Analyzing the Impact of Introducing Active Learning in a Blended Educational Environment

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***Abstract*—In large classrooms, keeping students active for a prolonged period is a difficult task. Studies have shown that students can keep their attention active for a shorter duration such as 15-20 minutes. Thus, the importance of introducing active learning techniques to classrooms has arisen. Active learning will ultimately lead to students being deep leaners. However, most of the lectures consist of 30-hour face-to-face sessions where students meet the lecturer for only 2 hours per week. Therefore, only introducing active learning in a face-to-face session, will not make students become self-directed deep learners. As a solution to this, active learning techniques can also be introduced in the online environment using a Learning Management System (LMS). This paper focuses on analyzing the impact of introducing different active learning techniques to promote deep learning in an Undergraduate Computer Science course conducted in a Blended Learning environment. The impact was analyzed using a mixed-method approach with respect to the student's active involvement, engagement, and performance in the assessments. For quantitative analysis, data obtained in the form of assessment marks, statistics based on three-most important points covered in the lecture, students feedback based on Likert and three-point scale questions, and LMS logs were used. For qualitative analysis, students' perceptions and observation techniques were used. Based on the results, it shows that students have actively participated in all activities in both the online and the face-to-face environment, and they also had good perceptions about the techniques introduced. Students' learning process has improved after introducing active learning techniques. Also, introducing formative assessments for active learning has a significant effect on the final examination.**

***Index Terms*—active learning, blended learning, experiences in education, formative assessment, higher education, interactive e-learning**

I. Introduction

Higher Education (HE) in the 21st century is moving toward more learner-centered environments as opposed to traditional teacher-centered classroom environments. Technology also brings added benefits to this by providing tools which can be used to introduce creative and innovative ways of teaching and learning. In university education systems, students have exposure to a Blended Learning (BL) Environments through Learning Management Systems (LMSs) providing them with benefits to learn in both face-to-face (f2f) and online environments. Therefore, active learning can be introduced in both environments to actively engage students in learning while promoting deep learning.

In Sri Lanka, school education systems are directed more towards teacher-centered education. Students' main goal is to enter a state university by obtaining higher marks at the G.C.E Advanced Level (A/L) examination which is considered as the most competitive examination since only a limited number of students who obtain the highest marks in the nation get this opportunity. Therefore, students expect teachers to spoon-feed them the knowledge and then, they memorize the learning content which in turn leads to passive learners. Being used to this kind of a learning environment, students expect the same from the university. However, in the university, students are directed towards learner-centered education and at the beginning, students find it difficult to adjust to this setting. Therefore, the need to introduce active learning which promotes deep learning arises.

Considering the above, this paper highlights the different active learning techniques introduced to promote deep learning in a third-year undergraduate Computer Science course carried-out in a BL environment at the University of Colombo School of Computing (UCSC) in Sri Lanka. The impact of introducing different active learning techniques are analyzed with respect to their active involvement, engagement, and performance in the assessments.

This paper is structured into six sections. Section 2 gives a brief introduction to the background of the study. Section 3 presents the aim of the study and the research questions addressed. Section 4 explains the methodology by presenting the active learning techniques introduced into the learning process. Then, Section 5 presents the evaluation and the results obtained. Finally, in Section 6, the conclusion of the study is discussed.

II. Background

Students' attention is limited, and they cannot attend and learn effectively when they are passive for longer than 20 minutes [1]. Therefore, to restore students' attention, different techniques such as allowing a short rest of a 5 minutes break, changing the nature of demands being made on attention, and introducing new demands on attention can be used [1].

In view of the above, active learning which is a method of learning in which students are actively or experientially involved in the learning process is best

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suited [2]. Active learning engages students in two aspects such as doing things and thinking (again) about the things they are doing [2]. Furthermore, Active learning empowers learners, as it helps them develop more responsibility, participate in the construction of knowledge, and challenge mainstream thinking and opinions [3]. Ultimately, because of active learning students become deep learners which arise from their own need to engage in the task appropriately and meaningfully [4]. Thus, students' will try to use the most appropriate cognitive activities to handle the task as his/her intention is to understand and relate evidence to conclusions [5]. Active learning techniques may range from simple methods such as class discussions and question-and-answer to advanced methods such as case study analysis, role-playing, peer teaching, and flipped lessons [6]-[8]. When applying active learning techniques both individual and collaborative activities can be used [3]. Based on past research there are success stories of implementing active learning to enhance students learning in STEM (Science, Technology, Engineering, Mathematics) and in other disciplines [8], [9].

Active learning in lectures is important to engage the students in the learning process and facilitate a bidirectional flow of ideas and content between teacher and students during a lecture [10]. Also, based on past research there is evidence that active learning has often shown enhancement of student learning and performance [11], [12]. Since student-teacher interaction is carried-out only during the classroom session which is limited to 2 hours per week, it is beneficial to have a BL environment where students can be provided with the best features of both f2f learning and online learning [13]. BL can also be considered as an instructional approach that replaces traditional f2f education with a part of online learning [14]. For online learning, a variety of active learning techniques such as quizzes, synchronous and asynchronous online discussions, chat sessions, virtual seminars, interactive lectures, video materials, and additional materials as links can be used. Even though active learning has been introduced through LMSs, only a very few numbers of students are instructively motivated to go through the online content to do self-studies. On the one hand, students do not see the benefit of it and on the other hand, it can be stated that students are driven by assessments. Therefore, to promote active learning and to make students aware of the benefits that it brings along, active learning techniques can be introduced in the blended environment as formative assessments to promote self-reflection for students and to allow them to take control of their own learning [15].

III. Research Design

This study focusses on evaluating the impact of introducing active learning techniques in both f2f and online environments. Under this, students' active involvement, engagement, and performance in the assessments will be analyzed both in f2f and online environments. With the above aim, this paper addresses three research questions:

- Does active learning have a significant impact on students learning process?
- Does using formative assessments for active learning has a substantial effect on the final examination?
- Does active learning have a significant impact on improving students' engagement in the online environment?

IV. Methodology

As the context of the study, 3rd-year Undergraduate Computer Science students of the University of Colombo School of Computing (UCSC), Sri Lanka were selected. As for the course, Human-Computer Interaction (HCI) which consisted of 236 students in the academic year 2018 was selected. The course had 2 hours of f2f lectures every week and the total duration was 15 weeks. The graduate skills expected from these students are analytical skills, creativity, problem-solving skills, and critical-thinking skills. The goals for introducing different active learning techniques are presented in Table I.

TABLE I. Active Learning Techniques and Goals

Technique	Goal
Incomplete handouts	Active and attentiveness throughout the lecture
Finish with a test	
Tell-Show-Do-Apply principle	
Interactive presentations	Cope with many students, active engagement, and promote to ask questions
Syndicate group think-outside-the-box in-class assessment with immediate feedback	Promote creativity and innovation, and learn necessary practical skills through group work
Syndicate group online assessment with immediate feedback	Promote intrinsic motivation, and increase self-motivation and commitment to do self-studies
Ground rules	Eliminate the intentional free-riders in group works, and create a learning environment of inclusion and respect for all
Flipped classroom	Promote intrinsic motivation, and to make students become responsible, self-motivated, and independent learners

Accordingly, to keep students active and attentive throughout the lecture, incomplete handouts [1] which included gaps in them were introduced. In the beginning, students were informed that they will be given a test at the end. This was based on the "finish with a test" [1] approach and the reasons for introducing this method was to evaluate what students have learned during the lecture session and to keep students active and attentive throughout the lecture as they will be anticipating a forthcoming test [1].

Before introducing incomplete handouts, during the first 30 minutes of the lecture, theoretical concepts were taught. Then, the first incomplete handout with gaps was

given. This task consisted of 30 minutes and the "Tell", "Show", and "Do strategies of the "Tell→ Show→ Do→ Apply" principle [16] were followed.

Students completed the handout together with me which enabled to clarify doubts and to show how the theory can be applied to a given real-world scenario. Next 30 minutes, students were given the second incomplete handout based on another scenario and they had used "Do" and "Apply" strategies. This was done in the form of a test and after completion, students were asked to exchange it with their neighbor and mark based on the shown answers. This task took 15 minutes and students were given a chance to clarify their doubts and discuss possible alternative answers. During the last 15 minutes, to evaluate whether this technique helped to increase students' attention, they were asked to write down the 3 most important points [1] discussed during the lecture. Students' feedback about the lecture was also obtained as a 3-point scale question and an open-ended question. [1].

To cope with a large classroom of 236 students, while allowing students to clearly see the content and interact with the lecture, interactive presentations were introduced from 2nd week of lectures onward. For this, Zeetings [17], an interactive presentation tool was used. Students were informed to bring their own device and were asked to access the presentation by typing a link (http://www.zeetings.com/enosha). Using this tool, students could access the presentation without login into the tool and the presentation was synchronized as they were on the same page as mine. Every 20 minutes, to check whether students have paid attention to the lecture and to keep them active a Multiple-Choice Question (MCQ) question was given, and students were asked to answer using their own device by selecting a suitable option. As students kept on answering, the percentage for each choice increased. This helped to understand the points which were not clear to students and to clarify them. At the end of the session, to evaluate the effect of introducing interactive presentations into the classroom environment, student's satisfaction was obtained through a Likert scale question and a poll based on how well they understood the topic.

Since practical skills are highly important in the HCI course, a think-outside-the-box in-class formative assessment was introduced to promote creativity and innovation. This was also used to motivate students to learn through divergent assessments. The aims of the assessment were to promote students to learn necessary practical skills through hands-on experience through group work by learning new ideas, reflecting on their own ideas, voicing their opinion and by obtaining immediate feedback, and to make the assessment process enjoyable while promoting deep learning. This assessment was based on the concept of Design thinking, a methodology for the creative problem solving which is a framework for real-world projects. In this assessment, both the process and the final product was evaluated. Through this, students were given exposure to obtain hands-on-experience skills in working with a client and involving him/her in the design process to solve a real-world problem. These skills will also benefit those students who would like to be User Experience (UX) designers in the future since they get an opportunity to obtain the necessary practical skills to design rapid prototypes by applying the concepts of User-Centered Design (UCD), Co-Design, and Participatory Design. The theoretical concepts of the above were taught previously in a classroom session.

Before the commencement of the assessment, students were asked to form syndicate groups of 5 members and were also informed to bring a bag of stuff (plastic straws, styrofoam, sticky pads, papers, scissors, pens, pencils, markers, staplers, etc.) to the class. Students were given the "Design Thinking Activity" sheet which consisted of 9 steps. When completing this activity sheet, "Tell→Show→Do→Apply" principle [16] was used. As the real-world challenge, students were asked to redesign the gift-giving experience for a client, therefore, they were encouraged to think-outside-the-box. Finally, the developed product was presented to the class and peer groups provided feedback. As the teacher, I also gave feedback and assigned marks. Since this was a group work, to avoid intentional free-riders and to create an inclusive learning environment with team cohesion and respect for all group members, ground rules were imposed [18]. Therefore, at the beginning of the assessments, the ground rules document was distributed, and students were asked to go through it and follow them. After completion of the assessment, they were asked to write down the 3 most important points [1] covered in the assessment to check whether they understood the applied concepts. To evaluate the effect of the assessment, students' thoughts on the assessment were obtained as an open-ended question and the observation technique was applied while they were doing the assessment.

The above-mentioned active learning techniques such as incomplete handouts, interactive presentations, and syndicate group think-outside-the-box in-class formative assessments were done in the f2f classroom sessions.

In addition to that, to keep students engage in the learning process and to make them become deep learners of the subject, all learning materials were provided online to the students through the LMS which included interactive learning content with quizzes, videos, and forum discussions. As mentioned before, since students are driven by assessments, a syndicate group online formative assessment with immediate feedback was introduced as challenges starting from the end of the 1st week of lectures and continued up to the 16th week, giving them the chance to be active even after the f2f lecture sessions were over. This assessment was introduced to enhance students' practical skills needed to become an effective User Interface (UI) Designer. For doing this assessment, students were expected to learn a UI design tool by themselves. The reason for introducing this method was to provide intrinsic motivation for them to become self-motivated learners. This activity was implemented as a formative assessment to promote self-reflection for students and to allow them to take control of their own learning [15]. This online assessment

consisted of 5 UI challenges which students had to complete after forming syndicate groups of 5 members. In total, there were 47 groups. The instructions were given in the LMS and were also communicated at the beginning of the lecture. Transparency of the assessment was maintained by explicitly and clearly displaying the marking criteria in the LMS allowing students to know the important aspects that they need to consider. After designing the UI, students had to post it on the forum by taking a screen capture of the design and by giving their group number. In total, 5 design challenges such as a Sign-up page for a website or a mobile App, a Landing page, a Credit Card Checkout form or a page, a Music Player web page or an App, and a Direct messaging App were given. After one group posted their UI design, fellow groups were asked to give immediate constructive feedback on peers' design as timely and constructive feedback motivates students to learn more efficiently [19]. Finally, I also provided the feedback and marks out of 5 for each group. At the end of each challenge, marks were published in the LMS to motivate them. After completion of all 5 Challenges, to evaluate whether student groups were able to improve their UI designing skills as an effect of feedback, the marks obtained by all groups for 5 UI Challenges were collated and analyzed.

By taking the benefit of the BL environment, the flipped classroom technique was introduced on the 12th week to keep students active in both the online and the f2f environments. Also, another reason was to provide a differential learning experience to students and to make them become responsible, self-motivated, and independent learners who will take ownership and responsibility for their own learning. In flipped classroom learning, *"the conventional notion of classroom-based learning is inverted so that students are introduced to the learning material before class, with classroom time then being used to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers*" [20]. Thus, students were provided with the pre-reading materials such as learning materials, interactive learning content and quizzes, and videos in the online environment for self-study during a period of 1 week. In the f2f environment, for 90 minutes, scenario-based questions were given, and students had to answer. They were given the freedom to look at their notes and discuss with neighbors. Finally, in the last 30 minutes, answers to the scenarios were discussed. To evaluate the effect of the flipped classroom session, observation technique and student's perception in the form of Likert scale and open-ended questions were obtained.

V. Evaluation

To analyze the impact of introducing active learning techniques into the BL environment, a mixed-method approach was used.

A. Does Active Learning Have a Significant Impact on Students Learning Process?

As mentioned in the Methodology section, techniques such as incomplete handouts, finish with a test, interactive presentations, a syndicate group think-outside-the-box in-class formative assessment, and flipped classroom were used in the f2f classroom sessions.

To evaluate the impact of the incomplete handouts, 3 most important points discussed during the lecture, students' feedback about the lecture in the form of a 3-point scale question [1], marks of the second handout (finish with a test), and feedback as an open-ended question were obtained. For 3 most important points covered, 88% of students mentioned all 3 main points correctly whereas 9% absorbed 2 points while 3% understood only one point. Results based on the 3-point scale question on whether students would like to do future lectures using the same method, 100% agreed by saying "yes". Considering the second handout marks, all students were able to score more than 70 marks, and 88% got 100 marks. The open-ended question on students' thoughts about the lecture also received positive feedback and a few of them can be noted as follows:

- *"Today's lecture was very interactive. All students actively participated in the lecture. I think the way of conducting today lecture is successful."*
- *"Today's lecture is very interactive especially because of the interactive assignment. The lecture did not depend only on slides. The questions and justifications were really helpful to improve our knowledge and we were not distracted since we were doing something throughout the lecture anticipating a spot test"*

For the syndicate group think-outside-the-box in-class formative assessment, the highest mark obtained for the whole activity including the presentation marks was 100% whereas the lowest was 69%. The overall average was 89.9%. When assigning marks, 30 marks were assigned for the presentation which was divided as 20 for the prototype solution and 10 for the presentation skills. Also, a total of 70 marks was assigned for the steps of the design thinking activity sheet which amounted to a total mark of 100 for the whole assessment. When looking at the reasons for the lowest mark, this group has not completed the 7th and the 9th steps in the activity sheet. The 7th step was about discussing with the client and generating a solution and the 9th step was about sharing the developed prototype and getting client feedback. However, they had designed a very creative prototype and presented with a mapping story. Therefore, they have obtained full 30 marks for the prototype. Based on this, it showed that they had put much effort to design the final prototype rather than focusing on the steps. When reflecting on this incident, it is needed to empathize the importance of following these steps for rapid prototyping. Overall, all groups have developed very creative and innovative prototypes. Most of them had a story to back up their prototype and an example is shown below.

"Our client is a father of an 11 years old boy. He wanted to give his son a memorable birthday experience. Son is an admirer of Sherlock Holmes and more into science. Considering all those facts, the client agreed to give his son a treasure hunt kind of experience. So, on his birthday when he woke up there was a small present in

his room and a hint that would lead him to his swing where another small present with a hint is kept. Next hint leads him to the pond and there was a small gift with another hint in a small boat. That hint leads him again to his room where the actual present is kept. Actual present was a telescope which he had been asking for a while."

When answering the 3 most important points covered in the assessment, all groups were able to list down correct points as Co-Design/Participatory Design, User-Centered Design (UCD), and Rapid Prototyping. Students' thoughts about the assessment obtained as an open-ended question are listed below.

- "Was a good experience of working together on making a prototype rapidly. It helped us to develop logical thinking, creativity, designing skills, and group work. If we can do another session like this, it will be really nice. We have gained practical skills rather than theoretical stuff which we are learning in traditional sessions."
- "It is a very interactive and funny assignment, we really like this kind of assignments. Not only fun, we learned a lot of things than books."

Students presentations showed creativity and think-outside-the-box ability. Through observation, it was noted that all students contributed equally. Since this is an innovative assessment, they were free from the stress of a normal in-class assessment and they could unleash their creativity. Also, based on the feedback, students prefer these types of assessments and they had enjoyed it.

To evaluate the use of interactive presentations done using Zeetings tool, a Likert question was asked using the tool about their opinion on a lecture as shown in Fig. 1. Accordingly, 82% mentioned "Excellent" and 18% said "Good". Also, when asked whether they understood the lecture, 100% answered as "Yes".

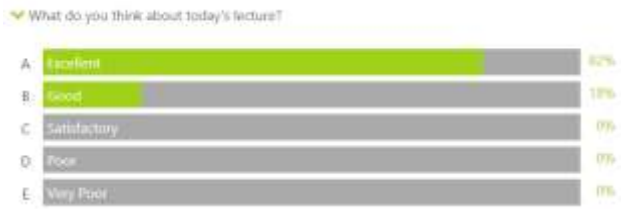

Figure 1. Students responses to "What do you think about today's lecture?".

As mentioned in the Methodology section, syndicate group online formative assessment with immediate feedback was introduced using the LMS in the online environment. To evaluate the effect of this, the overall average marks obtained for the 5 UI challenges (CH1-CH5) were analyzed as shown in Table II. For each challenge, marks were assigned out of 5 based on a rubric presented at the beginning of the formative assessment.

TABLE II. AVERAGE MARKS OBTAINED BY STUDENT GROUPS FOR 5 UI CHALLENGES

	CH 1	CH 2	CH 3	CH 4	CH 5
Overall average	3.73	3.94	4.13	4.56	4.87

As shown in Table II, on average all groups had successively improved their designing skills as the overall average marks of challenges have gradually risen. Overall, it can be stated that displaying marks at the end of each challenge, and the teacher and peer feedback have helped students to identify their mistakes and improve accordingly. When considering group wise marks, except 3 groups, all other groups were able to increase their marks successively or were able to keep their marks at a constant pace. When it comes to those 3 groups, their marks have improved from CH1 to CH2 and declined in the CH3 and increased from CH4 onward. When inquired about this, the reason was that the CH3 (a Credit Card Checkout form or a page) was simple and those groups had the impression that much creativity and effort was not needed. Almost all groups performed well in the CH5 and the reason was that it was to design a "Direct messaging App", which they were familiar with.

To evaluate the impact of introducing a flipped classroom, the observation technique and students' perceptions in the form of a questionnaire was obtained. Based on observation, students were capable of actively completing the given scenarios on their own. Some even had their own notes and they were referring to them while answering, which showed that they have studied the pre-reading materials given in the LMS. Since this is a new learning experience for them, to obtain their perception, a questionnaire was given at the end. Statistics of the students' feedback collected based on the Likert scale is presented in Table III. The Likert scale consisted of 5 ranges where 5 = Strongly Agree, 4 =Agree, 3 = Neutral, 2 = Disagree, and 1 = Strongly Disagree.

TABLE III. STATISTICS OF THE STUDENTS' FEEDBACK COLLECTED BASED ON THE LIKERT SCALE

	1	2	3	4	5
Pre-reading were available on the VLE before the Flipped Classroom	100%				
The classroom activities improved my understanding of the topic	92%	5%	3%		
The Flipped Classroom session inspired me to pursue further learning	92%	5%	3%		
More lectures should be conducted in the Flipped Classroom mode.	97%	2%	1%		
The lecturer engaged me in the activities and provided clarifications	96%	4%			

Most of the students either strongly agreed or agreed with the statements. Students have appreciated the pre-reading materials given in the LMS, and the support provided by me as the lecturer during the flipped classroom session. It also shows that classroom activities have helped them to improve their understanding of the topic as 97% agreed and only 3% remained neutral.

Also, 97% of students have been inspired to pursue further learning on the topic, and it shows that they have become self-motivated and independent learners. The majority (99%) would like to have more lectures in the flipped classroom mode. Some comments given by

students on their thoughts on the flipped classroom session are given below.

- "Overall, the interactive learning materials in the LMS made the classroom time less stressful. I could access them before the class and so I knew what direction the class discussion would go. So, I watched them several times to get familiar before coming to the class."
- "I watched the interactive materials and read the note 3 times. When watching interactive material in LMS, I could go back and watch them again. I also did the interactive quizzes and I got quick feedback and since they showed the success and failure times, I wanted to get all success, so I watched the materials several times before doing the quizzes."

It shows that most students preferred flipped classroom learning as opposed to traditional learning. Students have also studied beforehand knowing they will be evaluated in the classroom and this had motivated them to become responsible, self-motivated, and independent learners.

B. Does Using Formative Assessments for Active Learning has a Significant Effect on the Final Examination?

To analyze this, the Pearson Correlation Coefficient was calculated between the final mark of the Formative Assessments (FA) and the final face-to-face Summative examination (SA) as shown in Table IV.

TABLE IV. PEARSON CORRELATION COEFFICIENT BETWEEN THE FA FINAL MARK AND THE SA FINAL EXAMINATION

Correlation Coefficient	No of students
0.70	236

When calculating the final mark of the formative assessment, marks of the second incomplete handout, 5 UI challenges, and think-outside-the-box in-class formative assessment were considered. Based on the data, this indicates a positive correlation between FA and final SA. Also, the pass rate of the course was 95.68%. Considering both, it can be stated that introducing formative assessments for active learning has a significant effect on the final examination.

C. Does Active Learning have a Significant Impact on Improving Students' Engagement in the Online Environment?

To evaluate students' active participation and engagement in the online environment, log data available in the LMS was analyzed as shown in Fig. 2. The three actions create, view and update were taken into consideration when creating the interaction diagram. Labels "CH1" to "CH5" indicates the deadlines of the UI challenges where students were expected to post the screen capture to the forum. Therefore, there is a higher interaction frequency near the deadlines of the challenges. However, it also shows that students had actively engaged in the LMS throughout the duration of the semester and even after the end of the last challenge. It shows that at the beginning, students were not that active in the LMS and the interaction has gradually improved with the introduction of UI challenges.

Furthermore, as shown in Fig. 2, the interaction is slightly higher near the deadline of CH4 which is to design a Music Player. This could be because, as mentioned before, 3 groups had low marks in CH3 and they wanted to improve their marks by analyzing the peer feedback to reflect on their mistakes. Also, this was the same week (12^{th}) where online materials for the flipped classroom were introduced. The LMS access data on the pre-reading materials given for the flipped classroom shows that most of the students have viewed and attempted the video materials and interactive learning materials which also included interactive quizzes. For videos, the view count is 374 and for interactive learning materials, the access count is 543. It also showed that some students have downloaded the PDF learning material with a count of 207. Thus, this could be another reason for the spike near the 12^{th} and 13^{th} weeks as the f2f flipped classroom session was held on the 13^{th} week.

Furthermore, the total number of peer feedback provided as postings on 47 groups for each challenge were also analyzed as shown in Fig. 3. In the beginning, the number of feedback provided was less. Since students were not familiar with this type of interaction, the importance of providing peer feedback was explained. After that, the number of postings had gradually arisen and then, were able to maintain at a constant pace as shown in Fig. 3. This could be due to students realizing the importance of feedback to improve their UI designs.

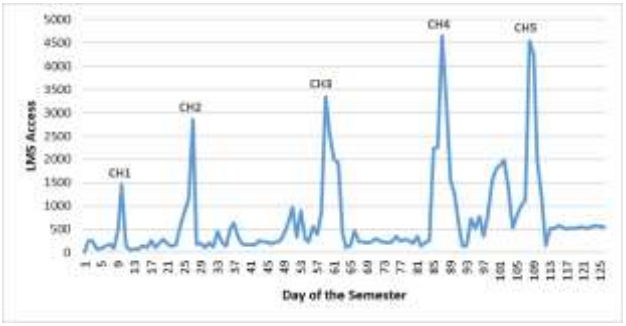

Figure 2. LMS access data for the whole semester.

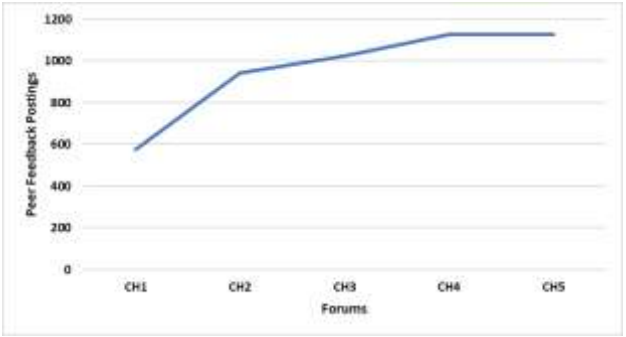

Figure 3. No. of peer feedback posted for each challenge.

Considering both Fig. 2, Fig. 3, and the access count on the pre-reading materials provided for the flipped classroom session, it can be stated that introducing active

learning has significantly improved students' engagement and interaction in the online environment.

VI. Conclusion

The aim of this study was to evaluate the impact of introducing active learning techniques in BL environments. Therefore, different learning and assessment activities were introduced to keep students active, attentive, and engage throughout the f2f lecture and in the online environment without the presence of the lecturer. To analyze the impact of introducing these techniques, students' active involvement, engagement, and performance in the assessments were analyzed. Based on statistics and student's perception, it shows that students had benefited through these activities and, they had a good perception of their learning experience. Activities such as syndicate group online assessment and flipped classroom have helped students to become self-motived and independent learners who take ownership of their learning which leads to deep learning, a reason for introducing active learning into the BL environment. Immediate constructive feedback also played a major role to improve students' performance. This was further proved with the engagement and interaction in the LMS. Syndicate group think-outside-the-box in-class assessments gave an opportunity for students to unleash their creativity. They also learned to apply theory to practice through role-playing. A correlation of 0.70 shows that introducing active learning as formative assessments had a significant impact on the final summative examination. This further proved with a high pass rate of 95.68%. Overall, it can be stated that introducing active learning in the BL environment has a significant effect on the students' learning process. From the teachers' part designing innovative active learning activities takes time. However, since these activities motivate students to be active, motivated, independent, self-directed, and deep learners, more of these activities need to be introduced in the future.

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