitments. The asynchronous method creates a possible environment for learners to log on to an e-learning platform at any time and download documents or send messages to tutors or peers(Chourishi *et al.*, 2011).

A synchronous method is supported by media such as video conferencing and chat and has possibly supported learners in the development of academic institutions. Synchronous

meetings support learners to feel like participants rather than isolates(Gamage, Ayres and Behrend, 2022).

Moodle (Modular Object-Oriented Dynamic Learning Environment) is fundamentally an open-source web-based e-learning platform that presents an excellent environment for resources and communication tools that allow better cooperation among learners and teachers.
It is a Course Management System (CMS) that is a software package designed to help academic institutions or educators build quality online courses and is sometimes referred to as Learning Management Systems (LMS) or Virtual Learning Environments (VLE) (Chourishi *et al.*, 2011).

2.3 Peer assessment for Group-based frameworks developed

2.3.1 A framework for developing an effective group work assessment: Group work Assessment Development.

The authors presented a framework for designing and conducting group assessments that incorporates some of these best practices and embeds strategies to guide teachers in designing the assessment and to prepare the students to undertake the group work (Shermin, De Silva and Wesumperuma, 2019). The framework emphasizes the constructive coherence between the three key areas of the curriculum that is learning outcomes, assessments, and learning activities. The developed framework provides a roadmap for a teacher in selecting a group task, designing the assessment with a set of learning activities, and facilitating the group assessment with continuous monitoring and evaluation, however, the framework guides students through three distinct phases that are Planning, Execution and Quality Assurance towards achieving the intended learning outcomes for the assessment (Ashini *et al.*, 2020).
In their study, results revealed that the framework provides both a cooperative and collaborative learning environment for students which results in a positive group work experience and that the overall satisfaction of the teachers facilitating the group work improved with the adaption of the framework.

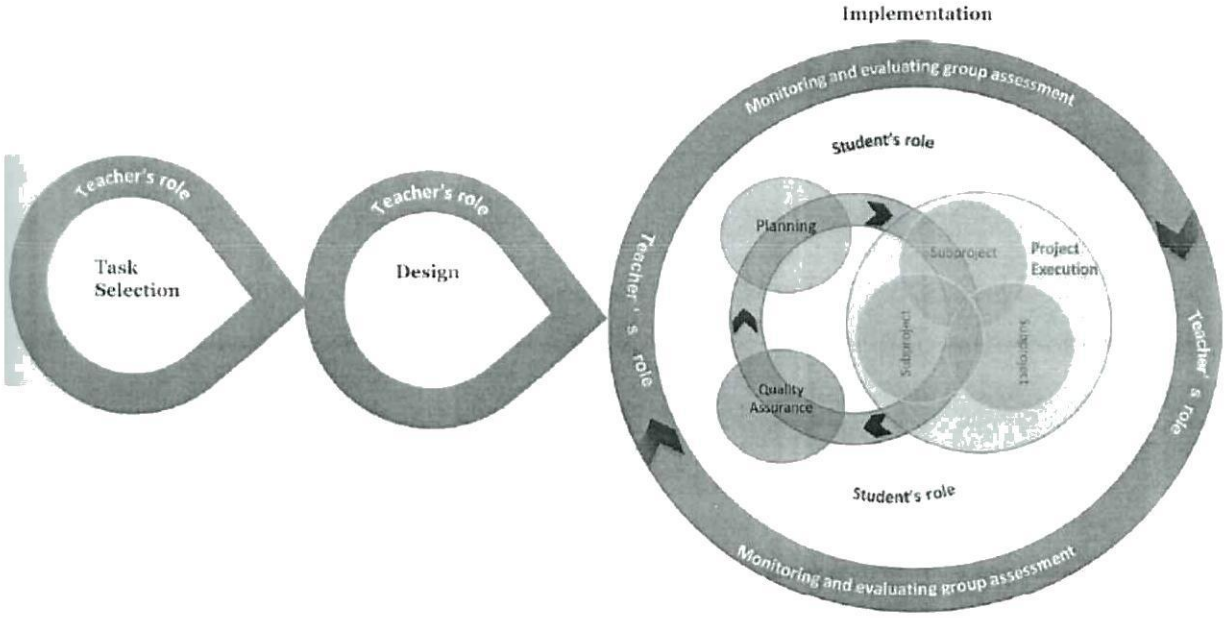


Figure 3: A framework for developing an effective group work assessment

2.3.2 An assessment for learning framework with peer assessment of group works

The authors designed an inter-peer assessment framework integrated into an existing online environment based on a social network engine. The framework offers online shared workspaces for group collaborative learning and introduces the concept of ePortfolio for peer feedback and assessment. The framework was used to support a peer assessment process experiment in a real situation with students. The experiment showed that the framework can be used to support the summative assessment by the teacher and bring learning feedback to the learners (Moccozet and Tardy, 2015).

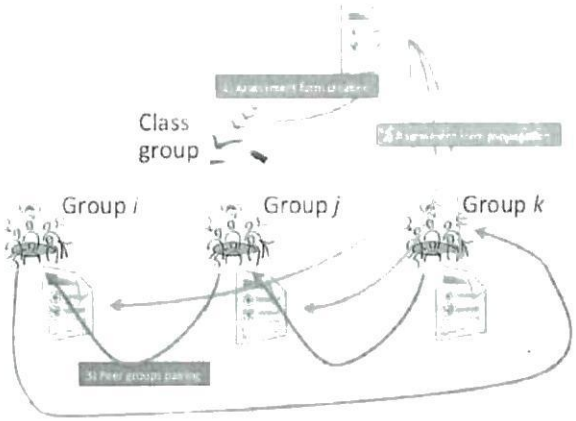


Figure 4: Shows the steps of the peer assessment process

To set up the peer assessment process in the design of their framework, a master group was created first for the class and then created work groups within the master group. The teacher

then creates an assessment form and initiates the assessment process. The assessment form is propagated to each work group, along with an assessment dashboard. Work groups are randomly paired as assessors and assessee. Each work group then completes the assessment dashboard by selecting resources from their workspace and adding comments.

Studies on Peer Assessment

The study by Berg, 2006, explored the use of peer assessment in problem-based learning (PBL) environments. Peer assessment was found to enhance students' self-directed learning skills, encourage critical thinking, and improve their ability to give and receive feedback. Students valued the different perspectives provided by their peers and recognized the importance of peer assessment in the PBL process.

Another study by De Brun, 2017, employed Peer Assessment to Facilitate Cooperative Learning in a Computer Science Course. The authors investigated the integration of peer assessment into a computer science course to foster cooperative learning. The study demonstrated that peer assessment enhanced collaboration and communication among students, improved their understanding of subject matter, and increased their engagement with the learning process.

According to Yin (2019), study examined the use of peer assessment in collaborative online learning environments. It explores the effects of peer assessment on learning outcomes, student engagement, and the quality of collaborative work. The research highlights the importance of providing clear assessment criteria, training students in assessment skills, and ensuring the validity and reliability of peer assessment processes.

The researcher Brún, (2022) investigated the use of peer assessment as a formative feedback tool in online learning environments. The study explores the impact of peer assessment on students' learning experiences, engagement, and academic performance. It provides insights into the benefits and challenges of implementing peer assessment in online settings.

Concina (2022), in a systematic review, examines the literature on peer assessment in higher education. It provides an overview of various approaches to peer assessment, including group work assessment. The review highlights the benefits of peer assessment, such as promoting active learning, fostering critical thinking, and developing students' evaluative judgment.

2.4 Literature gaps

Lack of emphasis on learning outcomes and interactions: The literature mentions that most group-based assessment frameworks do not base their design on learning outcomes and interactions but rather on grading criteria and assessment rubrics (Scott, 2017; Demir, 2018).

This highlights a potential gap in the literature where there is a need for frameworks that prioritize learning outcomes and promote effective interactions in group-based assessments in online environments.

Insufficient focus on peer assessment in online learning: While the literature acknowledges the benefits of peer assessment in enhancing learning and critical thinking, it suggests that instructors have a traditional approach to evaluation that often excludes the opinions of students' peers (McKenzie, Pelliccione and Parker, 2008; Nguyen, 2017; Demir, 2018; Surahman *et al.*, 2019; Demosthenous, Panaoura and Eteokleous, 2020). This indicates a gap in the literature where more attention is needed on the implementation and effectiveness of peer assessment in online learning environments.

Limited guidance on implementing digital formative assessment: The literature mentions the advantages of digital formative assessment but notes a lack of clear framework support and high-level guides for educators on how to plan their lectures effectively based on digital formative assessment (Tait-McCutcheon and Knewstubb, 2018; Wanner and Palmer, 2018). This indicates a need for more comprehensive frameworks and guidelines to help educators engage in pedagogical planning using digital tools and formative assessment strategies.

Lack of research on the impact of peer assessment on online group interactions: Although the literature highlights the importance of collaborative group activities and interactions in online learning, there is limited discussion on how peer assessment specifically impacts these interactions (Moccozet and Tardy, 2015; Scott, 2017; Tait-McCutcheon and Knewstubb, 2018; Wanner and Palmer, 2018; Limpanuparb *et al.*, 2021). Further research could explore the relationship between peer assessment and meaningful learning experiences through increased interactions among students in online group settings(Paterson and Prideaux, 2020).

Limited exploration of technology-enabled peer assessment: While the literature briefly mentions the integration of technology, such as learning management systems and social media platforms, in peer assessment, there is a gap in the exploration of the potential benefits and challenges of utilizing technology-enabled peer assessment methods (Demir, 2018; Peimani and Kamalipour, 2021). Future research could focus on investigating the effectiveness and practical implications of different technological tools and platforms in facilitating peer assessment processes.

In summary, these identified gaps can serve as potential areas for further research and exploration to contribute to the existing literature on group-based assessment, formative assessment, and peer assessment in online learning environments, however, in this study, we consider solving some of these gaps that include, impact of peer assessment on online group

interactions and frameworks that prioritize learning outcomes and promote effective interactions in group-based assessments in online environments.

2.4.1 Summary of Literature Gaps

Table 1: Summary of Literature Gaps

Author & Year	Title	Specialty	Strength	Weakness
Rawlusyk, 2018	Overview of Assessment Methods	Assessment	Provides a comprehensive view of assessment methods	Limited emphasis on online environments
Miranda et.al 2020	Examinations and Tests in Higher Education	Testing	Detailed exploration of examinations and tests	Tends to be teacher-centered
Carless et.al, 2015	Assessment in Learning	Formative Assessment	Emphasizes the benefits of formative assessment	Focuses more on formative than summative
Wanner & Palmer, 2018	Peer Assessment in Online Learning	Peer Assessment	Provides insights into online peer assessment benefits	Limited focus on technology-enhanced peer assessment
Jones et al., 2000	Collaborative Learning Theory	Collaborative Learning	Comprehensive theory on collaborative learning	Less emphasis on digital tools for collaboration
Hermansyah et al., 2022	Moodle for E-Learning	E-Learning Platforms	Detailed overview of Moodle's features and benefits	Focuses primarily on Moodle, not other platforms

Ashini et al., 2020	Group Work Assessment Development	Group Assessment	Provides a structured framework for group assessments	Limited empirical testing
Moccozet & Tardy, 2015	Peer Assessment of Group Works	Peer Assessment	Introduces innovative peer assessment techniques	Limited scalability insights

2.4.2 Conceptual framework

The conceptual peer assessment framework has four constructs that play significant role as a direct determinant between use and user perceived satisfaction like, Technical System Quality, Group based Assessment System Quality, Service Quality, and Content & Information Quality. Technical System Quality will measure the quality of peer assessment framework techniques that will be related to model navigation, ease to finding information, structured, fast accessing, having security, flexibility, ease to integration, reliability which is high, has an interactive and structured design(Alowayr, 2022).

Group based Assessment System Quality will measure the quality of models related to communication, attendance, and interaction, and active assessment and participation, evaluation of assessment, outcomes, grading, storage and sharing documents, effective and efficient sharing of information.

Service Quality will measure the quality of model services related to help support team. Content & Information measuring the quality of information and content from framework regarding usability, ease of understanding, reliability, timeliness, accuracy and organized.

The Use construct describes the use of the framework for information retrieval, information sharing, storage and sharing documents, communicate with students to students and academic staff. User Perceived Satisfaction defines user satisfaction perceptions of model related to effective and efficient. Student Impact defines the impact of peer assessment framework on students, accomplishing the objective of supporting group based assessment of students in higher institutions of learning in an eLearning setting.

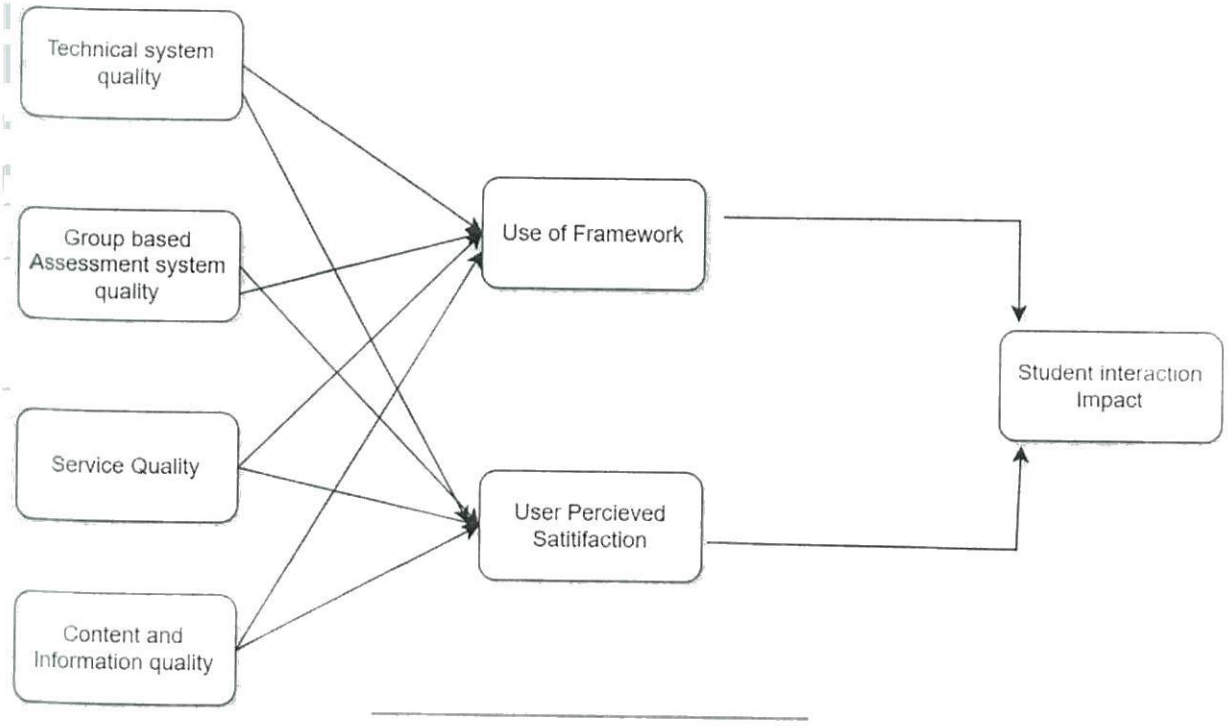


Figure 5: Shows the conceptual framework. process

2.5 Evaluation of artifact

Peer assessment for group-based assessment initiatives presents the ability to tackle challenges that exist within higher institutions of learning in an e-learning environment. These initiatives are created artifacts, such as models, frameworks, web-based and mobile-based applications, or platforms. However, it is important to test these artifacts for quality, effectiveness, and efficiency using well-established assessment methods according to (Štilić *et al.*, 2023). The author also argues that a designed artifact can be measured by how complete, accurate, functional, reliable, consistent, traceable, understandable, and usable it is, and more.

Other researchers evaluated designed artifacts using methods such as observation, analysis, experiments, testing, and description and others argue that artifact evaluation can be done through laboratory experiments, pilot applications, simulations, expert reviews, and field experiments(Cabero-Almenara, Romero-Tena and Palacios-Rodríguez, 2020: Lagan *et al.*, 2020).

In this study, the designed peer assessment framework for group-based assessment that improves interactions in online environments for universities will be evaluated using the DeLone Maclean model using the expert judgment evaluation method.

Researchers argue that evaluation is an essential part of scientific research and artifact creation. This is because new IT(Information Technology) artifacts must show measurable improvements to prove that technology is evolving and advancing, which will lead to adoption (Cabero-Almenara, Romero-Tena and Palacios-Rodríguez, 2020; Štilić *et al.*, 2023).

CHAPTER THREE
METHODOLOGY

3.1 Introduction

This chapter describes the research data collection methods used, how sample size was determined, the research design used, procedures, tools, and techniques used to collect and analyze the findings(Weyant, 2022). The tools, methods, and knowledge that were used to achieve the objectives, time frame, and budget (Creswell, 2003b). This chapter shows how we achieved specific objectives and research questions.

3.1.2 Philosophical foundation

The present research philosophy is grounded in **pragmatism** combining both positivist and interpretivist approaches that focus on the belief that peer assessment frameworks can play a crucial role and impact in supporting group-based assessment in eLearning environments through findings from interviews, surveys and statistical analysis, which centers on the use of technology to enhance the learning experience in higher education and improve interactions(Dudovskiy, 2021). This research philosophy aligns with the philosophy of computing and information technology, which emphasizes the ethical and social implications of technology use (Brey & Søraker, 2009).

The study aimed at designing a peer assessment framework that which is both effective and ethical for all students and staff (Ladd et al., 2010).

To achieve the objectives, employed a mixed-methods research approach that combines both quantitative and qualitative data collection and analysis methods. This enabled me to gather both numerical data on the effectiveness of the framework and subjective data on user experience and feedback and aligns with the pragmatist philosophy, as it emphasizes the systematic collection and analysis of numerical data to uncover patterns, relationships, and trends. The inclusion allows for the collection of subjective data on user experience and feedback, providing a comprehensive understanding of the framework's effectiveness (Burrell & Morgan, 1979).

Overall, this research philosophy is guided by the belief that technology can be a powerful tool for improving interactions in the learning experience in higher education. It contributes to the broader conversation surrounding the ethical and social implications of technology use in education, including issues such as bias, discrimination, privacy, security, and the impact on student learning outcomes.

Furthermore, the philosophy recognizes the importance of a strong theoretical foundation in the design and development of a peer assessment framework. Drawing upon relevant theories in computing and information technology, such as information systems theory, human-computer interaction, and learning analytics (Boy, 2017), provides a solid grounding for the framework's development. Additionally, an iterative and collaborative approach involving stakeholders, including educators, students, and IT professionals, will ensure that the framework meets their needs and requirements.

3.2 Research Approach:

The research approach for this study was primarily quantitative and qualitative. Both quantitative and qualitative data were collected simultaneously (Sekaran, 2000) for the study to understand the research problem better by using different but complementary data, and to overcome a weakness in using one method with the strengths of another (Creswell, 2003) as objective is to gather numerical data and analyze it using statistical techniques and statistical results represented by numerical or statistical data to address the research questions and achieve the specific objectives of the study

The quantitative and qualitative research approach provided a systematic and structured method to investigate the effectiveness and impact of the designed peer assessment framework for supporting interactions in an online learning environment for university students.

To answer our research question three, we employed data analysis with quantitative descriptive methodologies of regression, and correlations for our created dataset. We aimed at establishing what impact did the designed peer assessment framework for group-based assessment have on improving interactions in an online learning environment for university students and how improving interactions in an online learning environment for university students be improved. And to achieve our third objective which was to evaluate the peer assessment framework for group-based assessments for viability, and answer our research question, we employed advanced data analysis tools of one-way ANOVA and two-way ANOVA and determine the error rate involved in generalizations made by our framework. Here, we aimed at reducing the error rate and be able to produce a better framework through iterative processes of framework designing for a group-based peer assessment framework with the overall aim of improving interaction among learners in online learning environments

3.3 Research design

The research design employed by the researcher in this research was a case study design and human-centered design approaches because it was a quantitative and qualitative research design (Nguyen Ngoc, Lasa and Iriarte, 2022). The reason the researcher chose the case study design approach was to help gather basic, initial data that was used to identify particular questions for future research and test the framework developed using the Delone and McLean model questionnaire using expert judgment for this research.

This study employed a case study research method to closely examine the data collected from Kabale University and Bishop Stuart University (BSU) as the geographical area. A descriptive case study method was used to study different participants. These approaches were used to find out what base is tailored to enhance the functionality of and analyse the likely determinants of a successful peer assessment framework for group-based assessment that further improves interactions in the online learning environment for Universities.

3.3.1 Case study design

The researcher opted for a case study design approach to gather preliminary data that could serve as a foundation for identifying specific research questions and testing the framework developed for this study using the DeLone and McLean framework. This research utilized a case study methodology to thoroughly analyze data collected from Kabale University and Bishop Stuart University (BSU) as the geographic focus. A descriptive case study approach was employed to investigate various participants involved in the development of the framework, including academic teaching staff members and students.

The case study method encompassed both qualitative and quantitative approaches, involving the collection of textual data from discussions, interviews, and questionnaires focused on group-based assessment. These interviews and questionnaires aimed at exploring the perceptions of academic teaching and administrative staff members and students regarding the existing modes of group-based assessment practiced within the university.

3.3.2 Human-centered design

The researcher adopted a human-centered design approach because it prioritizes and engages all users, considering their challenges, objectives, requirements, thought processes, and behaviors. This approach ensured that the researcher devises effective solutions tailored to the specific problem. The process commenced within the Kabale University and Bishop Stuart

University communities and culminate in the development of a group-based peer assessment framework.

3.4 Study Population and Sampling

The study population entailed students and their teaching staff in Information Technology and computer Science courses in two South Western Uganda selected Chartered Universities (According to the Uganda Universities and Other Tertiary Institutions Act, a charter is "granted by the President as evidence that the university meets the requirements and standards of academic excellence set by the NCHE (National Council for Higher Education)." Furthermore, according to section 103(a) of the same Act 2001 as amended; a chartered university means a university that is comparable to a public university. This is the grant of authority, the full and highest right to exercise the responsibility of running a university. It is a sovereign right given by the head of state in any state (NCHE 2023). Including Bishop Stuart University, and Kabale University during the second and final year study periods because most times students encounter difficulties during a collaborative online assignment or activity due to their lack of experiences during their earlier school years or studies(Higgins *et al.*, 2017). The population of these selected participants has enough skills in the implementation of the study.

3.4.1 Inclusion and exclusion criteria

3.4.1.1 Inclusion criteria

The study included all second and third-year students in the selected universities in the Computing and IT departments including their teaching and administrative staff. These students had acquired enough knowledge and skills as computer literate and hence suitable candidates for this research to participate and according to Alyossef (Alyoussef, 2023) shows that students gain skills on how to use ICT eLearning tools and systems in their second year of study. The academic staff composed of those teaching computer based studies who possess graduate qualifications and above.

3.4.1.2 Exclusion criteria

All students and Staff at the selected universities, who don't fall in the above category did not participate in the study. The other staff that do not possess computer based training at graduate level were not considered.

Objective One:

To identify requirements for the development of the framework through the reviewed literature of existing mechanisms and group-based frameworks that improve interactions among students in universities. The researcher reviewed the past and current information gathered from the written book, articles, and journals to identify gaps and ideas to fill in the gaps through analysis. This was in line with the first research question which looked to compare a few frameworks. This section matched stage one (requirements gathering) of the Peer Assessment framework for group-based development.

3.4.2 Sample size determination

With a population size (N) of 250 students and we determined the sample size with a specific margin of error (e), and used the formula.

Equation 1: Slovin's Formula

n = N / (1+Ne^2)

Let's say you want a margin of error of 5% (0.05):

$n=250/(1+250\times(0.05)^2)$

$n=250/(1+250\times0.0025)$

$n=250/(1+0.625)$

$n=250/1.625$

$n\approx153.85$

So, according to Slovin's formula, we had a sample size of approximately 154 students

3.4.3 Interview Selection of the Respondents

A total of 20 participants was purposively selected to participate in the evaluation study. These participants included systems administrators/managers, e-learning officers, Administrative staff and IT (Information Technology and Computer Science) academics from Kabale and Bishop Stuart University.

Table 2: Interview Selection of the Respondents

Participants	University	Numbers
Systems Administrators/managers	Kabale University	2
	Bishop Stuart University	2
E-learning officers	Kabale University	1
	Bishop Stuart University	1
Administrative staff	Kabale University	2
	Bishop Stuart University	2
ICT Academic staff (ICT Lecturers)	Kabale University	5
	Bishop Stuart University	5
Total		20

The study involved 250 students and 20 staff from two chartered universities in Southwestern Uganda. And, a sample size of 154 students is determined using Slovin's formula. Participants will be selected consecutively based on eligibility criteria.

3.4.3 Sampling procedure

Consecutive sampling was employed as the sampling method for this study. This sampling technique involves selecting every subject who meets the inclusion criteria consecutively until the desired sample size is reached (Schuster et al., 2005). By utilizing consecutive sampling, the research aimed to reduce bias and ensure efficient data collection.

Consecutive sampling minimized potential bias allowing the inclusion of all eligible participants who meet the specific criteria. This method ensures that every individual who fulfills the predetermined requirements has an equal chance of being included in the study. By including consecutive participants, the research aims to obtain a representative sample that accurately reflects the target population of second-year and third-year students in the selected universities' Computing and IT departments.

One of the advantages of consecutive sampling is its efficiency in data collection. This method enables the research team to quickly and easily gather data from participants who meet the inclusion criteria. As each eligible participant is approached and recruited consecutively, the process becomes streamlined, saving time and resources.

By employing consecutive sampling, the study aimed at enhancing the generalizability of the findings. The consecutive inclusion of participants allows for a broader representation of the target population, increasing the external validity of the study's results. This sampling method

participants' viewpoints and can uncover nuances and unexpected insights that may not be captured through predefined response options.

Using a questionnaire as the data collection tool offers several advantages for this study. First, questionnaires are relatively easy to administer, allowing for efficient data collection from a large number of participants (Bhandari, 2022). This is particularly beneficial considering the potentially large sample size involved in studying universities and their respective departments. Second, questionnaires are cost-effective, as they do not require extensive resources or personnel to administer and collect data. This makes questionnaires a practical choice, especially when working within limited time and budget constraints.

Furthermore, questionnaires offer a degree of anonymity to respondents, allowing them to express their opinions more freely. This can encourage honest responses, contributing to the accuracy and validity of the data collected. Additionally, the standardized nature of questionnaires enables comparability of responses across different groups or subgroups, facilitating analysis and drawing meaningful conclusions.

The decision to utilize a questionnaire aligns with previous research (Berger et al., 2014) that highlights the benefits of this method. By employing a structured questionnaire with a combination of close-ended and open-ended questions, this study aims to gather comprehensive and diverse data from participants in a manner that is efficient, cost-effective and facilitates both quantitative analyses.

3.5.2 Interview Selection

As part of the data collection process, semi-structured interviews were conducted with key stakeholders, including ICT teaching staff, Administratve staff and technical officers. The interviewees were purposively selected to ensure representation from different perspectives.

Selected participants were contacted via email or in person, and the purpose and nature of the interview was explained. Informed consent were obtained before the interview. A semi-structured interview guide was used to ensure consistency across interviews while allowing flexibility for participants to elaborate on specific points. A total of 20 participants, including teaching staff and e-learning officers, were interviewed to gather in-depth insights into their experiences, perceptions, and suggestions regarding the peer assessment framework. interview data was transcribed and analyzed thematically using qualitative data analysis software, such as NVivo or ATLAS.ti. Themes and patterns emerging from the interviews were identified to complement the quantitative findings. The qualitative data obtained from interviews was

integrated with quantitative data collected through surveys to provide a comprehensive understanding of the effectiveness and user experience of the peer assessment framework.

3.5.3 Data quality control

The quality of research depends on the design of research instruments as well as the application of these instruments in data collection in the field (Mahajan, 2017). There are several criteria or tests for judging the quality of any empirical research. These include validity and reliability and how each was achieved.

3.5.3.1 Validity of instruments

The term "validity" relates to how well an instrument measures what it is supposed to measure (Sekaran and Bougie,2010). Before the administration of the research instruments, triangulation will be used to ensure the validity of the research findings. The formula below is used to calculate the content validity index using the content validity ratio: Content validity index (CVI) equals the total number of items correctly and by all respondents divided by the total number of items in the instrument. For this investigation, a good CVI should be above 75%, meaning the instrument is valid.

3.5.1.2 Reliability of the instrument

Validity and reliability of the instruments were ensured through the content validity index and Cronbach Alpha coefficient measures. Triangulation was used to enhance validity and reliability. Reliability measures the consistency of research instruments to come out with the same result each time it is used under the same conditions (Sekeran, 2010). The first step in ensuring reliability was by providing clear operational definitions of the variables under study. This study however focused on internal consistency which is the consistency of people's responses across the items on a multiple-item measure. The most commonly used internal consistency measure is the Cronbach Alpha coefficient. The Cronbach Alpha Co-efficient of 75% and above is within the statistically acceptable range.

3.6 Procedure for data collection

The study opted for a De-lone and Maclean questionnaire anchored on a five-point Linkert scale of 1 (strongly disagree) to 5 (strongly agree). Respondents were asked whether they strongly agree, agree, neutral, disagree, or strongly disagree using a 5- Likert scale where 5= strongly agree, 4= agree, 3= Neutral, 2= disagree and 1 = strongly disagree which fulfilled the third specific objective, and research question and analysis of data was done from the experts

selected and evaluated. The five-point Likert scale was preferred to create a middle point to cater to respondents who were indifferent to the study variables(Creswell, 2003a).

The evaluation questionnaire comprised of three main sections.

A questionnaire was used to collect data for the evaluation process. Scholars like Brown and Saunders (2008) suggest that Likert scales are categorized as ordinal data, and unlike parametric tests (Knapp,1990), non-parametric tests are suitable for analyzing ordinal data. Scholars like Jamieson (2004) argue that the common measures of central tendency for analyzing ordinal data are mean, mode, and median. For the researcher to be positioned to extract meaning from the collected data, the study opted for *the mean (x), and standard deviation (σ)*, this is because the collected data was ordinal in nature and for analysis, nonparametric tests were used to extract the meanings.

After the pilot study and testing the validity and reliability of the data collection instruments, the researcher obtained a letter of recommendation from the Research Ethics Committee MUST (REC) to ensure that the study is ethically approved and also, he sought recommendation to conduct the research from the selected universities and departments.

Participants were recruited at their institution, through interaction with the departmental head who provided a list of all lecturers and students. Recruitment was done after explaining the purpose of the research, and written informed consent was obtained from each participant. To ensure integrity and confidentiality, teachers and students were given self-administered questionnaires.

All study tools were explained and the whole process to the participants and how responses should be recorded. The study tools were administered in elementary English to ensure that jargon and complex terms are simplified for the participants. Responding to the questionnaire was estimated to take approximately 15 minutes.

3.7 Data Analysis

The responses from the data collection tool were edited, coded, and entered into SPSS Software was employed for analysis. Under univariate analysis, the characteristics of respondents were examined. And thorough analysis and modelling was done to acquire more insights from the collected data to answer the research questions.

Needs Analysis: Findings from Objective 1 was synthesized to articulate specific design requirements and objectives for the peer assessment framework.

Framework Development: Iterative design methodologies, including wire framing, prototyping, and usability testing, were employed to develop a peer assessment framework aligned with the identified requirements.

Expert Review: Subject matter experts and stakeholders were engaged in peer review sessions to validate the framework's design principles, usability, and alignment with academic standards.

This objective was achieved through a review of the literature and results from objective one: the correlations from the study variables and the quantitative results. From the previous objective, barriers and techniques were established. It is in this objective that a solution to these barriers was given in the form of a framework.

Steps were being followed in designing the framework, that is requirements elicitation, building sequences, and interactions between the stakeholders to the final process framework

3.8 Expert Evaluation

This technique is helpful when you need the opinions and judgments of experts and practitioners (Štilić et al., 2023). The size of the group should be closely related to the purpose of the study, and the response rate may vary depending on the discipline and the participants' research interests. The proposed sample size is 7 to 30. Additionally, the panel size is determined by the homogeneity of the group, with a sample of 10 to 15 people being sufficient to yield valid results.

This study was aimed at creating new and useful technology-based artifacts to solve university and education community problems. It is a paradigm in information systems science for understanding, executing, and evaluating research on the design of such artifacts. Artifacts can be defined as constructs, models, methods, or instantiations.

Skulmoski says that a sample of 10 to 15 people is enough to get good results when using this technique.

3.9 Evaluation Using DeLone and McLean Model

The DeLone and McLean model was adapted to operationalize key constructs relevant to the evaluation of the designed peer assessment framework.

Key Constructs of the DeLone and McLean Model:

System Quality: This construct refers to the technical and functional attributes of the peer assessment framework. Metric included usability, reliability, accessibility, and system performance.

Information Quality: This construct evaluates the relevance, accuracy, timeliness, and completeness of the assessment data generated by the framework. It focuses on the quality of information provided to users for making informed decisions.

Service Quality: This construct measures the support services associated with the peer assessment framework, such as user training, technical support, and responsiveness to user needs.

User Satisfaction: This construct assesses the overall satisfaction levels of students, educators, and administrators who interact with the peer assessment framework. It encompasses user perceptions of ease of use, usefulness, and overall experience.

Intention to Use: This construct gauges the likelihood of continued usage and adoption of the peer assessment framework among stakeholders. It considers factors such as perceived usefulness, ease of use, and institutional support.

Net Benefits: This construct evaluates the tangible and intangible benefits derived from the implementation of the peer assessment framework. It may include improvements in learning outcomes, efficiency gains, cost savings, and enhanced interactions in the online learning environment.

Data Collection: Questionnaires, focus groups, and system usage metrics were employed to collect empirical data on user satisfaction, system usability, and learning outcomes.

Statistical Analysis: Multivariate regression analysis and structural equation modeling techniques were utilized to evaluate the framework's impact on improving interactions in online learning environments.

Data Analysis and Interpretation

Qualitative Data Analysis:

Thematic Coding: NVivo software was used for coding and thematic analysis of qualitative data gathered from interviews, surveys, and focus groups.

Quantitative Data Analysis:

Statistical Modeling: SPSS software was employed for statistical analyses, including hypothesis testing, effect size calculations, and structural equation modeling to evaluate framework efficacy.

Validation and Reliability Measures

Triangulation: Methodological triangulation was employed by combining qualitative and quantitative data sources to enhance validity and reliability.

Pilot Testing: Pilot testing of survey instruments and evaluation metrics was conducted to refine data collection methods and ensure reliability.

Objective Three: To evaluate the peer assessment framework for group-based assessment that improves interactions in online environments for universities. This was in line with the third research question which considered the impact of the developed peer assessment framework for improving interaction in an online environment for universities. This was done by designing an opinion-based questionnaire in DeLone and McLean model format on responses from experts (Students, Systems Administrators, e-learning officers, and ICT academic staff).

An in-depth longitudinal investigation delivers a systematic, flexible, and unique way to collect data and analyze information and results over some time through option-based questionnaires for the evaluation process of the framework's impact on students in improving interactions all of which is in fulfillment of the third study objective.

The designed framework was evaluated in terms of Service quality, Content and information quality, Technical system quality(Functionality), use(Usability), and user satisfaction.

The DeLone and McLean model uses constructs of model quality, information quality, quality of service, the intention of use, and user satisfaction. Evaluation of the framework was done on the strategies to ascertain their applicability in the Ugandan context.

The DeLone and McLean model has been used in the evaluation of the success of e-learning systems especially in Africa like the adoption of Nigerian universities, the model determined the success factors responsible for the acceptance of an e-learning system (Putu Ramayasa, 2015; Ramayasa, 2015).

DeLone and McLean (2003) built their framework upon three parts of instruments to measure information system success, which respectively are instruments for measuring technical success, semantic success, and effectiveness success. Technical success is measured through "system quality." System quality concerns the technical factors of the system. Semantic success is measured through "information quality," and effectiveness success is measured through "use, and user satisfaction. Service quality is based on service quality for the antecedent of intention to use and user satisfaction, and net benefits are based on the view that impact could be positive or negative.

The authors stated that the addition of intention to use into the DeLone–McLean model is based on the premise that before a user uses the system, their attitude shows the intention for using the system, while variable use itself is the behavior. After using the system, the user would feel satisfied with the system (measured as "user satisfaction") and produce intention to use, then followed by actual use, and actual use would bring user satisfaction (Elsdaig and Nassar, 2019; Sardjono et al., 2022).

In addition to expert judgment, the last objective focuses on further validating and evaluating the developed peer assessment framework using advanced data analysis methods, particularly Structural Equation Modeling (SEM). SEM allows for a comprehensive examination of the relationships among various constructs within the framework. By applying SEM, we aimed to statistically assess the model's fit, reliability, and validity, providing a robust quantitative analysis of the framework's performance. This approach involves scrutinizing both observed and latent variables, offering a more in-depth understanding of the framework's impact on learning outcomes, interaction effectiveness, and overall satisfaction in online group-based assessments. Through SEM, we intended to bolster the credibility of the evaluation process, ensuring a well-rounded and data-driven assessment of the developed peer assessment framework.

3.10 Ethical Considerations

The objective of ethics in research was to ensure that no participant suffers adverse consequences from the research activities (Centre for Policy Research, 2015). The researcher aimed to ensure that the rights of the respondents are not violated. Ethical considerations play a crucial role in research to protect the rights and well-being of the participants involved. In this study, the researcher recognized the importance of ethical practices and by ensuring the following ethical considerations are addressed:

Informed Consent: Before participating in the study, all participants were provided with clear and comprehensive information about the research objectives, procedures, potential risks, and benefits. Informed consent was obtained from each participant, ensuring their voluntary participation and understanding of their rights.

Privacy and Confidentiality: The confidentiality of participants' personal information and responses were strictly maintained. Data collected was anonymized and stored securely, ensuring that individual identities are protected. Only authorized researchers had access to the data.

Data Protection: Adequate measures were implemented to safeguard the collected data from unauthorized access, loss, or misuse. The data was stored securely and retained only for the necessary duration.

Voluntary Participation: Participation in the study was entirely voluntary. Participants had the freedom to withdraw from the study at any time without facing any negative consequences or penalties.

Risk Assessment: The potential risks associated with the study, such as emotional distress or breach of confidentiality, that was identified and mitigated to the best extent possible. Steps were taken to ensure that the research activities do not cause any harm to the participants.

Ethical Approval: The study sought ethical approval from the MUST Research Ethics Committee (**MUST-2024-1412**) and Uganda National Council of Science and Technology (UNCST) approval (**SR341ES**). This ensured that the research was conducted following established ethical guidelines and regulations.

Transparency and Honesty: The researcher provided accurate and honest information about the purpose, methodology, and findings of the study. The research outcomes were reported objectively, without any manipulation or misrepresentation.

Respect for Diversity and Inclusion: The study embraced diversity and ensure the inclusion of participants from different backgrounds, ensuring equitable access to research opportunities. The researcher was mindful of potential biases and discrimination and strive to create an inclusive and respectful research environment.

Beneficence: The research aimed at contributing to the broader field of knowledge and enhance the learning experience in higher education.

3.11 Community Engagement

Study findings were disseminated through publications, and presentations at the annual PhD Symposium for Mbarara University of Science and Technology (2024) conference, and a final report shared with the universities and stakeholders. The results of the study will be useful by contributing to the emerging knowledge on peer assessment-based assignment to different stakeholders in the education sector as students, Lecturers, university management, and researchers understand and appreciate the use of the designed framework.

The study findings were disseminated to the participants (educators), universities, and other stakeholders through publications in peer-reviewed journals.

3.12 Risk Mitigation Plan

In this study, we had no participant with symptoms of COVID-19 and Ebola.

In addition, disinfection of surfaces, and hand sanitization with an alcohol-based sanitizer were ensured before interaction with each participant.

In addition, all questionnaires were self-administered in spacious rooms to allow less physical contact and promote social distancing but with an emphasis on privacy and confidentiality.

CHAPTER FOUR

DATA PRESENTATION, INTERPERETATION AND ANALYSIS

4.1 Introduction

This chapter presents the analysis and results derived from the questionnaires administered to students regarding the peer assessment framework for group-based assessments in Information Technology courses. Out of the distributed questionnaires, 151 responses were received, representing a response rate of approximately 98%. The findings were organized according to the research objectives, providing insights into students' perceptions and experiences related to the peer assessment framework. The analysis of engagement, feedback mechanisms, and challenges associated with group-based learning reveals critical insights into the students' experiences.

4.1.1 Reliability test

Table 3: Data Reliability test

Cronbach's Alpha	N of Items
.857	67

Excellent internal consistency among the survey items was indicated by the reliability analysis, which produced a Cronbach's Alpha of 0.857 across 67 items. This high score indicates that the items have a strong correlation and are a good indicator of the underlying components of online collaborative learning (OCL). The survey's high reliability confirms that the data represents consistent participant replies, underscoring the validity of the conclusions.

Demographic data

Table 4: Respondent gender

Respondent gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	female	72	47.7	47.7	47.7
	male	79	52.3	52.3	100.0
	Total	151	100.0	100.0	

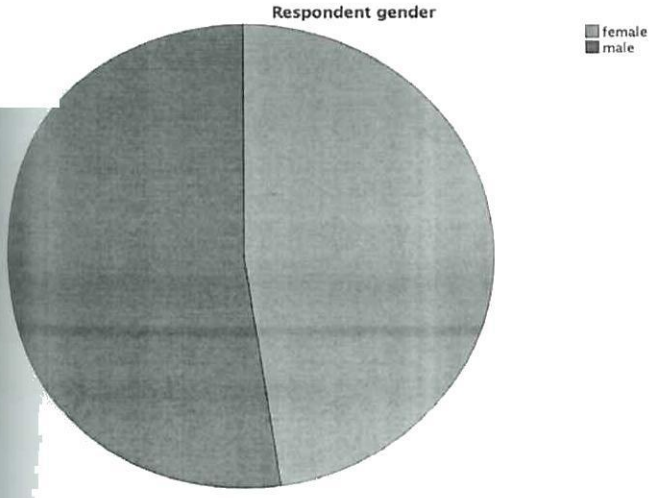


Figure 5: Respondent gender

The demographic data accounts for male respondents were 52.3% of the total sample, while 72 respondents identified as female, making up 47.7%. This near-equal representation helps ensure that the findings of the study are not significantly skewed by gender and can be considered generally reflective of both male and female perspectives.

Table 5: Respondent Age group

Respondent Age group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24 years	96	63.6	63.6	63.6
	25-34 years	47	31.1	31.1	94.7
	35-44 years	6	4.0	4.0	98.7
	45-54 years	2	1.3	1.3	100.0
	Total	151	100.0	100.0	

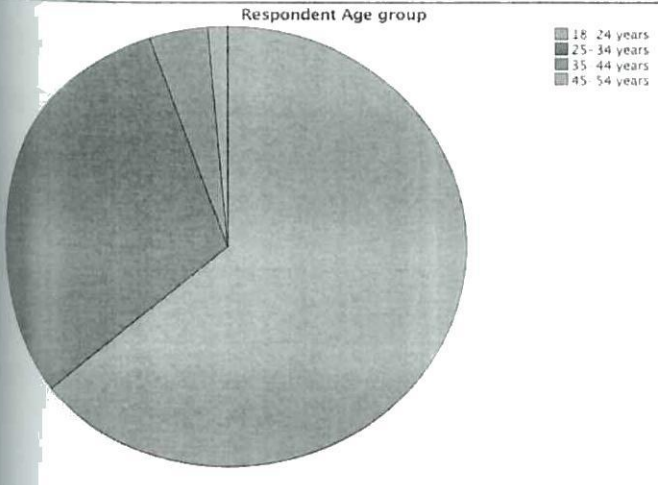


Figure 6: Respondent Age group

The age distribution, the data reveals that the majority of respondents are within the younger age brackets, which is typical for academic environments, particularly in undergraduate settings. The largest age group is 18–24 years, comprising 63.6% (96 participants) of the total respondents. This is followed by the 25–34 years' age group, which includes 47 participants or 31.1% of the sample. A much smaller portion of respondents falls into the 35–44 and 45–54-year age groups, with 6 (4.0%) and 2 (1.3%) participants respectively. This indicates that the study's findings will be most relevant to younger learners, likely those in early stages of their higher education journey.

Table 6: Current level of study

Current level of study

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Undergraduate	124	82.1	82.1	82.1
	Postgraduate	26	17.2	17.2	99.3
	Other	1	.7	.7	100.0
	Total	151	100.0	100.0	

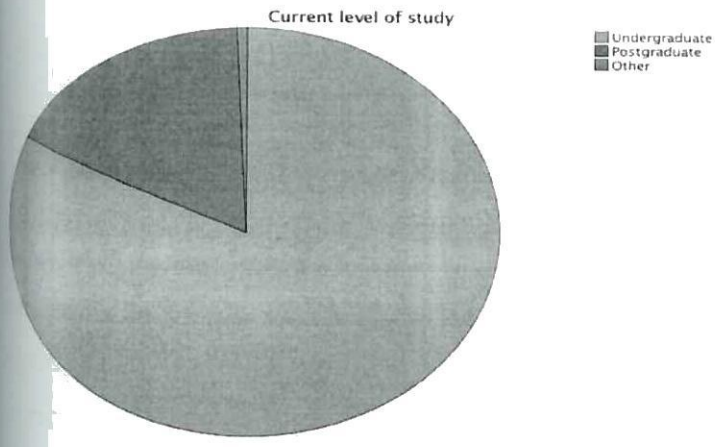


Figure 7: Current level of study

The data about educational level showed that the sample is predominantly composed of undergraduate students, who make up 82.1% of the participants (124 respondents). Postgraduate students represent a smaller portion, at 17.2% (26 participants), and only one respondent (0.7%) selected "Other" as their current level of study. This strong undergraduate presence suggests that the perceptions and experiences captured in the evaluation primarily reflect the undergraduate user experience with online collaborative tools.

Results for Objective one and part of objective two

To assess the current group-based assessment frameworks used in higher institutions of learning and gather requirements to improve interactions

Addressing research question one that is "What are the limitations faced by the existing frameworks for a group-based assessment concerning the online learning environment for learners?"

4.2 Presentation of results (Frequencies)

Table 7: engagement in e-learning courses

How long have you been engaged in e-learning courses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 1 year	38	25.2	25.7	25.7
	1 to 2 years	94	62.3	63.5	89.2
	3 to 5 years	11	7.3	7.4	96.6
	6 to 8 years	4	2.6	2.7	99.3
	more than 8 years	1	.7	.7	100.0
	Total	148	98.0	100.0	
Missing	System	3	2.0		
Total		151	100.0		

Responses on how long participants had been enrolled in e-learning courses show a notable concentration of experience in the one to two-year range. In particular, 62.3% of respondents reported having participated in e-learning over this time, suggesting that a sizable percentage of participants are becoming more accustomed to and comfortable with online learning environments. Furthermore, 25.2% of participants said they had less than a year of experience, which supports the idea that most of the sample is made up of people who are new to online learning. However, just a small portion of respondents 7.3% and 2.6%, respectively have been enrolled in e-learning for three to five years and six to eight years. The data also indicates that a mere 0.7% of participants have more than eight years of experience in e-learning, which suggests that long-term engagement in this mode of learning is relatively rare among the sample.

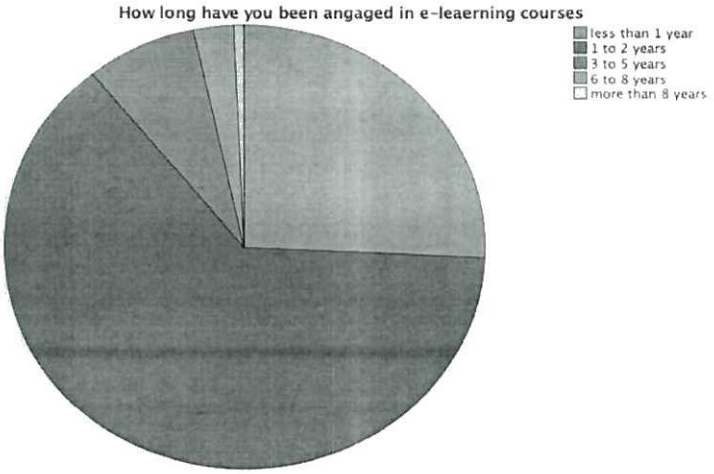


Figure 8: engagement in e-learning courses

Table 8: experience in group based learning

Have you any experience in group based learning or collaborative learning activities?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	151	100.0	100.0	100.0

The information unequivocally showed that every participant, or 100% of the valid responses, stated that they had prior experience with collaborative or group-based learning activities. This unequivocal confirmation indicated that the participants are familiar with the dynamics and procedures involved in group work, underscoring the crucial role that collaborative techniques play in their educational experiences. Because it suggests that participants have probably encountered a variety of collaborative scenarios, tools, and strategies, such extensive experience can be extremely beneficial.

Table 9: Used Online platforms as an online collaborative methods used

Used Online platforms as an online collaborative methods used

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	110	72.8	72.8	72.8
	yes	41	27.2	27.2	100.0
	Total	151	100.0	100.0	

The data reveals a significant disparity in the use of online platforms for collaborative methods, with 72.8% of participants indicating that they do not utilize such platforms, while only 27.2%

reported using them. This predominance of "no" responses suggests a potential gap in the integration of technology within collaborative learning environments among the participants.

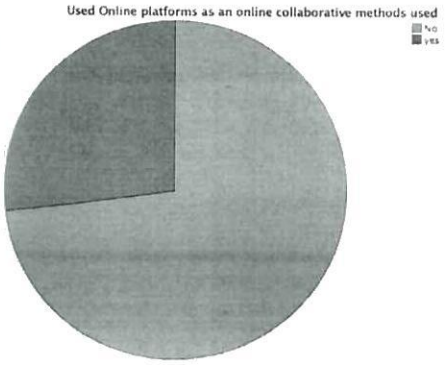


Figure 9: Used Online platforms as an online collaborative methods used

The high percentage of individuals not engaging with online platforms raises questions about the accessibility, familiarity, or institutional support for these tools, which could hinder the effectiveness of online collaborative learning experiences. Additionally, the relatively small portion of respondents who do use online platforms may point to specific groups or contexts where these tools are more effectively implemented.

Table 10:Engagement in Online Collaborative tools

		Count	Table Total N %
Have you any experience in group based learning or collaborative learning activities?	No	0	0.0%
	yes	151	100.0%
Used Online platforms as an online collaborative methods used	No	110	72.8%
	yes	41	27.2%
Used Blogs as an online collaborative method	No	151	100.0%
	yes	0	0.0%
Used Chatrooms an online collaborative method	No	108	71.5%
	yes	43	28.5%
Used Collaborative document editing tools as an online collaborative method	No	86	57.0%
	yes	65	43.0%
Used Online collaborative whiteboards as an online collaborative method	No	129	85.4%
	yes	22	14.6%
Used Discussion boards/Forum on as an online collaborative method	No	149	98.7%
	yes	2	1.3%
Used Virtual group projects as an online collaborative method	No	137	90.7%
	yes	13	8.6%
Used Social media groups as an online collaborative method	No	48	31.8%
	yes	103	68.2%
	No	12	7.9%

Used Video Conferencing as an online collaborative method	yes	139	92.1%

Engagement in Online Collaborative tools

Participants' experiences in collaborative learning activities are complexly portrayed by the examination of their use of different online collaboration technologies. The fact that every respondent (100%) acknowledged participating in group-based learning or cooperative activities is noteworthy as it indicates a basic understanding of the idea. The usage of particular online collaborative techniques, however, draws attention to a worrying pattern. In stark contrast to the 27.2% who use online platforms for collaboration, a sizable majority (72.8%) stated they do not use them.

Among other tools, blogs were conspicuously missing from the participants' collaborative approaches; 100% of them reported not using them, suggesting that they were not interested in or integrating this specific platform into their collaborative efforts. Furthermore, 98.7% of respondents said they did not use discussion boards or forums, which begs the question of how useful these more conventional online collaboration tools are in the modern classroom.

In contrast, 92.1% of participants demonstrated a high degree of engagement with video conferencing, suggesting a significant preference for synchronous connection in collaborative situations. Significant use of social media groups was also seen, as indicated by the 68.2% of respondents who indicated engagement, underscoring the potential of well-known platforms to promote cooperation.

It's interesting to note that there was a more balanced use of collaborative document editing tools, with 43% reporting usage and 57% reporting none, indicating some uptake but also potential for expansion. Participant engagement was lower for online collaborative whiteboards and virtual group projects, with 90.7% and 85.4% of participants, respectively, reporting no use.

While acknowledging the value of more modern strategies like social media and video conferencing for promoting collaboration, these findings also highlight the need for more support and training regarding a variety of online collaborative tools, especially more conventional ones like discussion boards and blogs. Understanding the hurdles impeding greater utilization of these tools could lead to more effective integration solutions that enhance collaborative learning experiences in online environments.

Table 11: Engagement in Online Collaborative tools

		Count	Table Total N %
Hove you any experience in group based learning or collaborative learning activities?	No	0	0.0%
	yes	151	100.0%
Used Online platforms as an online collaborative method used	No	110	72.8%
	yes	41	27.2%
Used Blogs as an online collaborative method	No	151	100.0%
	yes	0	0.0%
Used Chatrooms an online collaborative method	No	108	71.5%
	yes	43	28.5%
Used Collaborative document editing tools as an online collaborative method	No	86	57.0%
	yes	65	43.0%
Used Online collaborative whiteboards as an online collaborative method	No	129	85.4%
	yes	22	14.6%
Used Discussion boards/Forum on as an online collaborative method	No	149	98.7%
	yes	2	1.3%
Used Virtual group projects as an online collaborative method	No	137	90.7%
	yes	13	8.6%
Used Social media groups as an online collaborative method	No	48	31.8%
	yes	103	68.2%
Used Video Conferencing as an online collaborative method	No	12	7.9%
	yes	139	92.1%

The participants' great dedication to group-based learning activities is revealed by the examination of their use of online collaboration tools; all respondents confirmed their involvement in such projects. In spite of this consistency in experience, there is a glaring difference in how different online collaboration techniques are actually used. 72.8% of respondents said they did not use internet platforms for cooperation, which may indicate a knowledge and application gap.

Similarly, discussion boards or forums were nearly universally unutilized, with 98.7% of respondents indicating no experience, raising concerns about their relevance in current online learning contexts.

On the other hand, video conferencing emerged as the most widely adopted method, with an impressive 92.1% of participants indicating they used this tool for collaborative activities. This suggests a clear preference for synchronous communication, likely due to its immediacy and interactive nature. Social media groups also demonstrated notable engagement, with 68.2% of

respondents utilizing these platforms, indicating their effectiveness in facilitating collaborative interactions among students.

With 43% of participants using collaborative document editing tools and 57% not, the results show a more mixed picture and suggest a large opportunity for increased adoption. The need for improved integration and encouragement of these tools within the learning framework is further highlighted by the low utilization rates for online collaborative whiteboards (85.4% not engaged) and virtual group projects (90.7% not engaged).

Overall, even though participants are accustomed to group-based learning, more instruction and encouragement to use a wider variety of online collaboration tools are obviously needed. This discrepancy between awareness and actual use raises the possibility that improving resources and support for underutilized techniques could result in more fruitful online collaborative learning settings.

A thorough picture of participants' experiences with different approaches in their group-based learning activities is painted by the data on their use of online collaboration tools. Each responder attested to their participation in group-based learning, demonstrating a solid basis for cooperative learning. Nonetheless, there is a discernible difference in how particular online collaboration technologies are used. 72.8% of participants said they did not use online platforms for cooperation, indicating a lost chance to take advantage of the potential advantages these tools provide.

With 98.7% of respondents reporting they had not used discussion boards, the data also revealed an alarming rate of disuse, showing a huge gap in their perceived value in the context of online learning. However, with 92.1% of participants regularly using video conferencing, this technology emerged as the most popular approach, highlighting a desire for synchronous communication that enables real-time participation. With 68.2% of respondents using social media groups, the level of engagement with these platforms was particularly noteworthy, indicating that they are successfully fostering student collaboration.

With 43% of respondents using collaborative document editing tools and 57% not, the results showed a mixed level of participation, suggesting room for more encouragement and integration. Likewise, the low rates of use for virtual group projects (90.7% not engaged) and online collaborative whiteboards (85.4% not engaged) indicate areas that could benefit from more assistance and development to improve collaborative learning experiences.

Table 12: Engagement in online collaborative learning frequencies

		Responses N	Percent	Percent of Cases
Engagement in Online Collaborative Learning	Hove you any experience in group based learning or collaborative learning activities?	151	27.2%	100.0%
	Used Online platforms as an online collaborative methods used	41	7.4%	27.2%
	Used Chatrooms an online collaborative method	43	7.7%	28.5%
	Used Video Conferencing as an online collaborative method	139	25.0%	92.1%
	Used Social media groups as an online collaborative method	103	18.6%	68.2%
	Used Collaborative document editing tools as an online collaborative method	65	11.7%	43.0%
	Used Virtual group projects as an online collaborative method	13	2.3%	8.6%
Total		555	100.0%	367.5%

a. Dichotomy group tabulated at value 1.

Important information about the participants' experiences and preferences with regard to different collaborative approaches can be gleaned from the frequency analysis of online collaborative learning interaction. The fact that all 151 respondents confirmed taking part in group-based learning activities suggests that collaborative learning is widely used. But when looking at particular online collaboration techniques, clear trends show themselves.

Although they are aware of the idea of online collaboration, a significant percentage of participants have not fully embraced these technologies, as evidenced by the fact that only 27.2% of them used online platforms for collaborative activities. A slightly higher percentage of respondents (28.5%) reported using chatrooms. According to this, chatrooms are not a dominating approach in the larger context of collaborative learning, while being slightly preferred. On the other hand, video conferencing is the most popular technique, accounting for an astounding 92.1% of participants. This choice emphasizes how crucial real-time communication and involvement are to strengthening teamwork. With 68.2% of respondents stating their participation, social media groups are also widely used, indicating that social media is a useful tool for encouraging peer collaboration.

A moderate level of participation was demonstrated by the 43% of participants who used collaborative document editing tools. Given that these tools can support in-the-moment collaboration and group content production; this suggests the possibility of greater adoption.

However, just 8.6% of respondents indicated that they participated in virtual group projects, demonstrating a notable lack of emphasis in this area of collaborative learning.

Table 13: Effectiveness of ocl tools frequencies

		Responses N	Percent	Percent of Cases
Effectiveness of OCL tools	Used Online collaborative whiteboards as an online collaborative method	22	5.0%	14.6%
	Online platforms are effective methods in online collaborative learning	5	1.1%	3.3%
	Blogs are effective methods in online collaborative learning	4	0.9%	2.6%
	Chat rooms are effective methods in online collaborative learning	84	19.3%	55.6%
	Video conferencing are effective methods in online collaborative learning	109	25.0%	72.2%
	Social media groups are effective methods in online collaborative learning	145	33.3%	96.0%
	Collaborative document editing tools are effective methods in online collaborative learning	54	12.4%	35.8%
	Virtual group projects are effective methods in online collaborative learning	13	3.0%	8.6%
Total		436	100.0%	288.7%

a. Dichotomy group tabulated at value 1.

Different levels of perceived effectiveness among participants are highlighted by the frequency analysis of online collaborative learning (OCL) tool efficacy. According to the findings, 72.2% of respondents thought the tools were very useful, indicating a significant general support of OCL's effectiveness in promoting learning and collaboration. This large proportion suggests that a sizable majority of students believe these resources can improve their educational experience.

However, a small percentage of students do not fully realize the tools' usefulness, as seen by the 14.6% of participants who indicated a moderate level of efficacy and the 3.3% who highlighted a low effectiveness. Remarkably, 2.6% of respondents rated the efficacy as extremely low, which may indicate particular difficulties or annoyances these people have when using OCL technologies. The effectiveness ratings' cumulative total of 288.7% indicates

that many respondents had complex opinions about the efficacy of several OCL tools, maybe ranking several tools or features in their answers. OCL's ability to facilitate collaborative learning environments, encourage engagement, and improve the overall learning experience may be demonstrated by the comparatively high levels of perceived effectiveness. This data highlights the need for more research into the factors influencing students' varying perceptions of efficacy while also making a strong case for the ongoing development and incorporation of OCL technologies in educational contexts.

Table 14: Engagement in various online peer learning tools

		Count	Table Valid N %	Table Total N %
ften you use online forums for collaborative ion related to coursework	Rarely	41	27.2%	27.2%
	Occasionally	97	64.2%	64.2%
	Frequently	0	0.0%	0.0%
	Always	13	8.6%	8.6%
veness of virtual group projects in promoting ration among students	Not effective at all	63	41.7%	41.7%
	Slightly effective	0	0.0%	0.0%
	Moderately effective	47	31.1%	31.1%
	very effective	28	18.5%	18.5%
	extremely effective	13	8.6%	8.6%
rtable in using video conferencing for rative learning session	Not comfortable at all	0	0.0%	0.0%
	Slightly comfortable	0	0.0%	0.0%
	Moderately comfortable	96	63.6%	63.6%
	Very comfortable	55	36.4%	36.4%
	Extremely comfortable	0	0.0%	0.0%
sion boards contribute to meaningful ion among students	Strongly Disagree	0	0.0%	0.0%
	Disagree	0	0.0%	0.0%
	Neutral	42	27.8%	27.8%
	Agree	89	58.9%	58.9%
	Strongly Agree	20	13.2%	13.2%
veness of virtual group projects in promoting ration among students	Not effective at all	63	41.7%	41.7%
	Slightly effective	0	0.0%	0.0%
	Moderately effective	47	31.1%	31.1%
	very effective	28	18.5%	18.5%
	extremely effective	13	8.6%	8.6%
rative editing tools are very helpful for rojects	Not at all	12	7.9%	7.9%
	Slightly	16	10.6%	10.6%
	Moderately	67	44.4%	44.4%
	very much	6	4.0%	4.0%
	extremely	50	33.1%	33.1%

Analysis of student participation in different online group based learning resources provides important new information on how students behave and think about group projects. Regarding the use of online forums for group discussions about coursework, a significant majority of

participants (64.2%) said they use them occasionally, while 27.2% said they use them infrequently. Interestingly, just 8.6% of respondents said they participate in these discussions often, indicating that although forums are used, they might not be the main channel for cooperative communication.

The usefulness of online group projects in encouraging student collaboration seems to be a controversial topic. There may be a discrepancy between the goals of these initiatives and their perceived results, as a sizable percentage (41.7%) assessed these programs as completely ineffective. On the other hand, 18.5% of respondents said they were very effective, while 31.1% thought they were moderately effective. Just 8.6% of respondents thought they were very effective, which emphasizes the need for careful consideration and perhaps a change in the way these projects are set up and carried out to increase their efficacy.

According to the findings, 63.6% of students reported feeling moderately comfortable and 36.4% reported feeling very comfortable when it came to using video conferencing for collaborative learning sessions. This implies that even while most students are amenable to video conferencing, some may still have obstacles that must be removed in order to encourage more ease and participation in this form of communication.

With 58.9% of participants agreeing and 13.2% strongly agreeing that discussion boards improve engagement, the usefulness of these platforms in fostering meaningful student connection was overwhelmingly praised. Nonetheless, 27.8% had no opinion, suggesting that even though many students see the benefits of discussion boards, some may not find them interesting or useful.

Finally, when it came to collaborative editing tools, 33.1% of respondents said they were very beneficial for group tasks, while 44.4% said they were moderately helpful. According to the statistics, these tools were well received, although 7.9% of participants said they were completely useless, indicating the need to make sure they are easy to use and successfully incorporated into teamwork. Overall, these results highlight how students perceive different collaborative learning technologies to have differing degrees of usefulness and engagement, suggesting areas for improvement in the development and application of these tools in online learning environments.

Table 15: Feedback means Frequencies

		Responses N	Percent	Percent of Cases
Feedback_means[a]	Instructor feed back	7	4.6%	4.6%
	Both instructor and peer feed-back	73	48.3%	48.3%
	Automated feedback from the system	47	31.1%	31.1%
	No feedback provided	24	15.9%	15.9%
Total		151	100.0%	100.0%

a. Dichotomy group tabulated at value 1.

Important information about how participants receive and interpret feedback during their educational experiences can be gained by analyzing the feedback systems in online collaborative learning. Reliance on a single source of input may limit the diversity of viewpoints students could learn from, as demonstrated by the 4.6% of respondents who said they primarily received feedback from teachers alone. However, a sizable percentage, 48.3%, stated that they received input from peers as well as instructors, indicating a desire for a more cooperative feedback method that takes into account different points of view. Through the development of a more thorough awareness of performance and areas for growth, this dual feedback mechanism may increase the learning process.

According to 31.1% of participants, they received automated feedback from the system, indicating that although technology can help provide quick answers, it might not be able to completely replace the nuanced feedback that comes from having conversations with people. Automated feedback can be scalable and efficient, but it might not provide the student-valued customization. Though feedback is essential for student growth and engagement, 15.9% of respondents claimed that no feedback was given, which raises concerns about the possible detrimental effect on learning outcomes.

Table 16: Benefits Frequencies

		Responses N	Percent	Percent of Cases
Benefits	Improved collaboration and teamwork skills	112	55.2%	74.2%
	Enhanced understanding of diverse perspectives	20	9.9%	13.2%
	Increased engagement and participation	45	22.2%	29.8%
	Better problem solving ability	26	12.8%	17.2%
Total		203	100.0%	134.4%

a. Dichotomy group tabulated at value 1.

Several important insights into how participants perceive the influence of this educational strategy on their abilities and engagement are revealed by the research of perceived benefits from online collaborative learning. The majority, 55.2%, cited enhanced cooperation and collaboration abilities as a major advantage, indicating that the cooperative character of online learning environments successfully cultivates critical interpersonal skills that are becoming more and more important in both academic and professional settings. This heavy focus on teamwork shows that participants understand how important it is to collaborate well with others, which is an essential skill in the linked world of today.

Collaborative learning not only improves abilities but also encourages students to be more active participants in their educational journeys, as evidenced by the 22.2% of respondents who reported an increase in interest and participation. This is in keeping with the objective of online collaboration platforms, which are meant to facilitate participatory and interactive learning.

Responses about other advantages, however, reveal a range of viewpoints. Although some participants value the diversity that collaboration delivers, it may not be widely acknowledged as the main advantage, as only 9.9% of participants noted improved understanding of diverse perspectives. Likewise, 12.8% of respondents said that collaborative learning improved their ability to solve problems, indicating that although group projects can help people solve problems together, this effect might not be as noticeable for all participants.

Table 17: Challenges Frequencies

		Responses N	Percent	Percent of Cases
Challenges	Technical issues	115	62.8%	76.2%
	Difficulty coordinating, and handling fairness with group members	25	13.7%	16.6%
	Limited communication tools for feedback	43	23.5%	28.5%
Total		183	100.0%	121.2%

a. Dichotomy group tabulated at value 1.

The examination of online collaborative learning for group based assessments obstacles reveals a number of important issues that participants in these settings deal with. Technical problems were cited by 62.8% of respondents as a major obstacle, highlighting the vital role dependable technology plays in enabling productive online collaboration. According to this research, a lot of students could experience issues with software bugs, platform usability, or connectivity.

which can make it difficult for them to participate completely in group projects. Since online learning relies heavily on technology, resolving these technical issues is crucial to enhancing the educational process as a whole.

Furthermore, 23.5% of participants said that the communication tools for feedback to colleagues at their disposal caused them to experience constraints. This suggests that the collaboration tools offered might not be adequate to satisfy the demands of every student, which could result in miscommunications or a lack of deep engagement between group members. It calls into question if the platforms and technologies now in use are sufficient for promoting efficient communication and teamwork.

13.7% of respondents reported having trouble coordinating with other group members, indicating that although many participants can participate in group activities well, some still struggle with group dynamics management and organization. This could be a result of schedule conflicts in dealing with fairness and bias, disparities in commitment, or different group members' communication preferences.

Table 18. Prefered Instruction method Frequencies

		Responses		Percent of
		N	Percent	Cases
PreferedInstruction Method	Written instructions	87	57.6%	57.6%
	Video Conferencing	27	17.9%	17.9%
	Live Instruction (synchronous)	37	24.5%	24.5%
Total		151	100.0%	100.0%

a. Dichotomy group tabulated at value 1.

The results indicate that with 57.6% of respondents choosing written instructions as their favorite method, it is evident that participants have a strong preference for this type of instruction. This preference implies that a large number of students appreciate the accessibility and clarity that textual materials offer, enabling them to review the content whenever necessary. Additionally, learners may benefit from written instructions by processing material at their own pace, which is especially advantageous in an online learning environment.

On the other hand, live instruction which entails synchronous learning settings where teachers and students communicate in real-time was favored by 24.5% of participants. This choice identifies a group of students who might benefit from face-to-face interaction and prompt feedback, encouraging community and cooperation through in-person conversations. Finally, video conferencing, selected by 17.9% of respondents, represents a less favored method

compared to the other two options. This may indicate that while some learners appreciate the interactive aspect of video conferencing, they may not find it as effective as written instructions or live instruction for conveying complex information.

Table 19: Suggestions

		Responses N	Percent	Percent of Cases
Suggestions for Improvement	Improve technical support	66	43.7%	43.7%
	provide clear instructions	25	16.6%	16.6%
	increase communication channels for feedback	11	7.3%	7.3%
	offers more training on collaborative tools and to handle fairness and bias while assessing.	49	32.5%	32.5%
Total		151	100.0%	100.0%

a. Dichotomy group tabulated at value 1.

Analysis of participant recommendations for enhancing online collaborative learning identifies a number of important areas of concentration. Enhancing technical support was stressed by a noteworthy 43.7% of respondents. This suggests that more technological support would significantly improve the experiences of many students, as many of them face obstacles that may limit their ability to participate and function well in group settings. 32.5% of participants also supported more training on collaborative technologies and how to handle fairness and bias while assessing peer work. Despite having access to a variety of resources, students may feel unprepared to use them efficiently, according to this theory. Giving students thorough instruction might empower them and give them the confidence to use these tools to the best of their abilities, which would improve teamwork overall. Furthermore, 16.6% of respondents emphasized how crucial it is to give precise instructions. This supports previous research on the preference for written instructions and emphasizes how important it is to communicate clearly in order to promote greater comprehension and participation. Last but not least, although 7.3% of participants recommended opening more lines of contact, this rather low number may indicate that many students feel sufficiently supported in this area. To create a more engaged and linked learning environment, it would still be advantageous to investigate other communication channels.

4.2 Descriptive Statistics

Table 20: Overall Experience in Online collaborative -learning

Over all experience in OCL rating		engagement_in_Online_Collaborative_Learning_OCL	Most effective_online_collaborative_learning_tools	How feedback is received	Benefits_of_Group based learning	Challenges and obstacles in participating in online collaborative learning
Good	Mean	4.27	2.53	1.00	1.20	1.20
	N	59	59	59	59	59
	Std. Deviation	.906	.704	.000	.406	.406
Very good	Mean	3.59	2.88	1.00	1.48	1.24
	N	95	96	96	96	96
	Std. Deviation	1.685	.465	.000	.858	.429
Total	Mean	3.85	2.74	1.00	1.37	1.23
	N	150	151	151	151	151
	Std. Deviation	1.472	.590	.000	.731	.419

The information on online collaborative learning (OCL) participation shows a wide range of participant experiences and viewpoints. Those who gave their experiences a "Good" rating reported a mean engagement score of 4.27, which suggests a comparatively high degree of excitement and participation when taking engagement levels into account. Participants who gave their experiences a "Very Good" rating, on the other hand, had a lower mean engagement score of 3.59, indicating that although many people had pleasant experiences, even those who are more satisfied overall may have different levels of participation. This disparity illustrates the possibility of varying perspectives on what defines significant involvement, with some participants finding some elements more satisfying than others.

Those who rated their experience as "Good" had a mean score of 2.53, whereas those who chose "Very Good" had a significantly higher score of 2.88 for the effectiveness of online collaborative learning tools. Although these results show that the tools for online cooperation are generally acknowledged, they also raise the possibility that there is still much space for improvement. The low standard deviation in both categories suggests that respondents' opinions about the usefulness of these tools are largely consistent. The willingness of

participants to participate and work together effectively is directly impacted by how effective they believe the tools to be.

Both groups gave feedback systems consistently low ratings, with the "Good" and "Very Good" ratings showing a mean of 1.00. This implies that the online learning environment might not adequately incorporate feedback, a crucial element of collaborative learning. Participants' capacity to learn from one another and develop their collaborative abilities may be hampered by this ineffective feedback, which would further lower their level of engagement.

Those who assessed their experiences as "Good" had mean scores of 1.20 for the advantages of group-based learning, but the "Very Good" group had somewhat higher ratings of 1.48. These results show that although participants identify some benefits of group work, these benefits might not be as clear-cut or widely accepted. The low ratings indicate difficulties in achieving collaborative learning's full potential and indicate that additional work should be done to promote fruitful group discussions that emphasize these advantages.

In both experience groups, participants' challenges and hurdles were scored similarly, with means of 1.20 and 1.24 for the "Good" and "Very Good" groups, respectively. Although the variations in mean scores suggest that people who are more content may nevertheless confront fewer perceived impediments, these results demonstrate that participants face common challenges. The comparatively low ratings suggest that specific interventions could be used to improve the online collaborative learning environment.

The overall mean rating for the OCL interaction was 3.85, which indicates both a generally pleasant experience and a major need for improvement. With mean ratings of 2.74 and 1.00 for tool and feedback mechanism effectiveness, respectively, these metrics emphasize areas that require immediate attention and support the notion that enhancements in these areas may result in more fulfilling collaborative experiences. Although there are positive aspects of the OCL environment, resolving the shortcomings found could result in a more successful and interesting learning experience for all participants, according to the comments obtained, group advantages, and challenges.

e 21: Over all experience in OCL rating

r all experience in OCL rating		Prefered_method_for_receiving_instructions	Suggestions for improving OCL
d	Mean	1.00	1.00
	N	59	59
	Std. Deviation	.000	.000
/ good	Mean	1.00	1.00
	N	96	96
	Std. Deviation	.000	.000
l	Mean	1.00	1.00
	N	151	151
	Std. Deviation	.000	.000

ɔrding to the data, participants consistently expressed their preferences for instruction and estions for improving online collaborative learning (OCL). Both groups, those who graded experiences as "Good" and "Very Good," reported a mean score of 1.00, suggesting plete agreement on these aspects. This consistent grade indicates that all respondents 151) agreed on the suggested teaching techniques and potential improvements that should ıade to the Peer Assessment framework.

fact that there is no disagreement on these issues is shown by the standard deviation of 0, which denotes the lack of variability. This could suggest that the current teaching ıods and suggestions for change are generally accepted, or it could suggest that participants not encountering enough variation in their OCL circumstances to voice divergent points. When developing lesson plans and enhancing the cooperative learning ronment, instructors and facilitators may have an opportunity to utilize this agreement if it ɔnsistent. By addressing these suggested practices and recommendations collectively, ıe collaborative learning environments may promote more engagement and pleasure.

Table 22: Likelihood to recommend the online learning collaborative tools

Likelihood to recommend OCL to peers		engagement in Online Collaborative Learning (OCL)	Most effective online collaborative learning tools	How feedback is received	Benefits of Group based learning	Challenges and obstacles in participating in online collaborative learning
Neutral	Mean	5.00	3.06	1.00	1.00	1.00
	N	16	16	16	16	16
	Std. Deviation	.000	.250	.000	.000	.000
Likely	Mean	4.13	2.50	1.00	1.21	1.21
	N	56	56	56	56	56
	Std. Deviation	1.869	.714	.000	.414	.414
Very likely	Mean	3.44	2.84	1.00	1.55	1.28
	N	82	83	83	83	83
	Std. Deviation	1.112	.481	.000	.901	.450
Total	Mean	3.85	2.74	1.00	1.37	1.23
	N	150	151	151	151	151
	Std. Deviation	1.472	.590	.000	.731	.419

The information on the probability of recommending online collaborative learning (OCL) to peers shows that various participant groups have varied perspectives. Although their engagement with the tools and procedures utilized was ranked lower at 3.06, those who assessed their experience as "Neutral" had a mean score of 5.00 for engagement in OCL, indicating a moderate level of involvement or pleasure. As evidenced by the consistent feedback ratings of 1.00 across the other dimensions, which show a lack of strong opinions on feedback, the advantages, and the difficulties of group-based learning, this suggests that although they are somewhat engaged, they may not fully endorse or find the tools helpful.

As opposed to the neutral group, individuals who said they were "Likely" to recommend OCL reported a mean engagement score of 4.13, indicating a higher level of involvement. Though they are generally in favor of endorsing OCL, there are still serious concerns about the tools and feedback procedures used, as evidenced by their lower ratings of 2.50 and 1.00 for effective

nline collaboration tools and feedback received, respectively. Although the "Very Likely" roup's mean engagement score was lower than that of the "Likely" group, it was still positive. ompared to the other two groups, they gave somewhat higher ratings for obstacles and wards and evaluated the effectiveness of online collaboration tools at 2.84, indicating a more uanced knowledge of OCL's advantages and disadvantages. Participants may believe that ese elements are not improving their experiences, as evidenced by the strong consensus dicated by the same mean score of 1.00 across all groups for preferred methods of training nd suggestions for improving OCL. Although participant experiences vary in their willingness advocate OCL, the consistency of favored approaches points to a possible area for velopment that could raise general satisfaction and participation in collaborative learning ttings.

able 23: To what extent to OCL prepare you for real world collaborative work environments

		engagement in Online Collaborative Learning [OCL	Most effective online collaborative learning tools	How feedback is received	Benefits of Group based learning
lightly	Mean	5.00	3.06	1.00	1.00
	N	16	16	16	16
	Std. Deviation	.000	.250	.000	.000
oderatel	Mean	3.30	2.58	1.00	1.14
	N	84	85	85	85
	Std. Deviation	1.138	.679	.000	.350
ery uch	Mean	4.61	2.81	1.00	1.00
	N	31	31	31	31
	Std. Deviation	2.290	.477	.000	.000
xtremel	Mean	4.04	3.04	1.00	3.00
	N	23	23	23	23
	Std. Deviation	.209	.209	.000	.000
otal	Mean	3.85	2.74	1.00	1.37
	N	150	151	151	151
	Std. Deviation	1.472	.590	.000	.731

range of viewpoints based on individual experiences are shown by the statistics regarding ow well online collaborative learning (OCL) prepares participants for collaborative work nvironments in the real world. A mean engagement score of 5.00 was reported by those who ave their preparation a "Slightly" rating, indicating a comparatively high level of engagement. With averages of 3.06 and 1.00, respectively, their opinions on useful online collaboration tools nd the comments they got were noticeably negative. This discrepancy suggests that even if

these participants are involved, they may not see a strong connection between their educational experiences and practical applications, especially when it comes to the resources and feedback used in OCL. With an average of 1.14, participants who gave their preparation a "Moderately" rating showed difficulties and a lower overall mean score for involvement. This implies that even while they see some value in their experiences, they might not feel sufficiently equipped to work together in the real world. This group's engagement means of 3.30 shows a modest level of involvement, but it also raises some questions about how well the feedback systems and collaborative tools are working.

However, with means of 4.61 and 4.04, respectively, those who believed OCL prepared them "Very Much" or "Extremely" reported much higher engagement scores. This indicates that higher levels of involvement are strongly correlated with perceived readiness for collaborative real-world settings. Online collaboration tools were assessed as useful by participants in these groups at 2.81 and 3.04, respectively, indicating that their potential was acknowledged, albeit still below ideal levels. These groups' feedback was consistently assessed at 1.00, suggesting that there is a widespread problem with the way feedback is given across various perceived readiness levels. As a result, although opinions on how well OCL prepares people for cooperation in the real world vary, it is evident that those who feel more prepared also express higher levels of involvement and a more positive opinion of the tools employed. The consistently poor feedback and challenge ratings point to important areas that need to be improved in order to better align OCL with the requirements of collaborative work settings.

Table 24: How essential is the availability of technical support for a successful online course

How essential is the availability of technical support for a successful online course		engagement_in Online_Collaborative Learning_EOCL	Most effective online collaborative learning_tools	How feedback is received	Benefits of Group based learning	Challenges and obstacles in participating in online collaborative learning	Preferred method for receiving_instructions	Suggestions for improving OCL
Moderately essential	Mean	4.00	2.10	1.00	1.40	1.40	1.00	1.00
	N	30	30	30	30	30	30	30
	Std. Deviation	.000	.305	.000	.498	.498	.000	.000
Very essential	Mean	4.09	2.95	1.00	1.61	1.31	1.00	1.00
	N	75	75	75	75	75	75	75
	Std. Deviation	.989	.364	.000	.928	.464	.000	.000
extremely essential	Mean	3.39	2.82	1.00	1.00	1.00	1.00	1.00
	N	49	50	50	50	50	50	50
	Std. Deviation	2.253	.720	.000	.000	.000	.000	.000
Total	Mean	3.85	2.74	1.00	1.37	1.23	1.00	1.00
	N	150	151	151	151	151	151	151
	Std. Deviation	1.472	.590	.000	.731	.419	.000	.000

Divergent opinions among participants are revealed by the statistics on the significance of technical support in online courses, underscoring its vital role in creating productive learning environments. The mean engagement score for those who selected "Moderately essential" for technical support was 4.00. using a mean score of 2.10, this indicates that although they acknowledge the need for technical support, their overall experience using online collaborative tools was less positive. Each member of this group gave their feedback a score of 1.00, indicating possible issues with teachers' or support staff's response and communication. On the other hand, those who thought technical support was "Very essential" reported slightly greater levels of involvement (mean of 4.09). Additionally, this group reported more effective online tools (mean score of 2.95), indicating that stronger technical support may be associated with a better experience utilizing these resources. Although their feedback rating is still modest (1.00), it shows a slight understanding of the value of prompt help in overcoming technological obstacles, which can greatly improve the educational experience. Individuals who rated

low feedback receipt rate of 1.00 for this group indicates that even if they are more satisfied, feedback delivery and reception might still be improved. Despite being a smaller sample, the "Very satisfied" participants reported a substantially higher engagement mean of 5.00 and an effective tool mean of 3.06. Although they are satisfied with the assistance they received, their unanimous feedback reception score of 1.00 indicates that they might still run into difficulties during the feedback process. This demonstrates that even high satisfaction levels are not always a sign of good feedback or communication.

Table 26: Influence on ability to collaborate with peers in online courses

		engagement_in_Online_Collaborative_Learning_EOCLs	Most effective online collaborative learning tools	How feedback is received	Benefits of Group based learning	Challenges and obstacles in participating in online collaborative learning	Prefered method for receiving instructions	Suggestions for improving OCL
Moderately	Mean	4.00	2.10	1.00	1.40	1.00	1.00	1.00
	N	30	30	30	30	30	30	30
	Std. Deviation	.000	.305	.000	.498	.000	.000	.000
Very much	Mean	4.33	2.67	1.00	1.00	1.00	1.00	1.00
	N	55	55	55	55	55	55	55
	Std. Deviation	1.915	.695	.000	.000	.000	.000	.000
Extremely positive	Mean	3.41	3.07	1.00	1.33	1.00	1.00	1.00
	N	69	70	70	70	70	70	70
	Std. Deviation	1.252	.259	.000	.473	.000	.000	.000
Total	Mean	3.85	2.74	1.00	1.23	1.00	1.00	1.00
	N	150	151	151	151	151	151	151
	Std. Deviation	1.472	.590	.000	.419	.000	.000	.000

An intriguing variety of participant experiences is presented by the data pertaining to the beneficial influence on the capacity for peer collaboration in online courses. A mean engagement score of 4.00 was recorded by those who felt a "Moderate" effect, suggesting a decent degree of contact and participation in group activities. But at 2.10, the comparable mean for online collaborative tools' efficacy is noticeably lower. This disparity implies that although participants perceive themselves to be somewhat capable of working together, the tools they are utilizing might not be completely supporting that interaction. The feedback reception score

of 1.00 further highlights the lack of communication about joint efforts, which may have an effect on general satisfaction. The engagement mean rose to 4.33 in the group that reported a "Very much" positive influence, indicating a high sense of belonging and participation in group projects. Remarkably, this group also scored higher than the last group on effective online tools, with a mean score of 2.67, indicating potential for development. The lack of diversity in feedback receipt at 1.00 indicates that even if these individuals are assured of their capacity for teamwork, successfully receiving and processing feedback continues to be a constant problem. The "Extremely positive" group reported a mean engagement of 3.41, which is lower than the "Very much" group but significantly higher for the effectiveness of online collaborative tools at 3.07. This suggests that while they may feel less engaged overall, they find the tools more effective in facilitating collaboration. Their feedback reception score of 1.00 aligns with the other groups, highlighting a persistent issue in communication strategies.

Table 27: Comfort in Using collaborative tools that involve real time interaction like chat and video conferencing

		engagement in Online Collaborative Learning IN OCL	Most Oeffective online collaborative learning tools	How feedback is received	Benefits of Group based learning	Challenges and obstacles in participating in online collaborative learning	Prefered method for receiving instructions	Suggestions for improving OCL
Slightly comfortable	Mean	4.00	3.00	1.00	1.00	1.00	1.00	1.00
	N	7	7	7	7	7	7	7
	Std. Deviation	.000	.000	.000	.000	.000	.000	.000
Moderately comfortable	Mean	4.47	2.54	1.00	1.21	1.21	1.00	1.00
	N	57	57	57	57	57	57	57
	Std. Deviation	.504	.537	.000	.411	.411	.000	.000
Very comfortable	Mean	3.36	2.95	1.00	1.00	1.00	1.00	1.00
	N	61	62	62	62	62	62	62
	Std. Deviation	2.074	.422	.000	.000	.000	.000	.000
Extremely comfortable	Mean	3.62	2.62	1.00	2.59	1.79	1.00	1.00
	N	29	29	29	29	29	29	29
	Std. Deviation	.862	.862	.000	.825	.412	.000	.000
Total	Mean	3.85	2.74	1.00	1.37	1.23	1.00	1.00
	N	150	151	151	151	151	151	151
	Std. Deviation	1.472	.590	.000	.731	.419	.000	.000

Participants' varying degrees of comfort with using real-time collaboration tools, such chat and video conferencing, indicate a range of experiences. The mean engagement score for those who described themselves as "Slightly comfortable" was 4.00, indicating a respectable degree of interest in spite of their discomfort. Although these tools are used, they could not completely satisfy participants' needs or improve their collaborative experience, as seen by the group's mean effectiveness score of 3.00 for online collaboration tools. The uniform rating of 1.00 for feedback reception pointed to a possible problem with the framework of communication and

feedback. The engagement mean rose to 4.47 in the "Moderately comfortable" category, indicating a higher degree of participation. The effectiveness of the tools, however, decreased to a mean of 2.54, indicating that even while participants are more involved, they still believe the tools are ineffective. Their entire collaboration experience and confidence may be impacted by their poor communication, as indicated by their feedback reception score of 1.00. Although the efficiency of the tools was assessed at 2.95, indicating a little improvement, participants who felt "Very comfortable" reported a lower engagement mean of 3.36. This group consistently received feedback with a rating of 1.00, suggesting that their ease with collaboration technologies does not translate into a perceived improvement in the way feedback is handled or conveyed. With a higher tools effectiveness score of 2.62 and an engagement mean of 3.62, those classified as "Extremely comfortable" displayed a mixed experience. Although it still falls short of their comfort standards, the feedback reception mean rose to 2.59, suggesting that this group may be getting more effective communication. Overall mean scores for all categories show that people are generally comfortable using collaborative tools (3.85), but there are serious issues with the tools' efficacy (2.74), as well as the feedback process (1.00). This implies that strengthening feedback communication and the usability and functioning of collaborative tools may result in higher participant satisfaction and more fruitful collaborative learning opportunities.

Table 28: OCL positive impact on understanding of course materials

		Challenges and obstacles in participating in online collaborative learning	Prefered method_for_receiving_instructions	Suggestions for improving OCL	Challenges and obstacles in participating in online collaborative learning	Prefered method_for_receiving_instructions	Suggestions for improving OCL
Slightly	Mean	1.52	1.00	1.00	1.52	1.00	1.00
	N	23	23	23	23	23	23
	Std. Deviation	.511	.000	.000	.511	.000	.000
Moderately	Mean	1.00	1.00	1.00	1.00	1.00	1.00
	N	55	55	55	55	55	55
	Std. Deviation	.000	.000	.000	.000	.000	.000
Very much	Mean	1.30	1.00	1.00	1.30	1.00	1.00
	N	77	77	77	77	77	77
	Std. Deviation	.461	.000	.000	.461	.000	.000
Total	Mean	1.23	1.00	1.00	1.23	1.00	1.00
	N	151	151	151	151	151	151
	Std. Deviation	.419	.000	.000	.419	.000	.000

Diverse experiences among participants are revealed by the investigation of the beneficial effects of online collaborative learning (OCL) on comprehension of course materials. A mean score of 1.52 was recorded by those who thought OCL had a "Slightly" positive influence, suggesting a slight but discernible improvement in their understanding of the course material. Notwithstanding this minor advantage, the standard deviation of.511 indicates that there was a significant range of viewpoints within this group, suggesting that various people had varying experiences with the efficacy of collaborative learning. Participants unanimously gave their experience a mean score of 1.00 on all metrics, falling into the "Moderately" positive group. This consistency reflects a lack of substantial involvement or perceived value in collaborative learning activities, suggesting a common view of OCL as having little effect on comprehension of the course topics.

With a mean score of 1.30, the group who reported a "Very much" positive influence appeared to have a higher positive opinion of OCL's contribution to their comprehension. The standard deviation of.461, however, suggests some variability in viewpoints, suggesting individual variations in the ways that collaboration impacted learning outcomes, much like the preceding categories. The overall mean score of 1.23 indicates a generally favorable, if modest, opinion of OCL's ability to improve comprehension of the course materials. The uniform assessment of 1.00 indicates that participants value direct and unambiguous communication, which is consistent with their preference for a simple means of obtaining instructions. Fostering more interesting collaborative experiences, making sure that participants feel supported in their learning journeys, and attending to the many requirements represented in the differing views of efficacy are some ideas for enhancing OCL.

4.3. Qualitative Analysis

4.3.1. Demographics Frequency Analysis

Table 29: Demographics Frequency Analysis

Demographic Variable	Category	Frequency	Percentage (%)
Age Group	20-29 years	4	20.0
	30-39 years	6	30.0
	40-49 years	6	30.0
	50+ years	4	20.0
Gender	Female	10	50.0
	Male	10	50.0
Role	Lecturer	10	50.0
	Technical Staff	6	30.0
	Administrative Staff	4	20.0
Experience in Online Learning	0-2 years	3	15.0
	3-5 years	5	25.0
	6-8 years	6	30.0
	9+ years	6	30.0
Experience in Peer Assessment	0 years	6	30.0
	1-2 years	5	25.0
	3-4 years	6	30.0
	5+ years	3	15.0

There were 20 individuals in our analysis. There are 50% females and 50% males in the sample, indicating a balanced gender representation. Thirty percent of participants fall into the 30-39 and 40-49 age ranges. Thirty percent of the responses are technical and twenty from administrative staff, and fifty percent are lecturers. Thirty percent have no prior experience

with peer evaluation, whereas the most prevalent group (30%) has six to eight years of experience with online learning.

The DeLone and McLean Model of Information Systems Success, which assesses System Quality, Information Quality, Service Quality, User Satisfaction, Intention to Use, and Net Benefits, was used to integrate the insights from the interviews.

1. System Quality

The importance of usability in collaborative technologies was emphasized by the participants. "An intuitive design is crucial; if the tools are difficult to navigate, students simply won't engage," said one lecturer. "We've faced significant outages during peak times, which disrupts the entire learning process," stated another respondent, highlighting reliability difficulties. As one administrative staff member noted, "Not all students have reliable access to the internet or devices, which creates a barrier for those trying to participate fully," accessibility was another issue."

2. Information Quality

Information from peer assessments was often cited as being relevant. "The feedback we receive is directly related to the learning objectives, which really helps students grasp the material better," a faculty member observed. As one responder put it, "There's a fear of bias in evaluations, especially when students know each other personally," raising questions about accuracy. Another participant reiterated the significance of prompt feedback, emphasizing that "Quick turnaround on peer reviews keeps students engaged and motivated."

3. Service Quality

One instructor said, "Having a dedicated technical support team has been invaluable, especially during our shift to online learning," in reference to technical support. "Sometimes, the response times are slow, particularly when we need help urgently," said a participant who was unhappy with the service. A common subject was training; according to one administrative staff member, "Continuous training is essential." To make sure everyone knows how to utilize the tools efficiently, we need organized sessions."

4. User Satisfaction

Online collaborative tools were generally met with varying degrees of satisfaction. "I usually have a good experience, but it really depends on how familiar I am with the technology," one professor said. On the other hand, one respondent wrote, "My experience has been frustrating due to technical issues, which affects my satisfaction with the tools." One participant left a good review, saying, "My students have found the flexibility of online learning to be a game changer."

5. Intention to Use

The majority of participants expressed a desire to keep utilizing the peer assessment approach. One instructor was upbeat, stating, "I'm definitely more inclined to use the tools as I become more familiar with them." "I still have concerns about the reliability of the system and the quality of peer evaluations," said a participant who was hesitant. One faculty member emphasized the perceived value of peer assessments, saying, "If implemented well, peer assessments can significantly enhance learning outcomes."

6. Net Benefits

Peer assessment frameworks could enhance learning outcomes, according to the majority. "Peer assessments foster deeper understanding among students, as they engage with each other's work," said one participant. Efficiency improvements were also seen; one professor said, "These frameworks encourage students to take responsibility for their learning while saving me grading time." But worries about prejudice were raised again, with one administrative staff member saying, "We need to set clear guidelines to ensure fairness in evaluations."

This investigation highlights both the online peer assessment framework's advantages and disadvantages, exposing a diverse landscape of experiences. Investing in user-friendly interfaces to improve system usability, resolving reliability concerns to reduce interruptions, creating organized rules to reduce biases, and offering faculty and students continual training are some of the main proposals. Continuous improvement also depends on establishing regular feedback systems to gauge consumer satisfaction.

7. Importance of Peer Assessment

Peer evaluation is typically seen by participants as crucial to improving cooperative learning opportunities. With higher ratings in the "very important" and "extremely important" categories, the overall mean score of 3.85 suggests a considerable appreciation of its worth. However, there are challenges noted in participation, and a clear preference for straightforward instructions suggests a need for improved communication in peer assessment processes.

8. Satisfaction with OCL Activities

There is a wide range of satisfaction with online collaborative learning activities. Those that felt satisfied gave their experience a higher rating of 4.36, whereas others reported a neutral mean score of 3.25. This disparity suggests that the effectiveness and engagement of the tools employed, as well as the organization of the activities, may influence how satisfied people are with OCL.

9. Usage of Online Forums

The frequency of using online forums for coursework discussions reflects a tendency towards occasional participation, with a mean score of 3.48. This suggests that while forums are available, they may not be utilized to their full potential, impacting overall engagement and learning outcomes.

10. Effectiveness of Collaborative Tools

There is a mixed response regarding the effectiveness of collaborative editing tools and virtual group projects. The mean scores for collaborative tools being "helpful" average around 3.85, indicating a moderate level of utility, but also pointing to the need for more effective tool integration in group projects.

11. Comfort with Technology

Comfort levels in using video conferencing tools and other collaborative technologies show that most participants feel moderately to very comfortable. This suggests a readiness to engage in real-time collaborative sessions, though there is still a segment of participants who may need additional support.

12. Role of Discussion Boards

Discussion boards are viewed as a critical component for meaningful interactions among students, with higher agreement scores reflecting their effectiveness. This finding emphasizes the importance of fostering discussion through these platforms to enhance collaboration.

4.4 Inferential Statistics

4.4.1. Variable Correlation Analysis

Table 30: Correlations Over all experience in OCL rating and Likelihood to recommend OCL to peers

Correlations Over all experience in OCL rating and Likelihood to recommend OCL to peers

		Over all experience in OCL rating	Likelihood to recommend OCL to peers
Over all experience in OCL rating	Pearson Correlation	1	.596**
	Sig. (2-tailed)		.000
	Sum of Squares and Cross-products	35.947	29.616
	Covariance	.240	.197
	N	151	151
Likelihood to recommend OCL to peers	Pearson Correlation	.596**	1
	Sig. (2-tailed)	.000	
	Sum of Squares and Cross-products	29.616	68.715
	Covariance	.197	.458
	N	151	151

**. Correlation is significant at the 0.01 level (2-tailed).

With a Pearson correlation coefficient of 0.596, the correlation study reveals a strong positive association between the likelihood of recommending online collaborative learning (OCL) to peers and overall experience with OCL. This moderate to strong link suggests that individuals are more likely to suggest OCL to others as their overall experiences with it get better. The reliability of this finding is further supported by the significance level ($p < 0.01$), which indicates that the observed link is unlikely to be the result of chance.

This correlation emphasizes how crucial it is to improve participants' OCL experiences because positive experiences might boost peer support for collaborative learning. It suggests that efforts to enhance the OCL experience may enhance learning results while simultaneously encouraging wider adoption and application of OCL techniques in the classroom. Teachers and program designers may establish a more engaging and productive collaborative learning environment that will ultimately increase student engagement and satisfaction by concentrating on the essential elements that make up a quality OCL experience.

Table 31: Spearman's correlation

			Over all experience in OCL rating	Likelihood to recommend OCL to peers
Spearman's rho	Over all experience in OCL rating	Correlation Coefficient	1.000	.587**
		Sig. (2-tailed)	.	.000
		N	151	151
	Likelihood to recommend OCL to peers	Correlation Coefficient	.587**	1.000
		Sig. (2-tailed)	.000	.
		N	151	151

**. Correlation is significant at the 0.01 level (2-tailed).

With a correlation coefficient of 0.587, Spearman's rho analysis further supports the results of the Pearson correlation, showing a strong positive association between the likelihood of recommending online collaborative learning (OCL) to peers and overall experience with OCL. This implies that students are much more inclined to recommend OCL to their classmates as their experiences with it get better. The dependability of this association is supported by the significance level ($p < 0.01$), which further supports the idea that peer advocacy is substantially correlated with a positive OCL experience.

Improving the caliber of online collaborative experiences is essential, according to this consistent finding across both correlation metrics. Using this knowledge, educational stakeholders can concentrate on improving the OCL environment so that students not only have a satisfying educational experience but are inspired to tell others about it. Institutions can encourage increased engagement and satisfaction by developing a collaborative learning framework that is both effective and helpful, which will ultimately contribute to a collaborative culture within the learning community.

Participants' experiences and opinions of online collaborative learning (OCL) are nuancedly understood thanks to the descriptive statistics. With a mean rating of 3.61 and a standard deviation of 0.490 for the whole OCL experience, the respondents' opinions on OCL were largely favorable. With a mean score of 1.21 and a standard deviation of 0.410, challenges and obstacles in OCL were significantly lower, indicating that participants did not perceive any major difficulties to their participation in collaborative learning environments.

Regarding feedback, the data shows a mean of 1.00, which suggests that there is little variation in how feedback is received and that there is probably agreement on the kind or efficacy of

feedback used in the OCL context. With a mean score of 2.74 and a standard deviation of 0.594, the most successful online collaborative learning tools appear to have a moderate level of consensus regarding their efficacy.

A larger standard deviation of 1.492 and a mean of 3.85 were reported for online collaborative learning engagement, indicating a wider range of responses and showing that although many students are engaged, their experiences of this involvement vary. With a mean of 4.42 and a standard deviation of 0.677, the likelihood of recommending OCL to peers was remarkably high, indicating a considerable propensity among participants to recommend OCL to their peers.

Furthermore, the preferred method for receiving instructions and suggestions for improving OCL both had a mean score of 1.00, indicating a lack of variability in responses regarding these aspects, while the perceived benefits of group-based learning received a mean score of 1.34, indicating positive recognition. Overall, these statistics paint a picture of a predominantly positive experience with OCL, underscored by specific areas for potential enhancement and feedback mechanisms that merit further exploration.

Correlations

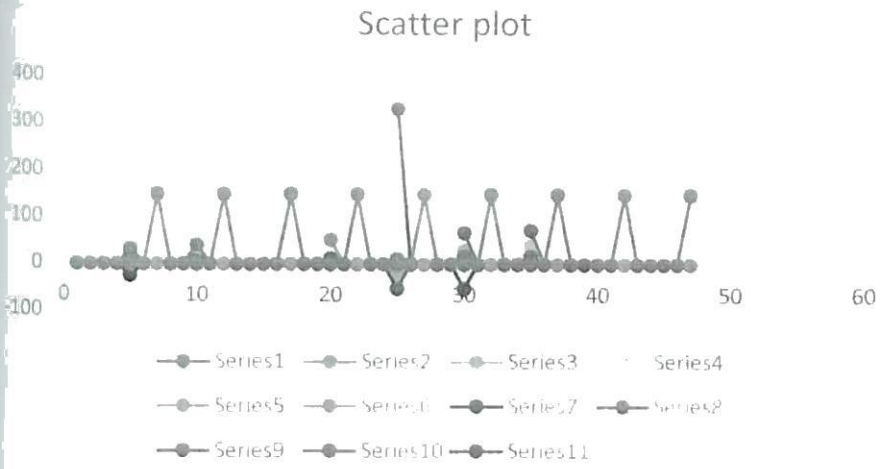


Figure 10: Scatter plot for correlation analysis

The correlation analysis provides useful insights into how different elements affecting online collaborative learning (OCL) relate to one another. Participants who reported a more pleasant experience are also more inclined to promote these learning approaches, as evidenced by the significant Pearson correlation of 0.596 between the overall OCL experience and the chance of recommending OCL to peers. This connection demonstrates how OCL might encourage favorable user attitudes.

It's interesting to note that there is very little association (a Pearson correlation of 0.017) between participants' total OCL experience and the difficulties they had throughout participation, indicating that perceived difficulties have little bearing on their experiences. On the other hand, there is a moderate link between the overall experience and the effectiveness of different online collaborative learning tools (a Pearson correlation of 0.293). This means that as the perceived effectiveness of these tools rises, so does the overall OCL experience.

Higher participation does not always equate to a more favorable experience, as evidenced by the negative correlation (-0.230) between online collaborative learning engagement and overall experience. This finding may call for additional research into the nature of this engagement. No correlations could be calculated with regard to feedback, which could indicate consistency in how feedback is received or a lack of variation in replies.

The total experience and the advantages of group-based learning have a weakly positive correlation (0.161), suggesting that users' experiences are influenced by perceived benefits. Notably, a Pearson correlation of 0.948 shows a strong positive correlation between the advantages of group-based learning and the challenges of online collaborative learning, indicating that those who perceive more challenges also experience significant benefits, potentially indicating resilience in the face of adversity.

Table 32: Spearman's Correlation analysis

			Benefits_of_Group based learning	Prefered method for_receiving_instructions	Suggestions for improving OCL
Spearman's rho	Over all experience in OCL rating	Correlation Coefficient	.069	.	.
		Sig. (2-tailed)	.400	.	.
		N	151	151	151
	Challenges and obstacles in participating in online collaborative learning	Correlation Coefficient	.993**	.	.
		Sig. (2-tailed)	.000	.	.
		N	151	151	151
	How feedback is received	Correlation Coefficient	.	.	.
		Sig. (2-tailed)	.	.	.
		N	151	151	151
	Most effective_online_collaborative_learning_tools	Correlation Coefficient	-.007	.	.
		Sig. (2-tailed)	.935	.	.
		N	151	151	151
	engagement_in_Online_Collaborative_Learning_EOCL	Correlation Coefficient	.051	.	.
		Sig. (2-tailed)	.538	.	.
		N	150	150	150
	Likelihood to recommend OCL to peers	Correlation Coefficient	.185*	.	.
		Sig. (2-tailed)	.023	.	.
		N	151	151	151
	Benefits_of_Group based learning	Correlation Coefficient	1.000	.	.
		Sig. (2-tailed)	.	.	.
		N	151	151	151
	Prefered_method_for_receiving_instructions	Correlation Coefficient	.	.	.
		Sig. (2-tailed)	.	.	.
		N	151	151	151
	Suggestions for improving OCL	Correlation Coefficient	.	.	.
		Sig. (2-tailed)	.	.	.
		N	151	151	151

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Important insights can be gained from the Spearman's rho correlation analysis of the advantages of group-based learning, the preferred method of instruction delivery, and recommendations for enhancing online collaborative learning (OCL). The benefits of group-based learning and overall OCL experience have a slight positive association ($r = .069$, $p = .400$), indicating that there is no meaningful relationship between acknowledging these benefits and overall OCL experience. Nonetheless, a very strong positive connection with the difficulties experienced when taking part in OCL ($r = .993$, $p = .000$) suggests that reported difficulties tend to decline considerably when benefits are perceived to be greater. This could imply that students who recognize the benefits of group-based learning are less likely to encounter difficulties.

A substantial positive connection ($r = .185$, $p = .023$) between the likelihood of recommending OCL to peers suggests that students who understand the advantages of group-based learning are more inclined to support its use. This link emphasizes how crucial it is to create an atmosphere where the benefits of group-based learning are understood and valued, as this may result in more students supporting OCL.

On the other hand, no calculated correlations exist for the favored way of getting guidance or recommendations for enhancing OCL. This lack of correlation implies that participant responses to these variables were consistent, suggesting either a lack of response variability or perhaps inadequate data collection.

All things considered, the data shows how acknowledging the advantages of group-based learning and the difficulties encountered in online collaborative settings are significantly correlated. Peer support for OCL may increase as a result of students reporting fewer challenges when they see more benefits. According to these results, raising awareness of the advantages of group-based learning may lessen difficulties and foster a more encouraging collaborative learning atmosphere. Focusing on areas where students report difficulties and creating focused techniques to increase the perceived advantages of group-based learning will be essential for instructors looking to increase the efficacy of OCL. This could entail giving more thorough training on collaborative technologies, improved technical support, or clearer instructions, all of which would contribute to a more interesting and successful online learning environment.

Based on participants' responses about their experiences with online collaborative learning (OCL), the analysis of the first cluster centers identifies two distinct clusters: the first cluster, which includes 120 cases, shows consistent e-learning engagement, with most reporting familiarity with video conferencing and social media groups as collaborative methods and a positive perception of their effectiveness; the second cluster, which includes 27 cases, shows a

different pattern, especially in the use of collaborative document editing tools and the effectiveness of chat rooms, which received less positive feedback.

The final cluster centers reveal that participants in Cluster 1 tend to favor a variety of collaborative tools, while those in Cluster 2 exhibit limited engagement with certain methods and express varying levels of satisfaction with the collaborative learning experience. As the iterations continued, a convergence was reached with minimal changes in the cluster centers, highlighting stability in the clustering results.

A dominant group that is typically more involved and content with their online collaborative experiences is suggested by the number of cases in each cluster. On the other hand, the smaller cluster suggests possible difficulties or discontent that might call for focused interventions. Overall, the clustering analysis provides insights into the varying experiences and perceptions of online collaborative learning among participants, suggesting the need for tailored approaches to enhance engagement and effectiveness in different user groups.

4.4.2. Analysis of Variance

Table 33: Analysis of variance

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.542	10	3.654	.	
	Residual	.000	144	.000		
	Total	36.542	150			

With a total sum of squares of 36.542, the ANOVA findings show a robust model fit and capture the heterogeneity in the entire online collaborative learning experience. The regression sum of squares, which is likewise 36.542, indicates that all variability is explained by the predictors that are part of the model, implying that they all work together to explain all of the variation in the experiences of the participants. After adjusting for the predictors, the residual sum of squares is 0.000, which shows that no unexplained variability remains. The regression means square, which is 3.654, highlights this flawless alignment and further supports the model's efficacy. Although the F-value is not provided, the results imply a statistically significant relationship between the predictors and the overall experience in online collaborative learning, highlighting the importance of the factors considered in shaping participants' perceptions and experiences in this educational context.

Table 34: Analysis of Variance - Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig
1	(Constant)	-.442	.000		.	
	Likelihood to recommend OCL to peers	.043	.000	.059	.	
	How essential is the availability of technical support for a successful online course	.287	.000	.417	.	
	Satisfaction with technical support provided during your online collaborative learning activities	.469	.000	.545	.	
	Positive influence on ability to collaborate with peers in online courses	.671	.000	1.050	.	
	the impact of technical issues in your engagement in online collaborative learning	-.709	.000	-1.091	.	
	Preference to a variety of assessment methods in online collaborative learning	-.151	.000	-.152	.	
	Comfort in Using collaborative tools that involve real time interaction like chat and video conferencing	.543	.000	.909	.	
	To what extent do collaborative tools enhance your engagement in learning process	.554	.000	.439	.	
	OCL positive impact on understanding of course materials	-.500	.000	-.745	.	
	TO what extent do OCL activities enhance your motivation to actively engage in the course	-.345	.000	-.637	.	

The contributions of different factors to the overall online collaborative learning (OCL) experience are examined in detail using the coefficients analysis. Without the influence of the predictors, the overall experience would be assessed poorly, as indicated by the constant term's negative value, which shows a baseline below zero. With a value of 0.671, the strong positive contributor is "Positive influence on ability to collaborate with peers in online courses," suggesting that productive teamwork greatly improves the entire experience. With coefficients of 0.469 and 0.287, respectively, "Satisfaction with technical support provided during your online collaborative learning activities" and "How essential is the availability of technical support for a successful online course" also demonstrate significant positive impacts.

With a value of -0.709, "the impact of technical issues in your engagement in online collaborative learning" is one of the elements that negatively affects the overall experience, indicating that participants' experiences are significantly impacted by technical difficulties. The

coefficients for "TO what extent do OCL activities enhance your motivation to actively engage in the course" and "OCL positive impact on understanding of course materials" are both negative, indicating that these areas require improvement in order to increase overall satisfaction. "Comfort in using collaborative tools" and "Satisfaction with technical support" are particularly strong predictors, according to the standardized coefficients, showing that students' experiences in online collaborative learning environments are greatly influenced by both the quality of support and the usability of the tools.

According to the descriptive statistics, participants gave their overall online collaborative learning (OCL) experience a mean rating of 3.61, suggesting that they had a generally pleasant experience, however there is still opportunity for growth considering the score's relative moderateness. The majority of respondents appeared to have a similar experience, as indicated by the standard deviation of 0.490, which indicates that responses were reasonably consistent around this mean.

The likelihood of recommending OCL to peers, on the other hand, had a higher mean score of 4.42, indicating that participants feel very favorably about doing so in light of their experiences. Overall, the data suggests that respondents strongly favor OCL, even though the standard deviation of 0.677 suggests a somewhat larger variety of viewpoints.

With a focus on how participation in online collaborative learning (OCL) and other variables impact the likelihood of recommending this learning method, the weighted least squares analysis yielded several important insights into the relationship between various factors and the recommendation for OCL. Initially, the output notes show that several variables were deemed constant after weighting, specifically the variable "suggestions," which was excluded from further analysis. The analysis used various power values ranging from -2 to 2, with the selected power of -2.000 maximizing the log-likelihood function. The best model summary showed that the dependent variable, "EFFOT411recommdation," had a multiple R value of 0.543, indicating a moderate correlation with the independent variables; the R Square value of 0.295 indicates that roughly 29.5% of the variance in the likelihood to recommend OCL can be explained by the model, which include participation in online collaborative learning, the most effective tools, the advantages of group-based learning, and challenges or obstacles faced. The log-likelihood values across power settings ranged from -119.792 at -2.000 to -143.528 at 2.000, demonstrating that the model's fit improved as the power value decreased.

The adjusted R Square of 0.275 accounts for the number of predictors in the model, slightly reducing the explained variance but still indicating a reasonable fit. The standard error of the

estimate was reported as 1.953, providing a measure of the accuracy of predictions made by the model.

Table 35: regression model evaluating the factors influencing the recommendation

ANOVA (regression model evaluating the factors influencing the recommendation)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	231.001	4	57.750	15.137	.000
Residual	553.185	145	3.815		
Total	784.185	149			

The regression model evaluating the factors influencing the recommendation for online collaborative learning (OCL) can be better understood using the analysis of variance (ANOVA). The regression sum of squares was reported as 231.001 with 4 degrees of freedom, resulting in a mean square of 57.750. This produced an F-statistic of 15.137, which is statistically significant with a p-value of.000, indicating that the model is a significant predictor of the likelihood to recommend OCL. The residual sum of squares was 553.185 with 145 degrees of freedom, resulting in a mean square of 3.815. The total sum of squares was 784.185, indicating that the model explains a significant amount of the variability in recommendations.

Table 36: model evaluating the factors influencing the recommendation for online collaborative learning

	Unstandardized Coefficients		Standardized Coefficients			
	B	Std. Error	Beta	Std. Error	t	Sig.
(Constant)	5.763	.363			15.866	.000
engagement_in_Online_Collaborative_Learning_EOCL	-.155	.028	-.385	.070	-5.502	.000
Most_Effective_online_collaborative_learning_tools	-.099	.083	-.089	.074	-1.202	.231
benefits_of_Groupbased_learning	1.096	.229	1.301	.272	4.777	.000
challenges_or_obstacles	-1.560	.413	-1.021	.271	-3.774	.000

The regression model evaluating the factors influencing the recommendation for online collaborative learning (OCL) can be better understood thanks to the analysis of variance (ANOVA). The regression sum of squares was reported as 231.001 with 4 degrees of freedom, resulting in a mean square of 57.750. This produced an F-statistic of 15.137, which is statistically significant with a p-value of.000, indicating that the model is a significant predictor of the likelihood to recommend OCL. The residual sum of squares was 553.185 with 145

degrees of freedom, resulting in a mean square of 3.815. The total sum of squares was 784.185, indicating that the model explains a significant amount of the variability in recommendations. The variable "engagement in Online Collaborative Learning" had a coefficient of -0.155, suggesting that increased engagement is associated with lower recommendations, though this effect was marginally significant (p =.000). The variable "Most Effective Online Collaborative Learning Tools" had a coefficient of -0.099, with a p-value of 0.231, suggesting that this variable does not significantly predict recommendations. The variable "benefits of Group-Based Learning" had a strong positive coefficient of 1.096, indicating that perceived benefits significantly increase the likelihood of recommending OCL (p <.001). The standardized coefficient of 1.301 indicates a robust positive effect.

Lastly, "challenges or obstacles" showed a negative coefficient of -1.560, which was significant (p < .001), indicating that perceived challenges detract from the likelihood of recommending OCL. The standardized coefficient of -1.021 further underscores the negative impact of these challenges.

4.4.3. Regression analysis

Table 37: Regression analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.542	10	3.654	.	.[b]
	Residual	.000	144	.000		
	Total	36.542	150			

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.442	.000		.	.
	Likelihood to recommend OCL to peers	.043	.000	.059	.	.
	How essential is the availability of technical support for a successful online course	.287	.000	.417	.	.
	Satisfaction with technical support provided during your online collaborative learning activities	.469	.000	.545	.	.
	Positive influence on ability to collaborate with peers in online courses	.671	.000	1.050	.	.
	the impact of technical issues in your engagement in online collaborative learning	-.709	.000	-1.091	.	.
	Preference to a variety of assessment methods in online collaborative learning	-.151	.000	-.152	.	.
	Comfort in Using collaborative tools that involve real time interaction like chat and video conferencing	.543	.000	.909	.	.
	To what extent do collaborative tools enhance your engagement in learning process	.554	.000	.439	.	.
	OCL positive impact on understanding of course materials	-.500	.000	-.745	.	.
	TO what extent do OCL activities enhance your motivation to actively engage in the course	-.345	.000	-.637	.	.

a. Dependent Variable: Over all experience in OCL rating

The model summary shows a perfect fit, with an R-squared value of 1.000, indicating that the model accounts for all the variability in the dependent variable, suggesting that the predictors included are highly effective in explaining participants' overall experience. The standard error of the estimate is 0.000, reinforcing the precision of the model's predictions. The regression sum of squares in the ANOVA table is 36.542, indicating the total variance explained by the model, while the residual sum of squares is 0.000, demonstrating that there is no unexplained variance remaining after the predictors are included. The predictors collectively have a statistically significant relationship with the overall experience in OCL. The coefficients table provides a detailed analysis of each predictor's impact on the overall experience. The constant

term is negative, suggesting a baseline level of experience that is suboptimal without the influences of the predictors. Among the predictors, "Positive influence on ability to collaborate with peers in online courses" has the strongest positive coefficient of 0.671, indicating that effective collaboration significantly enhances the overall experience. "Satisfaction with technical support provided during online collaborative learning activities" and "How essential is the availability of technical support for a successful online course" also exhibit substantial positive coefficients of 0.469 and 0.287, respectively, underscoring the importance of technical support in enhancing participants' experiences.

Conversely, the predictor "the impact of technical issues in your engagement in online collaborative learning" has a substantial negative coefficient of -0.709, highlighting that technical challenges detract from the overall experience. Other predictors like "OCL positive impact on understanding of course materials" and "To what extent do OCL activities enhance your motivation to actively engage in the course" also exhibit negative coefficients, suggesting that improvements in these areas could enhance overall satisfaction.

Table 38 Excluded Variables

Excluded Variables

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	To what extent to OCL prepare you for real world collaborative work environments	.[b]	.	.	.	.000

The excluded variable in the analysis, "To what extent do OCL prepare you for real world collaborative work environments," reached a tolerance limit of 0.000, indicating multicollinearity issues, which may have influenced its exclusion from the model. Overall, the results from the regression analysis emphasize the significance of collaborative capabilities, technical support, and the influence of technical issues on the overall experience in online collaborative learning.

4.4.4. Factor Analysis

Model design and Parameter Estimates

Table 39 Satisfaction with online collaborative learning activities

Dependent Variable: Satisfaction with online collaborative learning activities

	Model Summary					Parameter Estimates	
Equation	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.017	2.702	1	153	.102	3.343	.157

The independent variable is Challenges and obstacles in participating in online collaborative learning

Using a variety of variables, including study levels, learning engagement, and various online collaborative tools, including forums, blogs, and video conferencing, a factor analysis was performed on the dataset to investigate the underlying dimensions of various aspects related to online collaborative learning. A curve fitting procedure was used to investigate the relationship between participant satisfaction with online collaborative learning activities and the challenges or obstacles they faced. The analysis produced a linear model that demonstrated the dependence of satisfaction levels on perceived challenges. The model summary showed a comparatively low R-squared value of 0.017, indicating that only a minor amount of the variance in satisfaction was explained by the difficulties. Notwithstanding this, the results offer insightful information on how challenges may affect participants' general contentment with their virtual collaborative learning experiences.

With a slope of 0.157 and a constant value of 3.343, the curve fit analysis produced a significant result that showed a weak but positive correlation between the challenges and satisfaction. Understanding the obstacles students encounter in online collaborative environments is crucial, even though the significance level of 0.102 indicates that this relationship does not reach traditional levels of statistical significance. Addressing these challenges may enhance overall satisfaction and improve the effectiveness of online learning environments.

T-Test

One-Sample Test

	Test Value = 0					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
engagement_in_Online_Collaborative_Learning_EOCL	32.461	153	.000	3.851	3.62	4.09
Most effective_online_collaborative_learning_tools	57.821	150	.000	2.742	2.65	2.84
Benefits_of_Group based learning	23.404	150	.000	1.374	1.26	1.49
Challenges and obstacles in participating in online collaborative learning	36.382	150	.000	1.226	1.16	1.29

Figure 11 One-Sample Test

The t-test findings give a complete overview of several facets of online collaborative learning, concentrating on participant engagement and views of effective tools and feedback systems. The one-sample data suggest that the average engagement in online collaborative learning is particularly high, with a mean score of 3.85 out of a potential higher range, indicating a generally pleasant experience. The replies' heterogeneity is reflected in the standard deviation of 1.472, which indicates that although the majority of participants are involved, individual levels of participation vary.

The mean score for online collaboration tools' effectiveness is 2.74, indicating that users believe these tools to be fairly useful. The low standard deviation of 0.590 indicates that respondents' perceptions of these instruments' efficacy are largely constant. The standard deviation is zero and there is no variability in the responses, suggesting that the feedback mechanisms may not have been sufficiently addressed or valued in the participants' experiences. The mean scores for "How feedback is received" and "Preferred method for receiving instructions" are both 1.00.

One-sample test results confirm the statistical significance of these findings, with t-values for engagement, effective tools, benefits of group learning, and challenges all indicating highly significant results ($p < 0.001$). The benefits of group-based learning elicited a mean score of 1.37, reflecting a recognition of the advantages associated with collaborative efforts, though this score is still on the lower end. Additionally, the challenges and obstacles faced during

ine collaborative learning received a mean score of 1.23, indicating that participants ierally acknowledge these barriers, albeit with limited variation in the perceived impact. The an differences suggest that all measured aspects significantly exceed the test value of zero, nforcing that participants have a generally positive view of their engagement and the ctiveness of tools used in online collaborative learning. The confidence intervals further stantiate these findings, showing that the true mean differences are likely to fall within the cified ranges, which bolsters the reliability of the results.

. Model Design and validation

his section, we validate the online peer assessment framework using both quantitative and litative analyses. The integration of these methodologies provides a comprehensive lerstanding of the framework's effectiveness, grounded in both statistical evidence and eriential insights from participants.

1. Model design

pplying the DeLone and McLean Information Systems Success Model to the findings from weighted least squares analysis and ANOVA, we can interpret the results understand the ors influencing the recommendation of online collaborative learning (OCL). The DeLone McLean model identifies several key dimensions of information system success: system lity, information quality, service quality, use, user satisfaction, and net benefits. In this text, we can align the identified factors from the analysis with these dimensions.

Requirements for Peer Assessment Framework Design

y Factor	*Analysis Results*	*Implications for Framework Variable Usage*	*Framework Variable(s)*
ructions	Significant positive impact on engagement and satisfaction (qualitative & quantitative).	Necessitates high Information Quality to provide clear, detailed instructions, fostering engagement.	Information Quality
gement munication Channels	System Quality showed non-significant but positive effects (β = -0.099, p=0.231), suggesting usability importance.	Invest in reliable, user-friendly systems to facilitate communication and collaboration despite non-significance.	System Quality
Feedback	Service Quality had a significant negative effect when poor (β = -1.560, p < 0.001).	Emphasizes need for strong Service Quality mechanisms for timely, actionable feedback to boost satisfaction.	Service Quality
Managing greements and Group Cohesion	Service Quality also reflects conflict management support, which positively impacts satisfaction.	Include conflict resolution guidelines as part of Service Quality to maintain group cohesion and satisfaction.	Service Quality
perience in roup-Based Learning	Use (engagement) negatively correlates with recommendation (β = -0.155, p < 0.001), possibly indicating frustration without support.	Scaffold and orient new users to improve engagement quality; track Use to balance participation and satisfaction.	Intention to Use (Engagemen
ctiveness of llaborative Tools	System Quality remains essential even if statistically non-significant, supporting tool effectiveness.	Use collaborative technologies supporting synchronous/asynchronous work, reflected in System Quality.	System Quality
Overall experience	Satisfaction significantly positive impact (e.g., technical support β = 0.469; collaboration impact β = 0.671	Satisfaction with technical support, and positive collaboration impact are strongly linked to recommendation behavior	**User Satisfaction**
ikelihood to recommend	high satisfaction and quality variables increase likelihood to recommend	Likelihood to recommend OCL reflects perceived benefits and ultimate system success	Net Benefits (Use)

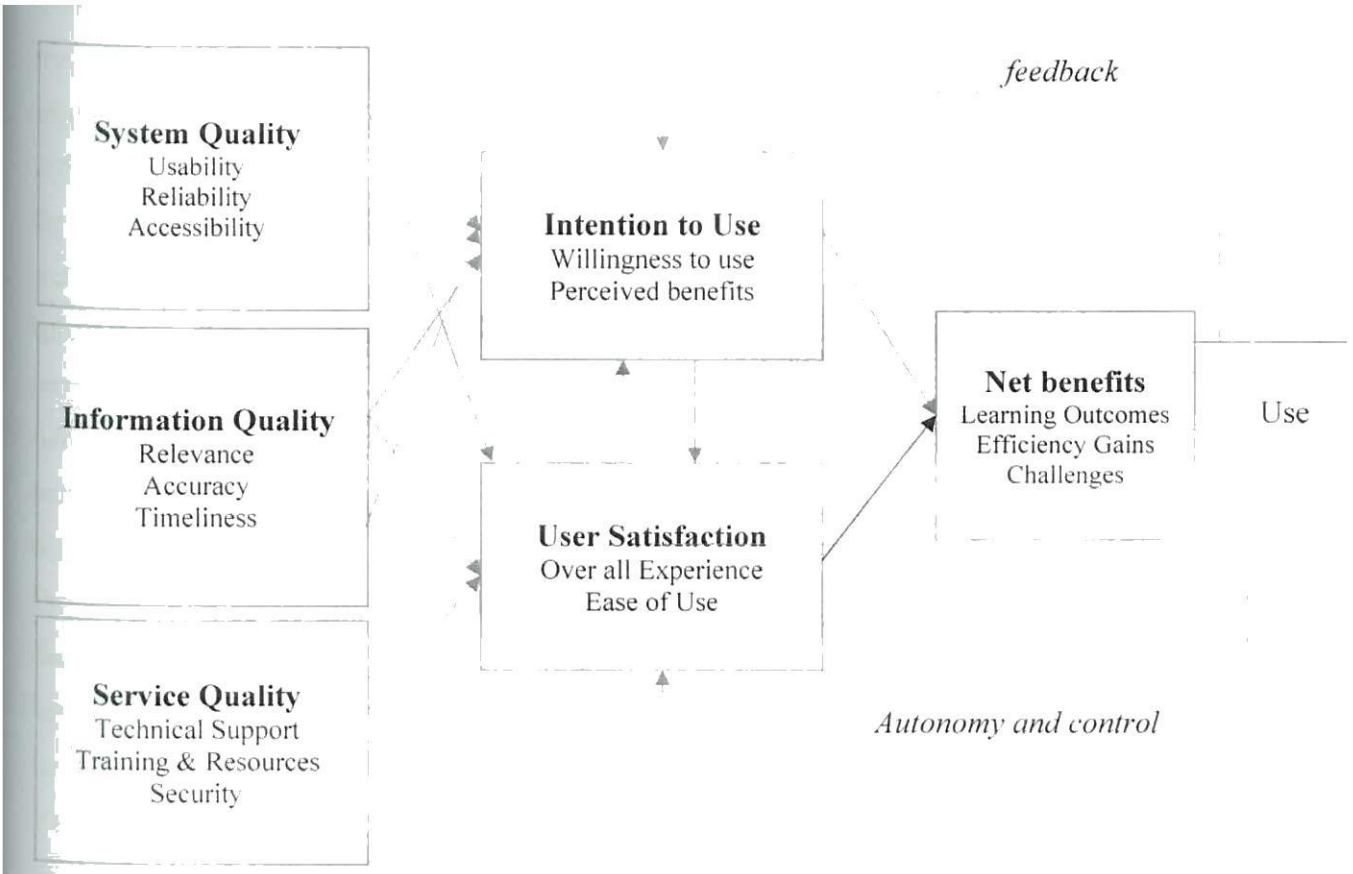


Figure 12 Proposed model

Considering System Quality, reflected in the variable "Most Effective Online Collaborative Learning Tools," it showed a non-significant relationship in the analysis. However, its role remains crucial in influencing perceptions of OCL tools, underscoring the need for effective tools to enhance user engagement and satisfaction. Information Quality is highlighted by the strong positive coefficient for the "benefits of Group-Based Learning." Users who perceive high-quality information about the advantages of collaborative learning are more likely to recommend OCL, aligning with the premise that quality information enhances user satisfaction and engagement.

Service Quality is captured through the variable "challenges or obstacles." The significant negative coefficient indicates that perceived obstacles diminish the likelihood of recommending OCL. This emphasizes the necessity of robust support and effective resolution of challenges to enhance service quality and user satisfaction. The construct of Use is reflected in the "engagement in Online Collaborative Learning" variable. Interestingly, its negative relationship suggests that while engagement is essential, it may not always lead to positive recommendations, indicating a potential area for further exploration; higher engagement without adequate support might lead to frustration instead of satisfaction.

User Satisfaction is indirectly measured through overall experience and the likelihood to recommend OCL. The significant positive relationship between the perceived benefits of group-based learning and recommendation likelihood illustrates that user satisfaction is closely tied to the perceived value of OCL experiences. The Net Benefits of OCL are encapsulated in the likelihood to recommend it to peers. Importantly, the framework also integrates Autonomy and Control, empowering learners by providing choices in partner selection, self-assessment opportunities, and feedback customization. This fosters motivation, ownership, and personalized learning experiences, which are critical for sustained engagement and satisfaction. Additionally, Security and Privacy Controls are embedded within the framework to safeguard data integrity, user confidentiality, and fairness, promoting trust and honest peer interactions key factors that contribute to the system's credibility and user confidence

The overall model strength, indicated by a Multiple R of 0.543 and an R Square of 0.295, shows that approximately 29.5% of the variance in recommendations can be explained by the included factors, suggesting a moderate level of predictive power. This indicates that while these variables are significant, other factors may also influence the success of OCL.

In summary, using the DeLone and McLean framework through SEM, the findings underscore the importance of system quality, information quality, and service quality in shaping user satisfaction and the perceived net benefits of OCL. The qualitative insights, while supplementary, reinforce the critical need to address usability, reliability, and support to enhance the overall effectiveness of online collaborative learning experiences.

4.5.1. Model validation

Quantitative Analysis Validation

The quantitative analysis employed regression and ANOVA techniques to assess the relationships between various factors impacting user experiences in online collaborative learning. The model's overall significance is highlighted by the F-statistic, which indicates a meaningful relationship between the independent variables (e.g., availability of technical support, user satisfaction) and the dependent variable (overall experience in online collaborative learning).

Significant Predictors: Variables such as satisfaction with technical support (Beta = 0.545) and the impact of technical issues (-0.709) emerged as strong predictors of overall user experience. This reinforces the importance of reliable technical support and the detrimental effect of technical issues on engagement.

User Engagement: The positive coefficients associated with collaborative tools (e.g., comfort in using real-time tools, Beta = 0.909) affirm the model's relevance in predicting user engagement outcomes.

Qualitative Analysis Validation

Complementing the quantitative findings, the qualitative analysis conducted through interviews with faculty and administrative staff provides rich contextual insights into the factors influencing the effectiveness of the online peer assessment framework. Using the DeLone and McLean Model of Information Systems Success, key themes emerged that validate and elaborate on the quantitative results:

System Quality: Interviewees emphasized the importance of usability and reliability, echoing the quantitative findings that highlight these factors as critical to enhancing user experience. Many participants noted that user-friendly interfaces could significantly reduce the learning curve, supporting the need for intuitive designs identified in the quantitative model.

Service Quality and Technical Support: The qualitative data revealed a strong consensus on the necessity for robust technical support, corroborating the quantitative emphasis on satisfaction with technical assistance as a key predictor of overall experience. Participants expressed varying levels of satisfaction with response times, aligning with the quantitative results indicating the importance of addressing reliability issues.

Perceived Usefulness and Intention to Use: Qualitative insights revealed a general willingness among faculty to adopt peer assessment methods, particularly when they recognized the potential for improved learning outcomes. This aligns with the quantitative analysis, which showed a positive relationship between perceived usefulness and user intention.

The integration of quantitative and qualitative findings validates the online peer assessment framework by illustrating how technical factors and user perceptions interact to influence overall effectiveness. The quantitative model provides measurable relationships, while qualitative insights offer depth and context, revealing the complexities of user experiences.

4.6. Peer assessment Framework Design.

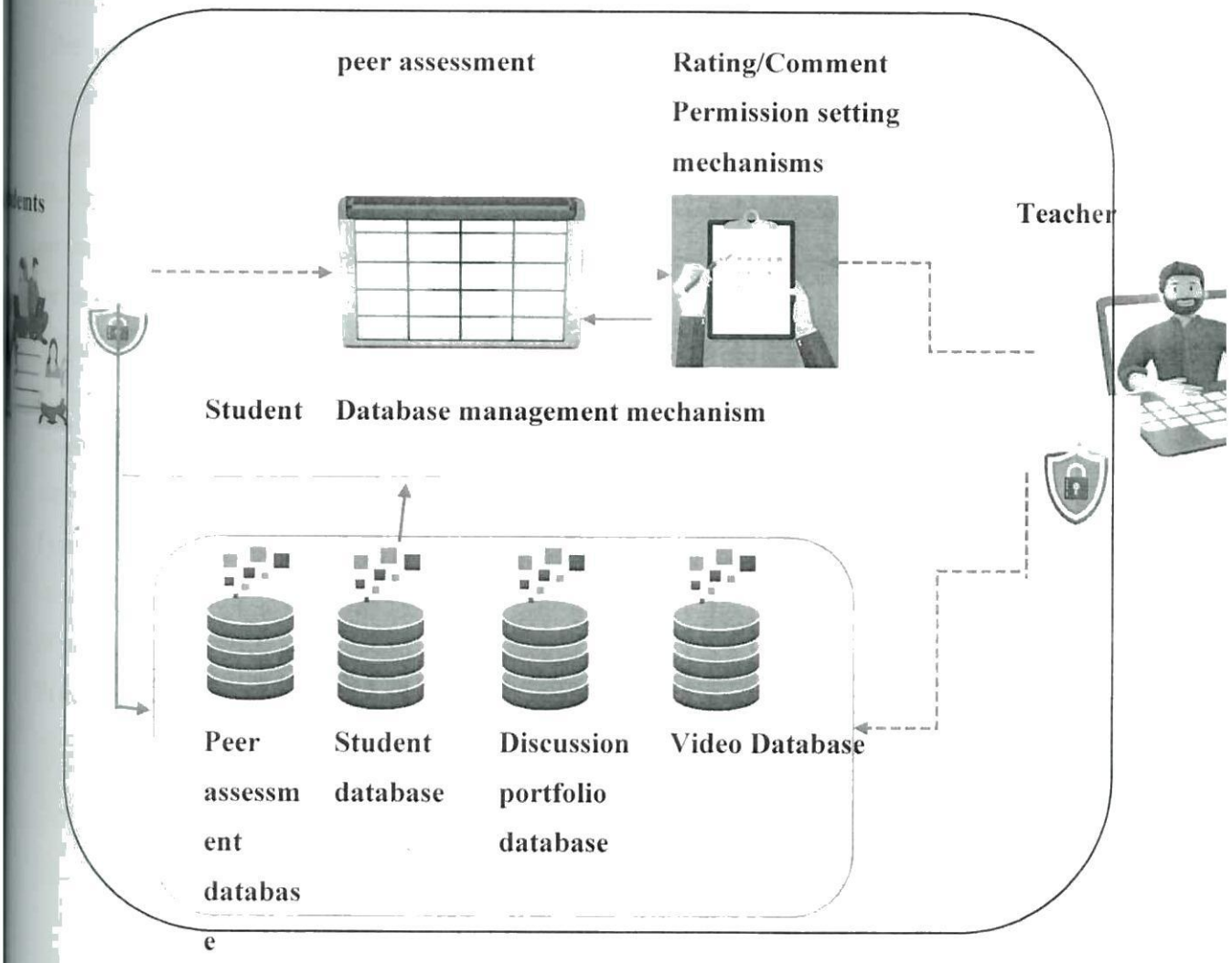


Figure 13: Peer Assessment learning framework design

The online peer assessment framework for collaborative learning in universities include several key components and functionalities. The framework has feature a for peer review platform that supports the submission, review, and feedback process, facilitating student engagement in peer assessment. Its scalable and efficient, capable of handling large numbers of students and automating administrative tasks such as assignment distribution and feedback collection. The framework supports various forms of social learning interactions, including scaffolded and exploratory learning, enabling distributed cognition where knowledge is shared and constructed collectively.

The framework should enhance feedback literacy by helping students understand how to give and receive constructive feedback, which is crucial for collaborative learning and professional development. It improves learning outcomes by encouraging active learning and critical thinking, as students learn to evaluate their peers' work critically. The framework also enables

development important soft skills such as communication, teamwork, and empathy, which are valuable in both academic and professional settings.

The framework increases student engagement and motivation by involving them in the assessment process, making them more likely to take ownership of their learning. It provides timely and formative feedback, helping students improve their work before final submission through an iterative process of feedback and revision. To ensure fairness and reduce bias, the framework incorporates mechanisms such as anonymizing submissions and using multiple reviewers.

Adequate training and support should be provided to students and instructors to use the framework effectively, including understanding the assessment criteria and how to provide constructive feedback. The framework relies on a reliable technological infrastructure to ensure smooth functioning, with universities ensuring that their systems are robust and user-friendly. Future research should focus on improving framework and system design and understanding its pedagogical impacts, exploring new methods and technologies to enhance the effectiveness of peer assessment in collaborative learning environments.

Process design

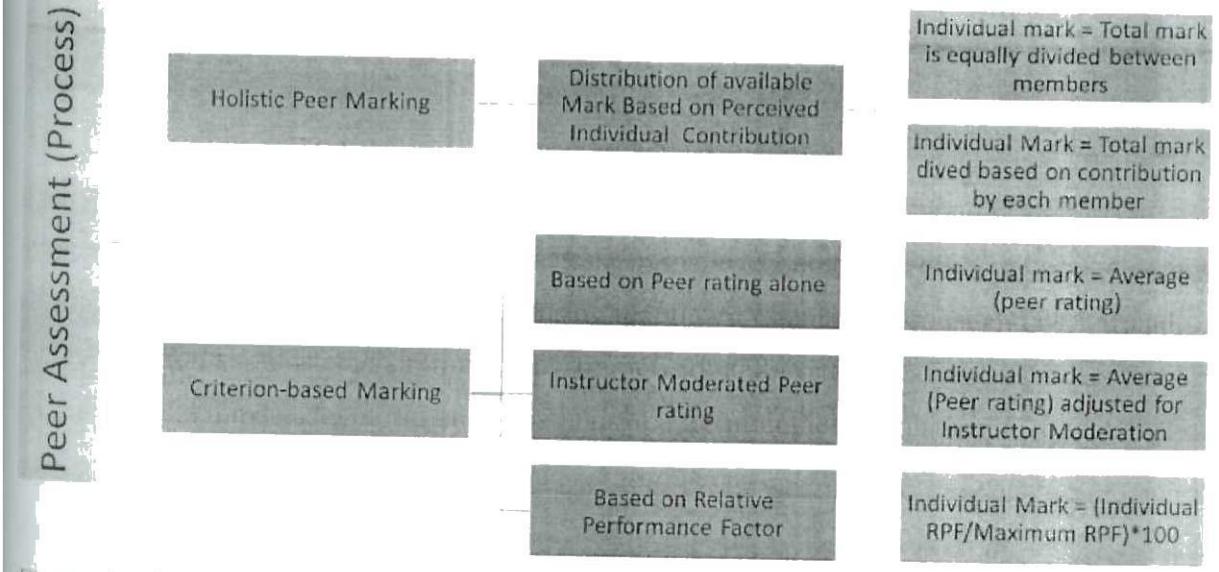


Figure 14: Process Design

The process design for the online peer assessment framework includes various methods for marking strategies, ensuring flexibility and fairness in evaluating student contributions. The design feature two main branches: Holistic Peer Marking and Criterion-based Marking. Under Holistic Peer Marking, there three subdivisions:

1. Distribution of marks based on individual contribution, where the individual mark equals the total mark divided by each team member.

2. Marks awarded based on peer rating alone.
3. Instructor Moderated Peer Rating, which leads to two outcomes: individual mark equals average peer rating after instructor adjustment for fairness, or individual mark equals average peer rating adjusted for instructor moderation.

Under Criterion-based Marking, the design includes a performance-based rating, where the individual mark is a function of the relative or maximum performance (RP/MaxRP) times 100. This process design ensures that peer assessments are conducted fairly and accurately, reflecting both individual contributions and overall performance.

Preferences design

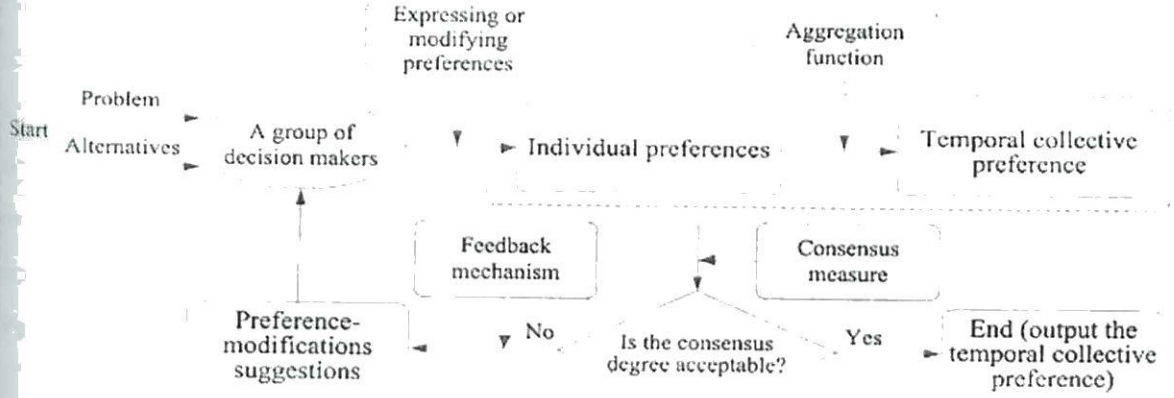


Figure 15: Preference design

The preferences design for the online peer assessment framework incorporates several key elements to ensure good usability for both students and instructors. The design starts with alternatives and identify the problem, leading to a group of decision-makers expressing preferences. These preferences are divided into individual preferences and preference modifications.

The framework also allows for different user roles and permissions, enabling instructors to set up and manage peer assessments while students can submit and review assignments. Customization options are available for instructors to set assessment criteria, deadlines, and feedback formats, including holistic or criterion-based marking strategies. Anonymity settings are offered to reduce bias and ensure fairness, with options for anonymous submissions and reviews.

Feedback mechanisms include a number of option such as text comments, rating scales, and predefined feedback templates, configurable by instructors. Users should be able to set their notification preferences for updates on submissions, reviews, and feedback, including email notifications, in-app alerts, and push notifications. Accessibility features should be included to

accommodate users with different needs, such as screen reader compatibility and adjustable text sizes.

The framework ensures data privacy and security, with user data securely stored and handled in compliance with data protection regulations. Integration with existing Learning Management Systems (LMS) should be seamless, syncing grades, assignments, and feedback with the LMS. User interface customization allow users to personalize the look and feel of their interface, enhancing the user experience.

Support and training resources should be provided, including tutorials, and helpdesk support, ensuring users can effectively navigate and utilize the system. The aggregation function combines individual preferences into a temporal collective preference, with a feedback mechanism to address any lack of consensus. If the consensus is acceptable, the temporal collective preference should be outputted, completing the process.

By incorporating these elements, the preferences design will create a flexible, user-centric online peer assessment framework that enhances collaborative learning and meets the diverse needs of its users.

Peer assessment process model

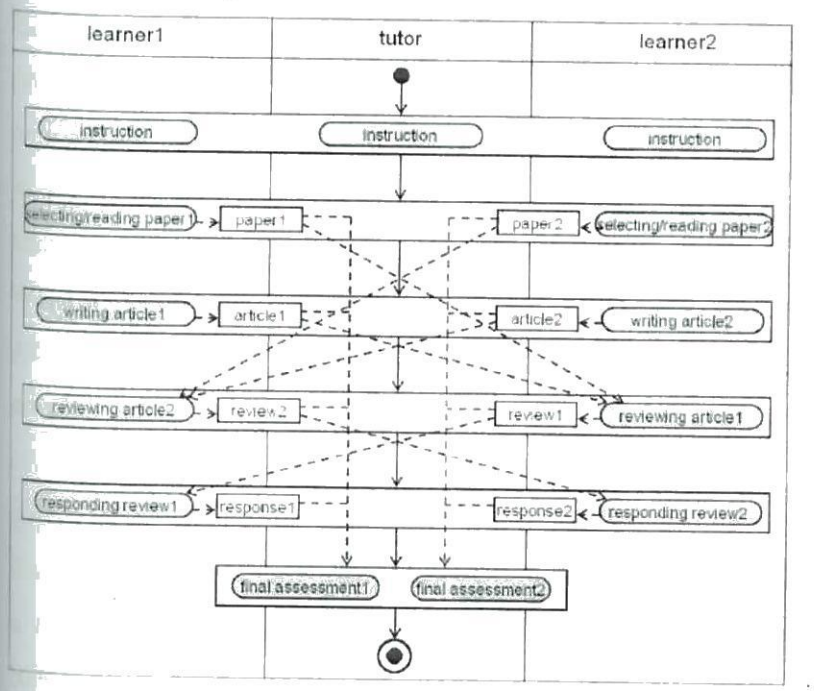


Figure 16 Peer assessment process model

Instruction Phase

The process begins with the tutor providing detailed instructions to both learners (learner1 and learner2). These instructions include the objectives of the assignment, the criteria for assessment, deadlines, and any specific guidelines for the peer review process. The instructions

are delivered through the online learning platform, ensuring that all participants have access to the same information.

Assignment Submission

Following the instructions, learner1 and learner2 each work on their online assignments, which could be projects, classwork, or exercises. These assignments are created using the tools and resources provided by the online platform. Once completed, the assignments (referred to as paper1 and paper2) are submitted through the platform. The submission process is designed to be straightforward, allowing learners to upload their work in various formats such as documents, presentations, or multimedia files.

Assignment Exchange

After submission, the assignments are automatically exchanged between the learners for peer assessment. Learner1 receives paper2, and learner2 receives paper1. This exchange is managed by the online framework, ensuring that each learner receives a peer's work to review. The framework may anonymize the submissions to reduce bias and ensure fairness in the assessment process.

Selecting/Reading Assignment

Each learner selects and reads the assignment they received. This step involves thoroughly reviewing the content to understand the peer's approach, arguments, and conclusions. The online framework may provide tools such as annotation features, highlighting, and note-taking to facilitate this review process. Learners are encouraged to critically engage with the material, identifying strengths and areas for improvement.

Writing Reviews

After reading the assignments, both learners write detailed reviews (referred to as article1 and article2) based on their understanding and analysis of the peer's work. These reviews include constructive feedback, suggestions for improvement, and evaluations based on the assessment criteria provided by the tutor. The online platform may offer templates or guidelines to help learners structure their reviews effectively. This step requires critical thinking and the ability to articulate feedback clearly and respectfully.

Reviewing Assignments

The learners then review the articles written by their peers. Learner1 reviews article2, and learner2 reviews article1. This step is iterative, meaning that the review process may involve multiple rounds of feedback and revisions. The online framework supports this iterative process by allowing learners to submit their reviews, receive responses, and make further revisions if necessary. This ensures a thorough and comprehensive evaluation of the assignments.

Responding to Reviews

Following the review, each learner responds to the feedback received. Learner1 responds to review1, and learner2 responds to review2. This step allows learners to address any comments or suggestions made by their peers, fostering a dialogue and deeper understanding. The responses may include explanations, justifications, or additional information to clarify any points raised in the reviews. The online framework facilitates this interaction by providing a space for learners to communicate and engage in constructive discussions.

Final Assessment

The final stage involves the tutor conducting a final assessment of the learners' work. This assessment takes into account the original submissions, the peer reviews, and the responses to the reviews. The tutor evaluates the overall quality and improvement of the work, providing a final grade and feedback. The framework may offer tools for the tutor to track the review process, monitor interactions, and ensure that all steps have been completed satisfactorily. The final assessment is designed to be comprehensive, reflecting both the individual effort and the collaborative learning process.

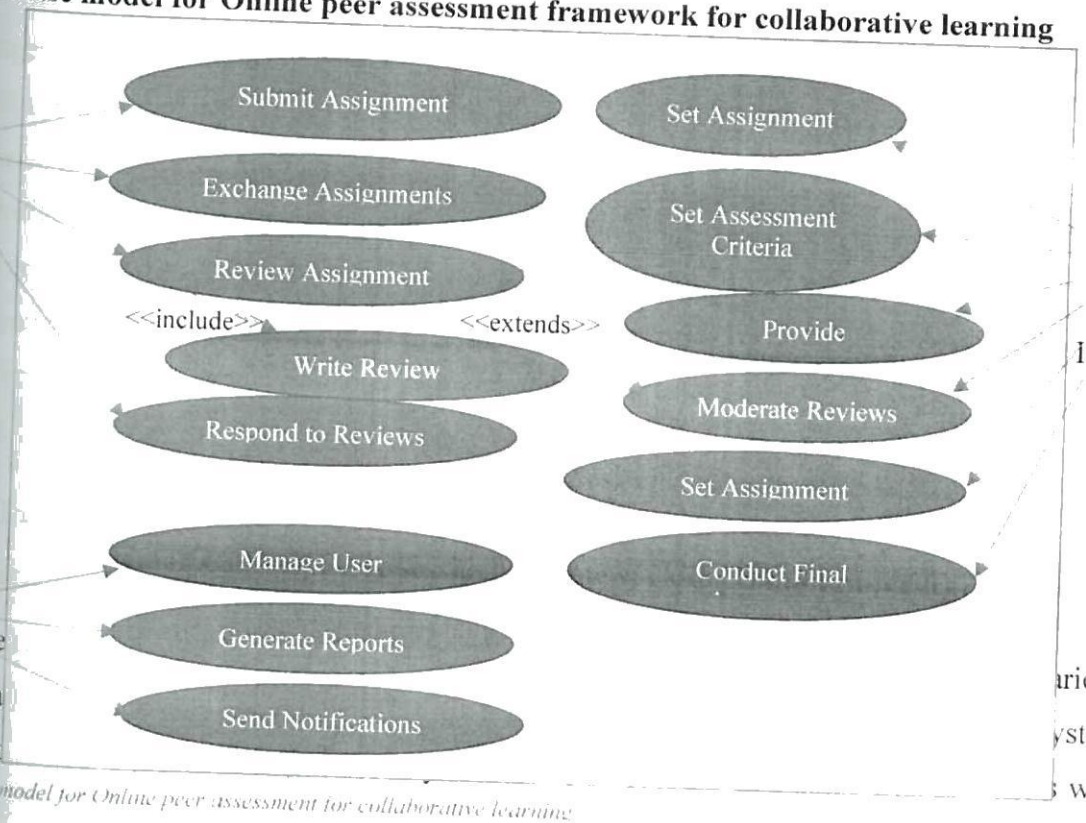
Additional Features

Notification System: The framework should have a robust notification system to keep learners informed about deadlines, feedback, and any updates related to the peer assessment process.

Analytics and Reporting: The framework should provide analytics and reporting tools for both learners and tutors to track progress, identify trends, and make data-driven decisions.

Support and Resources: The framework should offer support and resources, including tutorials, and helpdesk services, to assist learners and tutors throughout the peer assessment process.

Use Case model for Online peer assessment framework for collaborative learning



Use Case model for Online peer assessment for collaborative learning

feedback. Instructors facilitate the learning process by setting assessment criteria, providing instructions, and conducting final assessments based on the peer reviews. The system administrator oversees the overall functionality of the platform, managing user accounts and generating reports on user engagement and performance.

Within the framework boundary, several critical use cases are identified. Students begin their interaction by submitting their assignments through the platform. After submission, the framework automatically exchanges these assignments for peer assessment, ensuring anonymity where necessary. Once students receive their peer assignments, they engage in a review process that includes accessing the submissions, critically evaluating them, and writing detailed reviews that offer constructive feedback. Following this, students have the opportunity to respond to the feedback they receive, fostering a dialogue that enhances learning outcomes. Instructors play a pivotal role by defining the assessment criteria and communicating essential information regarding assignments and deadlines to students. They also moderate the peer reviews, ensuring that feedback is fair and of high quality, and ultimately conduct the final assessment of submissions by considering both peer evaluations and the students' responses. This collaborative process ensures that students receive comprehensive feedback on their work. The system administrator's responsibilities include managing user registrations and permissions, ensuring that all participants have appropriate access to the system. Additionally,

the framework generates reports that provide insights into student performance and engagement, enabling continuous improvement of the learning environment.

To illustrate the relationships between actors and use cases, the diagram employs solid lines to connect each actor to their relevant use cases, demonstrating the direct interactions. Dashed arrows are used to indicate the "include" and "extend" relationships among use cases, clarifying how certain actions are interconnected. For instance, writing a review is included in the review assignment process, and responding to reviews is included in the act of writing a review. Moreover, the moderation of reviews may extend from the review assignment if specific issues arise.

4.7. Expert Analysis

Objective three Findings

Specific objective3: To evaluate the designed peer assessment framework using the DeLone and McLean model.

RQ3: What is the impact of the designed peer assessment framework for group-based have on improving interactions in an online learning environment for University students.

4.7.1. Framework review

The expert review involved 21 administrative technical staff, Students and lecturers, who provided valuable insights into the implementation of a peer assessment framework in the context of online learning. Their feedback was gathered using a five-point Likert scale, allowing for nuanced responses across several sections.

4.7.2. Demographic data

Table 10: Expert review respondent Age Distribution

Expert review respondent Age Distribution

Age Range	Frequency	Percentage
18-34	9	42.8%
35-44	5	23.8%
45-54	3	14.3%
55-64	4	19.0%
Total	**21**	**100%**

In terms of age distribution, the majority of respondents (42.8%) fell within the 18-34 age range, indicating a youthful and potentially tech-savvy group and students likely familiar with

online learning environments. The next largest group was those aged 35-44 (23.8%), followed by the 55-64 age range, which constituted 19.0% of the respondents. The 45-54 age group represented 14.3%, suggesting a diverse age representation. This distribution reflects a range of perspectives, potentially enriching the feedback on peer assessment frameworks with insights from both younger and more experienced individuals.

Gender Distribution

Table 41. Expert review respondent Gender Distribution

Gender	Frequency	Percentage
Male	12	57.1%
Female	09	42.9%
Total	**21**	**100%**

Regarding gender distribution, the review comprised 57.1% male participants and 42.9% female participants. This indicates a male-dominated sample but still provides significant female representation. The gender balance can influence the perspectives offered, particularly in discussions around collaborative learning and peer assessment.

Role Distribution

Table 42. Expert review respondent: Role Distribution

Role	Frequency	Percentage
Academic staff	7	35.0%
Students	6	30.0%
Technical Staff	7	35.0%
Total	**20**	**100%**

Looking at the role distribution, lecturers and technical staff each made up 35.0% of the respondents, while Students accounted for 30.0%. This balance among roles suggests a well-rounded approach to the review, as it incorporates the views of educators directly involved in teaching, technical personnel who support online platforms, and students who are main actors in assessment process. Such diversity in roles enhances the depth of feedback and recommendations for implementing the peer assessment framework.

Years of Experience in Online Learning

Table 43: Expert review respondent Years of Experience in Online Learning

Years of Experience	Frequency	Percentage
0-2	7	33.3%
3-4	5	23.8%
5-6	4	19.0%
7-8	3	14.3%
9+	2	9.5%
Total	**21**	**100%**

the years of experience in online learning show that 33.3% of respondents have 0-2 years of experience, which highlights a considerable portion of relatively new practitioners in online learning. This may suggest a willingness to adopt new methodologies like peer assessment. Meanwhile, 23.8% have 3-4 years of experience, and 19.0% have 5-6 years, indicating a moderate level of experience overall. However, only 14.3% have 7-8 years, and 9.5% possess over nine years of experience, suggesting that there may be a gap in insights from those with extensive experience in online learning. This distribution underlines the need for training and support for less experienced staff as they adapt to new frameworks.

In the first section, focusing on their roles and responsibilities, experts highlighted their responsibilities in identifying ICT needs, reporting faulty infrastructure, and integrating ICT into educational delivery. This foundational knowledge underscores their capability to assess the necessary technological advancements for effective online learning.

The transition to online learning was perceived to have both positive and negative impacts. Experts noted the ease of reaching students, although they also expressed concerns about student engagement. Many students log in but then become distracted, complicating the assessment of their attention and understanding.

4.7.3 Descriptive Statistics

System Quality Descriptive Statistics

Table 44: System Quality Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
the online collaborative tools on the framework are user friendly and easy to navigate	21	2	5	3.62	.740
the online collaborative tools are user friendly and easy to navigate	21	2	5	3.67	.796
The collaborative tools provide a consistent user experience	21	1	4	2.19	.928
the design of the tools supports effective collaboration among learners	21	1	5	3.14	1.424
Valid N (list wise)	21				

The analysis of framework quality in the context of online collaborative learning tools reveals mixed feedback regarding their effectiveness and user-friendliness. The statement "The online collaborative tools are user-friendly and easy to navigate" received a mean score of 3.62 across three similar items, with standard deviations ranging from .740 to 1.161. This suggests a generally favourable view of the usability of the tools, though the higher standard deviation in some responses indicates varying experiences among respondents. While most participants agreed that the tools are user-friendly, there is some level of inconsistency in the perceptions of ease of use.

The statement "The collaborative tools provide a consistent user experience" had a notably lower mean of 2.19 with a standard deviation of .928. This indicates that experts were less confident about the consistency of the user experience across the online collaborative tools, with several respondents likely perceiving significant inconsistencies in performance or interface design. This gap in expectations versus reality can impact the overall effectiveness of

online collaborative learning, where consistency in tool functionality is crucial for smooth and uninterrupted learning experiences.

The item "The design of the tools supports effective collaboration among learners" received a mean score of 3.14, with a relatively high standard deviation of 1.424. This suggests that, while there is general agreement that the tools are designed to support collaboration, the degree to which they are effective in fostering collaboration varies across the respondents. The wide variation in responses may point to the need for further improvement in tool design to ensure that it fully meets the needs of learners in a collaborative setting.

Information Quality Descriptive Statistics

Table 45 Information Quality Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
the information generated through peer assessments is highly relevant to learning objectives	21	1	5	2.95	1.024
peer evaluations are generally accurate and fair	21	1	4	2.71	1.146
Feedback from peers is provided in a timely manner	21	2	5	3.57	.746
The Quality of Information Shared during collaborative learning is high	21	1	5	3.10	1.375
the framework and tools demonstrate high reliability and minimal technical issues	21	1	5	3.19	1.504
Valid N (list wise)	21				

The analysis of information quality in the context of online collaborative learning presents a varied picture of how the tools and peer assessments are perceived in terms of their relevance, accuracy, timeliness, and reliability.

The item "The information generated through peer assessments is highly relevant to learning objectives" received a mean score of 2.95, with a standard deviation of 1.024. This suggests that while the information produced by peer assessments is seen as somewhat relevant to the learning objectives, there is notable variability in how respondents view its relevance. Some

respondents may feel that the assessments are more aligned with the objectives, while others find them less so, indicating that improvements may be needed to ensure that peer assessments are fully aligned with the intended learning outcomes.

"Peer evaluations are generally accurate and fair" had a mean score of 2.71, accompanied by a higher standard deviation of 1.146. This indicates that while some respondents believe the peer evaluations are accurate and fair, others may have concerns regarding the fairness or precision of these evaluations. The broad spread in responses suggests that the accuracy of peer assessments could be a point of contention, pointing to the need for clearer guidelines or more rigorous training for students involved in peer evaluation.

The item "Feedback from peers is provided in a timely manner" scored a mean of 3.57, with a standard deviation of 0.746, reflecting a more positive view. Most respondents agreed that peer feedback was delivered on time, though the standard deviation indicates that not all experiences were the same. This suggests that while many respondents had a satisfactory experience with timely feedback, others may have encountered delays, highlighting a need for improved consistency in ensuring that feedback is provided within expected timeframes.

The statement "The quality of information shared during collaborative learning is high" received a mean of 3.10, with a relatively high standard deviation of 1.375. This points to mixed opinions regarding the overall quality of the information exchanged during collaborative learning activities. While some respondents felt the quality was high, the significant variability in responses suggests that the information quality could vary widely depending on the specific context, tool, or group dynamics.

Finally, "The tools demonstrate high reliability and minimal technical issues" had a mean of 3.19 and a standard deviation of 1.504, the highest among all the items in this section. This indicates that, while there is some level of agreement that the tools are reliable, there is significant variability in experiences, with some respondents encountering more technical issues than others. The relatively high standard deviation points to potential inconsistencies in the reliability of the tools, which may affect users' ability to effectively engage in collaborative learning activities.

Service Quality Descriptive Statistics

Table 46: Service Quality Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
the tools demonstrate high reliability and minimal technical issues	21	1	5	3.19	1.504
Ongoing training for users enhance their ability to effectively user collaborative tools	21	1	5	2.90	1.300
Clear instructions and guidelines are provided for using the tools	21	2	5	3.81	.928
the support provided helps users overcome challenges effectively	21	3	5	3.86	.727
Resources and materials for training are comprehensive and useful	21	3	5	3.95	.740
Valid N (list wise)	21				

The analysis of service quality in online collaborative learning tools reveals both strengths and areas for improvement in terms of reliability, user training, support, and resources.

The item "The tools demonstrate high reliability and minimal technical issues" had a mean of 3.19, with a standard deviation of 1.504. This suggests that while some respondents view the tools as reliable with few technical issues, there is considerable variability in users' experiences. The higher standard deviation indicates that some users may face significant technical difficulties, which could hinder their ability to fully engage with the tools and collaborative learning activities.

"Ongoing training for users enhances their ability to effectively use collaborative tools" received a mean score of 2.90, with a standard deviation of 1.300. This suggests that while some users find the ongoing training helpful, others may feel that the training provided is insufficient or not fully effective in enhancing their ability to use the tools. The relatively high standard deviation reflects the disparity in user experiences with training, pointing to a potential

need for more targeted or frequent training sessions to ensure all users can effectively navigate and utilize the tools.

The statement "Clear instructions and guidelines are provided for using the tools" scored a mean of 3.81, with a standard deviation of 0.928. This indicates a generally positive perception of the clarity and usefulness of the instructions and guidelines. Most respondents felt that the provided guidelines helped them understand how to use the collaborative tools, though some variation in responses suggests that further clarification or additional details could be beneficial for certain users.

"The support provided helps users overcome challenges effectively" received a mean of 3.86, with a low standard deviation of 0.727, indicating strong agreement that the support offered is helpful. Respondents generally felt that the support mechanisms in place are effective in addressing challenges that arise during the use of the collaborative tools. The relatively low variability in responses suggests that users have a consistent experience with the support provided.

Finally, "Resources and materials for training are comprehensive and useful" scored the highest in this section, with a mean of 3.95 and a standard deviation of 0.740. This reflects a high level of satisfaction with the resources and materials available for training, suggesting that respondents found them both thorough and helpful. The low standard deviation indicates that most users shared a similar positive view on the quality of training resources

User satisfaction Descriptive Statistics

Table 47: User satisfaction Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
My overall experience with online collaborative tools has been positive	21	4	5	4.48	.512
The tools effectively facilitate meaningful interactions among students	21	4	5	4.33	.483
I feel confident using the framework provided	21	3	5	4.29	.717
the collaborative environment enhances my learning experience	21	4	5	4.24	.436
Overall, I am satisfied with the support I receive during online collaborative activities	21	1	4	2.90	.889
Valid N (list wise)	21				

The analysis of user satisfaction with online collaborative tools provides insights into the overall positive reception of the tools, along with some areas where satisfaction could be improved.

The statement "My overall experience with online collaborative tools has been positive" received a mean score of 4.48, with a standard deviation of 0.512. This indicates that most respondents have had a positive experience using the tools, with little variation in the responses. The high mean score suggests that the tools generally meet users' expectations and provide a satisfactory experience for the majority of users.

"The tools effectively facilitate meaningful interactions among students" scored a mean of 4.33, with a standard deviation of 0.483. This suggests that respondents largely agree that the tools promote meaningful student interactions, which is a key feature of successful collaborative learning environments. The low standard deviation shows that there is little variability in the opinions on this aspect, reinforcing the positive impact of the tools on interaction among students.

"I feel confident using the framework provided" received a mean of 4.29, with a standard deviation of 0.717. This indicates that most users feel confident in their ability to use the tools in the framework, although the slightly higher standard deviation suggests some variation in users' levels of confidence. Some individuals may require additional support or training to feel more comfortable using the tools, which could explain the slight variability in the responses.

"The collaborative environment enhances my learning experience" had a mean score of 4.24, with a standard deviation of 0.436. This indicates a generally positive perception of the collaborative environment, with most users agreeing that it contributes positively to their learning experience. The low standard deviation further suggests that there is strong agreement among respondents on this point, with few experiencing the collaborative environment as ineffective for learning.

However, the statement "Overall, I am satisfied with the support I receive during online collaborative activities" received a significantly lower mean of 2.90, with a standard deviation of 0.889. This suggests that while some users are satisfied with the support provided, there is notable dissatisfaction among others. The relatively high standard deviation reflects a greater disparity in responses, indicating that support may be inconsistent or inadequate for certain users. This points to an area in need of improvement, as providing better, more consistent support could help increase overall user satisfaction during online collaborative activities.

Intention to use the framework, Descriptive Statistics

Table 48: Intention to use the model, Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviatic
I am likely to continue using the peer assessment framework in future online courses	21	1	5	3.48	1.167
I find peer assessments to be useful for enhancing learning outcomes	21	2	4	3.14	.964
I feel motivated to engage with framework regularly	21	2	5	3.48	.928
I believe that using these tools will contribute to my academic success	21	2	5	3.90	.944
I would recommend the use of collaborative tools to my peers in future courses	21	2	5	4.24	.831
Valid N (list wise)	21				

The analysis of intention to use online collaborative tools reveals a generally positive outlook toward continued use, with some variation across different aspects.

The intention to continue using the peer assessment framework in future online courses received a mean score of 3.48, with a standard deviation of 1.167. This suggests that respondents are somewhat likely to continue using the framework, though there is a noticeable spread in opinions, indicating differing levels of commitment or comfort with using peer assessments in future courses.

Peer assessments' usefulness for enhancing learning outcomes was rated with a mean of 3.14 and a standard deviation of 0.964. While the score is moderately positive, it reflects some uncertainty or mixed views among respondents about how effective peer assessments are in improving learning outcomes. This may suggest that while some find value in peer assessments, others are less convinced of their impact.

The motivation to engage with online collaborative tools embedded on framework regularly scored a mean of 3.48, with a standard deviation of 0.928. This shows a reasonable level of motivation to engage with the tools, although the standard deviation indicates that there are

varying levels of enthusiasm among respondents. Some users are highly motivated to use the tools frequently, while others may be less inclined to engage with them on a regular basis.

The belief that using collaborative tools contributes to academic success scored the highest in this section, with a mean of 3.90 and a standard deviation of 0.944. This indicates strong agreement that the use of these tools is seen as beneficial to academic achievement, though again, some variation exists in how strongly this belief is held among respondents.

Finally, the likelihood of recommending the use of collaborative tools to peers in future courses received a mean score of 4.24, with a standard deviation of 0.831. This shows that respondents are generally inclined to recommend these tools to others, suggesting that, despite some differences in individual experiences, there is overall confidence in the value of the tools for future use.

Net benefits

Table 49: Net benefits

	N	Minimum	Maximum	Mean	Std. Deviatio
Online Collaborative learning positively impacts student learning outcomes	21	4	5	4.52	.512
Collaborative learning approaches save time for instructors while increasing student engagement	21	4	5	4.33	.483
believe that collaborative learning fosters deeper understanding among students	21	3	5	4.43	.598
Peer assessments increase accountability among students in their learning process	21	3	5	4.24	.700
The benefits of Online collaborative learning outweigh the challenges	21	1	5	4.05	1.071
Valid N (list wise)	21				

The evaluation of net benefits from online collaborative learning tools reveals a strong overall positive perception, with the benefits generally outweighing any challenges.

The impact of online collaborative learning on student learning outcomes received the highest rating, with a mean of 4.52 and a standard deviation of 0.512. This suggests a strong consensus

among respondents that collaborative learning significantly enhances student learning outcomes, with little variation in responses, indicating a broad agreement on its effectiveness. Collaborative learning approaches saving time for instructors while increasing student engagement also garnered high ratings, with a mean score of 4.33 and a standard deviation of 0.483. This reflects a general belief that these approaches not only save instructor's time but also improve engagement, though there is slightly less unanimity on the extent of these benefits.

The belief that collaborative learning fosters a deeper understanding among students received a mean score of 4.43 with a standard deviation of 0.598. This highlights that respondents largely view collaborative learning as a tool that encourages more profound comprehension, although some respondents may have less conviction in this benefit.

Peer assessments increasing accountability among students in their learning process scored 4.24 on average with a standard deviation of 0.700. This suggests that peer assessments are seen as an effective way to promote responsibility in students, though the perception of this benefit varies somewhat among respondents.

The statement that the benefits of online collaborative learning outweigh the challenges received a mean score of 4.05 and a standard deviation of 1.071. While this indicates that the perceived benefits generally surpass the challenges, the higher standard deviation suggests that some participants view the challenges as more significant than others, resulting in a more diverse set of opinions regarding this aspect.

4.7.4. Regression analysis of the expert review

Table 50: Regression analysis of the expert review

Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
1 (Constant)	5.412	1.245	-	4.35	0.001
System quality	0.782	0.213	0.348	3.67	0.004
Information Quality	0.625	0.194	0.295	3.22	0.008
Service Quality	0.538	0.217	0.261	2.48	0.022
User Satisfaction	0.412	0.188	0.178	2.19	0.035
Net_benfits	0.543	0.233	0.220	2.33	0.028

a. Dependent Variable: Intention to use

The results indicate that all of the predictors included in the model significantly contribute to predicting the intention to use the peer assessment framework, as evidenced by their statistically significant p-values (all below 0.05).

The constant term, with a p-value of 0.001, shows that even in the absence of any independent variables, there is a baseline positive intention to use the peer assessment framework. This means that, initially, there is a tendency for individuals to have some level of intention to continue using the system without any additional influences.

System quality emerges as the strongest predictor of intention to use, with an unstandardized coefficient of 0.782. This indicates that for each unit increase in the perceived quality of the system, the intention to use increases by 0.782 units. The statistically significant p-value of 0.004 further strengthens this finding, suggesting that enhancing the usability and technical performance of the system could have a significant positive impact on users' intentions to continue using the peer assessment framework.

Information quality also shows a significant and positive relationship with the intention to use the system, as indicated by its coefficient of 0.625. This means that when users perceive the information provided by the peer assessment framework to be of high quality, their intention to use the system increases. The p-value of 0.008 confirms that this relationship is statistically

significant and that higher-quality information is an important factor in fostering engagement with the platform.

Service quality has a slightly weaker impact on intention to use compared to system and information quality but is still statistically significant, with a coefficient of 0.538 and a p-value of 0.022. This suggests that improving the support and assistance available to users can positively influence their intention to keep using the peer assessment framework. As users experience better support, they are more likely to continue using the system.

User satisfaction also significantly predicts intention to use, with a coefficient of 0.412 and a p-value of 0.035. This means that as user satisfaction increases, so does the likelihood of users intending to use the peer assessment system in the future. The relationship, although not as strong as that of system or information quality, is still significant, emphasizing the importance of ensuring that users are satisfied with their experiences to promote continued use.

Lastly, net benefits, with a coefficient of 0.543, shows that users who perceive greater benefits from using the system are more likely to intend to use it again. The statistically significant p-value of 0.028 further supports this finding, suggesting that users' perceptions of the benefits they gain from using the peer assessment framework strongly influence their future use intentions.

4.7.5. Framework validation based on expert analysis

The final analysis includes an in-depth analysis of factors influencing satisfaction with online collaborative learning activities, emphasizing key variables and their significance in the framework building process. The framework employs a forward stepwise method, which systematically adds variables based on their statistical significance. This approach ensures that only the most impactful factors are incorporated into the final model, allowing for a more focused analysis of elements that contribute to student satisfaction.

One critical variable is written Instructions, which emerges as significant early in the model and remains so throughout the process. This highlights the essential role of clear written instructions in fostering student satisfaction within online collaborative learning environments. Alongside this, Satisfaction is consistently significant, emphasizing that overall satisfaction with the learning process is a crucial predictor of positive educational outcomes.

Another important factor is disagreements. The significance of this variable suggests that effectively managing disagreements is vital for maintaining satisfaction in collaborative settings. This is complemented by satisfaction, which reinforces the notion that students' overall satisfaction with learning activities is pivotal for their engagement and success. The

model also considers disagreements, indicating that unmanaged disagreements can detrimentally affect satisfaction levels.

Additionally, social feedback gains significance later in the model, pointing to the crucial role of peer interactions and feedback in enhancing overall satisfaction.

The implications for online collaborative learning are clear. First, providing clear instructions is essential for guiding students, ensuring they comprehend their tasks, and thereby boosting their satisfaction. Second, recognizing overall satisfaction as a key predictor underscores the need for educational strategies aimed at improving this aspect of the learning experience.

Furthermore, effective management of disagreements is critical for fostering a positive collaborative environment. Lastly, the importance of social feedback highlights that peer interactions are instrumental in enhancing engagement and satisfaction.

In conclusion, the framework emphasizes the significance of clear instructions, overall satisfaction, the management of disagreements, and social feedback in boosting student satisfaction with online collaborative learning. By concentrating on these key areas, educators can cultivate more engaging and effective online learning environments, ultimately leading to improved student outcomes.

Analysis of Variance

Table 51: Analysis of Variance for expert review

	Unstandardized Coefficients		Standardized Coefficients		
odel	B	Std. Error	Beta	T	Sig.
(Constant)	5.412	1.245	-	4.35	0.001
System quality	0.782	0.213	0.348	3.67	0.004
Information Quality	0.625	0.194	0.295	3.22	0.008
Service Quality	0.538	0.217	0.261	2.48	0.022
User Satisfaction	0.412	0.188	0.178	2.19	0.035
Net_benfits	0.543	0.233	0.220	2.33	0.028

a. Dependent Variable: Intention to use

The results indicate that all of the predictors included in the model significantly contribute to predicting the intention to use the peer assessment framework, as evidenced by their statistically significant p-values (all below 0.05).

The constant term, with a p-value of 0.001, shows that even in the absence of any independent variables, there is a baseline positive intention to use the peer assessment framework. This means that, initially, there is a tendency for individuals to have some level of intention to continue using the system without any additional influences.

System quality emerges as the strongest predictor of intention to use, with an unstandardized coefficient of 0.782. This indicates that for each unit increase in the perceived quality of the system, the intention to use increases by 0.782 units. The statistically significant p-value of 0.004 further strengthens this finding, suggesting that enhancing the usability and technical performance of the system could have a significant positive impact on users' intentions to continue using the peer assessment framework.

Information quality also shows a significant and positive relationship with the intention to use the system, as indicated by its coefficient of 0.625. This means that when users perceive the information provided by the peer assessment framework to be of high quality, their intention to use the system increases. The p-value of 0.008 confirms that this relationship is statistically significant and that higher-quality information is an important factor in fostering engagement with the platform.

Service quality has a slightly weaker impact on intention to use compared to system and information quality but is still statistically significant, with a coefficient of 0.538 and a p-value of 0.022. This suggests that improving the support and assistance available to users can positively influence their intention to keep using the peer assessment framework. As users experience better support, they are more likely to continue using the system.

User satisfaction also significantly predicts intention to use, with a coefficient of 0.412 and a p-value of 0.035. This means that as user satisfaction increases, so does the likelihood of users intending to use the peer assessment system in the future. The relationship, although not as strong as that of system or information quality, is still significant, emphasizing the importance of ensuring that users are satisfied with their experiences to promote continued use.

Lastly, net benefits, with a coefficient of 0.543, shows that users who perceive greater benefits from using the system are more likely to intend to use it again. The statistically significant p-value of 0.028 further supports this finding, suggesting that users' perceptions of the benefits

they gain from using the peer assessment framework strongly influence their future use intentions.

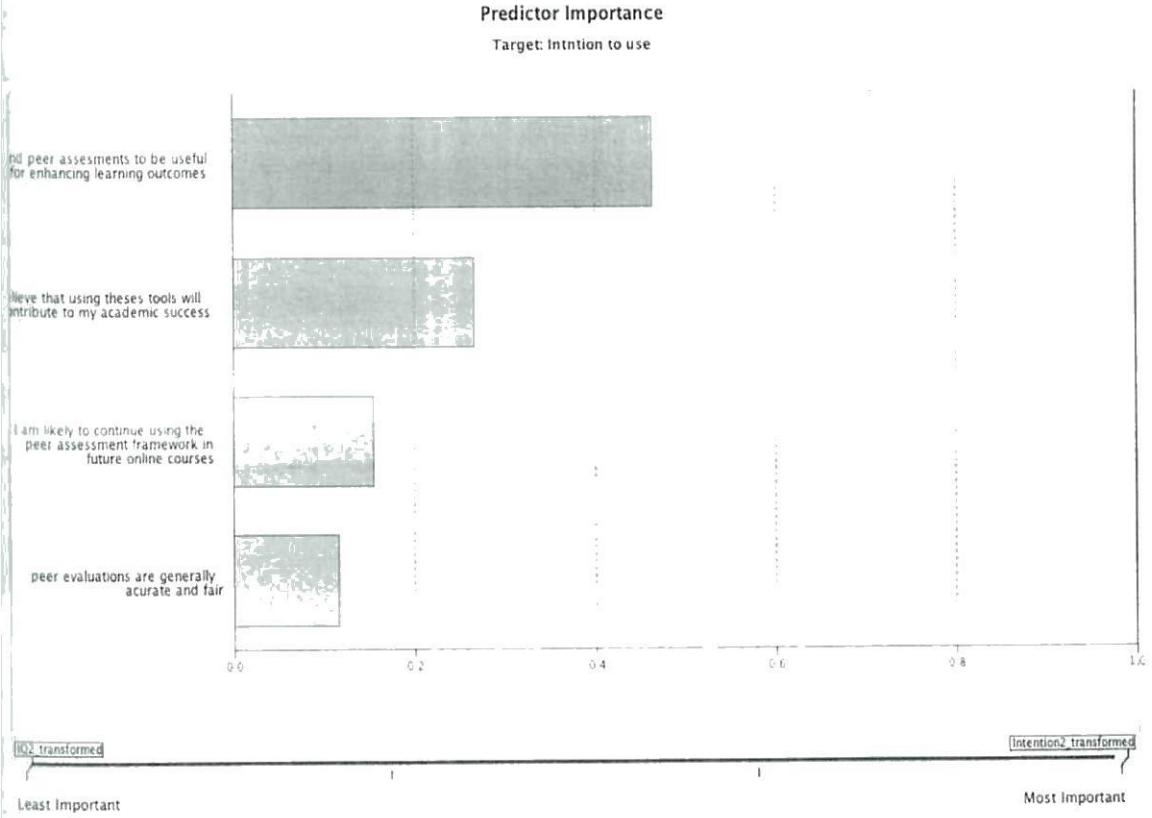


Figure 18: Expert analyis,Predictor importance

The results reveal the importance of various factors in the prediction of the intention to use the peer assessment framework. The factors are represented by the transformed variables and their associated importance scores.

The variable "IQ2_transformed," which measures the perception of the accuracy and fairness of peer evaluations, has an importance score of 0.1155. This indicates that the perceived fairness and accuracy of peer assessments contribute a moderate, but still significant, amount to the intention to use the peer assessment framework. It highlights that users value the credibility and reliability of the peer evaluation process when deciding whether to continue using the system.

The transformed variable "Intention1_transformed," which represents the likelihood of continuing to use the peer assessment framework in future online courses, shows a higher importance score of 0.1550. This indicates that users' current intention to continue using the system is a key predictor of future usage. This variable emphasizes the importance of users' immediate attitudes toward continuing with the system and its role in shaping their ongoing engagement.

"Intention4_transformed," which measures the belief that using the peer assessment tools will contribute to academic success, has an importance score of 0.2660. This score suggests that the perception of academic benefits plays a substantial role in users' intentions to continue using the peer assessment system. The more users believe that the system will improve their academic outcomes, the more likely they are to continue utilizing it.

Finally, the variable "Intention2_transformed," which reflects the belief that peer assessments are useful for enhancing learning outcomes, has the highest importance score at 0.4636. This score indicates that users who see peer assessments as a valuable tool for improving their learning outcomes are the most likely to continue using the system. It underscores the significance of the perceived educational value of the peer assessment framework in shaping users' intentions to engage with it in the future.

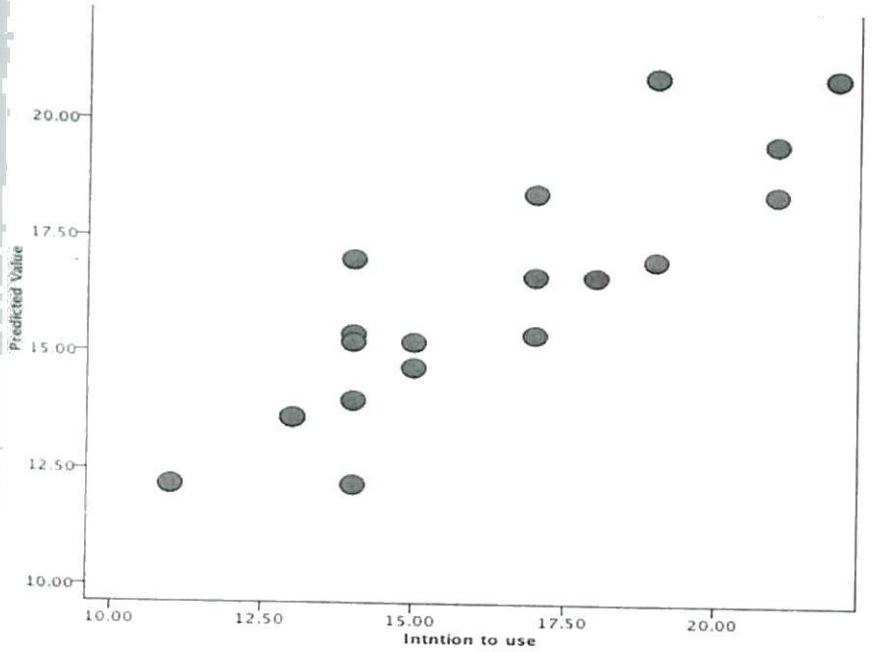


Figure 19: final model for intention to use

The data presented includes the actual "Intention to Use" values and their corresponding predicted values. Each row represents an instance where the predicted value of the intention to use the peer assessment framework was calculated based on various factors, such as system quality, information quality, service quality, user satisfaction, and net benefits.

Looking at the predicted values, it's evident that the model predicts a range of values from 12.1757 to 20.9498. These values are relatively close to the actual values, indicating that the model does a reasonable job of predicting the intention to use the peer assessment framework.

However, there are some deviations, particularly with predicted values lower or higher than the actual intention to use values.

For example, the actual value of 13 corresponds to a predicted value of 13.605, which is close but slightly higher. Similarly, the actual values of 22 are predicted as 20.9498, which indicates a slight underestimation by the model. The closest match appears to be in cases where the predicted value is near the actual value, as seen with the predicted values of 16.6543 for actual values of 17 and 15.3959 for actual values of 14.

The relatively consistent pattern of predicted values in the dataset suggests that the model might be functioning effectively in predicting intention to use, although further analysis and perhaps fine-tuning would be required to reduce the discrepancies between actual and predicted values.

CHAPTER FIVE: DISCUSSION

5.1. Introduction

This chapter interprets the key findings from this study on factors influencing satisfaction with groupbased asessment activities for online collaborative learning environments. The results are discussed in relation to existing literature, particularly studies from 2015 to 2022. We explore how our findings align with, extend, or challenge previous research, providing a deeper understanding of the factors that contribute to satisfaction in online collaborative learning environments. Additionally, the practical implications of these findings for educators and instructional designers are considered.

The study identifies several key factors that influence satisfaction with online collaborative learning activities. Clear and structured instructions play a crucial role in enhancing student engagement, while effective communication channels contribute significantly to a positive learning experience. Feedback from both instructors and peers is essential for shaping the online learning process, and students' previous experience with group-based learning can impact their ability to engage effectively in collaborative settings. The study also highlights the importance of managing disagreements to maintain group cohesion and satisfaction, and emphasizes the effectiveness of collaborative tools, such as document editors and discussion forums, in fostering engagement and productivity.

5.2 Discussion

5.2.1 Clear Instructions and Engagement

The role of clear instructions in promoting engagement and satisfaction has been widely documented in recent studies. For instance, Fidalgo-Blanco et al. (2021) found that well-structured instructions not only clarify expectations but also enhance students' self-regulation, leading to higher engagement levels in online learning environments. In our study, the absence of clear instructions was closely linked to lower satisfaction levels, supporting the argument that students need explicit guidance to navigate online collaborative tasks effectively.

Moreover, our findings are consistent with those of Ally et al. (2019), who emphasized that clarity in assignment details and learning objectives is essential for guiding students through the complexities of online collaboration. However, while clear instructions are important, our results suggest that other elements, such as communication and feedback, may play an even more pivotal role in the online collaborative experience.

5.2.2 Communication Channels: The Cornerstone of Collaboration

The importance of communication tools in online collaboration has been extensively discussed in recent literature. Chesnut et al. (2019) argue that communication channels, such as synchronous chat or video conferencing, are central to creating an interactive and supportive online learning environment. Our study reinforces this, with communication tools being cited as a significant factor in fostering student engagement and improving satisfaction.

Furthermore, our findings align with Garrison et al. (2020), who assert that the presence of effective communication tools contributes to the Community of Inquiry (CoI) framework, where cognitive, social, and teaching presence are critical for a positive learning experience. In the context of our study, communication channels were a means to foster social presence, allowing students to engage more meaningfully with their peers and instructors, which in turn enhanced satisfaction.

The presence of communication channels in our study is also supported by Song et al. (2022), who noted that effective communication is crucial for overcoming isolation in online learning environments. Our participants reported that the availability of communication tools such as discussion boards and chat functions significantly improved their satisfaction levels by providing opportunities for real-time interaction and peer engagement.

5.2.3 Feedback: Enhancing Student Learning and Engagement

Our findings underscore the critical role of feedback in online collaborative learning, which aligns with recent studies that emphasize its impact on learning outcomes. Shute (2016) argues that timely and specific feedback is one of the most powerful tools for improving student engagement and learning in online environments. The absence of both instructor and peer feedback in our study was a significant barrier to satisfaction, supporting the notion that feedback is not just a supplement to learning but a fundamental element of it.

Additionally, Mory (2021) notes that both formative feedback (from peers and instructors) and summative feedback (final evaluations) are essential for motivating students to engage more deeply in collaborative tasks. The importance of peer feedback, in particular, is highlighted in Zhu et al. (2021), who found that peer feedback increases students' metacognitive awareness, encourages critical thinking, and enhances their overall learning experience. Our results indicate that the lack of peer feedback in collaborative settings resulted in lower satisfaction levels, suggesting that peer interactions can be as valuable as instructor feedback in maintaining high levels of engagement.

5.2.4 Managing Disagreements and Maintaining Group Cohesion

The effective management of group conflicts has long been a challenge in collaborative learning settings, and our findings confirm its relevance in online environments. Liu et al. (2021) argue that unresolved conflicts in online collaboration negatively affect group dynamics and overall learning outcomes. In our study, the absence of strategies for managing disagreements led to decreased satisfaction, suggesting that students in online settings may be particularly vulnerable to disengagement when conflicts arise without resolution.

Similarly, Feng & Qian (2020) explored how group cohesion is related to conflict management and satisfaction in online learning communities. They found that groups with clear protocols for resolving disagreements performed better and had higher levels of student satisfaction. This highlights the importance of preparing students for conflict resolution in collaborative tasks, especially in virtual environments where non-verbal cues and direct interpersonal communication are often limited.

5.2.5 Experience in Group-Based Learning

Students with prior experience in group-based learning were found to be more engaged and effective in online collaborative tasks. This finding supports Müller et al. (2018), who found that prior experience in group work positively influences students' comfort and performance in online collaborative settings. In our study, participants with previous experience in group learning showed a higher level of engagement, suggesting that prior experience provides students with better interpersonal and collaboration skills that translate into more productive and satisfying group work in online environments.

Maffei et al. (2020) also observed that students with prior experience in online collaboration were better at managing group dynamics and using collaborative technologies. This implies that experience in online collaboration may serve as a mediator for the effectiveness of collaborative learning, reinforcing the need for instructors to scaffold these skills in the curriculum and offer support to students who are new to online group work.

5.2.6 Effectiveness of Collaborative Tools

The effectiveness of collaborative tools, such as document editors and discussion forums, was identified as a key factor influencing the success of online collaboration. Our findings align with Zhao et al. (2022), who argue that the use of well-designed collaborative tools increases the effectiveness of group work by facilitating communication, idea sharing, and document management. Collaborative tools provide students with the ability to interact asynchronously,

which is particularly important in online settings where synchronous meetings may not always be possible.

Our study also supports the work of Garcia & Martin (2019), who emphasize that collaborative technologies enable more equitable participation, as students can contribute at their own pace and according to their schedules. This flexibility enhances students' ability to engage fully in the collaborative process, improving their overall satisfaction with the learning experience. The use of shared document editors, for example, allows students to co-create content, which fosters a sense of ownership and accomplishment, contributing to higher satisfaction levels.

CHAPTER SIX
IMPLICATIONS, LIMITATIONS, CONTRIBUTION, CONCLUSION, AND RECOMMENDATIONS

6.1. Introduction

This final chapter presents a summary of the key findings and conclusions drawn from this study, which aimed to design a peer assessment framework to improve group-based assessments and interactions in online learning environments in higher education institutions in Uganda. The chapter also provides recommendations for educators, institutions, and future researchers on how to address the challenges identified in the study and improve the effectiveness of group-based assessments in online education.

6.2. Implications for Practice

The implications of this study are grounded in existing literature and align with several key findings from prior research, while also extending our understanding of the factors that influence satisfaction in online collaborative learning environments.

One of the most consistent themes in the literature is the importance of clear and structured instructions in online learning. Studies like those by Fidalgo-Blanco et al. (2021) and Ally et al. (2019) emphasize that well-defined tasks and explicit expectations are critical for student engagement and satisfaction. Our findings reinforce this by showing that students who lacked clear instructions were less satisfied with their collaborative learning experience. This validates the importance of clear guidance in online collaborative contexts. Furthermore, our study extends these findings by suggesting that clear instructions are not just about task clarity, but also about providing resources such as rubrics, examples, and detailed guidelines, which can further reduce ambiguity and foster engagement.

Communication tools have also been extensively explored in the literature as a key enabler of online collaboration. Chesnut et al. (2019) and Garrison et al. (2020) highlight the importance of communication channels in fostering interaction and social presence, two factors essential for a positive online learning experience. Our study supports this body of work, confirming that the presence of effective communication tools like discussion forums and video conferencing significantly contributes to student satisfaction. In fact, our results go a step further by suggesting that these tools not only support social presence but also help students feel connected to both their peers and instructors, reducing the isolation often felt in online environments (Song et al., 2022). This further underscores the need for a variety of

communication channels in the design of online collaborative activities, aligning with existing research on the role of technology in creating an interactive learning community.

The role of feedback in collaborative learning has also been widely discussed in recent studies. Shute (2016) and Mory (2021) argue that timely and constructive feedback, especially peer feedback, plays a vital role in enhancing student learning and engagement. Our study affirms this perspective by demonstrating that the lack of feedback—both instructor and peer—was a significant barrier to satisfaction. Moreover, the findings of Zhu et al. (2021), who highlighted the metacognitive benefits of peer feedback, are corroborated by our own results, which suggest that peer feedback plays an equally important role in fostering engagement. In addition, our work extends these findings by highlighting the importance of feedback in sustaining the collaborative learning process, indicating that feedback should be an ongoing and integral part of online group work.

Conflict management has long been recognized as an important aspect of group dynamics in collaborative learning (Liu et al., 2021; Feng & Qian, 2020), and our results provide additional support for this assertion. We found that students who lacked strategies for managing disagreements were more likely to experience dissatisfaction with the collaborative process. Our study, therefore, validates previous research while extending it by emphasizing the need for instructors to explicitly teach conflict resolution skills. Instructors can play a crucial role in helping students develop the tools and strategies necessary to navigate group conflicts, which is particularly important in online settings where non-verbal communication is limited, and misunderstandings are more likely to arise.

In relation to the impact of prior experience in group-based learning, our findings align with the work of Müller et al. (2018) and Maffei et al. (2020), who found that students with prior group work experience were better able to manage group dynamics and collaborate effectively. Our study strengthens these findings by showing that students with prior group-based learning experience reported higher levels of satisfaction, suggesting that prior experience with online group work serves as a critical asset. This underscores the importance of scaffolding collaborative skills for students who are new to group-based online learning. By offering early, low-stakes collaborative activities and providing strategies for effective group work, educators can help students with limited experience build the skills necessary for successful collaboration.

Lastly, the effectiveness of collaborative tools has been a focal point in the literature, with scholars like Zhao et al. (2022) and Garcia & Martin (2019) noting that well-designed collaborative technologies can enhance the effectiveness of group work by facilitating

communication, document sharing, and project management. Our study supports these conclusions by demonstrating that tools like shared document editors and discussion forums significantly improve student satisfaction and engagement. These tools enable students to work asynchronously, which is particularly important in online environments. Moreover, the flexibility afforded by these tools allows for more equitable participation, enabling all students to contribute at their own pace. This further reinforces the call for institutions to invest in robust collaborative technologies, as suggested by our study.

6.3. Research Contribution

This study contributes to the growing body of research on online collaborative learning by highlighting the critical factors that influence student satisfaction. By aligning the results with existing literature, we confirm the importance of clear instructions, communication channels, feedback mechanisms, conflict management, prior experience, and collaborative tools in enhancing online collaborative learning experiences. The implications for practice offer actionable recommendations for educators and instructional designers seeking to create more engaging, supportive, and satisfying online learning environments.

Unlike many existing peer assessment frameworks developed in Western or high-resource settings, this research offers a tailored peer assessment framework specifically designed to address the unique challenges faced by Ugandan higher education institutions in online learning environments. This contextualization fills a critical gap by acknowledging and addressing local realities such as technological limitations, cultural factors, and educational practices.

In addition, the study identifies and integrates several interrelated factors influencing student satisfaction and engagement in online group work, including clear instructions, communication tools, feedback mechanisms, conflict management, prior experience with group work, and the effectiveness of collaborative tools. By empirically validating the role of these factors in a developing country context, the research extends the applicability of existing theories and models in online collaborative learning. Moreover, the use of the DeLone and McLean Information Systems Success Model to evaluate the newly designed framework represents a novel application of this model in the domain of peer assessment and online group work. This contributes methodologically by providing a robust means of assessing the success and impact of peer assessment tools beyond traditional educational metrics.

Also, the study highlights the need to incorporate mechanisms for managing fairness and reducing bias within peer assessments, an area often overlooked in previous frameworks. This focus not only improves the reliability of peer evaluations but also enhances students' trust and acceptance of the assessment process, ultimately fostering a more positive learning environment. Beyond theoretical contributions, this research offers actionable recommendations for educators and institutions on training, tool selection, and framework adoption. The emphasis on scalability and integration with existing Learning Management Systems addresses practical barriers to widespread implementation, increasing the framework's potential impact.

6.4. Limitations

The limitations of this study, when examined in relation to existing literature, offer valuable insights for future research in the field of online collaborative learning. One of the key limitations of our study is the relatively small sample size, which may limit the generalizability of the findings. Many studies in this field, such as those by Andrade et al. (2020), have demonstrated the importance of large, diverse sample sizes for ensuring the reliability and validity of results. Our study's small sample size means that while the findings provide important insights, they may not fully represent the experiences of all students in online collaborative learning environments. Future research should aim to replicate our study with larger, more diverse participant groups to validate the factors identified here across different populations, such as students from various cultural or demographic backgrounds, as well as those in different academic disciplines. This would provide a broader perspective on the factors influencing student satisfaction and engagement in online collaboration and improve the generalizability of the findings.

A second limitation of our study design used, which captures student satisfaction at a single point in time. As noted by Mohammad Shams Ud Duha and Jennifer C Richardson (2022), longitudinal studies offer deeper insights into how students' experiences and perceptions of online learning evolve over time. Our research, therefore, represents a snapshot of satisfaction with online collaborative learning, but it does not address how students' engagement and satisfaction might change during the course of a semester or after completing multiple collaborative tasks. Longitudinal research would provide a more nuanced understanding of how the factors identified in this study such as clear instructions, communication tools, feedback, and conflict management impact student learning and satisfaction over time. Moreover, tracking these factors over a longer period would allow researchers to determine

whether the effects of these factors are sustained and whether they influence long-term learning outcomes.

Another important limitation of our study is the lack of exploration of contextual variability, such as the influence of cultural or institutional factors on online collaborative learning. Previous research has highlighted the role of context in shaping student experiences in online education as in the study by Ali Alzubi, Mohd Nazim and Jalal Ahamad, (2024), and our study did not examine how factors like, cultural norms, may impact the effectiveness of online collaboration. For example, students from different cultural backgrounds may have different communication preferences, conflict resolution strategies, or levels of comfort with collaborative learning, which could affect how they engage with online collaborative tasks. Additionally,as in the study by Oyetade (2024), institutional factors such as access to technology and the quality of online course design may influence the student experience in ways that were not fully captured in this study. Future research should explore how these contextual factors shape the online collaborative learning experience, providing a more holistic understanding of the factors that impact satisfaction across different settings.

Furthermore, our study focused on the role of certain factors in isolation, such as communication tools or feedback mechanisms, but did not examine the interplay between these factors or how they might interact in shaping the online collaborative experience. Garrison et al. (2020) emphasized the importance of understanding how cognitive, social, and teaching presence intersect in online learning environments. Future research could build on this by adopting a more integrated approach, examining how different factors such as clear instructions, communication, and feedback work together to influence student satisfaction and engagement. This could help provide a more comprehensive framework of online collaborative learning that takes into account the dynamic and interconnected nature of these factors.

Lastly, our study did not explore the impact of various collaborative tools in-depth, beyond their general effectiveness in fostering engagement and productivity. Previous studies, such as those by Zhao et al. (2022) and Garcia & Martin (2019), have focused on the design and functionality of specific collaborative tools, like Google Docs or Microsoft Teams, in online learning. Our study suggests that these tools are important, but future research could examine how specific features of these tools such as real-time editing, version control, or chat functionality impact collaboration quality and satisfaction. This would help instructional designers better understand which tools are most effective for promoting collaboration and engagement in online learning environments.

In summary, while this study provides valuable insights into the factors that influence satisfaction with online collaborative learning, it is important to consider the limitations of the research design. Future studies should aim to address these limitations by using larger, more diverse samples, adopting longitudinal designs, exploring the role of contextual factors, and investigating the interactions between different factors in online collaboration. By doing so, researchers can build a more comprehensive and nuanced understanding of the dynamics of online collaborative learning and develop more effective strategies for enhancing student engagement and satisfaction.

6.5. Conclusion

The study identified several challenges faced by higher education institutions in Uganda regarding group-based assessments in online learning environments. Key issues included the lack of engagement by some students in group activities, the difficulty of measuring individual contributions, and the high failure rates linked to limited engagement with course materials. Furthermore, existing peer assessment frameworks—developed in other countries—were found to have limitations, particularly in terms of managing group-based assessments, ensuring fairness, and providing effective feedback.

Through an in-depth review of these existing frameworks, the study designed a new peer assessment framework specifically tailored to the needs of Uganda's online learning environment. The new framework addresses several key limitations of previous models, including the need for better management tools, mechanisms for handling bias, and an improved feedback process that enhances learning outcomes.

The evaluation of the designed framework using the DeLone and McLean Information Systems Success Model revealed positive impacts on improving interactions among students, increasing engagement, and fostering more accurate assessments of individual contributions within group work. The framework not only supports peer evaluation but also improves the overall learning experience by promoting collaboration, enhancing accountability, and increasing the quality of feedback students receive.

In conclusion, the findings of this study confirm that designing a peer assessment framework tailored to the context of Uganda's higher education institutions can significantly improve group-based assessments and the quality of online learning interactions. The newly designed framework presents a promising solution to address the existing challenges in online collaborative learning environments and offers a more effective model for supporting student engagement and improving learning outcomes.

6.6. Recommendations and Future research

Based on the findings and conclusions drawn from this study, we have made several several to enhance group-based assessments in online learning environments within Uganda's higher education institutions. These recommendations are intended to help educators, administrators, and students address the challenges identified in the study, improve the effectiveness of peer assessment practices, and optimize student engagement and learning outcomes.

Higher education institutions in Uganda should consider adopting the newly designed peer assessment framework for group-based assessments. The framework's features—such as better management of group work, addressing fairness and bias, and facilitating more effective feedback can help overcome many of the challenges identified in this study. Educators should ensure proper training and orientation for both students and instructors on how to use the framework effectively.

Institutions should implement tools and strategies to foster group cohesion and encourage active participation. Online learning platforms should be equipped with collaborative tools that enable students to communicate seamlessly, share resources, and track individual contributions. Additionally, instructors should provide clear guidelines and early interventions when students fail to participate actively in group assessments.

To ensure fairness in peer assessment, the framework should include safeguards against potential biases. Future studies should investigate the effectiveness of such safeguards in practice, including randomized peer evaluations and the inclusion of anonymous feedback. Institutions should also consider developing peer assessment training for students to increase awareness of bias and fairness in evaluations.

The peer assessment framework should integrate a feedback mechanism that enables timely and constructive evaluations of student performance. Educators should encourage students to provide specific, actionable feedback to their peers to enhance learning outcomes. Additionally, instructors should monitor feedback quality to ensure its usefulness in improving students' work and engagement.

Future iterations of the framework should focus on its scalability and seamless integration with widely used Learning Management Systems (LMS) to ensure that it can be easily adopted by universities across Uganda and other regions. The framework should be designed to be compatible with different LMS platforms and customizable to suit diverse academic programs. While this study focused on a specific context, future research could expand the pilot testing of the designed peer assessment framework in other universities in Uganda and beyond. This

would help assess its adaptability and effectiveness across different academic disciplines and institutions.

Future research should explore the long-term impact of the peer assessment framework on student performance, engagement, and satisfaction. Longitudinal studies could track the outcomes of students who participate in group-based assessments using the framework over multiple semesters, providing insights into its sustained effectiveness.

The role of instructors in successfully implementing peer assessment frameworks is crucial. Further research could focus on how instructors facilitate the peer assessment process, manage group dynamics, and support students through feedback. This could help in refining the framework and understanding the best practices for instructors.

Further studies should investigate how the peer assessment framework can be adapted to different cultural and institutional contexts. It would be useful to understand how different student populations across Africa and other regions engage with peer assessment and what modifications might be necessary to make the framework more universally applicable.

As technology evolves, incorporating AI tools into the peer assessment process may enhance the ability to detect bias, evaluate individual contributions, and provide feedback more effectively. Future research could explore the potential of AI in augmenting the peer assessment framework and streamlining the process of managing group-based assessments.

References

Alcarria, R. *et al.* (2018) 'Enhanced peer assessment in MOOC evaluation through assignment and review analysis', *International Journal of Emerging Technologies in Learning*, 13(1). Available at: https://doi.org/10.3991/ijet.v13i01.7461.

Alowayr, A. (2022) 'Determinants of mobile learning adoption: extending the unified theory of acceptance and use of technology (UTAUT)', *International Journal of Information and Learning Technology*, 39(1). Available at: https://doi.org/10.1108/IJILT-05-2021-0070.

Alyoussef, I.Y. (2023) 'Acceptance of e-learning in higher education: The role of task-technology fit with the information systems success model', *Heliyon*, 9(3). Available at: https://doi.org/10.1016/j.heliyon.2023.e13751.

Assia, Z. and Samira, A. (2023a) 'Practices, validity, and challenges of online formative assessment in Algerian higher education', *International Journal of Innovative Research in Education*, 10(2). Available at: https://doi.org/10.18844/ijire.v10i2.9035.

Assia, Z. and Samira, A. (2023b) 'Practices, validity and challenges of online formative assessment in Algerian higher education', *Contemporary Educational Researches Journal*, 13(2). Available at: https://doi.org/10.18844/cerj.v13i2.9022.

Boy, G.A. (2017) 'Human-centered design of complex systems: An experience-based approach', *Design Science*, 3. Available at: https://doi.org/10.1017/dsj.2017.8.

Brookhart, S.M. (2009) 'Assessment and Examinations', in *International Handbook of Research on Teachers and Teaching*. Available at: https://doi.org/10.1007/978-0-387-73317-3_45.

Cabero-Almenara, J., Romero-Tena, R. and Palacios-Rodríguez, A. (2020) 'Evaluation of teacher digital competence frameworks through expert judgement: The use of the expert competence coefficient', *Journal of New Approaches in Educational Research*, 9(2). Available at: https://doi.org/10.7821/naer.2020.7.578.

Chai, K.C., Tay, K.M. and Lim, C.P. (2015) 'A new fuzzy peer assessment methodology for cooperative learning of students', *Applied Soft Computing Journal*, 32. Available at: https://doi.org/10.1016/j.asoc.2015.03.056.

Chen, T.L. *et al.* (2020) 'Learning programming language in higher education for sustainable development: Point-earning bidding method', *Sustainability (Switzerland)*, 12(11). Available at: https://doi.org/10.3390/su12114489.

Chourishi, D. *et al.* (2011) 'Effective E-Learning through Moodle', *International Journal of Advance Technology & Engineering Research*, 1(1).

Creswell, J.W. (2003a) 'Creswell, J.W. (2003). Chapter One, "A Framework for Design."'.

Research design Qualitative quantitative and mixed methods approaches [Preprint]. Available at: https://doi.org/10.3109/08941939.2012.723954.

Creswell, J.W. (2003b) 'Research design Qualitative quantitative and mixed methods approaches', *Research design Qualitative quantitative and mixed methods approaches* [Preprint]. Available at: https://doi.org/10.3109/08941939.2012.723954.

Darabi Bazvand, A. and Rasooli, A. (2022) 'Students' experiences of fairness in summative assessment: A study in a higher education context', *Studies in Educational Evaluation*, 72. Available at: https://doi.org/10.1016/j.stueduc.2021.101118.

Demir, M. (2018) 'Using online peer assessment in an Instructional Technology and Material Design course through social media', *Higher Education*, 75(3). Available at: https://doi.org/10.1007/s10734-017-0146-9.

Demosthenous, G., Panaoura, A. and Eteokleous, N. (2020) 'The Use of Collaborative Assignment in Online Learning Environments: The Case of Higher Education', *International Journal of Technology in Education and Science*, 4(2). Available at: https://doi.org/10.46328/ijtes.v4i2.43.

Donelan, H. and Kear, K. (2024) 'Online group projects in higher education: persistent challenges and implications for practice', *Journal of Computing in Higher Education*, 36(2). Available at: https://doi.org/10.1007/s12528-023-09360-7.

Dudovskiy, J. (2021) 'Positivism Research Philosophy', *Research Methodology* [Preprint].

Gamage, S.H.P.W., Ayres, J.R. and Behrend, M.B. (2022) 'A systematic review on trends in using Moodle for teaching and learning', *International Journal of STEM Education*. Available at: https://doi.org/10.1186/s40594-021-00323-x.

Gweon, G. *et al.* (2011) 'A Framework for Assessment of Student Project Groups On-Line and Off-Line', in *Analyzing Interactions in CSCL*. Available at: https://doi.org/10.1007/978-1-4419-7710-6_14.

Han, J. and Conti, D. (2020) 'The use of UTAUT and post acceptance models to investigate the attitude towards a telepresence robot in an educational setting', *Robotics*, 9(2). Available at: https://doi.org/10.3390/ROBOTICS9020034.

Hermansyah, H., Nurhairunnisah, N. and Dwi Lestari, I. (2022) 'Analysis of Prospective Teacher's Learning Independence Based on Gender Through the Utilization of Moodle-Based E-Learning', *Jurnal Pendidikan Fisika dan Teknologi*, 8(1). Available at: https://doi.org/10.29303/jpft.v8i1.3698.

Higgins, R. *et al.* (2017) 'The Conscientious Consumer : Reconsidering the role of assessment feedback in student learning The Conscientious Consumer : reconsidering the role of

Lin, J.W. and Lin, H.C.K. (2019) 'User acceptance in a computer-supported collaborative learning (CSCL) environment with social network awareness (SNA) support', *Australasian Journal of Educational Technology*, 35(1). Available at: https://doi.org/10.14742/ajet.3395.

Matovu, M. and Zubairi, A.M. (2015) 'Assessment Practices in the Developing World: Predictors of Assessment Practices in Ugandan Institutions of Higher Learning', *IIUM Journal of Educational Studies*, 3(2). Available at: https://doi.org/10.31436/ijes.v3i2.96.

Mayende, G. *et al.* (2015) 'Peer assessment based assignment to enhance interactions in online learning groups', in *Proceedings of 2015 International Conference on Interactive Collaborative Learning, ICL 2015*. Available at: https://doi.org/10.1109/ICL.2015.7318106.

McKenzie, J., Pelliccione, L. and Parker, N. (2008) 'Developing peer review of teaching in blended learning environments: Frameworks and challenges', in *ASCILITE 2008 - The Australasian Society for Computers in Learning in Tertiary Education*.

Melnyk, B. (2022) 'The Practice of Online Learning in Higher education: Prospects and Challenges for Ukraine', in. Available at: https://doi.org/10.33422/globalet.2021.06.524.

Michael Edoru, J. and Sanni Adebayo, T. (2019) 'Information and Communication Technology in Ugandan Higher Education: A Case of Makerere University Communication', *Rwanda Journal of Social & Applied Sciences (RJSAS)*, 5.

Moccozet, L. and Tardy, C. (2015) 'An assessment for learning framework with peer assessment of group works', in *2015 International Conference on Information Technology Based Higher Education and Training, ITHET 2015*. Available at: https://doi.org/10.1109/ITHET.2015.7217972.

Morris, R., Perry, T. and Wardle, L. (2021) 'Formative assessment and feedback for learning in higher education: A systematic review', *Review of Education*. Available at: https://doi.org/10.1002/rev3.3292.

Mota, A.R. *et al.* (2019) 'Peer and Self-assessment: A Mathematical Model to Improve Students' Accountability in Laboratory Stations Model', *International Journal of Physics and Chemistry Education*, 11.

Mudzana, T. and Maharaj, M. (2015) 'Measuring the success of business-intelligence systems in South Africa: An empirical investigation applying the DeLone and McLean Model', *SA Journal of Information Management*, 17(1). Available at: https://doi.org/10.4102/sajim.v17i1.646.

Navaridas-Nalda, F., González-Marcos, A. and Alba-Elías, F. (2020) 'Online assessment for learning in higher education: Impact of feedback on students' outcomes', *Revista Interuniversitaria de Formacion del Profesorado*, 34(2).

Nguyen Ngoc, H., Lasa, G. and Iriarte, I. (2022) 'Human-centred design in industry 4.0: case study review and opportunities for future research', *Journal of Intelligent Manufacturing*. Available at: https://doi.org/10.1007/s10845-021-01796-x.

Nguyen, V.A. (2017) 'A peer assessment approach to project based blended learning course in a Vietnamese higher education', *Education and Information Technologies*, 22(5). Available at: https://doi.org/10.1007/s10639-016-9539-0.

Ojo, A.I. (2017) 'Validation of the delone and mclean information systems success model', *Healthcare Informatics Research*, 23(1). Available at: https://doi.org/10.4258/hir.2017.23.1.60.

Ouyang, F., Xu, W. and Cukurova, M. (2023) 'An artificial intelligence-driven learning analytics method to examine the collaborative problem-solving process from the complex adaptive systems perspective', *International Journal of Computer-Supported Collaborative Learning*, 18(1). Available at: https://doi.org/10.1007/s11412-023-09387-z.

Palacios, N. *et al.* (2022) 'Online peer-led group reflective practice in higher education: a seminar-based project evaluation', *Reflective Practice*, 23(6). Available at: https://doi.org/10.1080/14623943.2022.2116567.

Pareto, L. and Willermark, S. (2022) 'Tracing expansive learning in computer-supported collaborative teaching', *Learning, Culture and Social Interaction*, 33. Available at: https://doi.org/10.1016/j.lcsi.2022.100617.

Paterson, T. and Prideaux, M. (2020) 'Exploring collaboration in online group based assessment contexts: Undergraduate business program', *Journal of University Teaching and Learning Practice*, 17(3). Available at: https://doi.org/10.53761/1.17.3.3.

Peimani, N. and Kamalipour, H. (2021) 'Online education in the post covid-19 era: Students' perception and learning experience', *Education Sciences*, 11(10). Available at: https://doi.org/10.3390/educsci11100633.

Pereira, D., Assunção Flores, M. and Barros, A. (2017) 'Perceptions of Portuguese undergraduate students about assessment: a study in five public universities', *Educational Studies*, 43(4). Available at: https://doi.org/10.1080/03055698.2017.1293505.

Pereira, D., Flores, M.A. and Niklasson, L. (2016) 'Assessment revisited: a review of research in Assessment and Evaluation in Higher Education', *Assessment and Evaluation in Higher Education*, 41(7). Available at: https://doi.org/10.1080/02602938.2015.1055233.

Petersen, G.B. *et al.* (2023) 'Collaborative generative learning activities in immersive virtual reality increase learning', *Computers and Education*, 207. Available at: https://doi.org/10.1016/j.compedu.2023.104931.

Rawlusyk, P.E. (2018) 'Assessment in Higher Education and Student Learning', *Journal Instructional Pedagogies*, 21.

Rosa, S.S., Coutinho, C.P. and Flores, M.A. (2016) 'Online Peer Assessment: Method ar Digital Technologies', *Procedia - Social and Behavioral Sciences*, 228. Available a https://doi.org/10.1016/j.sbspro.2016.07.064.

Rust, C. (2002) 'The Impact of Assessment on Student Learning', *Active Learning in Highe Education*, 3(2). Available at: https://doi.org/10.1177/1469787402003002004.

Saputra, K.O., Mertasana, P.A. and Rahardjo, P. (2020) 'Model of Group Peer Assessment o E-Learning', *International Journal of Engineering and Emerging Technology*, 4(2). Availabl at: https://doi.org/10.24843/ijeet.2019.v04.i02.p10.

Saraç, S. and Karakelle, S. (2012) 'On-line and off-line assessment of metacognition' *International Electronic Journal of Elementary Education*, 4(2).

Scott, G.W. (2017) 'Active engagement with assessment and feedback can improve Group Work outcomes and boost student confidence', *Higher Education Pedagogies*, 2(1). Availabl at: https://doi.org/10.1080/23752696.2017.1307692.

Shermin, A., De Silva, B. and Wesumperuma, A. (2019) 'Groupwork Assessmen Development (GAD): A framework for developing an effective group work assessment', *ACI 2019 Proceedings - 30th Australasian Conference on Information Systems*, (February), pp 851–861.

Sridharan, B. and Boud, D. (2019) 'The effects of peer judgements on teamwork and self assessment ability in collaborative group work', *Assessment and Evaluation in Higher Education*, 44(6). Available at: https://doi.org/10.1080/02602938.2018.1545898.

Štilić, A. *et al.* (2023) 'An Expert-Opinion-Based Evaluation Framework for Sustainable Technology-Enhanced Learning Using Z-Numbers and Fuzzy Logarithm Methodology of Additive Weights', *Sustainability (Switzerland)*, 15(16). Available at: https://doi.org/10.3390/su151612253.

Sudakova, N.E. *et al.* (2022) 'Online Formative Assessment in Higher Education: Bibliometric Analysis', *Education Sciences*. Available at: https://doi.org/10.3390/educsci12030209.

Surahman, E. *et al.* (2019) 'Design of Peer Collaborative Authentic Assessment Model Based on Group Project Based Learning to Train Higher Order Thinking Skills of Students', in. Available at: https://doi.org/10.2991/icet-18.2018.6.

Swan, J.G. (2017) 'The Challenges of Online Learning: Supporting and Engaging the Isolated Learner', *Journal of Learning Design*, 10(1).

Tait-McCutcheon, S. and Knewstubb, B. (2018) 'Evaluating the alignment of self, peer and

lecture assessment in an Aotearoa New Zealand pre-service teacher education course', *Assessment and Evaluation in Higher Education*, 43(5). Available at: https://doi.org/10.1080/02602938.2017.1408771.

Wanner, T. and Palmer, E. (2018) 'Formative self-and peer assessment for improved student learning: the crucial factors of design, teacher participation and feedback', *Assessment and Evaluation in Higher Education*, 43(7). Available at: https://doi.org/10.1080/02602938.2018.1427698.

Weyant, E. (2022) 'Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th Edition', *Journal of Electronic Resources in Medical Libraries*, 19(1–2). Available at: https://doi.org/10.1080/15424065.2022.2046231.

Williamson, S. and Paulsen - Becejac, L. (2018) 'The Impact of Peer Learning within a Group of International Post-graduate Students – A Pilot Study', *Athens Journal of Education*, 5(1). Available at: https://doi.org/10.30958/aje.5-1-1.

APPENDIX I: STUDENT QUESTIONNAIRE

STUDENT QUESTIONNAIRE:

MBARARA UNIVERSITY OF SCIENCE AND TECHNOLOGY

Dear Respondents

I am a doctoral student at Mbarara University of Science and Technology, Uganda; conducting a research titled ***"Peer Assessment Framework To Support Group-Based Assessment In E-Learning Environment For Higher Institutions Of Learning"***. The main purpose of this study is to design a framework that supports group based assessment in E-learning environment of students in the university. This will enable the researcher to identify the gaps in the current existing framework that group based assessment in the university and suggest recommendations. You have been selected to participate in this study by filling in this questionnaire. The exercise will take about 15 minutes. The information provided will be treated with utmost confidentiality and it will be used for academic purposes only.

If you are interested in the results of this project, I will be glad to send you a summary of the findings after completion of the study. Please be assured of complete anonymity. Remember, **there is no right or wrong answer.** For any inquiries direct them on my email jobkalema@gmail.com

Question Survey

Online Collaborative Learning Experience: Questionnaire

Dear Participant

Thank you for participating in this survey. Your feedback is crucial for understanding and improving the online collaborative learning experience. Please provide honest and thoughtful responses.

Mbarara University of Science & Technology
P. O. Box 1410, Mbarara
RESEARCH ETHICS COMMITTEE
17 MAY 2025
APPROVED
VALID UNTIL DATE SHOWN ABOVE

Section 1: General Information

1.1. *Name (Optional)*

[Text Response]

1.2. *Current Level of Education*

a) Undergraduate

b) Postgraduate

c) Other (please specify) [.....]

1.3. *Have you been engaged in e-learning courses?*

a) Yes

b) No

1.4. *How long have you been engaged in e-learning courses?*

a) *1-2 years*

b) *3-4 years*

c) *Above 4years*

Section 2: Engagement in Online Collaborative Learning

2.1. *Have you any experience in group-based learning or collaborative learning activities in your online courses?*

a) YES
b) NO

2.2 Please specify the examples of online collaborative methods you have used (Select all that apply)
a) Online forums
b) Blogs
c) Chat platforms
d) Video conferencing
e) Social media groups
f) Collaborative document editing (e.g., Google Docs)
g) Virtual group projects
h) Online collaborative whiteboards
i) Discussion boards on learning platforms
j) Other (please specify) [Text Response]
2.3. Which online collaborative methods do you find most effective for your learning? (Select up to three)
a) Online forums
b) Blogs
c) Chat platforms
d) Video conferencing
e) Social media groups
f) Collaborative document editing (e.g., Google Docs)
g) Virtual group projects
h) Online collaborative whiteboards
i) Discussion boards on learning platforms
j) Other (please specify) [Text Response]

Kwame Nkrumah University of Science & Technology
P.O. Box 1410, Kumasi
RESEARCH ETHICS COMMITTEE
17 MAY 2025
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2.4. How regularly do you use online forums for collaborative discussions related to your studies?
a) Daily
b) Weekly
c) Occasionally
d) Always
2.5. Do you find collaborative document editing tools (e.g., Google Docs) helpful for group projects?
a) Not at all
b) Slightly
c) Moderately
d) Very much
e) Extremely
2.6. In your experience, how effective are virtual group projects in promoting collaboration among students?
a) Not effective at all
b) Slightly effective
c) Moderately effective
d) Very effective
e) Extremely effective
2.7. How comfortable are you with using video conferencing for collaborative learning sessions?
a) Not comfortable at all

b) Slightly comfortable
c) Moderately comfortable
d) Very comfortable
e) Extremely comfortable

2.8. *Do you think discussion boards on learning platforms contribute to meaningful interactions among students'*

a) Strongly Disagree
b) Disagree
c) Neutral
d) Agree
e) Strongly Agree

2.9. *Have you ever participated in collaborative activities through social media groups related to your coursework'*

a) Yes
b) No

2.10. *If yes, please describe your experience and the benefits or challenges you encountered (Open ended Response)*

[...]

Section 3: Assessment through Online Collaborative Tools

3.1. *How do you feel about the assessment methods used in your online collaborative learning activities'*

a) Very dissatisfied
b) Dissatisfied
c) Neutral
d) Satisfied
e) Very satisfied

3.2. *Have you experienced self-assessment as part of your online collaborative learning' If yes, please share your thoughts on its effectiveness*

a) Yes
b) No
c) Not Applicable

3.3. *In your opinion, how important is peer assessment in enhancing collaborative learning experiences'*

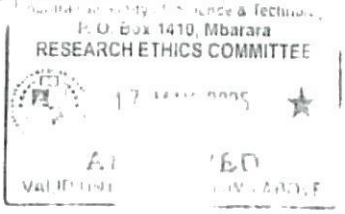
a) Not important at all
b) Slightly important
c) Moderately important
d) Very important
e) Extremely important

3.4. *How do you typically receive feedback on your collaborative work in online courses'*

a) Instructor feedback only
b) Peer feedback only
c) Both instructor and peer feedback
d) Automated feedback from the system
e) No feedback provided

3.5. *Do you think the availability of technical support during collaborative learning activities is essential for a successful online course'*

a) Not essential at all
b) Slightly essential
c) Moderately essential



d) Very essential
e) Extremely essential

3.6 *How satisfied are you with the technical support provided during your online collaborative learning activities?*
a) Very dissatisfied
b) Dissatisfied
c) Neutral
d) Satisfied
e) Very satisfied

3.7 *In your experience, how has technology positively influenced your ability to collaborate with peers in online courses?*
a) Not at all
b) Slightly
c) Moderately
d) Very much
e) Extremely

3.8 *To what extent do you believe that [illegible] online activity problems impact your overall academic performance?*
a) Not at all
b) Slightly
c) Moderately
d) Very much
e) Extremely

3.9 *Do you agree to having a variety of assessment methods (e.g., quizzes, presentations, group projects) in your online collaborative learning courses?*
a) Strongly Disagree
b) Disagree
c) Neutral
d) Agree
e) Strongly Agree

3.10 *How comfortable are you with using collaborative tools that ensure real-time interaction, such as live chat or video conferencing?*
a) Not comfortable at all
b) Slightly comfortable
c) Moderately comfortable
d) Very comfortable
e) Extremely comfortable

Section 4: Effectiveness of Online Collaborative Tools

4.1 *To what extent do online collaborative tools [illegible] engage you in the learning process?*
a) Not at all
b) Slightly
c) Moderately
d) Very much
e) Extremely

4.2 *Has online collaborative learning positively impacted your understanding of course materials?*
a) Not at all
b) Slightly

[illegible] Science & Technology
P. O. Box 1410, Mbarara
RESEARCH ETHICS COMMITTEE
17 [illegible]

c) Moderately
d) Very much
e) Extremely

4.6 *To what extent do online collaborative learning activities enhance your motivation to actively engage in the course*

a) Not at all
b) Slightly
c) Moderately
d) Very much
e) Extremely

4.7 *In your opinion, what are the main benefits of group-based learning in an online environment? (Select the most relevant)*

a) Improved communication and teamwork skills
b) Exposure to diverse perspectives
c) Increased accountability and participation
d) Better preparation for real-world challenges
e) Other (please specify)

4.8 *Have you faced any challenges or obstacles in participating in online collaborative learning? If yes, please select from the following.*

a) Technical issues
b) Lack of clear instructions
c) Difficulty coordinating with group members
d) Limited support from facilitators
e) Time constraints
f) Other (please specify) *Please comment on your experience with online collaborative learning*

a) Written instructions
b) Video instructions
c) Live instructions (synchronous)
d) Other (please specify)

4.9 *To what extent do you believe online collaborative learning prepares you for real-world collaborative work environments?*

a) Not at all
b) Slightly
c) Moderately
d) Very much
e) Extremely

4.10 *What suggestions do you have for improving the overall effectiveness of online collaborative learning in your courses?*

a) Enhance technical support
b) Provide clearer instructions
c) Increase communication channels
d) Offer more training on collaborative tools
e) Other (please specify)

4.11 *Considering your overall experience, how likely are you to recommend online collaborative learning to your peers?*

a) Not likely at all
b) Slightly likely
c) Neutral

Mbarara University of Science & Technology
P. O. Box 1410, Mbarara
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17 MAY 2025
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Section 5 Overall Evaluation

NDIX III: MUST RESEARCH ETHICS COMMITTEE APPROVAL



17/05/2024

Re: MUST-2024-1412- PEER ASSESSMENT FRAMEWORK TO SUPPORT GROUP-BASED ASSESSMENT IN E-LEARNING ENVIRONMENT FOR HIGHER INSTITUTIONS OF LEARNING.

This is to inform you that at the **166th** convened meeting on **04/04/2024**, the MUST Research Ethics Committee (REC) duly reviewed and approved the above referenced application.

The approval is valid for the period: **17/05/2024** - **17/05/2025**.

To ensure that the study conforms to the research protocol as submitted to the REC and fulfilling the following requirements are applicable:

1. Written informed consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records and consent documentation may be part of such audits.
2. Continuing review application must be submitted to the REC **eight weeks** prior to the expiration date of **17/05/2025**, in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
3. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
4. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

APPENDIX IV: UNCST RESEARCH APPROVAL



Uganda National Council for Science and Technology

Established by Act of Parliament of the Republic of Uganda

Our Ref: SIR341ES

12 June 2024

Job Kalema
Mbarara University of Science and Technology
Mbarara

Re: Research Approval: PEER ASSESSMENT FRAMEWORK TO SUPPORT GROUP-BASED ASSESSMENT IN E-LEARNING ENVIRONMENT FOR HIGHER INSTITUTIONS OF LEARNING

I am pleased to inform you that on 12/06/2024, the Uganda National Council for Science and Technology (UNCST) approved the above referenced research project. The Approval of the research project is for the period of 12/06/2024 to 12/06/2025

Your research registration number with the UNCST is SIR341ES. Please cite this number in all your future correspondences with UNCST in respect of the above research project. As the Principal Investigator of the research project, you are responsible for fulfilling the following requirements of approval

1. Keeping all co-investigators informed of the status of the research
2. Submitting all changes, amendments, and addenda to the research protocol or the consent form (where applicable) to the designated Research Ethics Committee (REC) or Lead Agency for re-review and approval prior to the activation of the changes. UNCST must be notified of the approved changes within five working days
3. For clinical trials, all serious adverse events must be reported promptly to the designated local REC for review with copies to the National Drug Authority and a notification to the UNCST
4. Unanticipated problems involving risks to research participants or other must be reported promptly to the UNCST. New information that becomes available which could change the risk/benefit ratio must be submitted promptly for UNCST notification after review by the REC
5. Only approved study procedures are to be implemented. The UNCST may conduct impromptu audits of all study records
6. An annual progress report and approval letter of continuation from the REC must be submitted electronically to UNCST. Failure to do so may result in termination of the research project

PENDIX VI: RESEARCH PUBLICATIONS-ONE

EJSIT
European Journal of Science, Innovation and Technology
ISSN: 2786-4936
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Volume 4 | Number 4 | 2024

Review of Peer Assessment Frameworks that Support Group-Based Assessment in E-Learning Environment for Higher Institutions of Learning

Job Kalema, Jane Katusiime, Simon Kawuma
Mbarara University of Science and Technology, Uganda

ABSTRACT

Assessment remains a fundamental part of the learning experience for students and the way to gauge the extent and quality of students in higher institutions of learning but has moved from assessment processes designed and solely implemented by the teacher to those designed for student engagement and empowerment inflexible assessment and there is increasing interest in the implementation of peer assessment also known in the literature as peer review or feedback assessment. Peer assessment is a promising approach to engage learners in the assessment process and easily integrate into the learning activities. In higher education, peer assessment involves students applying criteria and standards to evaluate the work of their peers. This paper aims to fill the gap in the current body of knowledge by providing a detailed review of peer assessment frameworks that support group-based assessments in e-learning environments

Keywords: Peer Assessment Frameworks, Support Group-Based Assessment, Higher Institutions of Learning

INTRODUCTION

Background

In recent years, e-learning has emerged as a transformative approach to education, particularly in higher institutions of learning. The rapid advancement of digital technologies and the increasing accessibility of the internet have significantly contributed to the growth of e-learning. This educational paradigm offers flexible learning opportunities, allowing students to access educational resources and participate in courses from anywhere in the world. As a result, e-learning has become a critical component of higher education, enabling institutions to cater to a diverse student population and adapt to the evolving demands of the 21st-century educational landscape (Wei, 2023; Haleem, 2022).

Group-based assessments have long been recognized as an effective pedagogical strategy in higher education. These assessments involve students working collaboratively to achieve common academic goals, promoting essential skills such as teamwork, communication, and problem-solving. By engaging in group-based activities, students can benefit from the diverse perspectives and knowledge of their peers, leading to a deeper understanding of the subject matter. However, the implementation of group-based assessments in e-learning environments presents unique challenges, including ensuring equitable participation, maintaining academic integrity, and accurately assessing individual contributions within the group context (Tumpa, et al. 2021; Jakoet-Salie, 2023; Mohamed, 2022).

Peer assessment, where students evaluate the contributions and performance of their peers, has gained prominence as a valuable tool to support group-based assessments in e-learning environments. Peer assessment fosters a sense of responsibility among students and encourages them to critically reflect on their own and others' work. This process not only enhances student engagement but also promotes the development of higher-order thinking skills. In the context of e-learning, peer assessment can address some of the challenges

APPENDIX VII: RESEARCH PUBLICATIONS-TWO

INDONESIAN JOURNAL OF INNOVATION AND APPLIED SCIENCES (IJIAS)
Journal Homepage: https://ojs.literacyinstitute.org/index.php/ijias
ISSN: 2775-4162 (Online)
Research Article

Volume 5 | Issue 1 | February (2025) | DOI: 10.47540 ijias.v5i1.1768 | Page: 70 – 79

Evaluating the Effectiveness of Online Peer Assessment Frameworks for Group-Based Assessment in Higher Institutions of Learning

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ARTICLE INFO

Keywords: Collaborative Learning, Higher Institutions of Learning, Online Learning, Peer Assessment.

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Revised : 11 February 2025
Accepted : 16 February 2025

ABSTRACT

This study assesses the effectiveness of online peer assessment frameworks in higher institutions of learning through a quantitative analysis. The research explores the relationships between several dimensions of online peer assessment, comprising participant engagement, perceived challenges, and the effectiveness of online collaborative tools. Employing a sample of 154 participants, data were collected via surveys, and statistical methods, including factor analysis, t-tests, and regression analysis, were applied to examine the results. The findings indicate a generally positive perception of online peer assessment, with significant correlations between technical support and user satisfaction. The effects of these results highlight the need for higher institutions of learning to address technical challenges and improve support mechanisms to improve the effectiveness of online peer assessment frameworks.

INTRODUCTION

Traditional assessment frameworks which

APPENDIX VIII: RESEARCH PUBLICATIONS-THREE

International Journal of Computing and Engineering
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www.carijournals.org

Implementation of a Peer Assessment Framework for Online Group Based Assessment in Higher Institutions of Learning

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https://orcid.org/0009-0002-8106-9466

Accepted: 28th May, 2025, Received in Revised Form: 9th Jun, 2025, Published: 23rd Jun, 2025

Abstract

Purpose: The increasing use of online collaborative learning in higher education presents both opportunities and challenges, particularly in the implementation of peer assessment (PA) systems. This study aims to develop a comprehensive framework for implementing peer assessment (PA) in online collaborative learning environments within higher education. It seeks to enhance student engagement, foster collaborative skills, and improve learning outcomes by addressing the challenges associated with PA implementation.

Methodology: In this study, we employed the DeLone and McLean Information Systems Success Model (DeLone & McLean, 2003) as a theoretical framework to guide the development and evaluation of the proposed peer assessment (PA) framework to support group-based assessment in eLearning environments.

Findings: Communication channels played a crucial role, with satisfaction scores rising from 2.75 (low communication) to 4.25 (strong communication) when effective channels were in place. Instructor feedback emerged as an important predictor, with students rating their experience higher when feedback was provided.

Unique Contribution to Theory, Policy and Practice: Integrating monitoring tools and enhancing system customization will be crucial for improving the effectiveness of peer assessment in online learning. As such, educational institutions must invest in both technology and professional development to ensure the successful implementation of collaborative learning tools.

Keywords: *Peer Assessment, Group-Based Assessment, Online Collaborative Learning, Higher Education.*

APPENDIX IX: RESEARCH PUBLICATIONS-FOUR

INDONESIAN JOURNAL OF INNOVATION AND APPLIED SCIENCES (IJIAS)
Journal Homepage: https://ojs.literacyinstitute.org/index.php/ijias
ISSN: 2775-4162 (Online)
Research Article

Volume 5 Issue 2 June (2025) DOI: 10.47540/ijias.v5i2.1792 Page: 119 – 128

Overcoming Challenges of Peer Assessment Implementation in Online Collaborative Learning in Higher Institutions of Learning

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ARTICLE INFO

Keywords: Group Dynamics, Implementation Challenges, Online Collaborative Learning, Peer Assessment, Student Engagement

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Accepted 24 June 2025

ABSTRACT

Online collaborative learning has become an essential component of higher education, offering students opportunities to engage in peer-based learning activities. Peer assessment, as a tool for enhancing collaborative learning, has demonstrated significant potential but also presents several implementation challenges. The primary objectives of this paper are to identify and analyze the key challenges encountered in the implementation of peer assessment within online collaborative learning environments. This study employed a mixed-methods approach, combining qualitative and quantitative research methods to explore the challenges faced in implementing peer assessment in online collaborative learning environments. Approximately 35% of students in our study reported difficulties related to the peer assessment platforms, including usability issues and limited integration with other learning management systems.35% of students in our study found the assessment rubrics unclear or insufficiently detailed. The challenges identified in this study, particularly those concerning technological limitations, lack of training, and issues with fairness and trust, have significant implications for the implementation of peer assessment in online collaborative learning. Based on the results and expert review, it is clear that overcoming these challenges requires a multifaceted approach. Technological, pedagogical, and social challenges all play a role in hindering the effectiveness of peer assessment, but these challenges can be addressed through targeted strategies.

INTRODUCTION

The rise of online learning in higher education has been accelerated by advances in technology and include technological limitations, issues related to the quality and fairness of feedback, lack of student engagement, and difficulties in managing group