A Virtual Classroom Approach towards Incorporating E-Learning Systems in Libyan Educational Institutions

Mohamed Edali[1,2,*], Asma Milad[1], Zaed Sahem[2], Walid Alaswad[1], Ali Bseibsu[1], Faraj Ben Rajeb[3], and Ali Elkamel[4]

[1]Department of Chemical and Petroleum Engineering, Elmergib University, Elkhoms, Libya.
[2]Creativity Group for Technical Services, Ottawa, Canada.
[3]Department of Oil and Gas Engineering, Memorial University, St. Johns, Canada.
[4]Department of Chemical Engineering, University of Waterloo, Waterloo, Canada.

[*] Corresponding author: dredalicreativitygroupts@gmail.com

Abstract

Educational developments have emerged from tremendous technology advancements and the internet in recent years. As a result, distance learning has become one of the most significant educational breakthroughs. Although remote learning, or education in which educators and students are separated physically, is not new, current technology and high-speed internet have made web-based distance learning practical. As a direct consequence of these advancements, some educational institutions have begun to adopt web-based remote learning systems to provide flexible, time and location-independent education. Asynchronous and synchronous learning are the two significant types of distance education. Asynchronous education does not need all students to engage online simultaneously, whereas synchronous instruction is certain. Asynchronous instruction allows students to interact at their convenience. Distance learning has the advantage of flexibility, which is especially important in light of the global epidemic and educational institution lockdowns worldwide. This study compares and examines all popular, widely utilized digital teaching tools and well-known learning management systems. According to the parameters of this study, Libyan universities and higher education institutions can broadly incorporate free, open-source learning management systems. Despite its latency in reacting, Libya's government must step up to the challenge and begin investing significantly in its educational system and developing national programs to incorporate information and communication technology (ICT) into education. The findings indicated that pandemic had forced it to create innovative e-learning techniques and equip the curriculum of the courses with new smart teaching Apps. Therefore, the Libyan educational ministry should act quickly by supporting universities to digitalize and apply the latest educational technologies presented in this study more effectively and efficiently. The research was conducted to determine the feasibility of introducing e-learning into Libyan higher education. It concludes with a proposal for an interdisciplinary approach to Libyan e-learning development. As a result, both instructors and students adopt and demonstrate a high level of interest.

Key words: Distance learning, students, Classroom, Libyan Educational Institutions

الملخص

ظهرت التطورات في التعليم من الثورة التكنولوجية الهائلة والإنترنت في السنوات الأخيرة. ونتيجة لذلك، أصبح التعلم عن بعد أحد أهم الإنجازات التعليمية. على الرغم من أن التعلم عن بعد، أو التعليم الذي يتم فيه فصل المعلمين والطلاب جسديًا، ليس مفهومًا جديدًا، إلا أن التكنولوجيا الحالية والإنترنت عالي السرعة جعلت التعلم عن بعد عبر

الويب عمليًا. كنتيجة مباشرة لهذه التطورات، بدأت بعض المؤسسات التعليمية في اعتماد أنظمة التعلم عن بعد القائمة على الويب لتوفير تعليم مرن ومستقل عن الوقت والمكان. التعلم غير المتزامن والمتزامن هما النوعان الرئيسيان للتعليم عن بعد. لا يحتاج التعليم غير المتزامن إلى مشاركة جميع الطلاب عبر الإنترنت في نفس الوقت، في حين أن التعليم المتزامن أمر مؤكد. تسمح التعليمات غير المتزامنة للطلاب بالتفاعل في الوقت الذي يناسبهم. يتميز التعلم عن بعد بالمرونة، وهو أمر مهم بشكل خاص في ضوء الوباء العالمي وإغلاق المؤسسات التعليمية في جميع أنحاء العالم. تقارن هذه الدراسة وتفحص جميع أدوات التدريس الرقمية الشائعة والمستخدمة على نطاق واسع وأنظمة إدارة التعلم المعروفة. يمكن للجامعات ومؤسسات التعليم العالي الليبية دمج أنظمة إدارة التعلم المجانية مفتوحة المصدر على نطاق واسع، وفقًا لمعايير هذه الدراسة. على الرغم من تأخرها في الاستجابة، يجب على الحكومة الليبية مواجهة التحدي والبدء في الاستثمار بشكل كبير في النظام التعليمي في البلاد، فضلاً عن تطوير برامج وطنية لدمج تكنولوجيا المعلومات والاتصالات في التعليم. أشارت النتائج إلى أن الوباء أجبرها على ابتكار تقنيات تعلم إلكتروني مبتكرة وتجهيز مناهج الدورات بتطبيقات تعليمية ذكية جديدة. لذلك، يجب على وزارة التعليم الليبية أن تتصرف بسرعة من خلال دعم الجامعات لرقمنة وتطبيق أحدث التقنيات التعليمية المقدمة في هذه الدراسة بشكل أكثر فعالية وكفاءة. تم إجراء البحث لتحديد جدوى إدخال التعلم الإلكتروني في التعليم العالي الليبي، ويختتم بمقترح لمنهج متعدد التخصصات لتطوير التعليم الإلكتروني الليبي. نتيجة لذلك، سيتبناه بشغف كل من أساتذة الجامعات والطلاب وسينتج مستوى عالٍ من الاهتمام.

1. Introduction

Several institutions of higher learning globally have designed and implemented presently available integrated e-learning infrastructure and applications. Traditional lecture formats are being combined with full or partial web-based courses at the majority of universities. Inability to deliver the most appropriate service to its learners and lecturers, educational establishments attempt to enhance their instructional practices. Using an e-learning system that allows students and teachers to share information improves the process and operations of teaching-learning services. Many colleges and universities worldwide have designed and deployed collaborative e-learning systems and services. Conventional lectures are mixed with full or partial web-based courses in most institutions. To deliver the most effective services to their students and professors, educational institutions seek to enhance their teaching-learning approaches. Utilizing an e-learning framework that enables students and lecturers to share knowledge improves the methodology and operations of students' learning services. E-learning technologies may also help an educational establishment handle professional academic service comprehensively and time-savingly. When technology is thoroughly evaluated, it is a usual protocol to state that it has a few flaws. As per our experience at Elmergib University in Libya, an e-learning environment favors web-based teaching; nonetheless, there are hurdles on the route to success. Most Libyan universities and colleges must employ the next most up-to-date e-learning strategy to monitor the speed of technological innovation in higher education. Students and instructors are well enough to use the internet and social networking sites in today's technology age, making participation in any online learning a straightforward method for becoming familiar with any type of web-based teaching-learning scenario. Unlike any other content-based system, an e-learning system necessitates a comprehensive design that enables the delivery of information depending on the needs and criteria of learners and educators. The invention of the internet and e-

learning has resulted in substantial changes in education systems worldwide, including in Libya.

As a result, all Libyan universities' educational institutes should consider e-learning a top priority. The applicability of any e-learning system and its capabilities by its own clients is a quantifiable point that reflects the profitability of the conceptual view. In recent research, Francom et al. compared two well-known learning management systems, namely Google Classroom and Brightspace [1]. Both LMSs were utilized in a low-impact blended learning scenario to augment face-to-face course sessions with online activities. According to their findings [1], participants preferred Brightspace overall, particularly in terms of productivity tools, attitude toward usage, and usability. They [1] proposed more studies comparing these two LMSs in diverse student groups and completely online courses. Additional investigations on LMSs might better lead to understanding classroom management opinions of usefulness, simplicity of use, attitude toward service, and behavioral intention to utilize the various LMSs. This study assesses the impact and factors that may influence Libyan students' adoption and usage of open-source, free-of-charge Learning Management Systems (LMS) such as Google Classroom.

2. Learning Management Systems' LMS.'

Learning management systems (LMSs) are web-based learning management systems that make instructional material and administration more convenient [2]. These technologies have swiftly acquired popularity in educational contexts as a means of facilitating both entirely online and mixed learning sessions [3]. A teaching method features cloud storage for coursework, a quiz tool, web content tools, diaries, streaming video, discussion boards, as well as many other learning tools. Therefore, the system's compatibility with the adopters' values, experiences, and requirements is critical. Another element is the system's relative advantage over competing learning management systems, the availability of a trial plan before implementation, and the system's visual simplicity of use [2] and [4].

2.1 LMS used as blended learning

When a university implements a learning management system or LMS, it may be used to support entirely online classrooms or other learning experiences in addition to face-to-face sessions. Blended learning is defined as a learning management system that incorporates the advantages of both face-to-face and online interactions [3]. The quality and utility of a learning management system are essential factors in blended learning success [5], [6]. Alammary et al. [7] provide three alternative design techniques for blended learning that an educator might use: low-impact blend, medium-impact blend, and elevated mix, in an evaluation of blended learning research publications. Part of the low-impact mix includes supplementing a face-to-face lesson with online exercises. This strategy is the easiest for face-to-face instructors to utilize because of its convenience [7]. The designer will substitute face-to-face activities with online activities in the medium-impact mix, and the replacement activities will be beneficial in the online domain. Finally, the creation of a new class from the ground up is required for a high-impact mix. For each learning outcome, the researcher assesses if the ideal medium is face-to-face or web-based [7]. Blended learning provides a lot of versatility when it comes to the quantity of online vs. face-to-face activities employed in a course.

2.2 Google Classroom

Google Classroom is a contemporary LMS that interacts well with technology in education and is free for educational establishments to use. So, according to early research, Google Classroom is the third most common LMS for elementary and secondary

schools, after Moodle and Canvas [8]. However, because of its internet infrastructure with current institution LMSs and student information systems, institutions of higher learning have not widely adopted Google Classroom [9]. There has been very little experimental observation comparing Google Classroom's usability or other features to competing LMSs [10], [11]. There are now just surface-level feature comparisons between Google Classroom and Brightspace. That was most probably due to the fact that Google Classroom is a newer LMS with limited uptake by higher education institutions. Brightspace and Google Classroom LMSs both offer online classrooms with an assignment repository, a testing tool, notifications, activity agendas, message boards, and the ability to upload materials in numerous formats, among other things (Brightspace Core for Higher Education, 2020; Classroom Features and Benefits, 2020). Although Brightspace has a full-featured grade book, Google Classroom is currently developing one. Brightspace, on the other hand, connects to these apps via a widget, whereas Google Classroom is strongly linked with Google Programs for Education (Google Apps, 2020).

3. E-learning Integration Trial Implementation

Individuals' passion frequently drives developments, with little or no external assistance or reward. A group of instructors at Elmergib University's chemical engineering department recently agreed to actively increase students' achievement and course flexibility by addressing some of the department's long-standing educational challenges. The inability to initiate constructive modifications at the start of each class due to lack of access to instructional material; an insufficient time for interactive knowledge merged activities all through lecture considering the majority of classroom time spent trying to copy learning materials from the board; and restricted feedback on summative assessment due to the fact that face-to-face interactions were the only means of communication with students who have simply the potential to judge. The instructor became uncomfortable with the limitations of traditional teaching methods and began to look for alternatives. The professor would need to employ a novel pedagogical technique before, during, and after activities to achieve three goals. Increase support, communication, assessment, and feedback on formative evaluation tasks introductory class; incorporate interactive educational activities during class; and, finally, improve support, communication, assessment, and feedback on student assessment tasks after class. To achieve these goals, the instructor looked at a variety of existing technologies and their capacity to support the before, during, and after framework; he came to the conclusion that implementing an educational web-based system could be a great solution, as shown next.

4. Pedagogical categories enabling versatility in web-based apps

As of the early months of the pandemic, in March 2020, instructors had to work rapidly to figure out the best ways to build up a virtual classroom that would keep their students engaged. Most countries implemented social distancing measures, hand-washing routines, and public mask-wearing as a precaution. Millions of students switched from state universities to some form of e-learning in March. Educators at all levels experimented with various tools and programs for months before settling on their favorites. To say that this had an impact on how instructors and learners interacted would be an understatement. A virtual classroom is an online learning environment where instructors and students collaborate using software's technical capabilities. Educational institutions utilize virtual classroom software to hold classes remotely while keeping the functionality of a typical classroom setting. A virtual classroom allows students to participate in real-time classes while maintaining the same collaboration tools and degree

of engagement as a physical classroom. Educational institutions use virtual classroom software to give access to students who are unable to attend in-person classes. Educators can connect with students and share information in a virtual classroom setting.
Web-based applications; enhancing educational flexibility concerning major themes in various domains. Before, during, and after sessions, there is a course agenda on the cloud system's site, where key dates and times and changes are always available. On the course site, you may find contact sessions, lectures before, during, and after activities, as well as lecture notes and demonstration materials. Handouts are unnecessary for students, and absentee students are not expected to come to the office to seek them. Therefore, it is possible to offer stuff more efficiently afterwards. Self-study, assignments, the instructor, and students may all post new study materials to the course site without the need to photocopy them. The professor may log through into the site during each engagement, check over the work students have submitted, suggest improvements, and record marks. Allows for more efficient material transmission, which improves the quality of responses. A significant effort If students get detailed information about the primary assignment's requirements, they will have fewer inquiries before, during, and after activities. After each activity, the instructor may log in to the site and assess the work that students have submitted, provide feedback, and record marks. That increases the amount as well as the quality of feedback. Mentoring and communicating as an instructor can contact students whenever wants and respond to their inquiries whenever he wants. Students may speak with each other or with the instructor before, during, or after activities, which allows for improved communication outside of class.

5. Chemical Engineering of Elmergib University Free Execution Trial of E-learning
The instructors' research team, Edali *et al.* [12], selected the Google Classroom Course Management System for the initial implementation. That included course material management, announcement posting, communication via discussion boards and emails, assignment and quiz processing, grade management, and links to the course website and other resources. Google Classroom is simple and free to use, with an advanced service for significantly lower prices per course. Google Classroom also provides an extensive course catalogue where students may access a class made up by their instructor or search for distance learning courses. In a forthcoming publication by the authors of this research paper, researchers will detail these aspects and how they influenced teaching and learning in this study. The enrolled students were chemical engineering students in their third, fourth, and fifth years at Elmergib University. They already had a decent command of English and had basic computer familiarity with M.S. Windows, M.S. Office, and the internet. All three components of the before, during, and after framework were addressed in the implementation. For illustration, the before element requires learners to pass pre-class anticipation such as finding examples of scope of study on the internet, annotating them, and submitting them to the Google classroom environment for use by all participants. This prerequisite was implemented to support students in taking charge of their education and spark class debate regarding study subjects. Furthermore, the prior session's materials were to be used to speed up the editing process at the start of the next course. The instructor used Google Classroom to offer instruction during the course by uploading demonstration materials such as PowerPoint slides, notes, and links weekly before scheduled classes; this online distribution of lecture notes sought to alleviate students from copying notes during lectures. Finally, the after component would include uploading follow-up exercises built on and amplified what occurred during the face-to-face sessions; these exercises were created to allow students to complete evaluation tasks

online, individually or in groups, and receive timely and personalized feedback on their work. Understudies communicated with one another and with their instructors via chat rooms and email. Shortly after the pilot course began, the understudies were to participate in a week-long preparatory course that was nearly entirely based on the Whiteboards Course-Management framework. Students primarily utilized the Google Classroom system for three purposes: access to course information, completion of assessment assignments, and communication with instructors and classmates. All undergraduates commonly used the Course Data Page to receive course data, while the Cites Pages were frequently referred to as course content. All students performed at least ten assignments; they engaged electronically, submitted online contributions, and received online feedback from their professors. Figure 1 depicts one of the Google Classroom-based Chemical Engineering at Elmergib University Computer Applications course for fifth-year senior students, term group 2021, administered by two of the research work's teachers. By clicking the +sign in the "Students" page or sending them an email with the course code attached, as shown in Figure 2, where the course registration process is completed.

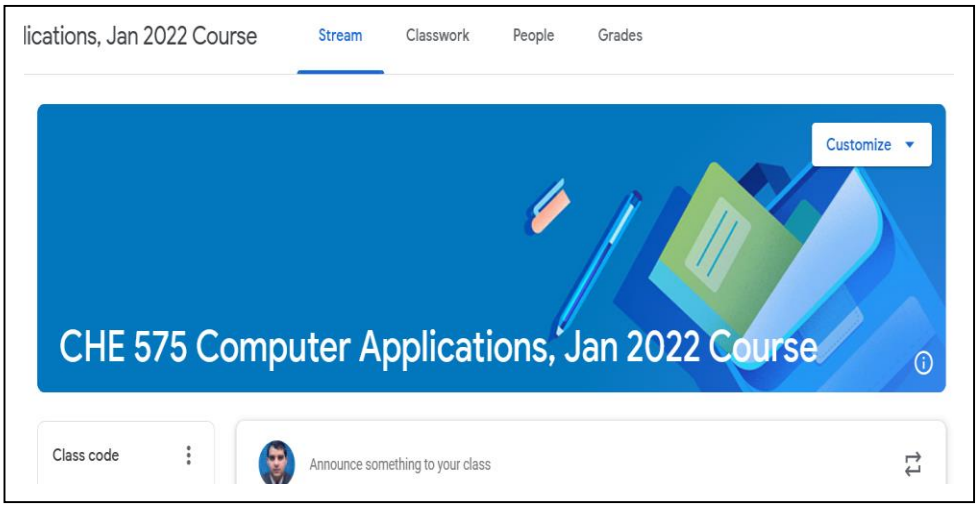

Figure 1. Computer Applications Google Classroom for Higher Studies, Term Group 2021 administered by two of the instructors of this research.

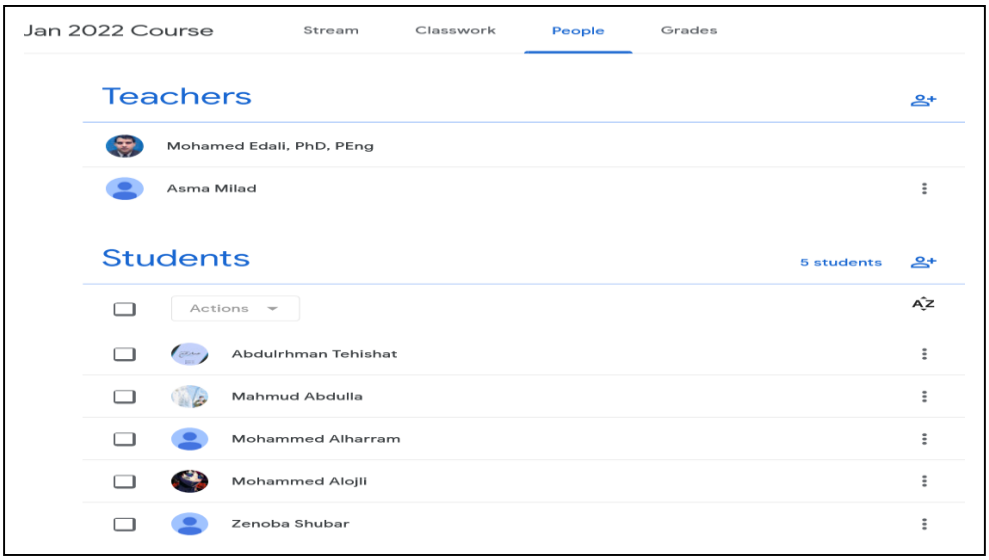

Figure 2. Computer Applications Course registration at Google Classroom.

The professors' next priority was achieving the course's learning objectives and structuring and distributing the knowledge to the students. Unlike some wealthy nations, developing countries, such as Libya, must consider all students' sociotechnical restrictions when planning course content and delivery. Furthermore, online courses are uncommon in most Libyan institutions, and chemical engineering lectures are typically delivered in a classroom environment. Therefore, a blended learning approach was taught using the Discover, Learn, Practice, Collaborate, and Assess (D-L-P-C-A) paradigm. The five components of (D-L-C-P-A) with a brief explanation of each element can be summurized. First, students have joined the Google Classroom, as in Figure 2. They were then instructed to find all learning materials created for the allocated topic, which were uploaded into the virtual class, including lecture handouts, progress trackers, lecture videos, amended course syllabus, and web connections to additional online resources. Next, the students must master the terminologies, ideas, and computations using the pre-recorded lecture videos and other materials. nline tests are set up with many sets of questions and a defined amount of time for completing and submitting answers in engineering reporting style. A long-time frame was suggested to provide students with more access, especially those with local internet connections.

The practice section helps students put what they've learned and apply it. As seen in Figure 3, most class time is spent with students collaborating on interactive activities such as quizzes and debates. Students' engagement with the instructor and peer learning should improve due to the collaboration component. Finally, as illustrated in Figure 3, the assessment component comprises assignments, quizzes, or exams given with allotted time to assess the student's understanding of the material based on the declared course learning objectives.

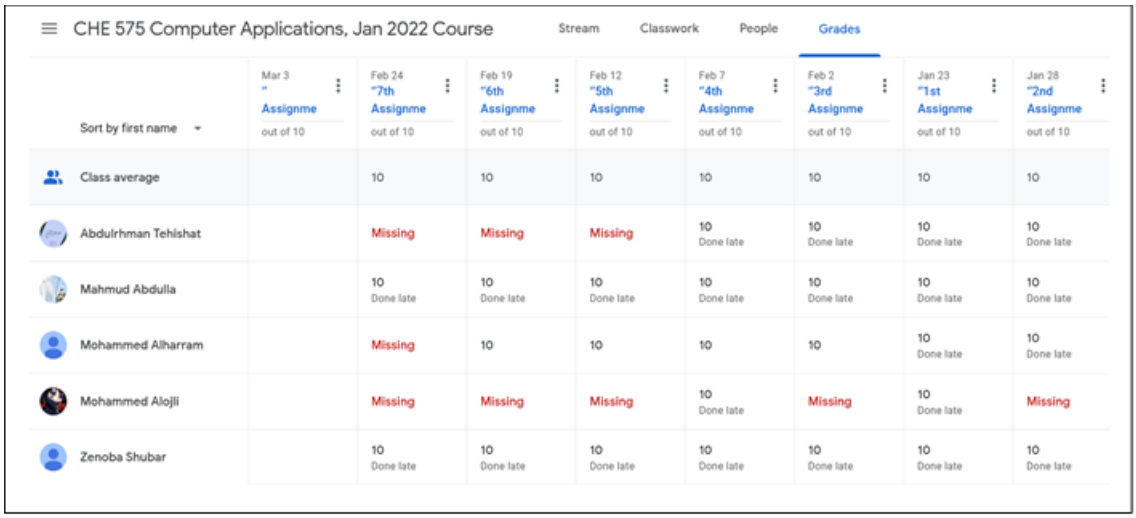

Figure 3. The chemical engineering computer applications course / Google Classroom Grades System.

6. Chemical Engineering Participants' Evaluations on the E-Learning Trial Technique

Figures 4 depicts the Google Classroom website for the courses (2016 – 2021 terms) that this research paper's professors ran. After completing each of the fifteen courses, in the same manner, an evaluation of the Google Classroom activity was undertaken among understudies, educators, and specialist personnel. In addition, an overview evaluation was undertaken among the participating understudies and instructors in the chemical

designing courses at Elmergib College, and a unique overview was presented to each group of responders. The questions were developed in order to understand more about the assessment system's influence on learning and teaching. That is, to what extent it aided in aiming before to, during, and after activities. The assessment includes survey questionnaires with specialist staff, course educators, and other educators who administered with the revamping and uploading of the course online, in addition to the overviews.

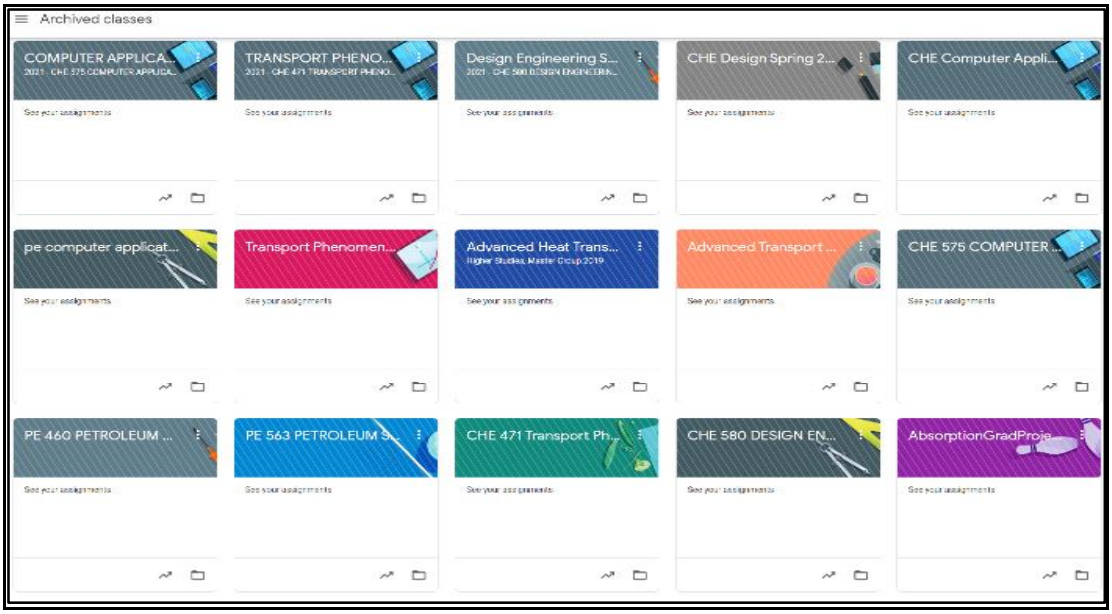

Figure 4. Google Classroom LMS website for the courses (2016 – 2021 terms), administered by this review work instructors.

Assessment techniques must be improved to reduce academic dishonesty while still providing students with the numerical and analytical ability needed to solve engineering problems. As a result, designing tests that limit collaboration and web surfing is crucial. The evaluation's complexity must be weighed against the time limits. Other factors, such as the time it takes to scan and save their solutions and the upload speed of their internet connection, must also be considered. These problems should not be disregarded in order to improve student fairness.

Students well received the course's Google Classroom-assisted market research. They talked about how it impacted their interactions with instructors and individual students, group work, assignment accommodations, feedback on evaluation tasks, learning quality, and attitudes toward web-assisted learning. Instead of having to wait for face-to-face encounters, students welcomed the ability to engage with instructors and classmates at any time via the internet. Several students reported a rise in online contact in their personal lives. The most commonly acknowledged improvement was communication, without which the learning and teaching processes would be regarded as worthless. It has communication features that allow us to communicate with our instructor and other students at any time and from any location. We started using email as an engaging medium for our coworkers, backed up with a web-based system. The implementation of the LMS Education system's evaluation process and the enhanced quality of feedback supplied to students and was positively influenced group work and assessment.

7. Comparison of Google Classroom and Brightspace

Going paperless is a huge timesaver from both public and private institutions in digital and non-digital environments. Google Classroom and Brightspace serve two different customers who want to stay updated on top-notch apps that enable a paperless approach. Google's educational contributions as a pro are entirely free, and as a con, it has a limited classroom capacity. Brightspace, on the other hand, is a market leader in learning management systems, where more than 1,000 students must be registered. Blended learning, asynchronous learning, and certification are all supported. A financial ability to purchase a Brightspace license subscription is required, where the cost will not be an issue to implement LMS both on-premises and in the cloud.

Conclusion

The preceding is some of the observations made by instructors in this research that may be useful to others contemplating using Google Classroom. First, the Google Classroom discussion tool permitted only text-based threads and answers in this research. Options like photos, links, and the like would have been valuable in the lectures, but they were restricted by the features now accessible. Furthermore, the professor cannot search for student discussion postings by name, making marking difficult when the class is large. Instead of searching by a student and seeing all posts and answers, the instructor would have to score the threads manually. Another notable feature of Google Classroom is that it is updated over time, and these upgrades are occasionally performed without much notice and the users' input. As a result, users may encounter difficulties due to possible interface changes, making it temporarily unable to navigate the system as intended. Significant interface changes were introduced during one of the study's semesters, causing considerable uncertainty. The benefit of this issue is that you may receive new features at any time and utilize them in a class as soon as they're ready. At a modest number of students, Google Classroom works well with Google Apps for Education, which many colleges and institutions use. Participants' experiences with various LMSs might also be revealed through qualitative research. Transformation is still occurring in all Libyan education areas that do not involve online learning. As a result, the Libyan Ministry of High Education should move quickly to help institutions digitalize and implement the study's latest instructional innovations more effectively and efficiently. Brightspace is recommended for the way to go to manage the Libyan academic institutions with more than a few thousand students at each university. Education Ministry should completely invest in digital learning tools for long-term use. University staff and students require Brightspace as a modern learning tool that is automated, comprehensive, and highly engaging. It should be implemented to install LMS both on-premises and in the cloud. As a result, both instructors and students agree that it is a smart move.

Acknowledgment

Professor Elkamel of Waterloo University offered academic and financial assistance in providing simulation software, which authors used to create the instructional Apps. Associate professor Edali of Elmergib University's chemical engineering department created and examined the produced Apps and their teaching methodologies presentations, which were then used in teaching in virtual classrooms. Virtual classrooms for different courses for undergraduate and graduate levels were administered following the set teaching philosophy. Appreciation goes as well to the undergraduate chemical engineering students, Abdulrhman Tehishat, Abdullah Abdulsalam, Mahmoud Elghuzlani, Mohammed Harram, Mohammed Alajeel, and Zeenoubah Shoubar.

References

[1] G.M. Francom, A. Schwan, & J. N. Nuatomue. Comparing Google Classroom and D2L Brightspace Using the Technology Acceptance Model. TechTrends 65, 111–119 (2021). https://doi.org/10.1007/s11528-020-00533-0.

[2] E. W. Black, D. Beck, K. Dawson, S. Jinks, M. DiPietro, (2007). Considering implementation and use in the adoption of an LMS in online and blended learning environments. *TechTrends*, *51*(2), 35–53.

[3] C. Graham, (2005). Blended learning systems. In C. Bonk & C. Graham (Eds.), The handbook of blended learning: Global perspectives, local designs (pp. 3–21). Pfeiffer.

[4] R. D. Rucker, L. R. Frass, (2017). Migrating learning management systems in higher education: Faculty members' perceptions of system usage and training when transitioning from Blackboard Vista to Desire2Learn. *Journal of Educational Technology Systems*, 46(2), 259 -277.

[5] K. A. Al-Busaidi, H. Al-Shihi, (2012). Key factors to instructors' satisfaction of learning management systems in blended learning. *Journal of Computing in Higher Education*, 24(1), 18-39.

[6] J.-H Wu, R. D. Tennyson, T.-L. Hsia, (2010). A study of student satisfaction in a blended eLearning system environment. *Computers & Education*, *55*(1), 155–164.

[7] A. Alammary, J. Sheard, A. Carbone, (2014). Blended learning in higher education: Three different design approaches. *Australasian Journal of Educational Technology*, 30(4), 440–454.

[8] L. McKenzie, (2018). *Canvas catches, and maybe passes, Blackboard as top learning management system for U.S. colleges | Inside Higher Ed*. Inside Higher Ed. https://www.insidehighered.com/digital-learning/article/2018/07/10/canvas-catches-andmaybe-passes-blackboard-top-learning.

[9] W. Fenton, (2017). *Google Classroom not in the college classroom*. Inside Higher Ed.
https://www.insidehighered.com/digitallearning/article/2017/06/21/google-classroomnot-college-classroom

[10] R. A. S. Al-Maroof, M. Al-Emran, (2018). Students' acceptance of Google classroom: An exploratory study using PLS-SEM approach. *International Journal of Emerging Technologies in Learning (IJET)*, *13*(06), 112–123.

[11] K. A. Azhar, N. Iqbal, (2018). Effectiveness of Google classroom: Teachers' perceptions. *Prizren Social Science Journal*, *2*(2), 52–66.

[12] M. Edali, W. Alaswad, A. Bseibsu, Z. Sahem, F. Ben Rajeb, A. Elkamel "Chemical engineering graduate courses curriculum development with simulation components," *Journal of Pure & Applied Sciences*, 20 (3), 64-73 (2021). Proceedings of the first national conference for the development of higher education institutions in Sebha U., Libya, December 12, 2020, http://nchel.sebhau.edu.ly/.

[13] Chemical Engineering Research Group website at Elmergib University for the ITCS-2022 Conference, https://sites.google.com/view/elmergib-u-chem-engin-itcs2022/itcs-2022-feb-20-21-2022-1st-scientific-conference-on-information.