**Student’s perception with embedded online activities during lecture time in an engineering course and impact on attendance**

**Abstract**

Non-attendance of lectures is a growing trend at universities worldwide. The determinants of university students’ attendance and its impact on academic performance are of interest to university teachers and management. Ongoing research about the reasons for students’ absenteeism at university lectures suggests that incorporating active learning tasks in class can increase the likelihood of attendance. Increasingly, students use their own portable devices in the classroom, often for non-academic purposes which distract and may result in lower academic performance. There are many recommendations on how to design effective instructional materials around the positive use of digital devices in class to foster engagement and attendance. However, there is not much research on the quality of engagement through digital device use and its impact on class attendance. This study addresses this gap by investigating the impact of online activities embedded in the lecture design to engage students during class time with the overall goal to improve students' attendance at engineering lectures. Both qualitative and quantitative data from student focus group discussions and Canvas learning analytics, respectively, were collected. Our findings indicate that the use of digital devices to complete online activities during class time can result in cognitive overload for students and degrade the quality of engagement. While the study did find weak correlation among embedded activities and lecture attendance, it also highlighted the importance of active learning in the classroom by fostering student-student and student-teacher connections contributing to an overall positive learning experience through timely feedback and engagement with the lecture content.

**Key words:** improving classroom teaching; student learning; active learning; student engagement; lecture attendance; technology enhanced learning

# Introduction

Universities are getting ready to embrace a new class of students who are born and raised in the twenty-first century which has seen a tremendous growth in communications and information technology (ICT). As a result, digital gadgets and technologies have become indispensable components of student’s lives which have also significantly changed the way they are educated. Consequently, traditional methods of university teaching need to be adapted to include ICT enhanced learning and course design (Breen, 2018; Fuh & Paul, 2015; Stîngu & Iftimescu, 2016). Wilson (2004) accentuated that traditional methods of instruction will no longer be good enough in a society that has undergone “a paradigm shift from emphasizing teaching to emphasizing learning” (p.119). Students are no longer fascinated by the transmission mode of teaching and prefer active classroom environments that are engaging and leverage ICT (Buskist, Busler, & Kirby, 2018; Crook, Harrison, Farrington-Flint, Tomás, & Underwood, 2010; Ellis, 2018). Therefore, in today’s higher education, the traditional lecture method is considered a relatively ineffective instructional approach, particularly for maintaining student attention which tends to decline after approximately ten minutes (Fuh & Paul, 2015). In addition, short attention spans are characteristic of the current student generation, also termed as the restless generation (Honore & Schofield, 2010; Kandlbinder, 2010). This implies university teachers need to increasingly deviate from traditional ways of lecturing to provide today’s students with suitable learning environments to improve their learning (Law, Lee, & Yu, 2010). Despite this paradigm shift described by Wilson some years ago (2004, p. 119) many lecturers fail to engage students as they take little account of contemporary thinking of student-centred learning strategies as claimed by Tormey and Henchy (2008). This notion is backed up by a large survey of British university students where over half found at least 50% of their lectures boring and a third most or all of them boring (Mann & Robinson, 2009). Similarly, a US survey of freshman across 500 colleges and universities found that 40% of the students stated that they are frequently bored in class(Pryor, Hurtado, DeAngelo, Blake, & Tran, 2010).

Irrespective of the various reasons for students’ non-attendance, including boredom, students’ attitudes, teaching styles, changing lifestyle and technology (Fryer, Ginns, Howarth, Anderson, & Ozono, 2018), many educators do not consider it a desired academic behaviour. Previously, Romer (1993) identified the positive relationship between lecture attendance and academic performance. Two decades later, Alija (2013) confirmed that students who regularly attend classes have a higher chance to get a passing grade which is in accordance with more recent studies (Alija, 2013; Bijsmans & Schakel, 2018; Credé, Roch, & Kieszczynka, 2010; Dey, 2018; Kassarnig, Bjerre-Nielsen, Mones, Lehmann, & Lassen, 2017; Osondu, 2018). Thus, a clear link exists between lecture attendance and academic performance, an issue that universities worldwide are grappling with as it can have broader implications affecting an institution’s reputation, a country’s economy and society at large. Improved lecture attendance is one of the major goals of all tertiary lecturers. In today's tertiary climate, students are encouraged to view their lectures online (asynchronously), but actively participate in tutorials and laboratory events by class attendance.

A more pertinent question remains as to how lecture attendance can be improved by engaging students in class through authentic learning tasks with relevance to emergent engineers to counter boredom during the lecture. This study will address this question by utilising students’ affinity to devices to the teacher’s advantage, in other words embedded in-class (synchronous) activities are designed to complement asynchronous online tasks to provide an active learning environment. For students to be engaged, class room presence is important irrespective of the learning environment, either face to face or online (Trowler & Trowler, 2010). A myriad of learning activities have been suggested to keep students engaged in class, ranging from small-group activities (Freeman et al. (2014) to clickers suitable for large classes as a response system to increase student engagement (Deslauriers, Schelew, & Wieman, 2011), and activities that require reflection on ideas while doing and feedback from teachers or peers (Fayombo, 2012).

The use of technology in the classroom to increase engagement and therefore the probability of attendance has benefits, as described above, but also some disadvantages. Handheld digital devices such as smartphones and tablets play a significant role in everyday lives of students, the non-academic use of such devices during teaching sessions can be a risk for distraction and disengagement (Colb, 2006; Murray, 2011). Distractive multi-tasking behaviours have been shown to lead to lower engagement and performance (Junco & Cotten, 2011; Kornhauser, Paul, & Siedlecki, 2016; Rosen, Carrier, & Cheever, 2013). However, it is nearly impossible as a teacher to shun personal mobile technology from the classrooms. Instead, the otherwise negative behaviour of students playing with their phones in class can be transformed into a positive learning experience by making use of these devices for pedagogical purposes, for example, communication and peer collaboration (Bowen & Pistilli, 2012) and peer support for exam preparation (López, Cerezo, Menéndez, & Ballesteros, 2015).

The current study re-designed an engineering module that is taught face to face in a lecture theatre by including online learning activities that students could perform while attending the lecture. The activities are asynchronous in nature because students can complete those in class at any time when not interacting directly with the teacher. The idea is that when students are craving for the use of a digital device, they remain connected to the lecture content through online activities instead of being distracted by non-academic personal activity, for example, checking emails, social networking, gaming etc. The overall objective is to bring students to the lecture and retain them there by incorporating the use of personal digital devices into meaningful academic tasks. In particular this study seeks to explore students' perception with embedded online activities during lecture time in focus groups and compare those to system log data from the learning management system to evaluate students' online engagement.

This research answers the following questions:

* Can introduction of asynchronous activities improve student’s engagements and learning?
* Can online activities enhance student’s attendance?

# Study design and methods

The study was conducted in the first semester (fifth overall) of the academic year of a third year “Digital System Design” course towards a bachelor degree in Computer Systems Engineering with approval from the local university ethics committee (reference 018848). There was no obligation to participate in the research as part of the course work; it was completely voluntary. The class comprised seventy five undergraduate students (80% male); the average age was 21 years. Qualitative data were collected through three focus group discussions with students (N=25) complemented by quantitative data such as lecture attendance and engagement data logs (N=75 students) from the learning management system Canvas (Instructure). The data collected included the number of times the student viewed the activities, engagement with activities and the number of activities complete. The activities were conducted for three years between 2017 and 2019. Activities were run during the year 2017 and 2019. During 2018, six activities were allocated marks and 5 of the activities allocated no marks. It was done deliberately so that we could find out the response of the students if no marks were allocated. The attendance record and activity engagement data was collected for all three years.

Table 1: Class demography

|  |  |  |  |
| --- | --- | --- | --- |
| Year | # of Students | Male | Female |
| 2017 | 75 | 60 | 15 |
| 2018 | 60 | 51 | 9 |
| 2019 | 82 | 74 | 8 |

## *Student focus groups*

Three focus group discussions lasting approximately 45 minutes comprised 7 to 10 students each. Each group comprises both types of students: one who have been regularly attending the lecture and, others who not been attending the lectures regularly. They were conducted by a female teaching assistant to avoid any conflict of interest as the teacher (first author) is also the principal investigator. The group discussions were conducted in English, being the medium of instruction of the course, during week 10 at which point students gained an understanding of the impact that embedded in-class activities can have on their studies and attendance. A semi-structured format was followed exploring student’s reasons for attendance and non-attendance, the main benefits of lecture attendance from the student perspective, and the kind of tasks and modes of engagement during lectures that were considered helpful for their learning.

The facilitator’s role was confined to asking standardised introductory questions and keeping the discussions on topic according to predetermined discussion prompts. Audio recordings were transcribed verbatim into written text and coded in NVivo (version 11) qualitative data analysis software. After initial identification of transcript passages that relate to factors influencing supplementary learning activity use, an inductive approach was used to analyse the data (Gale, Heath, Cameron, Rashid, & Redwood, 2013). This was followed by thematic coding, during which similar conceptual categories were merged in order to create larger, overarching concepts as described by (Saldaña, 2015).

## *Learning activities*

The embedded in-class activities were developed using Xorro-Q integrated into Canvas. XorroQ is a real-time audience response system designed to make lectures more interactive and engaging. The activities were conducted during week 5 to 10 of semester 1 and designed in keeping with Keller’s ARCS (attention, relevance, confidence, and satisfiability) model (1987) to enhance student engagement. In line with Keller’s suggestions to synchronize learning tasks with the lecture slides for optimal engagement, a total of nine online quizzes plus two writing exercises were administered, one activity per lecture. Quizzes were designed to give students feedback on their comprehension (multiple choice) and retention of facts from the lecture as well as having to apply learnt knowledge to solve a problem, for example, requiring students to research the internet to answer a question. The activities were conducted in an unstructured and uncontrolled environment for students to perform the tasks. Activities were available a few hours prior to the lecture until midnight that day so not to disadvantage any student who did not attend. However, for learning activities that took place during class time, students were instructed to launch the activity, read the question, listen to the teacher, wait for the part of the lecture where the related topic was discussed and then answer the question. Feedback to students on their responses was provided during the lecture without allocating a specific time for discussions. It was not compulsory for students to complete the activities, however, participation carried a low percentage of marks (3% of total mark) as a reward for year 2017 and 2019. No marks were allocated (except writing activities) during the year 2018. It should be remembered that this course is offered only once a year.

*Engagement measures*

Student attendance was collected via paper-based attendance during all 6 weeks and recorded in an Excel spreadsheet. Canvas data about students’ online activities was collected from the university’s learning management system Canvas and exported into an Excel spreadsheet for each student for the six week period of embedded online activities during lectures. The proxy for online engagement in this study was counting the number of online activities completed and submitted (nine quizzes and two writing exercises) i.e., time invested in learning and subsequent success. It should be noted that students were allowed to complete the activity by midnight on the day of lecture. The data for the activity completion rate was downloaded very next day.

# Results

Data were gathered using qualitative and quantitative methods to provide an in-depth picture of the impact of embedded in-class online activities on students’ attendance and perceptions about their usefulness. Student’s interaction with embedded online activities is automatically recorded by the learning management system Canvas and students did not have to do anything else above completing the tasks online. The findings from the quantitative data on students’ online behaviour in relation to attendance are detailed below, followed by a summary of the main issues pertaining to in-class embedded activities that emerged from the focus group discussions after coding the written transcripts into overarching themes.

## *Online engagement and lecture attendance*

Figure 1a­ details the eleven activities and the number of students who completed those in comparison to lecture attendance data over the six week period of the course. It indicates that students were engaged online; on average 82% completed the activities. Canvas log data showed that each student logged in about 28 times in order to complete the eleven activities. Interestingly, online engagement with the learning tasks was higher by about 10% than the actual recorded (head count) lecture attendance. A slight decline in participation, both online and lecture attendance, can be observed over time which can be attributed to students meeting deadlines for assignments towards the end of semester (average lecture attendance was at 72% dropping to as low as 57%). However, online activity regularly exceeded lecture attendance indicative of students who did not attend engaging in tasks asynchronously. As these activities did not carry any significant weighting towards the final mark, some students may view them as unnecessary (about 18% did not complete any tasks).



**Figure 1a: Student engagement and attendance for 2019**



**Figure 1b: Student engagement and attendance for 2018**



**Figure 1c: Student engagement and attendance for 2019**

The same experiment was repeated for 2018 and 2019 semesters with only difference that some

of the activities during 2018 did not carry any marks. The attendance rate and activity completion rate is shown in the Figure 1b and Figure 1c. The attendance rate for consecutive three year was 73%, 58%, and 64%, respectively. Similarly, activity completion rate was 85%, 47%, and 82%, respectively. It can be seen that the lecture attendance decreased slightly when activities did not carry any marks and same is the case with the activity completion rate. It should be noted the year 2017 had more writing activities which students are required to complete in the class. The attendance on the days of the activities was quite high (more than 90%).The attendance rate was higher in 2017 as compared to 2019 that can attributed to the fact that the 2017 has more writing exercises compared to the 2019. Higher completion of online activity compared to the lecture attendance implies that engagement of students does not depend on the student attendance and activity completion rate of around 50% in 2018 is the indication that grades are not the only reason for completing online activities and students do it because they want to learn.



**Figure 2: Student engagement and attendance comparison**

During 2019, we explored the effect of these activities on student learning. The content of activities were incorporated in different assessments which include two interview assessments conducted for evaluating students’ performance in the mini-project and the final exam. As shown in the Figure 3, with few exception, students’ performance in the assessment is proportional to the performance in the activities. It should also be noted that these activities were reopened close to the assessment on students’ request but data is not incorporated here. It can be seen that in some cases students with poor performance in activities performed better in the assessment might have completed the activities but not graded as they were completed after due date had passed. In other words, students who engaged with the activities demonstrated better retention of knowledge and scored higher in assessments. This shows that online activities have positive effect on student learning.



**Figure 3: Effect of activities on student learning**

## ***Usefulness of online activities: The student perception***

The analysis of focus group data revealed several benefits but also concerns relating to the usefulness of embedded in-class activities and students’ reasons for attendance or non-attendance of lectures. The three main themes revealed through thematic analysis of written transcripts can be summarised into theme 1. positive reinforcement of good study behaviour, theme 2. multitasking in class leads to cognitive overload for students, and theme 3. a need for detailed and meaningful feedback on activities conducted during the lecture. Although the different groups discussed different ideas and experiences, all three themes were represented, suggesting a strong convergence of data.

***Theme 1: Positive reinforcement of good study behaviour***

Overall, students felt they were engaged by the activities and some mentioned that they eagerly awaited the release to get started with them before going to the lecture and/or afterwards.

*“Most of the students will look at the quiz before the lecture”.*

*“It is pretty good because it gives you the opportunity to do it ("NVivo qualitative data analysis Software, Version 11. ,") second time as well”.*

Furthermore, students remarked on the positive use of their personal devices contributing to their learning instead of being tempted to use it for social networking, surfing the internet, watching videos, playing games etc. The most frequent positive comments were related to the task “find answers” as reported by one participants:

*“Most of the time I will start googling it”.*

Many agreed that the task “find the answer” helped to familiarize with the content of the lecture and provided instant feedback about their own knowledge and potential gaps:

*“The questions were good and if you answer the questions, you know that you understand the contents of the lecture and in that way it was good”.*

In terms of attendance, students’ responses signalled that if there were no incentives (low percentage of final mark) to complete the online activities attendance would drop. Some students thought that online activity indirectly “forced” them to attend. In contrast, others commented that they attended all the lectures because they did not want to miss the content, irrespective of whether interactive tasks are provided in class or not. However, the purpose of the online activities appears to be understood by students as a way of checking on their classroom presence, as one student poignantly said:

*“It seems that online activity aimed at getting a roll call. The question he (teacher) can ask is: are you present in the class? Yes or no. It is an indirect way”.*

Students also commented on the quality of engagement which matters to them, rather than the quantity. For example, students did not appreciate the mere engagement through online activities instead they liked to pay full attention to the task with clear learning outcomes as illustrated by the comments below:

*“I think he should allocate some time for the quiz and then carry on”.*

*“Some of them we submit the opinion based answers like the long answers and some of them are correctly defined answers and lot of times we don’t get the answers when we do, it seems that (lecturer) is expecting different answers obviously”.*

## *Theme 2: Multitasking and cognitive overload*

Asynchronous online activities allowed students to complete the tasks at their own pace and whenever they choose to do it either during or after lecture time. However, some students did not like to complete those asynchronously because being part of the in-class experience was something they valued as shown by the following comment:

*“Online activities are distractive giving time inside the class to do it will not be helpful.”*

Students commonly commented on the problem of having to multitask in class, i.e. having to engage with the interactive tasks while listening to the teacher and possibly other students’ discussion comments leading to cognitive overload as is evident from the following student quotes:

*“Would you focus on the quiz or listen to the lecturer. Is it ok to switch between quiz and listen to lecturer? I think he (lecturer) needs to give you a specific time to do (Alija) quiz”.*

*“I always get distracted by the discussion that what he (lecturer) is saying and my eyes are always are on the part and I should read this question”.*

Another student compares his problem of having to listen and doing things in class at the same time to that of an FPGA, a device used for digital system design and well known for its ability to perform parallel computations:

*“I am afraid I am not a FPGA“.*

Multitasking means that the task is being interrupted and picked up a number of times before it can be completed resulting in a delayed and degraded product. Although students were fully engaged in the activities they felt overwhelmed at times and lost track of the lecture as stated by one student:

*“Everyone is trying to get the answer right, finish the MCQ and paying attention to Xorro-Q and do something…..It is supposed to help you with the lecture not taking you away from the lecture.”*

It also became clear during the focus group discussions that students would prefer time to finish a task in one go instead of having to break it up into chunks throughout the lecture:

*“You are doing it in one go in 15 minutes and googling stuff and your focus is on the question and not on what (Trowler & Trowler) lecturer is saying because you wanted to get it done and then it will distract you”.*

## *Theme 3: Need for in-class feedback*

The basic motivation behind the introduction of the online activities was to increase student engagement during class time and raise lecture attendance due to its linkages with improved academic performance as well as fostering the academic use of personal devices in class. However, another dimension, timely feedback on learning, emerged out of the focus group discussion with students.

*“…sometimes when it is new contents, the teacher is just explaining the concept, you want to know that your thoughts are on the concept leading towards the right direction but if it is short questions then you know you are right.”*

Although at the end of each activity students were provided with feedback in terms of scores it seems that it was not sufficient as one student expressed:

*“Some form of feedback is better than nothing because we do not discuss it”.*

In fact, students expected more meaningful and explanatory feedback, for example, in the form of a discussion instead of correctness or incorrectness of a question as illustrated by the following quote:

*“Question should be so that class needs to do it in two minutes and then they submit the answer on the Xorro-Q so that he can discuss it and keeps them engaged... He can then give the answers and it can become more interactive”.*

Students not only value the feedback from the lecturer but also from their peers. The following student comment highlights also the social element of learning which may be a factor for some to attend the lecture on a regular basis:

*“The quizzes or some questions should be in groups so that you could discuss it with people so that there is more interaction and you are more inclined to go because people are with you in a way. I think group collaboration is something which people like“.*

It became apparent that feedback in any form is very much appreciated. Interestingly, students prefer feedback on more complex questions only after they had a chance of applying their knowledge first. In that instance, feedback is sought as an affirmation of their learning, for example:

*“Give us few minutes to try and then give the solution. If I have the solution available for the reference that will be really helpful.”*

# Discussion

This paper demonstrates that the use of embedded online activities can enhance student engagement in class. It also reinforces good study behaviour by occupying students’ own personal digital devices for academic tasks to divert undesirable activities such as social networking, gaming etc. during class time. The quantitative analysis revealed that students’ average attendance was higher when the activities bear some reward (even if it quite minimal) but we cannot find qualitative relationship between embedded activities (not carrying an marks) and the link between increased lecture attendances through active learning as initially postulated, some other interesting results emerged from this study with respect to students’ need for instant feedback and the risk of cognitive overload when implementing online tasks for students to complete during lecturing.

Regarding the improvement of attendance, as these online activities did not carry any substantial marks (3% of total) some may be more likely to view those as unnecessary and place a low priority on completing them (Friedman, Rodriguez, & McComb, 2001), particularly when online activities can be submitted outside the class time. The main reasons behind attending the lectures cited by students were not just in-class activities. There was a divide as some students thought that it did improve attendance whereas others did not agree with that statement. However, overall there was increased attendance compared to the previous year but it remains anecdotal until more data are available. Other factors may have played a role, e.g. an increased number of students enrolling for the course compared to other years, lecture room location, timing, and differences in incoming GPA. In summary, the link between attendance and in-class activities cannot be made with the limited data available from one cohort.

A majority of students participated and completed the activities (82%). This engaged them in the lectures and also prompted the use of digital devices for academic purposes. It has been shown previously, that students’ disengagement can easily lead to distraction and digital device use for non-academic purposes (Colb, 2006; Murray, 2011). Embedded online activities introduced during class-time to create ‘pauses’ (Fayombo, 2012) not only diverts undesirable online behaviour but at the same time provide students with opportunities to clarify and consolidate their knowledge to affirm positive learning behaviour.

Students’ desire to not only receive immediate feedback about the right or wrong of answers but more detailed explanations as to why, was frequently emphasized in focus group discussion. For example, the word “discussion” was mentioned numerous times, placing importance on receiving detailed feedback to clarify the complex concepts and ambiguities of electrical engineering. This is in agreement with Nicol (2010) that effective feedback relies on a two-way communicative process. In other words, students receive feedback and reflect upon it by posing the questions. This has implications for the design of online activities to be used in the classroom. Design elements, therefore, need to include collaborative opportunities for students to engage in as opposed to feedback provision as a single event lacking depth and detail. In concordance with Liu and Carless’ (2006) findings, our study showed that feedback to students was equally valued from the lecturer as well as peers.

Many students are eager to complete the activities before the start of the lecture which indicate that students seem to hint at the value of doing initial thinking and independent learning prior to the class, rather during or after the class. Flipped classroom is an instructional strategy and a type of blended learning which is used to deliver instruction contents online but outside of the classroom. This suggest that asynchronous online activities can be used to promote flipped learning and use the classroom time then to deepen understanding through discussion with peers and problem-solving activities facilitated by teachers.

One of the criticisms that emerged from the focus meetings was that the online activities carried out in parallel with the lecture gave rise to multitasking where students felt cognitively overloaded. One could argue that both tasks, listening to the lecturer and completing online activities, are related as they share the same content. However, if the tasks are not synchronized they could become unrelated (as they are temporally not aligned) leading to a cognitive bottleneck, especially in situations where more complex tasks are involved. Here, the problem occurred because the resources were allocated to two cognitive events (listening to the lecture and reading the activity) as well as a task that requires motoric skills, i.e. engaging with the digital device and finding the right option to click on. This has previously been described and explained through cognitive load theory (Sweller, Van Merrienboer, & Paas, 1998). In brief, Sweller et al (1998) proposed that cognitive overload is typically high when learning something new due to a lack of prior knowledge and the absence of a schema to process this new information. Our findings concur with this notion that due to the uncontrolled and unsynchronized nature of the activities presented in class, they became irrelevant to schema acquisition and acted as an extraneous load impairing learning. Clear instructional design is therefore necessary when online tasks are to be embedded into a lecture. Specifically, one needs to allow time for students to complete the tasks without interference, i.e. having to pay attention to the lecture in parallel.

Overall, we can draw from students’ comments that embedded online tasks were an effective way of engagement and helped to familiarize with the lecture content. Furthermore, the activities provided an instant check on students’ understanding, especially for those who not confident enough to ask questions in front of their peers for affirmation of their own understanding. Online activities can be empowering for students towards becoming self-regulated learners and assists in meaning making as previously noted (Pintrich & Zusho, 2002).

One issue remains, namely students’ perception of the activities not being interactive at all. To increase student-student and teacher-student interactions utilising online tasks, more time would need to be allocated for this in class by, for example, discussing the results and providing feedback. One caveat is that engineering lectures are often content heavy. Therefore, time for interactions during lectures needs to be finely balanced against the need of covering disciplinary content as Bonwell (1991) found. For online learning to be successful and avoiding cognitive overload, the role of the teacher, or e-moderator (Salmon, 2013), is crucial to guide students through a structured and developmental process of learning. The integration of e-tivities from Salmon’s (2013) five-stage model can provide a framework for blended classrooms to pace students through all five or selected stages of learning which inlcude: (1) access and motivation, (2) online socialization, (3) information exchange, (4) knowledge construction, and (5) development.

Students also highlighted the need for more examples during the lecture as well as practice questions as homework, similar to what they experienced at high school. This shows that students have not yet become independent learners and are still transitioning to university study. Walbeek (2004) reasoned that this behaviour may be the result of pampering students in their initial years at university. However, well-designed online activities with clear instructions and intended learning outcomes supplementing the lecture can counteract this ‘spoon-feeding’ type of learning behaviour.

**Limitations**

One limitation of the current research is that it only takes into account one specific course with around 75 students over three years. Another study of replication of the current research in different courses and a different student population may help to get a more general statement about the effect of online activities on student’s attendance. Adding an assessment weighting to participation in online activities brings with it an external motivation which may cloud the evaluation of intervention. We did try nullify it by running activities for one year without any weighting to participation. Also, all participants in this research came from various cultural and educational backgrounds that may impact on our findings. For example, international students whose primary language is not English are often reluctant to express their views in front of their peers. This threat was addressed by taking special care during the formation of the focus groups to have an even representation of the various values. Also, during the discussions care was taken to let students express their honest opinions without being dominated by students who would impose their ideas on others.

**Conclusions**

Increasing attendance due to its positive relationship with academic performance is an important goal for most tertiary education providers worldwide, and particularly essential at undergraduate level for retention purposes. While the study did not find any significant relationship between online activities and attendance, it did yield insights into the importance of classroom presence and feedback for students to succeed in their learning. Students’ decision to attend class is likely affected by a myriad of other factors which require further investigation. Our research suggests that embedded online activities can improve students’ motivation of engaging with the lecture content, irrespective of attendance. Moreover, embedded online tasks can help deviate the undesired behaviour of students “playing” with their portable devices in class for non-academic purposes. Besides the proposed goal of increasing attendance, the study highlighted that embedded online tasks can be a pathway for teachers to connect with their students and in turn increase their engagement. In summary, for embedded activities to be effective in the classroom without leading to students becoming cognitively overloaded, a well-thought out learning design with respect to pedagogical intent as well as temporal alignment with the lecture content needs to be implemented

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