University of Kerbala
College of Computer Science & Information Technology
Computer Science Department

Motivating Undergraduate Participation in Synchronous e-Learning Using Fuzzy Logic Data Driven

A Thesis

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Dedication

First, I dedicate it to Karbala, Imam Hussein and Imam Al-Abbas, peace be upon them, then to my mother, father, sisters, husband and daughter, who stood with me and supported me in my study journey and were the best support for me and finally for the rest of my family.

Zainab Ahmed

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Abstract

The Covid-19 pandemic has disrupted the traditional education system, leading to a significant shift towards online education. However, this transition has brought forth challenges in terms of communication and engagement between instructors and students. Many instructors and students have expressed concerns about poor communication and disengagement during online classes. To address these issues, we propose a solution to enhance the interaction between lecturers and students, ultimately improving student engagement.

Our proposed solution utilizes various parameters during synchronous learning to provide lecturers with valuable insights. By analyzing students' interactions and feedback in real-time, lecturers can address questions and highlight specific topics based on student engagement. Additionally, the solution incorporates fuzzy logic principles to track and monitor students' activities during online classes, generating live statistical data.

The primary objective is to enhance students' simultaneous participation in online lessons. By tracking and analyzing students' events and providing statistical evaluations to lecturers by using fuzzy logic principles, the proposed solution aims to increase student participation and improve the overall learning experience in online classes. This data-driven approach aims to create a more interactive and engaging online learning environment.

By leveraging the power of data analysis and fuzzy logic principles, our solution aims to bridge the communication gap between lecturers and students in the online learning space. This will ultimately lead to improved student engagement and better learning outcomes in the e-learning ecosystem.

Declaration Associated with this Thesis

Some of the works presented in this thesis have been published or accepted as listed below:

1. "Conceptual Framework for Enhancing University Students Engagement in Online Courses ", International Conference on Information Technology, Applied Mathematics and Statistics ICITAMS 2023 on 9-3-2023, Certificate ID I13A6K-CE000022.
2. "A Survey on Online Courses: State of the Art and Current Challenges", Third Al-Sadiq International Conference on Communication and Information Technology (3 rd AICCIT-2023) on 18/6/2023, https://sadiquni.com/conferences/public/index.php/index.

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List of Abbreviations

Abbreviation	Description
Bscw	Basic Support for Cooperative Work
Claroline	Collaborative Learning Environment
CMS	Course Management Systems
FIS	Fuzzy Inference System
ICTs	Information And Communication Technologies
Ilias	Integrated learning - information and Collaboration System
LMS	Learning Management System
MOODLE	Modular Object-Oriented Dynamic Learning Environment
MUPSE	Motivating Undergraduate Participation in Synchronous e-Learning
OSS	Open-Source Software
SAKAI	Systems Architecture- Knowledge and Infrastructure
VLEs	Virtual Learning Environments
WebCT	Web Course Tools
XP	Extreme Programming

CHAPTER ONE

INTRODUCTION

1.1 Overview

The Internet plays a significant role in changing societies, organizations, and markets. It enables people to connect from all over the globe by removing distance barriers and make it easier for individuals and groups to collaborate and communicate. Internet flexibility make it spreads to many fields within a short period [1]. According to Bowles [2], e-learning has drawn similar interest since the World Wide Web's introduction in 1991.

There are numerous definitions of e-learning. E-learning is defined as electronically mediated asynchronous and synchronous communication for the purpose of creating and validating knowledge [3]. Naidu[4] also defined e-learning as "Intentional use of networked information and communications technology for educational purposes". E-learning is also described by Zhang and Nunamaker[5] as "any form of learning environment where instructional content is given electronically via the Internet when people need it". It's important to note that terms like "computer-assisted learning," "web-based learning," "distance learning," "e-learning," and "virtual education" are all used in various contexts. These concepts are sometimes synonymous with each other and different concepts have been used by the authors to express a purpose; they generally mean web-based learning [6]. However, some researchers such as Joi L. Moore et al.[7] identified slightly differently for these terms. For example, when distinguishing between meaning of online learning and e-learning, that online learning provides live lessons (synchronous) to be conducted by an experienced lecturer/tutor online and also guidance by an experienced lecturer/tutor. In addition, both lecturers and students must be attended at the same time, while no live lectures are conducted only the materials and/or pre-recorded video lectures as well as students have to go through

materials themselves. In addition, Students can follow video lectures, quizzes or test anytime in e-learning [8].

An online course transmission method is the means by which an instructor conveys educational content to students [9]. Three types to deliver the course. The first type is the direct or conventional face-to-face classroom, in which all interactions between lecturers and students take place in a real classroom on campus. The second type is the fundamental online approach[10], which doesn't require any on-campus sessions and generally offers the course online, this method was used in Iraq during the period of the Covid-19 outbreak and is currently used in many other nations. The third way is the only available solution during COVID-19 quarantine, but with the engagement enhancements in online classrooms that will be presented in this study. The third type called the "blended technique," which combines the conventional classroom delivery approach with the learning management system (LMS), which some lectures are given in a real classroom, and the LMS contains course resources that support particular curricular objectives. In the United States, 4,600,000 undergraduate students are now enrolled in at least one of their online courses, according to New Horizons[11].

Online approach may be used synchronously or asynchronously. In asynchronous learning, the course content is typically prepared or provided in the form of written materials, videos, or online modules, and made available to the student. Learners can access these resources whenever they want, allowing them to fit their learning around their own schedules. They have the freedom to review the material multiple times, pause and resume their learning.

Synchronous communication, on the other hand, refers to simultaneous, real-time communication using facilities like chat rooms or video conferencing.

Synchronous communication is better because of the interaction and participation of students directly with the lecturer. In our study, we will focus on the online courses, which are managed synchronously through the learning management system (Moodle), and this system will be explained in the Chapter Two.

With the wide spread of the Corona virus and the need to use distance solutions, the development of computer networking platforms and the shifting of individuals and organizations to the use of computer network-based systems; The approach of higher education institutions of using the Internet to provide educational services to students is a necessity that is important in terms of the range of cultural and social impacts [12].

The development of this category in the Covid-19 pandemic for higher education is such that information technology plays a unique role in improving quality and making education more effective. During the Covid-19 pandemic, the e-learning system uses the above mentioned methods to convey course content (knowledge) in the "teaching-learning" process for students[1].

The establishment of e-learning systems to overcome the constraints of time and geographical location, has provided the ground of education for people who are not able to attend classrooms, and facilitated the process of evaluation and improving student performance[13]. Our goal is to improve students' simultaneous participation in online lessons by monitoring and tracking students' events and providing statistics of students' evaluations to the lecturer by using the principle of fuzzy logic. In this chapter, obstacles related to student participation in online courses in higher education institutions will be identified and solutions provided.

1.2 Problem Statement

Traditional methods of education and learning are limited in their scope and accessibility, often resulting in inadequate and unequal educational opportunities. Additionally, the COVID-19 pandemic has further highlighted the need for effective and inclusive e-learning platforms. However, existing e-learning solutions often lack engagement, interactivity, and fail to leverage the power of user activity-driven insights to improve the e-learning experience.

This problem statement aims to address the challenges and limitations of current e-learning platforms by proposing the development of a user activity-based e-learning system. The goal is to leverage the vast amounts of data generated through user interactions, assessments, and feedback to create personalized, adaptive, and engaging learning experiences.

1.3 Research Questions

This thesis focuses on examining the problems with students' engagement in online learning activities and the key variables that affect their synchronous participation in those activities. The purpose of this study is to answer the following research questions regarding student engagement in online learning activities:

RQ1: What significant occurrences influence and improve university students' synchronous participation in online learning activities?

RQ2: What is the Target of synchronous engagement in online courses?

1.4 Research Objectives

SOL1: To utilize student interactions and events to measure student engagement through monitoring and tracking user engagement (activities) and providing lecturers with statistical data about users' activities during class.

SOL2: To make students more interactive and more communicative in the online classes through make Moodle platform more interactive for both students and lecturers during lecture time.

1.5 Related Works

This study investigated the improvement of students' participation in online lessons by monitoring and tracking students' events during the lesson on the Moodle platform, considering a previous studies, Courtney K. Baker et al.[14] relied in their study on improving student participation by designing purposeful interactions to enhance synchronous learning experiences using the blackboard video conferencing tool. The role of the lecturer to increase student interaction with the content was to take advantage of the navigation feature in virtual sub-rooms in synchronous learning environments, but the weakness of this study is the use of the blackboard platform, as it is one of the commercial platforms and cannot be adopted by many universities for online lessons due to the high cost.

Similarly, Eman Al-Sheikh [15] focuses on techniques for engaging students in an online computer programming course. The study explores the challenges faced by educators in keeping students engaged and motivated in an online learning environment. The author discusses various strategies and techniques that can be used to enhance student engagement, such as interactive learning materials, collaborative

activities, and real-world problem-solving tasks. The research emphasizes the importance of providing timely feedback and support to students to keep them motivated and actively involved in the learning process. Overall, the study provides valuable insights into effective methods for engaging students in online computer programming courses.

Although numerous studies have explored ways to increase student engagement through asynchronous online activities, such as submitting assignments and taking exams via email, Soffer et al. [16] argue that the success and performance on the final exam can be indicative of the significance of participating in various course activities. However, this perspective is not entirely accurate as students can simply study and pass the course exams within the designated exam period without actively engaging in the other course activities. In a similar vein, Sheng-Shiang Tseng[17] discussed the impact of lecturer annotations on student participation when utilizing the VideoAnt annotation tool. This tool allows lecturers to add annotations to course videos, aiming to enhance student engagement and understanding. However, it should be noted that this approach has a drawback in that it can potentially discourage students from actively engaging with the material. This is because they are unable to watch the videos and provide real-time comments simultaneously.

Some of them mentioned that a well-designed course greatly affects online learning experiences and supports student participation. Orna Farrell et al. [18] stated that inappropriate course design can negatively affect student participation in online lessons and also included the views of both lecturers and students towards the course design and the actual rate of the various participation strategies that currently exist, but his study lacks evidence of the actual use of these strategies.

The research conducted by Hye Jeong Kim et al.[19] focused on analyzing students' perceptions of e-learning by considering their experiences. The study aimed to develop hypotheses regarding the relationship between students' adoption and engagement in e-learning and their digital readiness, technological skills, and overall proficiency. The researchers explored how students' experiences with e-learning influenced their attitudes and beliefs towards online education. They hypothesized that students who possessed higher digital readiness and technological skills would be more likely to adopt and actively participate in e-learning. By examining these relationships, the study aimed to provide insights into the factors that influence students' engagement and success in online learning environments.

According to the study conducted by Somenarain et al.[20] , certain blended learning strategies have been found to increase student engagement in both synchronous and asynchronous online learning environments. The researchers examined student perceptions and learning outcomes in courses using blended learning approaches. They collected data over two semesters to evaluate the impact of distance learning on student progress and perceptions of online education. The study compared course grades and satisfaction survey responses between two different online teaching organizations. The findings indicated that there was no significant difference in course grades or student satisfaction between the two online groups. In another study, Heliporn et al.[21] , the focus was on exploring the methods employed by instructors to promote active student involvement in blended learning environments. Blended learning combines synchronous and asynchronous elements in diverse course structures. The findings highlighted the significance of carefully designed and organized training sessions that effectively utilize both synchronous and asynchronous components of blended learning. The study revealed that students were more inclined to participate in blended learning activities when instructors

provided a comprehensive course outline and set clear expectations at the start of the semester. This approach helped students understand the structure of the course and their responsibilities, ultimately enhancing their engagement and participation in the learning process.

Furthermore, Christos et al.[22] described a research paper in which they developed an intelligent mobile game-based learning application called Quiz Time! The application incorporated various modules, including an assessment module for measuring knowledge, a personalized collaboration module for recommendations, a fuzzy logic-based advice generator, and a cognitive learner modeler. The study highlighted the effectiveness of incorporating personalization and collaboration in mobile game-based learning to enhance knowledge levels among students in higher education. By leveraging the engaging nature of games and utilizing mobile devices, mobile game-based learning was found to improve the learning process, increase student motivation, and enhance student participation.

The literature review of this research paper also discussed future directions, focusing on advancements in synchronous, asynchronous, and hybrid communication methods to enhance student participation in online courses. The study provided insights and suggested strategies to enhance synchronous sharing strategies in online learning, taking into consideration concerns about the less successful adoption of technology in diverse learning contexts and previous studies highlighting failures and doubts surrounding e-learning.

Table 1.1: The Related Works Summary to Enhance Student Engagement in E-Learning

Reference	Year	Communication Type	Methodology Technique	Weakness/Drawback
[15]	2009	Synchronous learning	Desire2Learn TM.	High cost
[20]	2010	Blending learning	In synchronous and asynchronous online learning environments in courses, they looked at student perceptions and learning results. .	High cost
[14]	2019	Synchronous learning	blackboard video conferencing tool.	High cost due to using the Blackboard platform, as it is one of the non-free platforms.
[16]	2019	Asynchronous learning	In their research, they emphasized the significant link between active participation in the course activities, achieving success, and passing the final exam.	This is not accurate because students have the opportunity to study and comprehend the course material during the exam period, enabling them to pass the exams.
[19]	2019	Asynchronous learning	Their research focused on the relationship between e-learning, student engagement, and their digital skills and technological proficiency.	Specific to IT-experienced individuals.
[22]	2019	Blending learning	mobile game-based learning, a fuzzy logic-based advice generator.	Mobile devices have technical limitations, which can affect the design and functionality of mobile game-based learning applications. In addition, the entertainment aspect of games can be

				distracting for students, which can affect their focus on the educational content.
[17]	2020	Asynchronous learning	VideoAnt annotation tool	Reduces student motivation due to inability to participate simultaneously with the lecturer.
[18]	2020	Asynchronous learning	The authors highlighted the negative impact of inadequate course design on student participation in online lessons. They incorporated the perspectives of both lecturers and students regarding course design and the utilization of different participation strategies.	Lacks empirical evidence of implementing these strategies.
[21]	2021	Blending learning	The study provided a comprehensive picture of strategies used by lecturers to enhance student engagement in BL. Course structure, pace, activity selection, and lecturer's role and interactions were divided into three meta-categories.	Failed to investigate the description and comparison of lecturers' strategies across fields.

1.6 Thesis Organization

Chapter two reviews a comprehensive description of the main principles, which will be used later in this thesis.

The third chapter discusses the research methodology we employed. A description of the case study locations, participant samples, and the methods used for data collection and analysis using focus group meetings are also included in this chapter.

The main results of this study are discussed and evaluated in the fourth chapter.

The last chapter includes conclusions arise from our research as well as limitations and gives suggestions for future work.

CHAPTER TWO

THEORETICAL BACKGROUND

2.1 Introduction

E-learning has emerged as one of the most important applications of ICT in the last decades. This type of training, also known as training without the need for physical presence, is a new approach to the training process that relies on information technology tools and new technologies. Face-to-face teaching is completely mimicked and provided virtually through e-learning. This teaching strategy can be used asynchronously and synchronously (live)[23]. In a simultaneous way, the exchange of information between the instructor and the students takes place live and in the moment. Simultaneous teaching enables student-lecturer interaction as well as discussion, question and answer during teaching and learning. In asynchronous education, educational materials are provided to students in the form of text, audio, and video recordings to be viewed at a later time. This type of education also makes it possible to evaluate education through tests and assignments [24]. In other words, online learning, which is used in e-learning, is another type of teaching methods [25].

In this chapter explains the basic elements mentioned in this research.

2.2 E-Learning Concepts

The term "e-learning" refers to a learning environment where teaching and learning activities are conducted using information and communication technologies (ICTs), Ayad et al.[26] defined e-learning as "the use of Internet services to improve teaching in a virtual environment in addition to the traditional teaching approach". Although "digital technology" has another description, it’s been described as "pedagogy empowered by technology"[27].

E-learning can either be synchronous or asynchronous. Real-time synchronous learning involves all participants interacting simultaneously. Asynchronous learning, on the other hand, is an educational approach that allows individuals to participate in learning activities and exchange ideas or information without the need for simultaneous interaction with other participants. In this mode of learning, learners have the flexibility to access and engage with educational materials, discussions, and assignments at their own convenience and pace[28].

E-learning is a form of interactive learning in which the course materials are available online and students receive immediate feedback on their learning activities [1]. As a result, there is a growing need for Virtual Learning Environment (VLE) methodologies and technology. The definition of a VLE is "interactive learning" when the learning materials are available online and feedback is automatically given to the students' learning activities. In this context, the term "VLE" refers to a variety of online interactions, including online learning that happens between students and instructors.

There are presently over 250 commercial providers of e-learning services; over 45 of them offer free Virtual Learning Environments (VLEs) created using open-source software (OSS). Modular Object-Oriented Dynamic Learning Environment (Moodle), Integrated learning - information and Collaboration System (Ilias), Collaborative Learning Environment (Claroline), Systems Architecture- Knowledge And Infrastructure (SAKAI), Web Course Tools(WebCT), and Basic Support for Cooperative Work (Bscw) are among the OSS with the greatest development communities[29].

Despite the many advantages of e-learning, including usability in any place and time, some studies have considered e-learning to be successful if the necessary infrastructure for e-learning is available and it can be widely used. Also, various

factors such as people's self-efficacy, enjoyment of education and attractiveness of education, increasing interaction with lecturers, active presence of lecturers and trainers during e-learning, cultural factors and trust in e-learning have been emphasized by students as conditions for the success of e-learning.

Salloum at al.[30] examined the factors affecting the adoption of e-learning in the UAE. Their primary goal was to investigate the factors that could influence college students' adoption of online learning environments. Their findings indicated that university quality and information exchange have a positive effect on college students' adoption of e-learning. The acceptability of the e-learning system was determined not to be significantly influenced by trust or innovation. They believed that it would be more advantageous to offer better e-learning services if they could identify the factors that influence its acceptance.

In Poland Rizun et al. [31] examined the changes in distance learning in students. The findings of this study, which involved 1692 students, demonstrated that self-efficacy and enjoyment of learning are two of distance learning's top advantages.

According to research by Ayu [32], several colleges have progressively come around to the idea of e-learning and are now incorporating it into their curriculum to meet the different learning needs of their students and give more interactive materials that make it simple to obtain knowledge. E-learning has the ability to alter how we teach and learn in general, enhance standards, and boost student engagement in the learning process. This cannot replace the role of lecturers, but it can improve quality while decreasing time spent.

The majority of research studies in this area have placed a strong emphasis on using e-learning strategies as much as feasible and have regarded it as a form of instruction that is appropriate for the time being. There are various difficulties, including

inadequate infrastructure and educational facilities. Has been important to providers and recipients of education; Therefore, while providing infrastructure, educational facilities and promoting attractiveness to increase the quality of new education in the current critical period, it is better to pay special attention to improving student participation in e-learning during and after control of Covid-19 so that everyone can benefit from it in the coming years.

2.3 E-Learning Strategies

E-Learning Strategies refer to the various approaches and techniques used to deliver educational content and facilitate learning through electronic means. With the advancements in technology, e-learning has become increasingly popular as it offers flexibility, accessibility, and convenience to learners. One of the key advantages of e-learning strategies is their ability to cater to diverse learning styles and preferences. Learners can access educational materials at their own pace and convenience, allowing for personalized learning experiences. Additionally, e-learning provides opportunities for collaboration and networking among learners from different geographical locations[33].

2.3.1 Synchronous Learning

Synchronous engagement allows students to participate in class materials at the same time as their lecturers and classmates in virtual learning environment provided [34]. Virtual synchronous classes are extremely interactive, especially with web conferencing tools. The lecturer and students can converse live synchronously by typing in the chat box, exchanging emoticons, and writing on the shared whiteboard. The ability to upload presentation slides and both the learner and the lecturer may speak and send messages [35]. This is a convenience and the adaptability that makes online learning appealing to students [34]. In this type of learning, students determine when and how they interact and participate [35].

Tabak stated that teachers have to take into the account relative advantage, complexity, risk and compatibility attributes of new technologies before incorporating them to the courses [36]. In addition, this is so important to evaluating organizational support availability like managerial support as well as financial resources. In the team works for the course projects which needs group interactions, synchronous online conferencing could be considering very important and valuable.

Similarly, Misbah M. et al.[37] mentioned it in the research that e-learning should enable users to have a synchronous interaction. Therefore, structures and tools have been created to implement face-to-face educational structures in the virtual world of Cyber space that can implement the features of Synchronous interaction face-to-face training in e-learning. In this regard, it is necessary to provide an environment in which users feel the presence of classes and face-to-face conferences and understand and follow the rules that govern it (discipline). Various structures have been created to create this interaction, which can create Synchronous audio and video communication for users according to its structure and capabilities.

2.3.2 Asynchronous Learning

Asynchronous learning allows students to complete their coursework in a specific amount of time on their own schedule. Students get unlimited access to reading time, assignments, lectures, and other learning materials [38]. Due to the asynchronous educational system, students may engage in more reflective thinking prior to answering or discussing issues, as opposed to a synchronous or in-person interaction, and they can also participate at their own convenience.

Worthy et al. [39] mentioned in their paper on using asynchronous learning to increase student engagement. The authors used data from a quasi-experiment to demonstrate that students who participated in both face-to-face on-campus classes and asynchronous online learning options were more engaged than those who only

attended face-to-face sessions. The results also showed a correlation between students' asynchronous engagement and their grades (final grades).

According to Dziuban et al. [40], a variety of factors, including media culture, digital, personal, and mobile technologies, as well as student learning preferences and pedagogy, could affect the level of satisfaction with asynchronous learning.

Similarly, Collins et al. [41] reported that increased student participation has the potential to reduce attrition rates by fostering a greater sense of community and reducing feelings of isolation among online students. It is possible that the instructor's social presence is the most important factor in facilitating learning and retention. Using asynchronous video to promote instructor social presence and student engagement in online classrooms may be effective due to improvements in communication enabled by technological advancements.

2.3.3 Blending Learning

Blended learning (hybrid learning)[42] is an educational approach that combines different teaching strategies. Blended learning encompasses not only learning through scheduled events but also learning through independent study, real-time online instruction, and traditional classroom settings [43].

Blended learning, as described by Singh [44] , combines many modes of instruction to maximize student engagement and knowledge retention. Lecturers can include online chances into their classes through a variety of mediums, such as live chat, self-paced learning, instant messaging, social networking, blogs, forums, applications, and webinars.

The National Institute for Innovation in Teaching classifies blended learning into three models as either attitude-driven, skill-driven, or competency-driven. Attitude-

driven learning, in which a variety of events and delivery methods are used to cultivate a certain mindset, skill-driven learning, in which students work at their own speed with guidance from an instructor or facilitator, and competency-driven learning, it blends performance support tools, knowledge, and mentoring resources to develop workplace competencies [43].

Somenarain et al.[20] compared the attitudes and performance of students in synchronous and asynchronous online learning environments. The results of a two-semester study on the impact of online education on students' growth and attitudes were presented. The results of a course evaluation and a student satisfaction survey from two groups of online learners were compared. The results showed no significant difference in final grades or student satisfaction between the two online groups. Using synchronous learning components in tandem with asynchronous learning has been shown to make the course more engaging and increase learning outcomes in earlier study. Students in a hybrid online course should have some experience with asynchronous learning in order to be prepared for the synchronous components of the course[20].

2.4 Types of E-Learning Platforms

E-learning platforms have gained significant popularity in recent years, especially with the global shift towards remote learning and online education. These platforms provide a convenient and flexible way for individuals to acquire knowledge and skills through digital resources and interactive tools. There are several types of e-learning platforms available, each catering to different learning needs and preferences [45].

One type of e-learning platform is the Learning Management System (LMS), which serves as a centralized hub for delivering educational content, managing courses, tracking progress, and facilitating communication between learners and instructors. LMS platforms like Moodle, Blackboard, and Canvas have become

widely adopted by educational institutions worldwide due to their comprehensive features and scalability[46].

Another type is the Massive Open Online Course (MOOC) platform, which offers free or low-cost online courses from renowned universities and institutions. MOOCs have gained immense popularity due to their accessibility and flexibility, allowing learners to access high-quality educational content from anywhere at any time[47]. Platforms like Coursera, edX, and Udacity have witnessed exponential growth in recent years[48].

In addition, there are also classroom management platforms that help make learning run smoothly and create a respectful and supportive environment. These platforms offer various features to enhance classroom organization and student engagement.

Here are some examples of classroom management platforms[49]:

1. Google Classroom: Google Classroom requires the use of a Gmail account to access Classrooms. This platform is fantastic for easy communication, teamwork, and sharing homework files. Plus, you can even use Classroom to make a class website and store important resources or information for students.

2. Buncee: Buncee is a fun and simple tool that helps students and teachers create course materials, presentations, and stories. The platform has over 2,000 templates that allow users to build charts and visual art creations. Buncee is a multi-purpose, web-based tool for educational, business, and personal applications.

3. EdModo: As a global learning management system (LMS), EdModo is a collaborative platform that connects teachers, students, and parents. Students have

a greater chance of reaching their full potential thanks to EdModo's organized class folders and built-in planner.

4. Edulastic: As a valuable online education tool, Edulastic's high standards help you administer assessments, help students, and track their progress. Google Classroom synchronization is available free to use in combination with Edulastic.

5. Eduplanet21: Eduplanet21 recently began allowing teachers and groups to receive a free subscription to use their platform. Developers also released a software module called "Lesson Planner," which helps you to produce and alter lesson plans for remote learning.

2.5 Fuzzy Logic

We used the concept of fuzzy logic in our work to obtain an assessment of the student's level in online synchronous courses.

Fuzzy logic, a new computer model influenced by how the human mind functions, was first introduced by Zadeh [50].To produce a precise output when there is uncertainty and the input is hazy or ambiguous, fuzzy logic is used. The simplest concept in fuzzy logic is the fuzzy set. It is a set of ordered pairs that consists of a set x member and the membership grade that corresponds to that member, which ranges from 0 to 1. As the bounds of a fuzzy set are soft, it is simple to deal with uncertainty or inaccurate information to provide an accurate result.

As a result of the rules for analyzing the inputs and forecasting the outputs being based on actual, living things known as linguistic variables, the applications of fuzzy logic have grown significantly since their invention by Zadeh. In a fuzzy-based system, for instance, the typical rule-building approach is IF X THEN Y. X

and Y in this context allude to linguistic variables that are actually mathematical propositions with a truth value. X is referred to as the antecedent in fuzzy logic, and Y is the consequent. In order to make the analysis intelligent, each fuzzy rule produces the corresponding output depending on all the inputs, which reflect how people would actually see the problem. For dynamic learning in this research, type-2 fuzzy sets have been used in the e-learning scenario [51].

A relatively new method for creating system models is fuzzy modeling. It use languages built on fuzzy logic predicates to qualitatively characterize system behavior [52]. A fuzzy model is used to specify the system with fuzzy values, which are stated as fuzzy integers and have associated linguistic meanings. The representation is:

$$R_1: if\ x_{11}\ is\ A_{11} \&\ \ldots \&\ x_{1p}\ is\ A_{1p} then\ y\ is\ B_1$$

$$R_2: if\ x_{21}\ is\ A_{21} \& \ldots \&\ x_{2p}\ is\ A_{2p} then\ y\ is\ B_2$$

$$R_r: if\ x_{r1}\ is\ A_{r1} \& \ldots \&\ x_{rp}\ is\ A_{rp} then\ y\ is\ B_r$$

Where p is the number of input values, r is the number of rules, $x_j, 1 \leq j \leq p$ is the j-th input variable, A_{ij}, $1 \leq i \leq r$ is the fuzzy set associated with the j-th input variable in the i-th rule. y is the output variable and B_i the fuzzy set related to the output variable in the i-th rule [53].

These models make it easier to incorporate current knowledge into the modelled system. In addition, human specialists can quickly understand their knowledge and findings [53].

In order to provide data management that is more in line with human logic, fuzzy inference is used in e-learning systems. This is a crucial component of these systems since lecturers and students alike frequently lack expertise in the analysis

and interpretation of data. [54] was one of the earliest methods to use fuzzy logic in e-learning modeling. This educational setting was suggested as a model for an evaluation system.

Fuzzy rules are used in a fuzzy inference rule (FIS) to model the problem that needs to be solved. These rules pertain to inclusion in sets and have the IF-THEN format.

A FIS consists of three main components: the fuzzifier, the inference engine, and the defuzzifier.

Fuzzifier: The fuzzifier is responsible for converting crisp (precise) input values into fuzzy sets. It assigns degrees of membership to these fuzzy sets based on the input values. The degrees of membership represent the degree to which the input values belong to each fuzzy set. This process involves applying membership functions to map the crisp input values to their corresponding fuzzy values[52].

Inference Engine: The inference engine applies fuzzy logic rules to the fuzzy sets obtained from the fuzzifier. Fuzzy logic rules are typically expressed in the form of "IF-THEN" statements, where the "IF" part consists of fuzzy sets and the "THEN" part defines the output fuzzy sets. The inference engine evaluates the degrees of membership of the input fuzzy sets based on the fuzzy logic rules to determine the appropriate output fuzzy sets[52]. There are three main fuzzy logic inference systems:

1. Mamdani type (which is used in this work).
2. Sugeno type.
3. Tsukamoto type.

Defuzzifier: The defuzzifier converts the fuzzy output sets obtained from the inference engine into crisp output values. It calculates a single crisp value that

represents the final output by considering the degrees of membership and the shape of the output fuzzy sets. Different defuzzification methods can be used, such as centroid, mean of maximum, or weighted average. Defuzzification techniques come in a variety of forms in the literature[53]. It is converting process Fuzzy output to crisp value and represents converting decisions to actions. Defuzzification operates on the implied fuzzy sets produced by the inference mechanism and combine their effects to provide the "most certain "controller output. [52]Defuzzification can be resulted using several known methods, some of these methods are the following:

1. Centroid method.
2. Middle of Max method.
3. First of Maxima method.
4. Last of Maxima method.

1- Centroid of Area

Is the most popular one. Mathematically, this *center of gravity (COG)* can be expressed as:

$$COA = \frac{\int_z \mu_A(z) z dz}{\int_z \mu_A(z) dz}$$

where $\mu_A(z)$ is the aggregated output MF and z is the output quantity.

For discrete values, above equation can be put in the form:

$$COA = \frac{\sum_{k=1}^{n} \mu_A(z_k) z_k}{\sum_{k=1}^{n} \mu_A(z_k)}$$

where $\mu_A(k_z)$ are the k=1,2,…,n sampled values of the aggregated output membership function.

2- Middle of Maxima:

In this defuzzification technique, the average output value is obtained, where z_1 is the first value and z_2 is the last value, where the output overall membership function, $\mu_A(z)$, is maximum.

3- First of Maxima:

In this defuzzification technique, the first value of the overall output membership function with maximum membership $\mu_A(z)$ degree is taken. It should be noted that this is equal to z_1 used in the MOM defuzzification method.

4- Last of Maxima:

When this defuzzification technique, the last value of the overall output membership function with maximum membership $\mu_A(z)$ degree is taken. It should be noted that this is equal to 2 z used in the MOM defuzzification method[52].

In general, the defuzzification operations are time consuming and they are not easily subject to rigorous mathematical analysis.

As shown in Figure 2.1

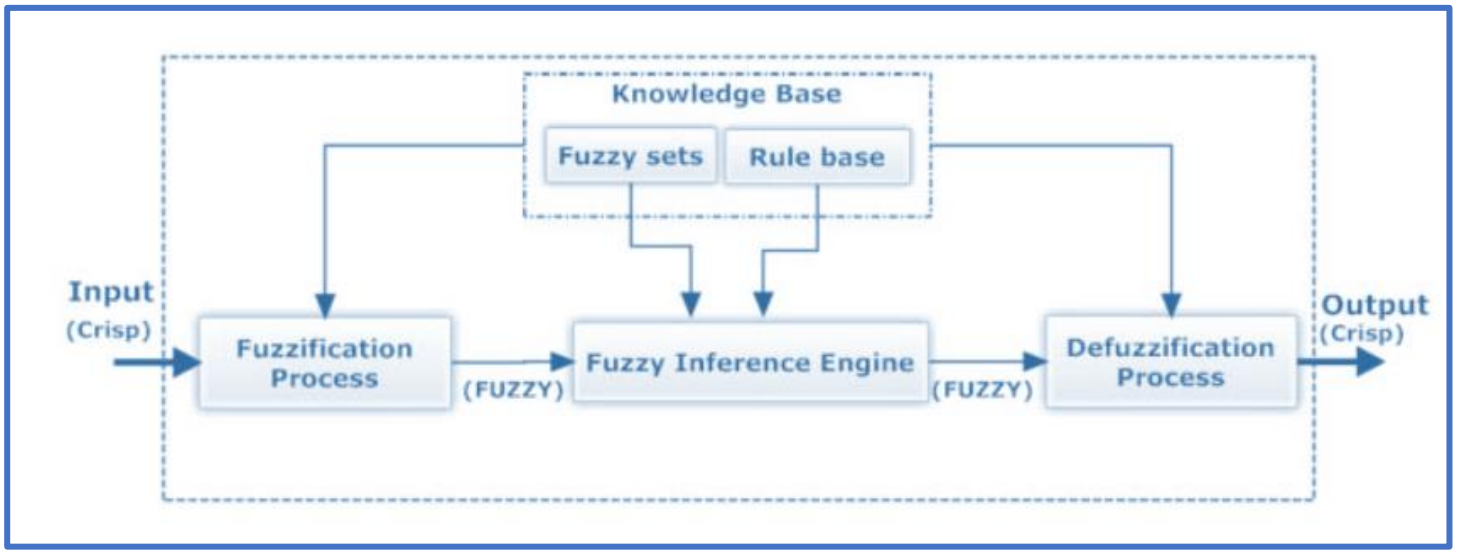

Figure 2.1 Fuzzy Inference Architecture

2.6 Learning Management System (LMS)

Learning management system (LMS) is a computer software that is used to organize, plan, report, automate, and distribute educational programs, training materials, and courses [55]. E-learning gave rise to the concept of a learning management system, which was first presented in the late 1990s [56]. Learning management system adoption has considerably expanded due to the COVID-19 pandemic. [57].

Learning management system (LMS) is a type of e-learning technology that can engage students in the process of teaching and learning, enhancing their comprehension of particular subjects, altering the structure of traditional teaching, and offering a simple means for individuals to teach and learn online [58].

Learning management systems were created in order to identify training and learning gaps utilizing analytical data and reporting. LMSs are largely focused on providing online education and also setting up learning management systems (LMS) in many universities across the world to support connections between students and lecturers outside of the confines of a traditional classroom[46]. Despite the fact that they

enable a variety of functions, LMSs are primarily focused on these two things. It is a setting with digital technologies for controlling user learning interventions and providing students with learning materials and content[56]. A range of findings from earlier studies have been presented in regard to the effects of adopting LMS in the higher learning environment at numerous universities across the world.

Although new users at first appear bewildered and unable to navigate the system, they soon learnt how to utilize it effectively while maintaining their designation as open and distance learners despite coming from a variety of backgrounds, ages, course levels, and cognitive capacities[56].

2.7 MOODLE

Moodle (**M**odular **O**bject-**O**riented **D**ynamic **L**earning **E**nvironment) is a free, open source learning management system that is compatible with the GNU General Public License[59]. It is used in schools, universities, businesses, and other industries for blended learning, remote education, flipped classrooms, and other online learning projects in addition to creating custom websites with online courses and enabling community-sourced plugins[60][61]. Also, it provides lecturers with high-quality learning so they may give students a platform in addition to graded assignments, lessons, quizzes, workshops, and chat[62].

Moodle was created especially to support lecturers who wish to develop top-notch online courses[63] and it as an online learning platform by a large team of experts who worked on all of its many stages. It includes all development-related details, a roadmap, a coding manual, and a standard method for handling source codes when gaining access to them in major software projects. Moodle is available in a variety of download packages with varied degrees of consistency from their official website[64].

A key component of Moodle as a VLE is the Moodle.org website, which serves as a hub for communication and collaboration among Moodle users, including system administrators, instructional designers, and course developers. To satisfy community needs, this website is always being updated[29].

Today, Moodle is utilized by independent lecturers, high and primary schools, nonprofits, private businesses, and institutions in addition to universities. It is vital to comprehend the Moodle environment and look into its capabilities and restrictions in order to work on the Moodle platform.

2.7.1 Key Justifications for Selecting Moodle

There are couple of reasons that makes Moodle as a learning management system platform in this work:

1. Since it is an open-source project (OSS), anybody may download, use, edit, and even distribute it in accordance with the GNU license [65].

2. Excellent online courses can be delivered using the CMS and VLE Moodle, which enables lecturers to communicate with their students regarding papers, graded assignments, discussion boards, and other materials in a clear manner [66].

3. Virtually every server that supports PHP can run Moodle. Users can quickly upgrade it from one version to the next [67] and download it to use on any machine.

4. Moodle has a sizable advantage over competing platforms due to its solid foundation in social constructionist pedagogy and its superior educational materials[68].

5. Independent lecturers, schools, universities, and businesses use Moodle software all across the world. Moodle has a very high level of credibility. Currently, 3324

websites registered with it from 175 different countries, and it supports 75 different languages [66].

6. Moodle works flawlessly on any PHP-compatible platform, including Windows, Linux, and Unix. Other databases are supported in addition to MySQL, PostgreSQL, and Oracle [69].

7. It includes various features that will be helpful to students, including simple installation, helpful support, customizable options and settings and guidance, and efficient teaching tools. Additionally, it offers strong administration, security, and thorough documentation support [68].

2.8 Video Conferencing

Video conferencing is a technology that enables real-time audio and video communication between individuals or groups located in different geographical locations. It allows people to hold virtual meetings, collaborate, and interact as if they were in the same room, fostering remote communication and enhancing productivity[70].

We now explain the video conferencing Jitsi and we used it in our system because it is free and easy to install and use.

2.8.1 Jitsi

Jitsi video conferencing inside Moodle was used in our work because it is one of the free and easy-to-use video conferencing.

The learning management system's Jitsi Meet application is utilized for video conferencing, which can be used to enhance online learning[71]. A free community-

hosted version of Jitsi Meet is run by Jitsi under the domain name meet.jit.si. The advantage of Jitsi Meet is that you may build a meeting room without having to register for an account in order to conduct a video conference[72]. Also, for the safety of the newly established meeting room, a password may be applied to prevent unauthorized individuals from freely joining the meeting room. The URL of the newly made meeting room can be directly shared with attendees who will be invited to video conference[71]. Jitsi Meet also offers chat capabilities, desktop sharing, YouTube video URL sharing, blur background effects, and no less impressive, it is completely Jitsi Free[72].

Many institutions, including the University of Strasbourg, the NLnet Foundation, the Region of Alsace, and the European Commission, have supported Jitsi[71].

2.9 XP Methodology

This methodology was adopted in our research because our work requires taking stories from experts (they are lecturers from the College of Computer Science and Information Technology at the University of Karbala who have experience in the field of e-learning and we worked with them in a focus group meeting) repeatedly while working to reach the desired result for the experts.

The XP (Extreme Programming) methodology is an agile software development approach that emphasizes iterative development, close collaboration between team members, and continuous feedback. It consists of several steps or practices that are followed throughout the development process[73]. [74]Here are the key steps involved in the XP methodology:

1. Planning: The team, including developers and stakeholders, collaboratively identifies and prioritizes the features or user stories to be implemented. The planning

process focuses on short iterations called "sprints" and sets achievable goals for each iteration.

2. User Stories: User stories capture the requirements from the perspective of the end users. They describe the desired functionality in a concise, non-technical language. User stories are written, estimated, and then added to the backlog for future implementation.

3. Small Releases: XP promotes frequent and regular releases of working software. After each sprint, a potentially shippable product increment is delivered, allowing for quick feedback and validation from users and stakeholders.

4. Iterations: The development process is divided into short iterations, typically lasting one to two weeks. During each iteration, a set of user stories is selected from the backlog and implemented, tested, and integrated into the evolving software.

5. Continuous Integration: XP emphasizes frequent integration of code changes into a shared repository. Developers integrate their code multiple times a day to ensure that all changes work together without conflicts. Automated tests play a crucial role in detecting integration issues early.

6. Test-Driven Development (TDD): Test-Driven Development is a practice in which tests are written before the corresponding code. Developers define automated tests based on the requirements, write the code to make the tests pass, and refactor as needed. TDD helps ensure code quality and maintainability.

7. Pair Programming: XP encourages developers to work in pairs, with one person actively writing code (the "driver") and the other reviewing and providing feedback (the "navigator"). Pair programming enhances code quality, knowledge sharing, and collaboration.

8. Continuous Refactoring: Refactoring involves improving the design and structure of the code without changing its functionality. XP promotes continuous refactoring to keep the code clean, maintainable, and adaptable to future changes.

9. On-site Customer: XP advocates having an on-site customer or a representative closely involved with the development team. The customer provides real-time feedback, clarifies requirements, and helps prioritize the implementation of user stories.

10. Continuous Feedback: XP emphasizes frequent communication and feedback loops among team members. This includes daily stand-up meetings, regular demos of working software, and retrospectives to reflect on the development process and identify areas for improvement.

These steps or practices in the XP methodology collectively aim to deliver high-quality software that meets the evolving needs of the users while fostering collaboration, adaptability, and customer satisfaction[73].

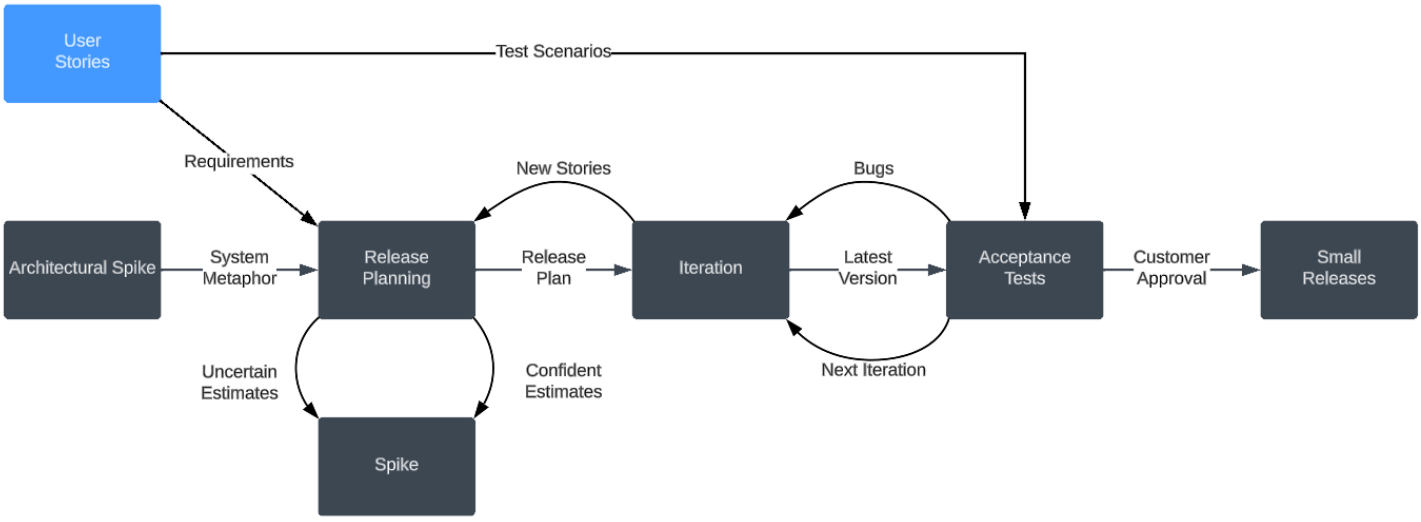

Figure 2.2: Extreme Programming (XP) Overview

The XP framework typically entails five iterative steps or stages of the development process[74]:

- Planning: The customer meets with the development team during the planning stage to present the requirements in the form of user stories that explain the desired outcome. After that, the team estimates the stories and develops a release plan that is divided into the number of iterations required to complete the desired functionality piece by piece. So-called spikes can be created if one or more of the stories cannot be estimated, indicating the need for greater study.
- Designing: Although it is actually a step in the planning process, designing might be mentioned separately to highlight its significance. It relates to simplicity, one of the key XP characteristics that we'll cover next.
- Coding: is the stage of the project where the real code is written using XP techniques like pair programming, continuous integration, and collective code ownership (the entire list is described below).
- Testing: The heart of XP in software engineering is testing. It is a routine activity that includes both acceptance tests and unit tests, which are automated tests to see if the built feature functions as intended (customer testing to verify that the overall system is created according to the initial requirements).
- Listening: Continuous feedback and communication are key components of listening. Customers and project managers are involved in describing the intended value and business reasoning.

CHAPTER THREE

PROPOSED METHODOLOG

3.1 Introduction

In this chapter, we delve into a comprehensive discussion of the proposed methodology that forms the foundation of our work. The chapter aims to provide a clear and detailed understanding of our approach, beginning with an overview of the proposed methodology.

Firstly, we present a concise summary of the key elements and objectives of our methodology, offering readers a high-level understanding of its purpose and scope. This overview sets the stage for the subsequent sections, where we delve into a more in-depth explanation of the methodology.

Next, we meticulously elaborate on the various components and steps involved in our proposed methodology. By doing so, we aim to provide readers with a comprehensive understanding of our approach, ensuring clarity and transparency. We discuss the rationale behind our choices, the techniques employed, and the strategies implemented in order to achieve our research objectives.

Lastly, we elucidate the evaluation process employed to assess the efficacy and performance of our developed system. We shed light on the metrics and benchmarks utilized, as well as the data sets and experimental setup employed during the evaluation. By presenting this evaluation, we aim to validate the effectiveness of our methodology and provide insights into its strengths and limitations.

3.2 General View of the Proposed System (MUPSE Module)

The MUPSE (**Motivating Undergraduate Participation in Synchronous e-Learning**) Module for e-learning in our research was designed to address the challenge of low student participation in online classes. This module aims to create an interactive and engaging learning environment for students to help them stay focused and motivated throughout the online learning process.

MUPSE Module consists of 4 components (Get Report, Engagement for Each Event, Idle Students, Attendance Statistic) that allow lecturers to express requirements model.

MUPSE Module is implemented in JavaScript, PHP and Python programming languages. It was developed using Visual Studio and PyCharm Integrated Development Environments.

The proposed system for enhancing students' simultaneous participation in online courses was developed through the application of Extreme Programming (XP). This methodology allowed for the identification of key events, integration of user experiences, and iterative development based on user feedback. The system's design and functionality were refined based on the input from experts, and the student's level was evaluated using the concept of fuzzy logic due to its closeness to the work of the human mind, and testing ensured its validity and practical applicability. Ultimately, the system aimed to provide an improved online learning experience for students.

The designed framework includes five basic events (Activities): Total Time Attendance, Chatting Interaction, Mouse Events, Device Type, and Hand Raised.

They were chosen after they were discussed by specialists in the field of e-learning in the focused group meeting at the College of Science and Information Technology

at the University of Karbala, in addition some researchers have benefited from these events in their research to enhance engagement through online.

These activities are presented in the structure of the system in two scenarios: The first scenario includes the transfer of events to the scheduled lecturer at a time determined by experts, in which case the user's (student) events are sent to server and then saved in the database.

Activities (student events) are presented in the system structure in two scenarios. The first scenario includes the transfer of events to the scheduled lecturer at a time determined by experts, in which case the user's (student) events are sent to server and then saved in the database and then returned to the server and delivered to the lecturer at the predetermined time.

The second scenario situation is when the instructor requests the user's (student's) events be provided; when the lecturer presses a button to request that the events be withdrawn fetched, the request is sent to the server, where it is then retrieved from the database and displayed on the lecturer's website lecturer interface. The architecture of the system is depicted illustrated in Figure 3.2 .

ID	Name	Events					Level Engagement	evaluation degree
		Raise Hand	Chat Interaction	Mouse Events	Device Type	Total Time Attendance		
1	Ahmed	5	3	100	Laptop	01:30:00	High	81
2	Zainab	0	1	50	Laptop	01:30:00	Low	35
3	Haider	3	1	150	Smart phone	01:00:00	Medium	61

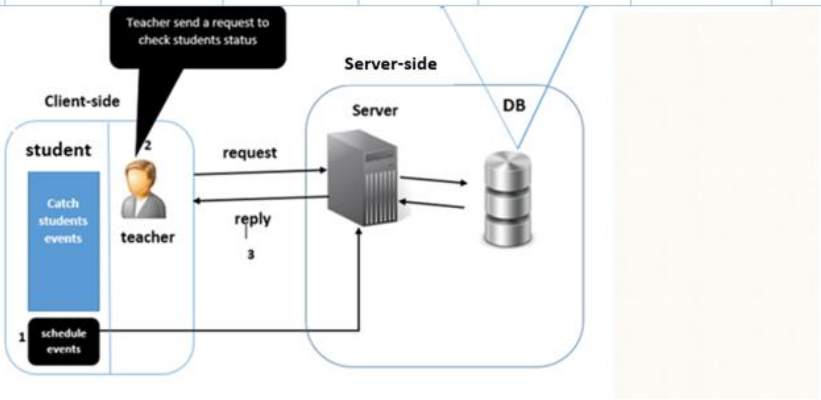

Figure 3.1: System Architecture Diagram

3.3 The Proposed Methodology

Our proposed system initiates by gathering the student's events through expert . These events serve as input values for determining the student's level in online lessons Our proposed system initiates by gathering the student's events through experts, and the selected events are (Mouse Events, Chatting interaction, Raise Hand, Total Attendance Time) .Subsequently, we obtain crisp values and consult the experts again to determine the corresponding fuzzy values, utilizing fuzzy logic. The experts have chosen to categorize the values as high, medium, or low.

Once the values of the student's entered events are obtained, they are transformed using the concept of fuzzification through the implementation of the fuzz.trimf() function in Python. We then consult the experts once more to determine the possibilities for the student's level (output), which can be classified as high, medium,

or low based on the type of device used by the student, such as a computer or a tablet/smartphone.

The probabilities are then fed into the inference rule step using the ctrl.ControlSystemSimulation() function in Python. Finally, the fuzzy values of the output (the engagement level) are subjected to defuzzification using the compute() function, converting them into crisp values, this process allows us to obtain the student's evaluation score in online lessons.

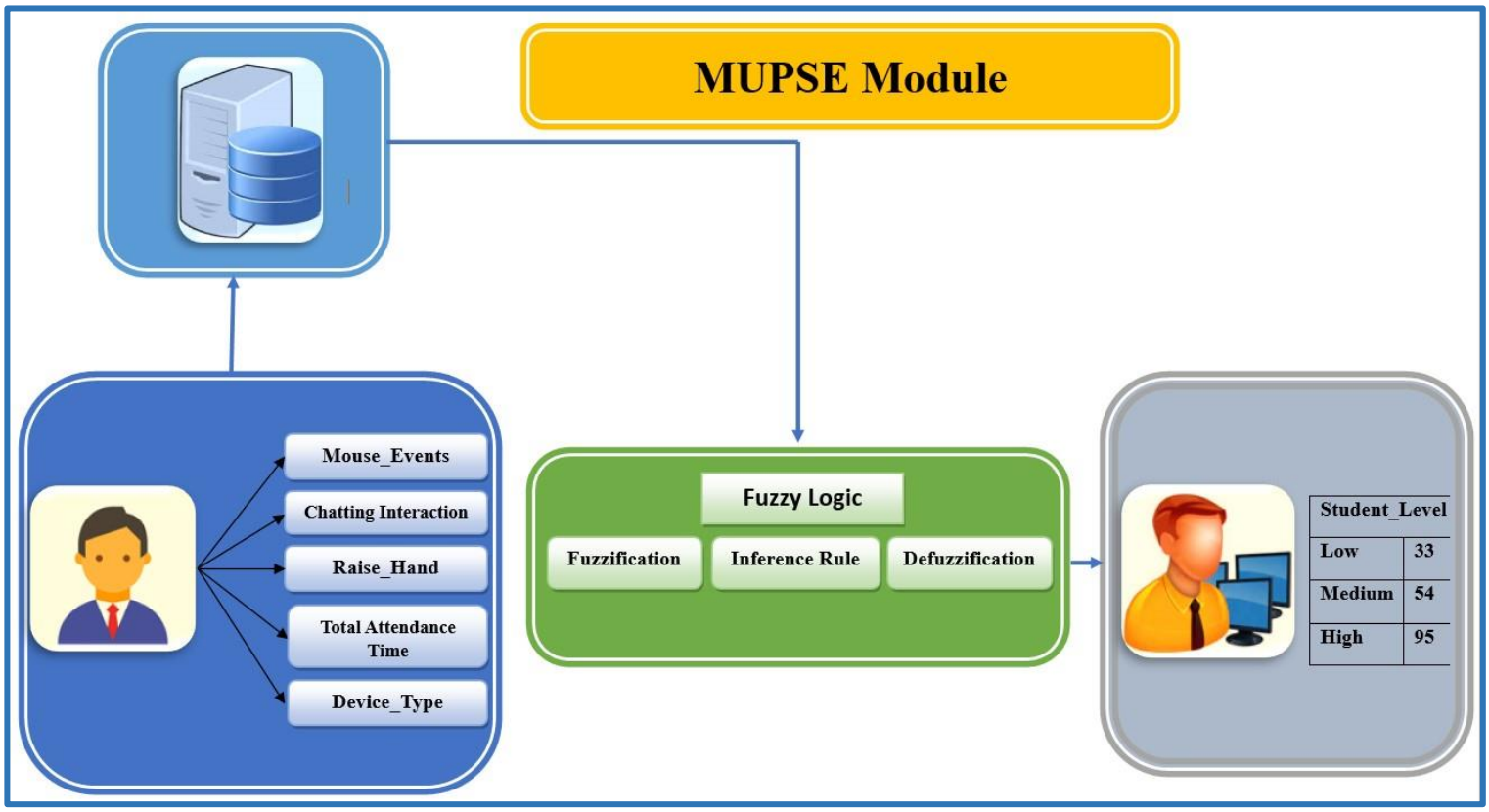

Figure 3.2 Block diagram of the framework of the proposed system

The detailed explanation of the above block diagram steps is as follows:

Step 1:

To co-construct knowledge or design for the module in this study, a group of expert lecturers participated in a focus group. They filtered and adjusted existing knowledge and added contextual and empirical knowledge based on agreed categories or subjects. The designed framework comprises five fundamental events (Activities): Total Time Attendance, Chatting Interaction, Mouse Events, Device Type, and Hand Raised. These events (activities) are essential for enhancing effective online educational participation.

Step 2:

Before applying fuzzy logic, the experts determined the type of fuzzy values to be used. They categorized these values into three types: high, medium, and low. Furthermore, each group of values was assigned to a specific type by the experts.

Step 3:

The crisp values obtained from the input data are fed into the fuzzification process to convert them into fuzzy values.

Step 4:

The experts were consulted to establish the output value (engagement level) based on the probabilities of the input values (student events) and the type of device used by the student.

Step 5:

During the inference rule stage, the system uses the probabilities of the input values (student events) to determine the value of the output (engagement level).

Step 6:

The fuzzy output values are then passed through the defuzzification stage to obtain crisp values, which are used to determine the student's evaluation degree in online lessons.

3.4 System Evaluation

We surveyed the lecturers who participated in the beta test to get their evaluation of MUPSE Module. Survey results according to a five-point Likert scale after use of MUPSE in chapter four.

Since the degree of variability is average in the Likert scale questionnaire, this means that the responses of the participants in the questionnaire were homogeneous. This indicates that individuals gave similar answers or that they agree with the same opinion because in a Likert scale variance is used to assess the level of agreement or disagreement between responses.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The purpose of this chapter is to present and discuss the results of MUPSE (Motivating Undergraduate Participation in Synchronous e-Learning) Module developed within Moodle program to address the shortcomings of existing related works to improving student synchronous engagement in e-learning.

Through a structured presentation of data, the "Results" section aims to objectively display the research findings. Utilizing tables, and figures, the obtained results are communicated in a clear and comprehensible manner. These results are aligned with the research objectives and hypotheses established earlier in the thesis.

Following the presentation of results, the "Discussion" section plays a fundamental role in comprehensively analyzing and interpreting the data. By comparing and contrasting the findings with existing literature and prior studies, the discussion contextualizes the significance of the research within the broader academic domain.

4.2 Data Collection Description

4.2.1 Case Study

The case study examines the real scenario at the University of Karbala College of Computer Science and Information Technology, a college that includes many experts(lecturers) with experience in the field of e-learning and online learning.

The focus group meeting was 90 minutes long in a conference room and started by explaining our research and asking research questions for experts to identify events to enhance synchronous student participation in online courses. The results of the meeting were the experts' suggestions for the important activities, which are:

- Total attendance time
- Texting interaction

- Mouse events
- Device type
- Raise hand

4.2.2 Criteria Selection for Participants

Since this research needed people with experience in online learning, we needed to study and conduct research in the Faculty of Computer Science and Information Technology. Where we were able to reach the relevant professors. The College of Computer Science and Information Technology was an ideal location for our studies due to the high percentage of professors specializing in technology in general and we had a meeting with them. This purposive or strategic sampling, the deliberate selection of participants for a specific reason, allowed us to gather the data needed to address our research questions. These individuals have the knowledge and experience related to the phenomenon required to study enhancing the participation of college students in online courses based on user activity. Five professors were selected, and we tried as much as possible to balance the experiences and ages of the participants. We have created a master list of potential faculty members. From this model (described in Appendix A), we began by inviting professors to participate in the study. Our goal was to have a focus group of at least 5 experts, as Prince and Davies[75] indicated that small groups of 4 to 6 people can be effective because they encourage members to actively participate in the conversation, generating a large number of Unique ideas about the issue under discussion over a specific period of time. Below is photo from the focus group meeting.

Figure 4.1 Focus Group Meeting with Experts

4.2.3 Data Collection and Analysis

Once the approval of the department head in the College of Computer Science and Information Technology was obtained, we invited the lecturers to participate in this study using the strategy and procedures described earlier. Working with lecturers require sticking to a meeting time, writing an invitation, and reminding them of the place and time, and we sent it to them personally as well as via the e-mail system (as shown in Appendix A). After receiving permission and approval from the participating lecturers, I began collecting data. Five lecturers participated in the focus group to discuss the research questions. Copies of these templates are delivered to each teaching participant in the meeting. The lecturers were informed

that their participation was voluntary. Also, they were made aware that the data will not be used for any other purpose outside the research project.

The meeting began by clarifying the subject of the research and its objectives and mentioning the parameters specified by us and taking their views and their suggestions was to focus on four or five parameters and work on them instead of scattering a lot.

Then us began posing research questions to experts as written in the focus group question template (As shown in Appendix B) to identify critical parameters to improve students' simultaneous participation in online courses and based on expert opinions. The result was a focus on the following events:

- Total attendance time
- Texting interaction
- Mouse events
- Device type
- Raise hand

The forms illustrated in Appendix C.

Finally, the experts discussed the method of calculating the participation level, and the result of calculating the level was to rely on fuzzy logic. The meeting ended on time after presenting the final results to the experts as shown in Appendix D.

4.3 Fuzzy System Results

4.3.1 Fuzzification

Convert the student's entered (Total attendance time, Texting interaction, Mouse events, Raise hand) events from crisp values to fuzzy values according to the following table:

Table 4.1 Membership Input

Events	Membership Input (Events of Student) values		
	Low value range	Medium value range	High value range
Mouse Move	0-0-150	149-200-250	249-350-500
Raise Hand	0-0-3	2-3-5	3-5-10
Texting Interaction	0-0-3	2-3-5	3-5-10
Total Attendance Time	0-0-60	59-70-90	89-100-120

The result of the fuzzification in our system is as shaded in the table below:

Table 4.2: Level Engagement for Students in Fuzzy Value

ID	Name	Events					Level Engagement	Level Engagement (crisp value)
		Raise Hand	Chat Interaction	Mouse Events	Device Type	Total Time Attendance		
1	Ahmed	5	3	100	Laptop	01:30:00	High	81
2	Zainab	0	1	50	Laptop	01:30:00	Low	35
3	Haider	3	1	150	Smart phone	01:00:00	Medium	61

4.3.2 Inference Rule

Through the probabilities of the inputs and determining the value of the output (**Engagement Level**) previously given by the experts, the fuzzy values of the inputs will be entered and a fuzzy value of the output (**Engagement Level**) will be determined according to the following table:

Table 4.3 Membership output

	Membership Output (Student Engagement Level)		
	Low value range	**Medium value range**	**High value range**
Engagement Level	**0-0-35**	**34-40-60**	**59-70-100**

The rules that you entered in the Inference Rule stage to find the output (Engagement Level) are the possibilities that we took from the experts and are found in the Appendix E.

4.3.3 Defuzzification

Converting the fuzzy values of output (**Engagement Level**) into crisp values to determine the student's evaluation degree in online courses using the compute() function in Python.

The figure below shows the result of the work that appears to the records and the results of the fuzzification after entering inference rules in the field (**Engagement Level**) and defuzzification in the field (evaluation degree).

The result of the fuzzification in our system is as shaded in the table below:

Table 4.4: Level Engagement for Students in Crisp Value

ID	Name	Events					Level Engagement	Level Engagement (crisp value)
		Raise Hand	Chat Interaction	Mouse Events	Device Type	Total Time Attendance		
1	Ahmed	5	3	100	Laptop	01:30:00	High	81
2	Zainab	0	1	50	Laptop	01:30:00	Low	35
3	Haider	3	1	150	Smart phone	01:00:00	Medium	61

4.4 System Result for Statistical Measures

4.4.1 Research Setting

During the academic year 2020-2022, the course was offered for five subjects in the Department of Computer Science to students at various academic levels.

Lecturers were encouraged to implement the LMS Moodle with MUPSE Module in their classes. Moodle was used as an eLearning platform on which instructors uploaded their course materials, syllabi, and all other class-related topics, and managed the lectures. Students utilized Moodle to obtain course materials, participate in class discussions, and communicate with instructors, 25 lecturers answered a questionnaire after using the LMS Moodle with MUPSE Module as part of their course.

4.4.2 Measurement Tools

A 5-point Likert scale questionnaire was used for the purpose of measuring the level of agreement or opinion of the lecturers on a set of questions, where 1 indicates strongly disagree and 5 indicates strongly agree. The content and geometry of the scale were investigated. The table below shows the results of the MUPSE Module utilization statistical measure.

Table 4.5 Results of a 5-point Likert scale after using the MUPSE Module

	Items	5	4	3	2	1	N	M	SD	Variance
1	**Engagement and interaction**	13	10	2	0	0	25	4.44	0.65	0.42
2	**Student monitoring and tracking**	15	8	2	0	0	25	4.52	0.65	0.43
3	**Student attendance**	13	9	2	1	0	25	4.36	0.81	0.66
4	**Answering questions during and at the end of the lecture**	12	10	2	1	0	25	4.32	0.8	0.64
	After using the MUPSE Module	47	41	8	4	0	100	4.31	0.79	0.6201

- N: represents the total number of data points
- M: represents the mean (average) of the data
- SD: represents the Standard Deviation
- Variance: represents the level of agreement or disagreement among the responses.

4.5 System Limitation and Results Discussion

4.5.1 System Limitation

The outcomes of the evaluation of the suggested methodology supported the goals and objectives of this study. Yet, it's important to state about the research's shortcomings. The limitations are summarized as follows:

- The Learning Management System (Moodle) platform which needs to programming knowledge and Information technology. A major problem with this system is that it takes 18-24 months of time and effort - to plan and implement.

- Being an open-source software, Moodle is constantly being upgraded and integrated with many other digital tools. In addition, it is difficult to upgrade to new versions.
- Some students might encounter difficulties if they do not have access to fast or powerful Wi-Fi networks. Another issue is the overheating of electrical devices after prolonged online contact.

4.5.2 Results Discussion

The MUPSE (Motivating Undergraduate Participation in Synchronous e-Learning) Module, developed in our research, aimed to tackle the challenge of low student participation in online classes. The module's primary objective was to create an interactive and engaging learning environment for students, thereby fostering increased focus and motivation throughout the online learning process. This section presents the key results obtained from implementing the MUPSE Module and discusses its impact on enhancing student engagement in online courses.

Implementation and Technical Details:

The MUPSE Module was implemented using a combination of JavaScript, PHP, and Python programming languages. The development was carried out using Visual Studio and PyCharm Integrated Development Environments, ensuring a robust and functional system. The application of Extreme Programming (XP) methodology facilitated iterative development and continuous feedback from users, contributing to the module's effectiveness.

Framework and Activities:

The designed framework of the MUPSE Module incorporated five fundamental events or activities to measure student engagement: "Total Time Attendance," "Chatting Interaction," "Mouse Events," "Device Type," and "Hand Raised." These activities were thoughtfully chosen based on discussions with e-

learning specialists during a focused group meeting at the College of Science and Information Technology, University of Karbala. Additionally, other researchers in the field have validated the efficacy of these activities in enhancing student engagement in online learning.

Scenario-Based Structure:

The system's structure presented two scenarios for handling student events. In the first scenario, events were transferred to the scheduled lecturer at a predetermined time specified by experts. The user's (student's) events were sent to the server, saved in the database, and then delivered to the lecturer as planned. This allowed educators to assess student engagement and participation proactively.

The second scenario was initiated when instructors requested the user's (student's) events. By pressing a button, the lecturer could request the events, which were then fetched from the server and displayed on the lecturer's website interface. This scenario enabled instructors to access real-time engagement data during lectures or at specific points of interest.

Evaluation and Validity:

The module's effectiveness in enhancing student engagement was evaluated using the concept of fuzzy logic. This approach, which closely resembles human thinking, provided a comprehensive assessment of students' engagement levels. Rigorous testing ensured the validity and practical applicability of the system.

Discussion and Implications:

The implementation of the MUPSE Module has shown promising results in addressing the challenge of low student participation in online courses. By incorporating interactive activities and tracking engagement metrics, the module succeeded in creating a more dynamic and engaging learning environment for students.

Educators can now proactively monitor student participation and make timely interventions to enhance engagement and learning outcomes. The MUPSE Module's scenario-based structure allowed for versatile usage, catering to different teaching styles and requirements.

Furthermore, the application of the Extreme Programming (XP) methodology proved instrumental in delivering a robust and user-centric system. The continuous feedback loop ensured that the system's design and functionality were refined based on expert input and user experiences.

In conclusion, the MUPSE Module has successfully contributed to improving the online learning experience for students. It empowers educators with valuable insights and data to foster active participation and maintain student motivation throughout their online learning journey. The module's implementation offers a promising avenue for advancing online education and student engagement in e-learning environments.

4.6 System Comparison

Our proposed system, MUPSE Module, was compared with the Moodle system previously used by lecturers in their electronic lectures, according to four criteria for testing and comparing our system with the previous system:

1- Engagement and interaction

2- Student monitoring and tracking

3- Student attendance

4- Answering questions during and at the end of the lecture

And we explained the results of the teachers' answers on our system with the previously Moodle system in a chart.

Figure 4.2 shows the teachers’ answers. Mostly, 1 and 2 mean that they do not agree or strongly disagree with the use of the previous Moodle platform. While Figure 4.3

shows the teachers' answers after using the Moodle platform with our system, most of the answers were 4 and 5, meaning agree and strongly agree.

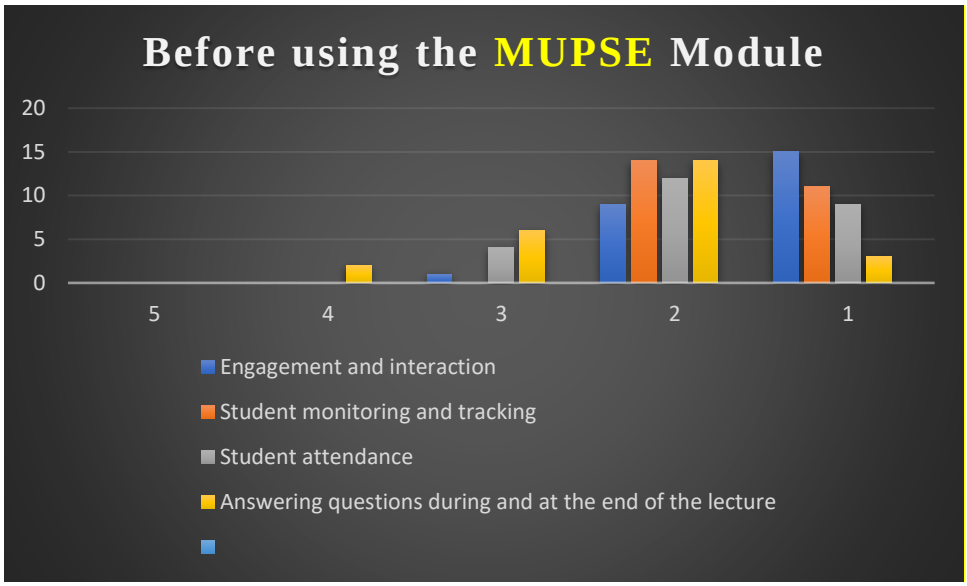

Figure 4.2 The Chart represents the opinions of teachers before using the MUPSE Module

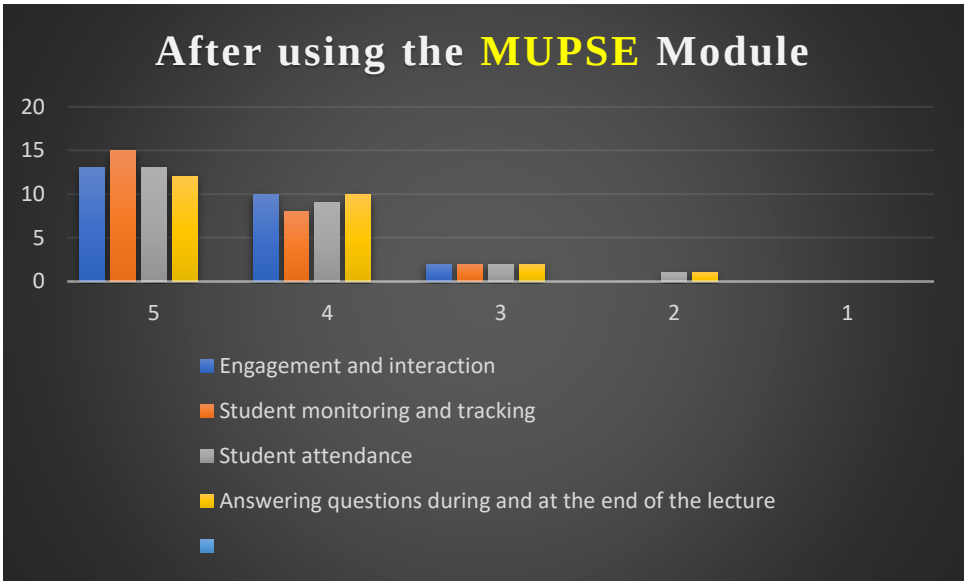

Figure 4.3 The Chart represents the opinions of teachers after using the MUPSE Module

Finally, we will present a comparison between MUPSE and other learning platforms such as Google Meeting and Zoom Meeting.

	MUPSE Module	Google Meeting	Zoom Meeting
GET REPORT" Button	The lecturer can fetch student events either every quarter of an hour or at a specific time chosen by the lecturer	Google Meet does not have a built-in "GET REPORT" button specifically designed for fetching student events.	While Zoom does offer some basic reporting features, it may not have the same level of flexibility in fetching student events as described in the MUPSE Module. Zoom's reporting features may not be as extensive or customizable.
IDLE STUDENTS" Button	The system contains an "IDLE STUDENTS" button that allows the lecturer to obtain a list of students who have not been actively engaged during the class.	Google Meet does not have a built-in "IDLE STUDENTS" button for identifying students who haven't participated in any events.	Zoom may have attendance tracking features, but it might not have a specific button like "IDLE STUDENTS" that focuses on identifying inactive participants.
ATTENDANCE STATISTIC" Button	Provides a comprehensive list of lectures held throughout the semester and the total number of events recorded for students during each specific lecture.	Google Meet may have basic attendance tracking, but it does not have a dedicated "ATTENDANCE STATISTIC" button that displays the total number of events recorded for students during each lecture.	Zoom does provide some basic attendance reporting, but it may not present the same level of comprehensive attendance statistics as the MUPSE Module.
ENGAGEMENT for EACH EVENT" Button	Allows the lecturer to view individual student engagement for each event separately, providing insights into student activities, such as the type of devices they are using.	Google Meet does not have a built-in "ENGAGEMENT for EACH EVENT" button with detailed insights into individual student engagement.	While Zoom provides some participation data, it may not offer the same detailed insights into individual student engagement or device usage.

Student Device Identification	The system can determine the type of device a student is using, whether it is a PC or a Smartphone/Tablet.	Google Meet does not offer a built-in feature to identify the type of device a student is using during the meeting.	Zoom might not have the built-in capability to automatically identify the type of device a student is using during a meeting.
Tracking Total Time Spent Attending Lecture	Tracks the total time each student spends attending the lecture and provides regular updates, such as every quarter of an hour, showing the active participation time for each student.	Google Meet may have some basic time-tracking features, but it does not offer the same level of detailed tracking as the MUPSE Module.	While Zoom may display the duration of the meeting, it might not have the same level of granular tracking of individual student participation time as described in the MUPSE Module.

CHAPTER FIVE

CONCLUSION AND FUTURE WORKS

5.1 Overview

The purpose of my study was to improve students' synchronous involvement in online learning environments, and the study's main question were: What are the main factors that influence and improve students' synchronous participation in e-learning activities?

At the beginning of this chapter, we present the conclusion of this research, then we review the limitations of this study, and the final section of the chapter discusses possible future research projects.

5.2 Conclusion

Online education offers learners and educators the flexibility to acquire knowledge and deliver instruction anytime, anywhere. The Covid-19 pandemic has underscored the importance of ensuring high-quality e-learning systems for online education. To enhance student engagement in e-learning, it becomes crucial to monitor and track various student activities, such as assessing events like clicks and mouse movements, active participation in class through actions like raising hands and engaging in chat interactions, and recording the total duration of their lesson attendance. These measures aim to improve student-teacher interaction and foster higher levels of engagement, providing more precise insights into their involvement compared to other communication methods.

The primary objective of this study is to promote simultaneous student participation in online learning by creating an interactive environment between students and teachers on the Moodle platform. Moodle offers numerous advantages, including its

open-source nature, user-friendly interface, and flexibility, allowing for code customization and seamless integration of over 500 additional features and plugins.

The research methodology employed in this study is the XP (Extreme Programming) methodology. This approach involves multiple steps, starting with identifying significant events through expert consultations, which are then transformed into research questions to be addressed. User events, representing students in this context, are meticulously managed to generate accurate time estimates for release planning. The design of the interactive environment adheres to agreed-upon standards, and the final step includes extensive testing by experts to evaluate the reliability, relevance, and practicality of the collected evidence.

To assess the degree of students' participation in online lessons, the concept of fuzzy logic was utilized, enabling a nuanced and adaptable evaluation process in student engagement assessment.

5.3 Future Works

Based on the evaluation of the five lecturers who tested the system, their comments for future work are as follows:

- Integration of QR Code for Student Identification and authentication.
- Adding Camera image analysis as new parameter for the FIS.
- Using machine IP address in the student engagement evaluation.

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Appendix A

Invitation to the participating experts

السلام عليكم ورحمة الله وبركاته،

ارجو ان تكونو بخير وصحة وعافية

م / دعوة

تحية طيبة.....

يرجى تفضلكم لحضور مناقشة مجموعة Focus Group الخاصة في بحث الدراسات العليا المعنون Enhancing University Students Engagement in Online Courses based on Activity drivenللباحثة زينب احمد سعيد وبأشراف الدكتور محمد محسن العبادي وذلك يوم الاثنين المصادف 23-5 – 2022 عند الساعة 12:00 ظهرا في قسم علوم الحاسوب في قاعة الاجتماعات.

مع جزيل الشكر والتقدير

Appendix B

focus group question templet

Focus group questions

1. From your experience in online classes, are there any events/parameters (within the LMS platform) that might enhance or indicate the engagement of students?

_____

_____

_____

2. Below are the events list and some environmental parameters:

Events / Parameter	Describe
Click	
Key Down	
Key Up	
On Key Press	
On Mouse Move	
On Mouse Down	
On Mouse Up	
Select	
raising hands, chat interaction,	
On Focus	
Screen size	
IP address	
Operating System	
Device type	
Internet speed	

Are there any other event or parameter you might find it useful?

3. How you can interpret the combinations of the above parameters/events over a period of time? For example

Events/parameters	The inference of student Status
No mouse move	Student absent
Only mouse move	Type 5

4. How would you evaluation the student if he did not participate in the lecture but answered the quiz?

_____

_____

_____

5. Do you think the proposed approach is useful? Justify your answer please?

_____

_____

_____

6. Any other suggestions for how we can improve student engagement in online learning?

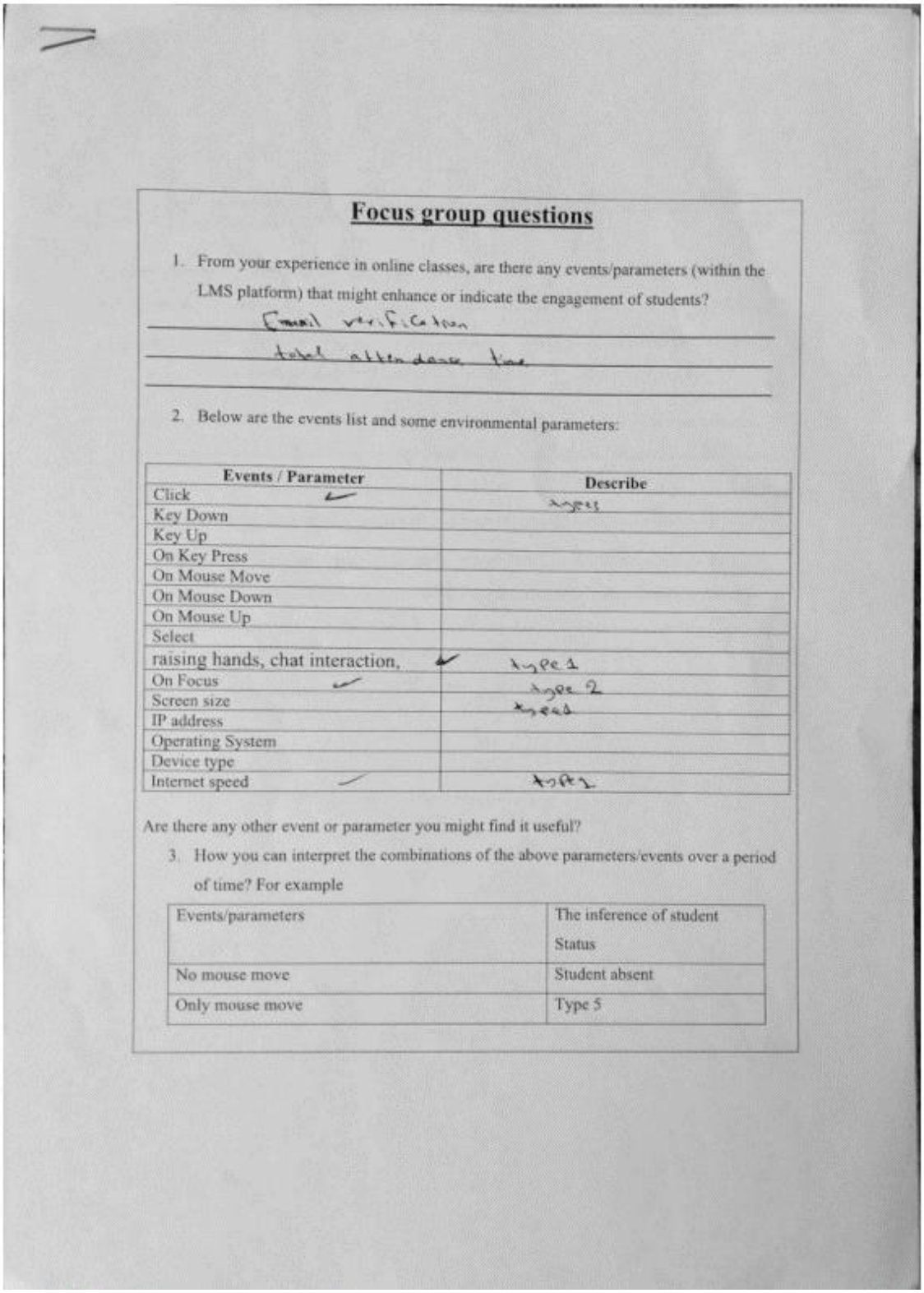
_____

_____

_____

Notes:

Appendix C



Focus group questions

1. From your experience in online classes, are there any events/parameters (within the LMS platform) that might enhance or indicate the engagement of students?

Email verification

total attendance time

2. Below are the events list and some environmental parameters:

Events / Parameter	Describe
Click	type 1
Key Down	
Key Up	
On Key Press	
On Mouse Move	
On Mouse Down	
On Mouse Up	
Select	
raising hands, chat interaction,	type 1
On Focus	type 2
Screen size	type 2
IP address	
Operating System	
Device type	
Internet speed	type 2

Are there any other event or parameter you might find it useful?

3. How you can interpret the combinations of the above parameters/events over a period of time? For example

Events/parameters	The inference of student Status
No mouse move	Student absent
Only mouse move	Type 5

4. How would you evaluation the student if he did not participate in the lecture but answered the quiz?

جيدة

5. Do you think the proposed approach is useful? Justify your answer please?

فكرة جيدة وتتيح التركيز على نقاط الضعف وتحسينها
وتقلل الملل وتشجع المشاركة.

6. Any other suggestions for how we can improve student engagement in online learning?

add quick quizes without notify the students.
إضافة أسئلة بدون علم الطلاب

Notes:

Focus group questions

1. From your experience in online classes, are there any events/parameters (within the LMS platform) that might enhance or indicate the engagement of students?

Camera

2. Below are the events list and some environmental parameters:

Events / Parameter	Describe
Click	2
Key Down	3
Key Up	4
On Key Press	5
On Mouse Move	6
On Mouse Down	7
On Mouse Up	8
Select	
raising hands, chat interaction,	
On Focus	
Screen size	
IP address	
Operating System	
Device type	
Internet speed	1

Are there any other event or parameter you might find it useful?

3. How you can interpret the combinations of the above parameters/events over a period of time? For example

Events/parameters	The inference of student Status
No mouse move	Student absent
Only mouse move	Type 5

4. How would you evaluation the student if he did not participate in the lecture but answered the quiz?

He Type 1

5. Do you think the proposed approach is useful? Justify your answer please?

Yes. As a lecturer engagement is a part of the lecture that I must achieve, so measuring it will improve my teaching

6. Any other suggestions for how we can improve student engagement in online learning?

Notes:

Focus group questions

1. From your experience in online classes, are there any events/parameters (within the LMS platform) that might enhance or indicate the engagement of students?

QR for student ID

2. Below are the events list and some environmental parameters:

Events / Parameter	Describe
Click	
Key Down	
Key Up	
On Key Press	
On Mouse Move	
On Mouse Down	
On Mouse Up	
Select	
raising hands, chat interaction,	
On Focus	
Screen size	
IP address	
Operating System	
Device type	
Internet speed	

Are there any other event or parameter you might find it useful?

3. How you can interpret the combinations of the above parameters/events over a period of time? For example

Events/parameters	The inference of student Status
No mouse move	Student absent
Only mouse move	Type 5

4. How would you evaluation the student if he did not participate in the lecture but answered the quiz?

he has some sort of engagement. could be Type 1 or Type 2

5. Do you think the proposed approach is useful? Justify your answer please?

Yes, it is very useful, to measure the level of engagement for the students

6. Any other suggestions for how we can improve student engagement in online learning?

This is two way process which depends on the presenter and the students.

Notes:

Appendix D

Focus group

For

Enhancing University Students Engagement in Online Courses based on Activity driven

Name of moderators: م.د. محمد محسن حسون العبادي / الباحثة زينب احمد سعيد
Date: 24 – 5 - 2022

Goal of Research	improve the synchronously engagement methods of online learning by monitoring and tracking user engagement (activities) on Moodle platform.
Propose Of Focus Group	discuss the experts about their views on events that enhance student participation in online learning activities.
Participant Profile	Men and women between the ages of 30 and 45, who are IT teachers with experience in the field of e-learning. أ.م. د. هبة عدنان رحيم علي المحمد م.د. عصام حامد عباس حسن ال محمد م.د. زيد حسن علي عبود نصر الله م.د. انور عدنان م.د. محمد محسن حسون العبادي
Result / analysis	The results of the meeting were the suggestions of experts for the activities Total attendance time Texting interaction Mouse events Device type Raise hand

Appendix E

PC / Laptop				
Total attendance time	**Raise hand**	**Mouse_ Events**	**Texting (Keyboard)**	**Engagement (Low, Medium, High)**
low	low	low	low	Low
low	low	low	medium	Low
low	low	low	high	Low
low	low	medium	low	Low
low	low	medium	medium	Low
low	low	medium	high	Low
low	low	high	low	Low
low	low	high	medium	Low
low	low	high	high	Low
low	medium	low	low	medium
low	medium	low	medium	Low
low	medium	low	high	Low
low	medium	medium	low	Low
low	medium	medium	medium	Low
low	medium	medium	high	Low
low	medium	high	low	Low
low	medium	high	medium	Low
low	medium	high	high	medium
low	high	low	low	medium
low	high	low	medium	medium
low	high	low	high	medium
low	high	medium	low	medium
low	high	medium	medium	medium
low	high	medium	high	medium
low	high	high	low	medium
low	high	high	medium	medium
low	high	high	high	medium
medium	low	low	low	low
medium	low	low	medium	low
medium	low	low	high	low
medium	low	medium	low	low
medium	low	medium	medium	low
medium	low	medium	high	low
medium	low	high	low	low
medium	low	high	medium	low
medium	low	high	high	low
medium	medium	low	low	medium
medium	medium	low	medium	medium
medium	medium	low	high	medium

medium	medium	medium	low	medium
medium	medium	medium	medium	medium
medium	medium	medium	high	medium
medium	medium	high	low	medium
medium	medium	high	medium	medium
medium	medium	high	high	low
medium	high	low	low	low
medium	high	low	medium	low
medium	high	low	high	low
medium	high	medium	low	low
medium	high	medium	medium	low
medium	high	medium	high	low
medium	high	high	low	low
medium	high	high	medium	low
medium	high	high	high	low
high	low	low	low	low
high	low	low	medium	medium
high	low	low	high	medium
high	low	medium	low	medium
high	low	medium	medium	medium
high	low	medium	high	medium
high	low	high	low	medium
high	low	high	medium	medium
high	low	high	high	medium
high	medium	low	low	high
high	medium	low	medium	medium
high	medium	low	high	medium
high	medium	medium	low	medium
high	medium	medium	medium	medium
high	medium	medium	high	medium
high	medium	high	low	medium
high	medium	high	medium	medium
high	medium	high	high	medium
high	high	low	low	high
high	high	low	medium	high
high	high	low	high	high
high	high	medium	low	high
high	high	medium	medium	high
high	high	medium	high	high
high	high	high	low	high
high	high	high	medium	high
high	high	high	high	high

Smartphone / Tablet				
Total attendance time	**Raise hand**	**Mouse_ Events**	**Texting (Keyboard)**	**Engagement (Low, Medium, High)**
low	low	low	low	Low
low	low	low	medium	Low
low	low	low	high	Low
low	low	medium	low	Low
low	low	medium	medium	Low
low	low	medium	high	low
low	low	high	low	low
low	low	high	medium	low
low	low	high	high	low
low	medium	low	low	medium
low	medium	low	medium	low
low	medium	low	high	low
low	medium	medium	low	low
low	medium	medium	medium	low
low	medium	medium	high	low
low	medium	high	low	low
low	medium	high	medium	low
low	medium	high	high	low
low	high	low	low	medium
low	high	low	medium	low
low	high	low	high	low
low	high	medium	low	low
low	high	medium	medium	low
low	high	medium	high	low
low	high	high	low	low
low	high	high	medium	low
low	high	high	high	low
medium	low	low	low	low
medium	low	low	medium	medium
medium	low	low	high	medium
medium	low	medium	low	medium
medium	low	medium	medium	medium
medium	low	medium	high	low
medium	low	high	low	low
medium	low	high	medium	low
medium	low	high	high	low
medium	medium	low	low	medium
medium	medium	low	medium	low

medium	medium	low	high	low
medium	medium	medium	low	low
medium	medium	medium	medium	medium
medium	medium	medium	high	low
medium	medium	high	low	low
medium	medium	high	medium	low
medium	medium	high	high	low
medium	high	low	low	high
medium	high	low	medium	high
medium	high	low	high	high
medium	high	medium	low	high
medium	high	medium	medium	high
medium	high	medium	high	high
medium	high	high	low	high
medium	high	high	medium	high
medium	high	high	high	high
high	low	low	low	low
high	low	low	medium	low
high	low	low	high	medium
high	low	medium	low	low
high	low	medium	medium	low
high	low	medium	high	medium
high	low	high	low	low
high	low	high	medium	low
high	low	high	high	medium
high	medium	low	low	high
high	medium	low	medium	medium
high	medium	low	high	medium
high	medium	medium	low	medium
high	medium	medium	medium	medium
high	medium	medium	high	high
high	medium	high	low	medium
high	medium	high	medium	medium
high	medium	high	high	medium
high	high	low	low	high
high	high	low	medium	high
high	high	low	high	high
high	high	medium	low	high
high	high	medium	medium	high
high	high	medium	high	high
high	high	high	low	high
high	high	high	medium	high
high	high	high	high	high

الخلاصة

أدى جائحة Covid-19 إلى تعطيل نظام التعليم التقليدي، مما أدى إلى تحول كبير نحو التعليم عبر الإنترنت .ومع ذلك، فقد أدى هذا الانتقال إلى ظهور تحديات من حيث التواصل والمشاركة بين المعلمين والطلاب .أعرب العديد من المدرسين والطلاب عن مخاوفهم بشأن ضعف التواصل وفك الارتباط أثناء الفصول الدراسية عبر الإنترنت .لمعالجة هذه المشكلات، نقترح حلاً لتعزيز التفاعل بين المحاضرين والطلاب، مما يؤدي في النهاية إلى تحسين مشاركة الطلاب .

يستخدم حلنا المقترح معلمات مختلفة أثناء التعلم المتزامن لتزويد المحاضرين برؤى قيمة .من خلال تحليل تفاعلات الطلاب وردود الفعل في الوقت الفعلي، يمكن للمحاضرين معالجة الأسئلة وإبراز موضوعات محددة بناءً على مشاركة الطلاب .بالإضافة إلى ذلك، يشتمل الحل على مبادئ منطقية غامضة لتتبع ومراقبة أنشطة الطلاب أثناء الفصول الدراسية عبر الإنترنت، مما يؤدي إلى إنشاء بيانات إحصائية حية .

الهدف الأساسي هو تعزيز مشاركة الطلاب المتزامنة في الدروس عبر الإنترنت .من خلال تتبع أحداث الطلاب وتحليلها وتقديم التقييمات الإحصائية للمحاضرين باستخدام مبادئ المنطق الضبابي، يهدف الحل المقترح إلى زيادة مشاركة الطلاب وتحسين تجربة التعلم الشاملة في الفصول الدراسية عبر الإنترنت .يهدف هذا النهج المستند إلى البيانات إلى إنشاء بيئة تعلم عبر الإنترنت أكثر تفاعلية وجاذبية .

من خلال الاستفادة من قوة تحليل البيانات ومبادئ المنطق الضبابي، يهدف حلنا إلى سد فجوة الاتصال بين المحاضرين والطلاب في مساحة التعلم عبر الإنترنت .سيؤدي هذا في النهاية إلى تحسين مشاركة الطلاب وتحسين نتائج التعلم في نظام التعليم الإلكتروني.

جامعة كربلاء

كلية علوم الحاسوب وتكنلوجيا المعلومات

قسم علوم الحاسوب

تحفيز الطلاب الجامعيين على المشاركة في التعلم الإلكتروني المتزامن باستخدام بيانات المنطق الضبابي

رسالة ماجستير

مقدمة الى مجلس كلية علوم الحاسوب وتكنولوجيا المعلومات / جامعة كربلاء وهي جزء من متطلبات نيل درجة الماجستير في علوم الحاسوب

كتبت بواسطة

زينب احمد سعيد مجيد

بأشراف

الاستاذ المساعد الدكتور محمد محسن حسون جواد

1444هـ 2023 م