Engineering Students' Engagement and Their Perspective on Compulsory Classroom Attendance

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***Abstract*—The link between class attendance, student engagement, and student success is controversial in Higher Education. Some universities monitor student attendance in the classroom. The difference between monitoring or recording attendance and enforcing a compulsory attendance policy should be clarified. This paper aims to explore engineering students' experience of applying attendance monitoring and enforcing a mandatory attendance policy. The relation between increasing the attendance rate and student engagement is also investigated. The primary research questions are: what are student perspectives on compulsory attendance monitoring? and why do senior engineering students attend classes? A pilot case study investigates senior undergraduate engineering student experience before and after the attendance monitoring system was performed. A survey was used to determine the view of students on how the compulsory attendance system influences their motivation and engagement in the classroom and what motivated them to attend before the compulsory policy became in effect. The findings can enrich higher education teaching and learning authorities with thoughts on future strategic policies and strategic research in the digital transformation era.**

Keywords—Attendance Monitoring System, compulsory attendance policy, student engagement, engineering education, student's motivational beliefs

I. Introduction

Many in the educational process would debate the importance of student attendance to their learning. Educators in higher education have different views about compulsory attendance. While one group agrees with imposing mandatory attendance [1], the other group insists that university attendance should be made non-compulsory [2]. Students' absences may or may not lead them to fail their degrees. If they progress without attendance, their institution's reputation must be questioned. If their absence leads to their failure, the program or the degree might be at risk of being nonattractive, eventually affecting the program or institution's sustainability [3]. The difference between monitoring or recording the attendance and enforcing a compulsory attendance policy should be clarified.

At the University of Nottingham Ningbo China, an electronic Attendance Monitoring System (AMS) has recently been implemented, and a compulsory attendance policy has become in effect. The policy was initially drafted to manage students' attendance of modules delivered by another school rather than the home school where the student belongs. The system helps students register their attendance, and the faculty and admin staff monitor the record. One advantage of having a plan for recording attendance is to help both academics and admin staff to collect data on students enrolled in a module or a program. This can be useful for making statistics to discover areas of improvement, visualizing the progress of a module or a program over time, or comparing different modules or programs. Another advantage is having a platform and an efficient mechanism that helps the educators and admin staff collect the attendance data. It would sometimes be challenging for the educator to collect the data manually, primarily as the number of students attending the module or program increases [4]. A third significant advantage is that a poor attendance rate may indicate students are at academic risk. Therefore, when monitoring their attendance, academic support and pastoral care could be offered in the early stages before it's too late for them to progress [5].

However, having an efficient system for collecting and recording attendance information doesn't necessarily mean enforcing a compulsory attendance policy equally for all programs and years of study, as attendance isn't the only factor indicating academic achievement [6]. Implementing a compulsory attendance policy certainly increases the attendance rate, but it doesn't justify academic achievement. Moreover, there's not much research investigating if compulsory attendance can improve student engagement in the classroom.

This paper presents a pilot study investigating why engineering students engage with a final year optional module. The study was motivated by the very high attendance rate and student engagement in the module before the compulsory attendance policy was applied. The study also presents students' views towards the attendance monitoring system and compulsory policy one semester later and its impact on their motivation and creative thinking. There are other reasons why students prefer to attend classes rather than compulsory attendance. The paper is structured as follows: Section II gives a brief review of the literature on attendance, performance, and student engagement in higher education. Section III overviews the attendance monitoring system at the University of Nottingham Ningbo China. Section IV presents the approach applied in the taught module used in this pilot study. Section V explains the methodology, Section VI presents the student survey and results, and section VII concludes.

II. Literature Review

Students' attendance and academic performance have been the subject of debate in higher education. Several studies have found some correlation between classroom attendance and academic achievement. Using quantitative analysis, a case study examined the tutorial program for first-year economics students at Stellenbosch University [7]. The study confirms that a tutorial program can improve the performance of first-year economics students, and peer teaching should therefore receive more attention as part of academic support initiatives for first-year students. The use and benefits of tutorials in a

large enrolment first-year economics course were examined in [8]. The study revealed that many students attended the first tutorial of the semester. Most attended at least three tutorials, while fewer than half participated in all five. One tutorial did not improve performance on the final exam or the course as a whole, but multiple tutorials had a cumulative effect on the exam and course performance. Attending teaching sessions provides more than just a better grade. Within the context of employability, internationalization, and the move towards research-rich learning, session attendance is an integral component of a student's overall learning experience, with the development of skills and acquisition of knowledge that may not be directly assessed [9]. Without attendance, students may pass exams and coursework assignments, but their educational experience would be incomplete and calls for additional research on the broader advantages of attendance. In addition, students may miss out on peer support and require extra staff time [10].

Despite the widespread belief that there is a positive correlation between class attendance and academic performance, other studies have found this correlation is weak. The difference between the whole class and average attendance has led to a margin of one to three points in test scores. Therefore, compulsory attendance has a weak impact on performance [11, 12]. Similar findings resulted from studies made on engineering students [13-15]. A theoretically and practically relevant survey evaluated the relationship between teaching session attendance in higher education and students' classroom engagement using mediation analysis. As indicated by the results, cognitive and behavioral engagement fully mediated the relationship between attendance and performance [16]. The critical problems of student engagement are identified in a study that also conceptualized a framework to overcome those problems [17]. Another study investigated the definition of student engagement from engineering student and their faculty point of view. The study found that engagement is a process and outcome observed in class discussions and research projects with classmates and professors [18]. While [2] stated that a compulsory attendance policy would demotivate students instead of maintaining class attendance influenced by motivational beliefs and class context.

III. Attendance Monitoring System

The University of Nottingham Ningbo China has decided to implement an AMS based on QR-code scanning in the classroom venue. A dynamic QR-code appears on the classroom display for the first 10 minutes of each teaching session, and all students attending the class can scan a dynamic QR-code using their smartphones. According to the announced attendance policy, students who arrive later than 10 minutes will be recorded absent. A pilot run of the AMS was done to record the attendance to the language module seminars over four teaching weeks at the end of the semester prior to the one in which the AMS was implemented widely for all modules and programs of study. Student's guide on how to sign in their attendance using their smart devices was shared with all students before the AMS launch. A soft launch was done in the first three teaching weeks period of the semester. This period covers the first two weeks of the semester, also known as the change of mind period, where attendance monitoring is not mandatory. During this soft launch, technical support and troubleshooting were offered to all students and lecturers to familiarize them with the monitoring system. Students were able to record their attendance in the classroom, but there was no penalty for their absence. The compulsory attendance policy was applied starting teaching week four until the end of the semester. Students who attended online due to approved learning disruption reasons, such as the pandemic, were exempted from scanning the code. During the entire semester, lecturers were able to monitor students' attendance to their classes on the cloud using their official university accounts.

The compulsory attendance policy was developed in accordance with the university regulations on engagement and attendance. The regulations require students to attend teaching activities to pursue their studies. The policy's objectives are to ensure students' satisfactory engagement by attending scheduled teaching activities that are needed to complete their studies and to provide consistent guidance across the university for identifying students who require additional support if their engagement is not deemed satisfactory. The policy states that students are required to attend at least 50% of their timetabled teaching activities; otherwise, their engagement is marked unsatisfactory. Students were still allowed to submit an absence form that their senior tutor should approve according to the rules. Where the accumulated unapproved absence reaches 30%, the student is called for an attendance meeting with their personal tutor to improve the student's attendance before any penalty is applied.

IV. Alternative Blended Learning Approach

A mixed-mode teaching approach was applied to deliver the optional final-year engineering module utilized in this study [19]. This teaching delivery was made available to all students attending the module, whether they were still stranded off-campus or couldn't participate in one or more face-to-face teaching activities for any reason, allowing them to attend from anywhere. Several instructional tools were employed to make this approach as interactive as feasible. Moodle was used as the virtual learning environment for sharing learning materials, module information, and coursework submission. MS-Teams was introduced to promote immediate communication with students and office hours. MS-Teams was utilized to live-stream all classes, including lectures and seminars. A Microsoft Tablet with digital ink was used for online teaching, while the session was projected onto the classroom display for in-person teaching. Electronic whiteboards have replaced traditional whiteboards. The assurance was given to students that they may choose their preferred mode of attendance, whether in-class or online, and both will be manually recorded as present. To preserve the seriousness and interest of the online attendance, students were required to attend in a quiet environment and keep their microphones on for the entire teaching session. To promote classroom interaction, the classroom loudspeakers were used to broadcast the voice of online attendance at the classroom end.

V. Methodology

A pilot study was conducted on engineering students attending one optional engineering module of the BEng Electrical and Electronic Engineering program. The module contributes ten credits out of 120 credits students must complete in their final year of study. In-class attendance was made non-compulsory in this module in the semester before the AMS, and compulsory attendance policy was applied across the campus. The alternative online teaching approach

was used during the entire semester, and students were assured they could opt for the online mode of learning in any teaching session without justifying the reason for in-class absence. To guarantee the freedom for attendance, students were also assured that all teaching sessions, including lectures and seminars, would be recorded and published on MS-Teams immediately at the end of each session. All videos will remain available the whole semester. All students in this module lived on campus, and no learning disruptions were noticed during the entire semester. The attendance was recorded manually at the beginning of each class. Students who attended online were marked attend.

A. Participants

Students were diverse in terms of their academic rank. Participation in the student survey was voluntary, and students were asked to complete an informed online consent form before completing the survey. The study was conducted under the human subjects guidelines from the institutional research ethics committee and was approved by the faculty research ethics officers.

B. Procedures

Students completed online self-report surveys regarding their engagement in the optional module when the in-class attendance was made non-compulsory and their view of the AMS and compulsory attendance policy in the following semester. Participants were told by their instructor that the specific responses to the surveys were anonymous and not graded. There was no chance for any participant to be disadvantaged as the survey was shared with the students at the end of the following semester of their attendance to the optional module. As a general instruction, it was emphasized that there were no right or wrong answers and that honest answers were valued. MS-Forms was used as a platform for the online survey. The survey was shared with all 26 students who attended the optional module. Announcements to the survey were made on the module team on MS-Teams. More than 69% of them voluntarily completed the survey.

VI. Student Survey and Results

For the optional module used in this study, the attendance was manually recorded during the entire semester; however, the first two weeks were not considered for the attendance as it is the change of mind period. Fig. 1 shows the distribution of two modes of attendance over nine weeks, starting teaching week 3. Two teaching sessions, a lecture, and a seminar were taught every teaching week, and one revision session in the final week. Fig. 2 shows the overall attendance distribution during the semester. The average percentage of student attendance was above 92%, while the maximum absence was in teaching weeks 8 and 10, where the attendance percentage was recorded as 81%. This percentage was still considered very high, knowing that the reasons for absence in those two weeks were due to several coursework submission deadlines. No online attendance was recorded in more than 35% of the semester, and the highest online attendance (~15%) was in the revision week, where there was no absence as all students were keen on attending either in-class or online, so they not to miss the final revision. More than 61% of the students said they attend unless they're sick, while 22% said attendance depends on their view of their lecturer's teaching quality. Other reasons for classroom attendance included the relevance to assessment tasks or social reasons.

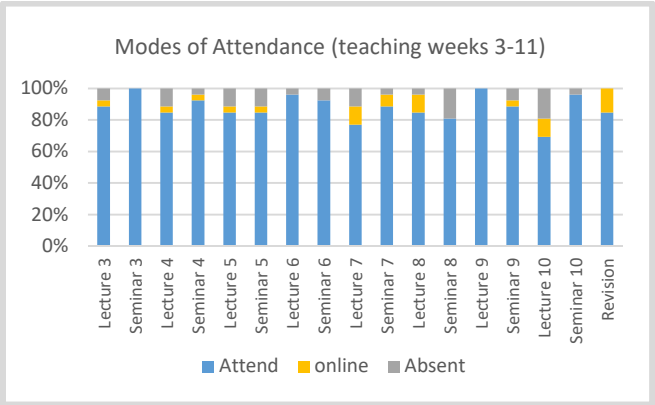

Fig. 1. In-class and online attendance distribution

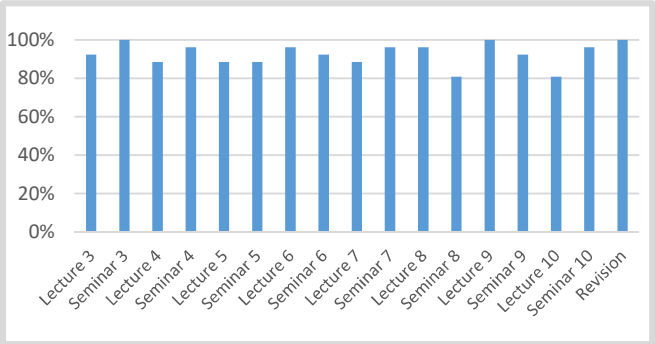

Fig. 2. Overall attendance percentage

A. Classroom Context

In an intervention to investigate the effectiveness of the classroom context, students were asked about their experience of classroom interaction using the electronic whiteboard and lecturer annotation. 89% felt using the electronic whiteboard improved their learning experience, while all students thought the slide annotation was extremely useful, as shown in Fig. 3.

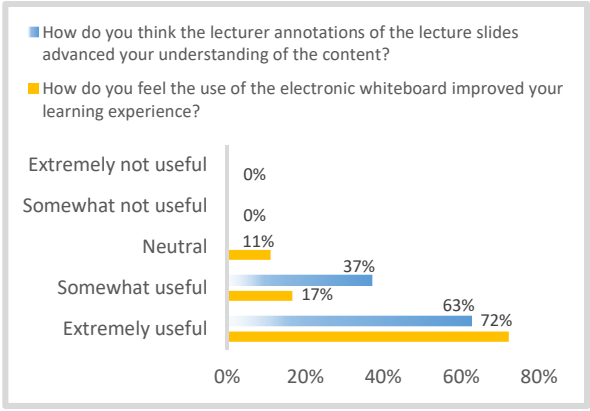

Fig. 3. Student's view of the effectiveness of the classroom context

Fig. 4 shows other reasons motivating students for in-class attendance. Besides having the learning material in advance, the lecturer seems to be a critical factor in attracting students for face-to-face attendance. 94% of the students said an effective and energetic lecturer makes their class enjoyable. Engineering students also feel motivated when their lecturer advises not necessarily on the topics but tips for gaining skills such as time management or future study or career.

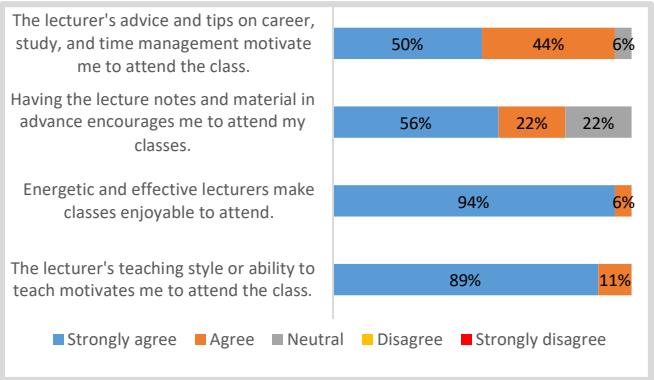

Fig. 4. Students' motivation for in-class attendance

B. *Compulsory Attendance and Academic Performance*

Fig. 5 shows the students' view of the AMS and the compulsory attendance policy deployed across campus. Most students agree that the technology used for the AMS system is efficient, and it's easy to scan the QR-code. It also seems that the students could accept that the system may help those at academic risk to be identified or get the chance to speak to their tutor; however, the majority couldn't make a clear opinion. Also, it isn't easy from the students' responses to determine if the attendance rate has increased after the AMS has become in effect. This's because the tendency of this group of students to attend their classes was already high before the compulsory attendance policy was made active, as indicated in Fig. 1 and Fig. 2. Even though, from Fig. 5, it seems that students disagree that compulsory attendance improved their academic achievement.

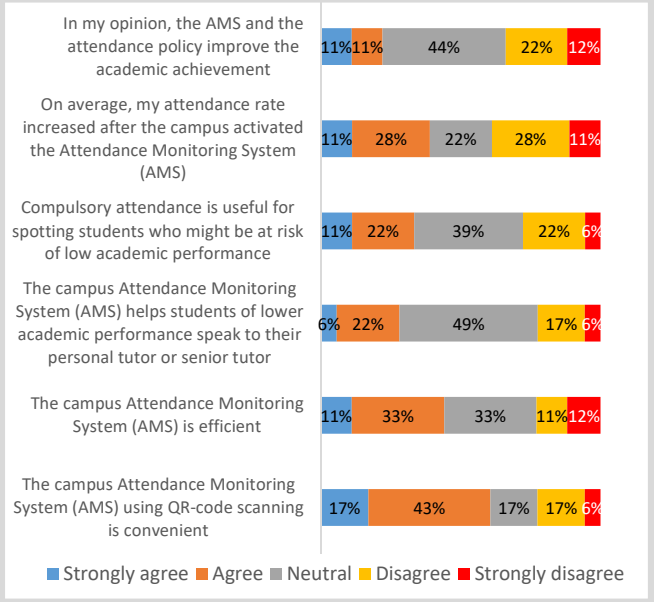

Fig. 5. Students' view of the AMS and compulsory attendance

When the students were asked to comment on their responses, most students criticized the compulsory attendance policy:

"*It's not an effective way to attract students to attend the lectures. The attendance, in my perspective, is solely based on interest towards the subject, lecturer, nothing more.*"

"*Students should have the right to decide whether to attend the classes based on their own views.*"

They also emphasized that compulsory attendance has a low impact on improving academic performance:

"*weak for helping students of lower academic performance to improve in their academic performance.*"

Some students even disagreed that scanning a code is an efficient way to spot in-class attendance:

"*Since you can scan a QR code anywhere, it's not an efficient way either for monitoring attendance.*"

C. *Student Motivation and Academic Achievement*

In an intervention to investigate the applicability of the compulsory attendance policy, students were asked to express their views about applying compulsory attendance in different programs or years of study. Fig. 6 shows that 67% of the students either strongly agree or agree that compulsory attendance can be more effective for the early years of study, such as year one and year 2. These findings are consistent with the previous research denoting that class attendance mostly impacts the academic performance of the first and second years [6]. Students also expressed that compulsory attendance is more applicable to language study than engineering modules. To learn more about the impact of the compulsory attendance policy on the students' motivation, as shown in Fig. 6, 61% of the students either strongly agree or agree that they feel more motivated if the attendance was recorded without making it compulsory, while 17% of them disagreed. 34% of the students disagreed that compulsory attendance improved their classroom engagement, while 28% agreed it did. On the other hand, as per their response in Fig. 6, 67% of the students either strongly agree or agree that their motivation increases when they have the freedom to decide whether or not to attend a teaching session. This gives some insight that although the goal of the attendance policy is to improve students' engagement, there might be a risk of demotivating students whose attendance rate is very high, like the group that participated in this study.

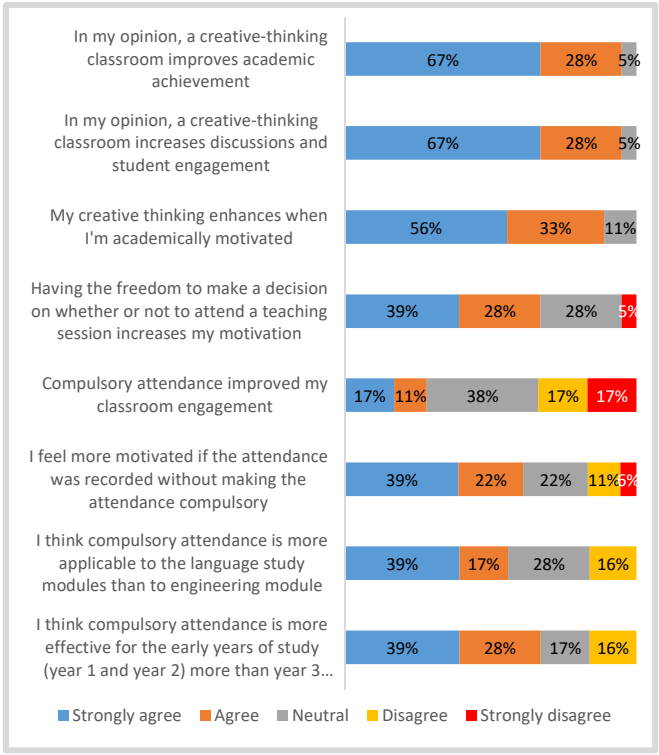

Fig. 6. Student motivation and academic achievement

To further learn about students' motivation and how this influences their academic achievement, 89% of the students either strongly agree or agree that their creative thinking enhances when they're academically motivated. It also turns out from their response that the majority (95%) of them think that such a creative-thinking classroom environment increases their discussions and engagement, improving academic achievement. This is commensurate with previous research demonstrating how engineering students defined classroom engagement [18].

D. Student's Behaviour

To investigate the students' behavior towards classroom attendance, students were asked how they would spend their time if they decided not to attend. As per the response in Fig. 7, 66% of the students either strongly agree or agree that they prefer to spend their time on more valuable tasks when they feel no value in attending a particular class. 28% of the students agree they think they're more likely to check non-class-related websites or use a text platform to chat with others during class time, while the same percentage also disagreed with the statement. 39% of the students agreed they attend to achieve high marks, against 11% disagreed, while 45% of them agreed they regularly attend to avoid feeling guilty or ashamed, against 16% disagreed.

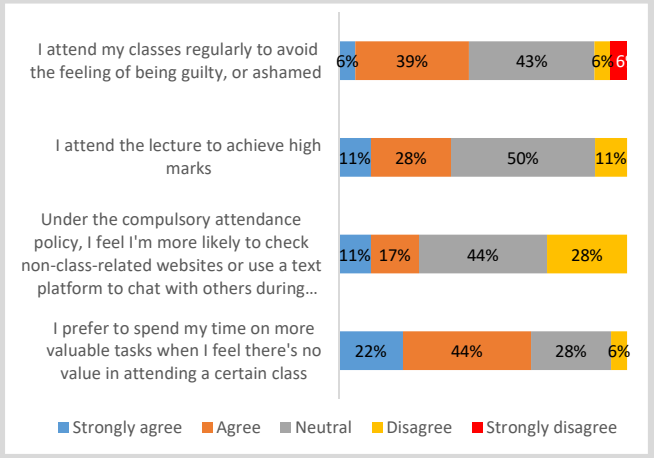

Fig. 7. Students' behavior towards classroom attendance

VII. Conclusion

In this paper, a pilot study was made on a group of final-year engineering students. The study was motivated by the notable students' engagement in an optional engineering module before a compulsory attendance policy became effective. It turns out from the student survey that having an efficient and convenient system to record classroom attendance is beneficial for both students and their lecturers. On the other hand, there is a risk of demotivating students of high engagement if the compulsory attendance policy is applied equally among all programs and years of study. Instead, to improve academic achievement, a creative thinking classroom environment should be maintained to enhance discussions and student engagement. The study also found that engineering students become further motivated toward classroom attendance when some class time focuses on giving them tips and advice on their current and future study, time management, and skill development.

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