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Juth, A., Söderberg, J., Byström, F. et al (2026). LINKING STUDENT ATTENDANCE TO COURSE RESULTS. Proceedings of the International CDIO Conference: 697-706

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LINKING STUDENT ATTENDANCE TO COURSE RESULTS

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ABSTRACT

Student attendance is widely regarded as an important factor influencing engagement and academic success in engineering education, yet maintaining consistent onsite participation continues to pose challenges. At the same time, little is known about how attendance at different types of learning activities relates to performance within individual courses, particularly in the context of introductory engineering education where students form foundational study habits. This study examines attendance patterns in a first-year, project-based mechanical engineering course, using a QR-based digital tool integrated into the learning management platform to document participation across lectures, workshops, supervision sessions, and project activities. The tool was introduced as a neutral documentation mechanism rather than an assessment component, allowing attendance to be recorded unobtrusively in both compulsory and voluntary activities. The results show clear variation in attendance across activity types, with high participation in early and mandatory sessions and somewhat lower attendance in later or skills-oriented activities. Analysis reveals a weak positive correlation between attendance and both individual and group performance, aligning with established findings in educational research. Subgroup analyses suggest that attendance–performance relationships may vary across age and gender groups, pointing to areas of interest for future work. Beyond the empirical results, the study demonstrates the practical feasibility of systematic attendance tracking on a large scale. Students showed no resistance to the tool, indicating that the method is straightforward to implement and well tolerated. The ability to visualize attendance across the course offers instructors a valuable basis for reflective teaching and for identifying which activities may benefit most from strong student presence.

KEYWORDS

Attendance, Education, Engineering, Performance, Absenteeism, Standards: 4, 8, 11

INTRODUCTION

As engineering educators in higher education, we aim to support students in succeeding academically, and student presence is a key factor in fostering meaningful engagement. Recently, onsite attendance has become an area of increasing concern, as absenteeism may negatively affect learning outcomes and make it more difficult for students to complete their courses. Although the importance of active participation is well recognized, achieving consistent attendance remains challenging.

With the introduction of a QR code scanning tool integrated into the learning management system Canvas, we can now measure attendance systematically and relate it to student performance. Since courses differ in subject matter and pedagogical structure, an in-depth analysis of a single course may reveal more targeted opportunities for improvement.

The course Introduction to Mechanical Engineering, redesigned and launched in 2025, was selected for this analysis. Its structure provides a suitable context for examining how attendance relates to performance and for identifying insights that may guide future course development. Introducing attendance tracking in an introductory course is also strategic, as it may shape students' early study habits and potentially promote higher attendance throughout the entire program. Furthermore, the act of measuring attendance may itself influence student behavior. Against this background, analyzing the course data offers an opportunity to identify factors that could support improved learning outcomes.

Aim and Research Questions

The aim of this study is to analyze how student attendance correlates with academic performance in a project-based course for first year mechanical engineering students at Chalmers University of Technology. The study focuses on relationships between attendance, individual and group results, and whether the results vary by age and biological gender. The following research questions have been guiding the project:

- What is the relationship between student attendance and individual versus group performance in the course?
- What is the relationship between student demographics, age and biological gender, and their attendance patterns and academic performance in the course?

Furthermore, we hope that this study, together with future investigations, will help clarify which implementations of an attendance-tracking tool have the greatest potential to enhance the students' fulfillment of learning outcomes.

Scope and limitations

- This study is limited to first year students enrolled in the mechanical engineering program at Chalmers University of Technology.
- The study is limited to the research of one project-based course and does not include other types of courses.
- This study does not compare different tools or ways to track student attendance.
- The demographic analysis is limited to the variables available in the dataset, namely age and legal gender.

THEORY

Higher attendance rates have been linked to improved academic performance. Cred et al. (2010), in meta-analysis on this topic, concluded that there is a strong relationship between attendance and achievement and suggested that initiatives to improve attendance rates could enhance college grades. Supporting this, a study of electronic engineering courses at the University of Alcalá found that students with full course attendance had a 91% pass rate as well as a 97% attendance in the exams (De Andres Rubio et al., 2024). The results also showed that the average course grade rose alongside increased attendance. Similarly, Gudjonsdottir (2024) analyzed eleven courses in the field of mathematics and physics and reported that students who attended all lectures had scored 2-22% higher on exams compared with those with less attendance.

While higher attendance generally correlates with better academic outcomes, this effect may depend on the design of the course. Gal et al. (2011) conducted a comparative study between two physiology courses. One course was taught using a traditional approach with lectures and laboratory work, and one course using a more active approach with added problem-based learning, discussion, and teamwork. In their analysis of exam results and attendance, Gal et al. (2011) found a significant difference in exam scores in the active teaching group, where students with poor attendance got a lower result. This indicates that students struggle to compensate for missed activities courses with more active learning, whereas traditional methods allow for easier compensation through available textbooks. The study concludes that attendance is particularly important in physiology courses that practice active learning methods.

Reasons for students not participating in course activities vary. According to Nilsson et al. (2025), the decision to attend or not is often strategic, influenced by factors such as prioritizing other courses, perceived poor teaching quality in combination with illness or procrastination, and substituting course content with online alternatives.

In contrast with other studies emphasizing increased attendances as a primary goal, Nilsson et al. (2025) suggests a different focus. They suggest a focus on developing teaching methods that enhance understanding and skill development. Teaching methods are also mentioned by Freyhult (2017). In an analysis of physics students' responses to questions regarding attendance, Freyhult found that the main thing that students thought would improve attendance was more problem-based and active teaching methods.

Monitoring students' attendance could influence the attendance rates, according to Heru et al (2024). They studied how an attendance system changed the student's behavior in vocational high schools, where they compared two groups of students. The findings revealed that the implementation of a web-based attendance system improved both motivation and attendance. This system included both the opportunity for parents to monitor their children and for students to get real-time feedback. Heru et al. (2024) also argue that this type of system contributes to promoting the habit of attending and responsibility, which could make them more prepared for their future work life.

METHOD

The study was conducted in the course IMS165, *Introduction to Mechanical Engineering*, a 7.5 ECTS project-based course given during the first semester of the Mechanical Engineering program at Chalmers University of Technology in autumn 2025. The course enrolled 247 first-year students (55 legally female and 192 legally male). The students were organized into 9 classes, each with 5 project groups of five to six students.

The course included lectures, supervision, workshops, laboratory exercises, hands-on project activities related to product development (product development hereafter “PU”), CAD, presentation, and report writing. Assessment comprised an individual quiz (“PU Quiz 1”) and a group-based project. The quiz was graded on a 0 – 100 point scale, while the project report used a 3–5 scale with decimal increments.

The course was designed according to the principles of constructive alignment with close integration between learning outcomes, learning activities, and assessments. Each learning activity was mapped to one or more learning outcomes, and the corresponding assessments (PU Quiz 1) were built upon these activities to evaluate the same learning outcomes. The project report as an assessment method was primarily assessing a single learning outcome (regarding report writing).

Student attendance was recorded using NVO Attendance, a QR-code system integrated into the Canvas learning management system. Attendance was registered by students scanning a dynamically updating QR code displayed in the classroom, preventing off-site registration. In cases of technical issues, attendance was manually recorded by the instructor. The system was introduced at the start of the course as a tool for documenting participation patterns rather than as a control or assessment mechanism; attendance at non-compulsory sessions was voluntary and not linked to grading.

Attendance was recorded across lectures, workshops, supervision sessions, and project-related activities, covering a total of 23 scheduled sessions. Of these, 10 were supervision sessions and 10 were optional lectures. After course completion, attendance data was exported from Canvas, resulting in a dataset with one row per student. The dataset included demographic variables (age, legal gender, class section, and project group), binary session-level attendance indicators (present = 1 / absent = 0), and performance outcomes in the form of individual quiz scores and group project results.

Data Analysis and Ethical Considerations

Exploratory data analysis (EDA) was applied to examine relationships between attendance patterns, course activities, and both individual and group-based performance outcomes, including quiz results and project performance. The analysis focused on data visualization to identify visual patterns, tendencies, and variation, rather than to establish causal or statistical relationships. Attendance and performance data were processed in Microsoft Excel and visualized using the statistical software JMP.

All data was anonymized prior to final analysis. Personal identifiers were removed, and demographic information was used solely for analytical purposes. Students were informed about the study and could opt out without academic consequences. Data analysis was conducted after final course grades had been assigned, and all results are reported at an aggregated level.

RESULTS

Attendance rates varied across different course activities, see Figure 1. The highest rates were at the mandatory (M) sessions, with 94-96% attendance. The introduction lecture and first PU lecture had 92% respectively, 87% attendance. The following PU lectures were around 70%. Student participation varied in the supervisions from 85% to 64%. The lowest attendance was recorded in the lecture about oral presentation with 52%.

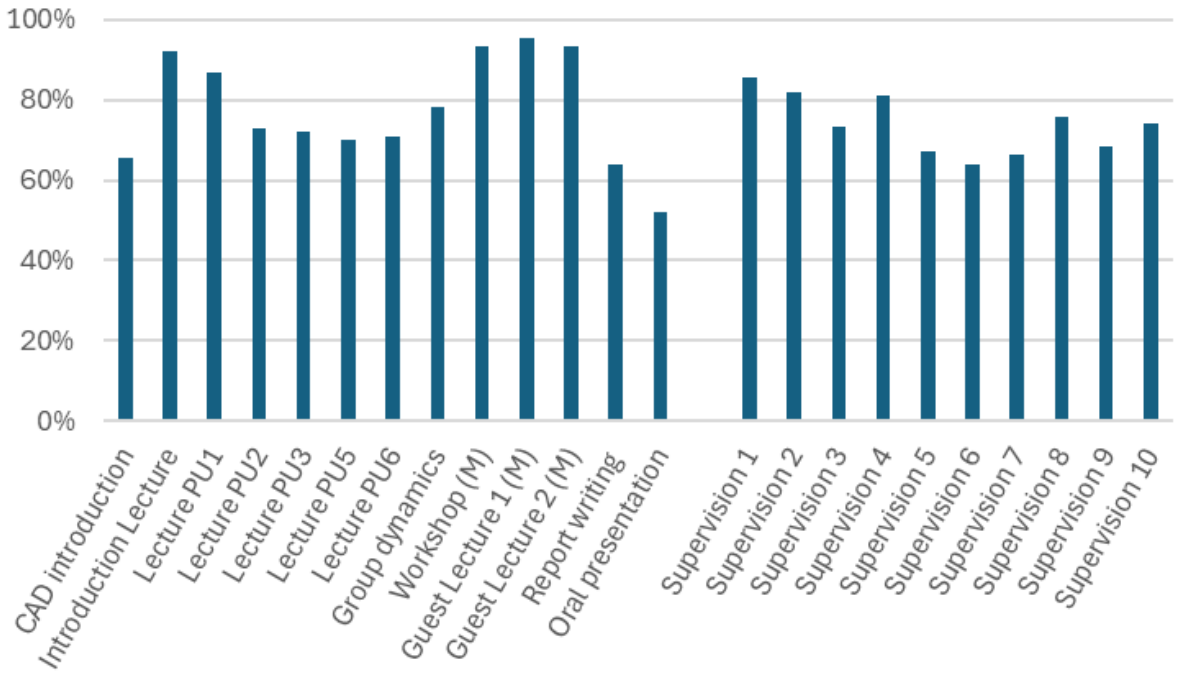

Figure 1. Attendance rates across different course activities

Quiz score increased with overall attendance for both female and male students, as seen in Figure 2, with a weak correlation. Separate linear regression models indicated different slopes for the two groups, with estimated slopes of 0.62 for female students and 1.17 for male students, respectively. The project grade and overall attendance also show a weak correlation. No statistically significant difference in overall quiz score was observed between female and male students when attendance was not considered ($p > 0.05$).

Further visual evaluation of the data suggests that, in most age groups, quiz scores tend to increase with higher attendance for both genders. In contrast, the 23–30 age group shows a different tendency, where higher attendance appears to coincide with lower quiz scores for both female and male students. When viewing quiz score distributions by age group alone, no clear or systematic differences between age groups are visually apparent, indicating substantial overlap in performance outcomes across ages ($p > 0.05$).

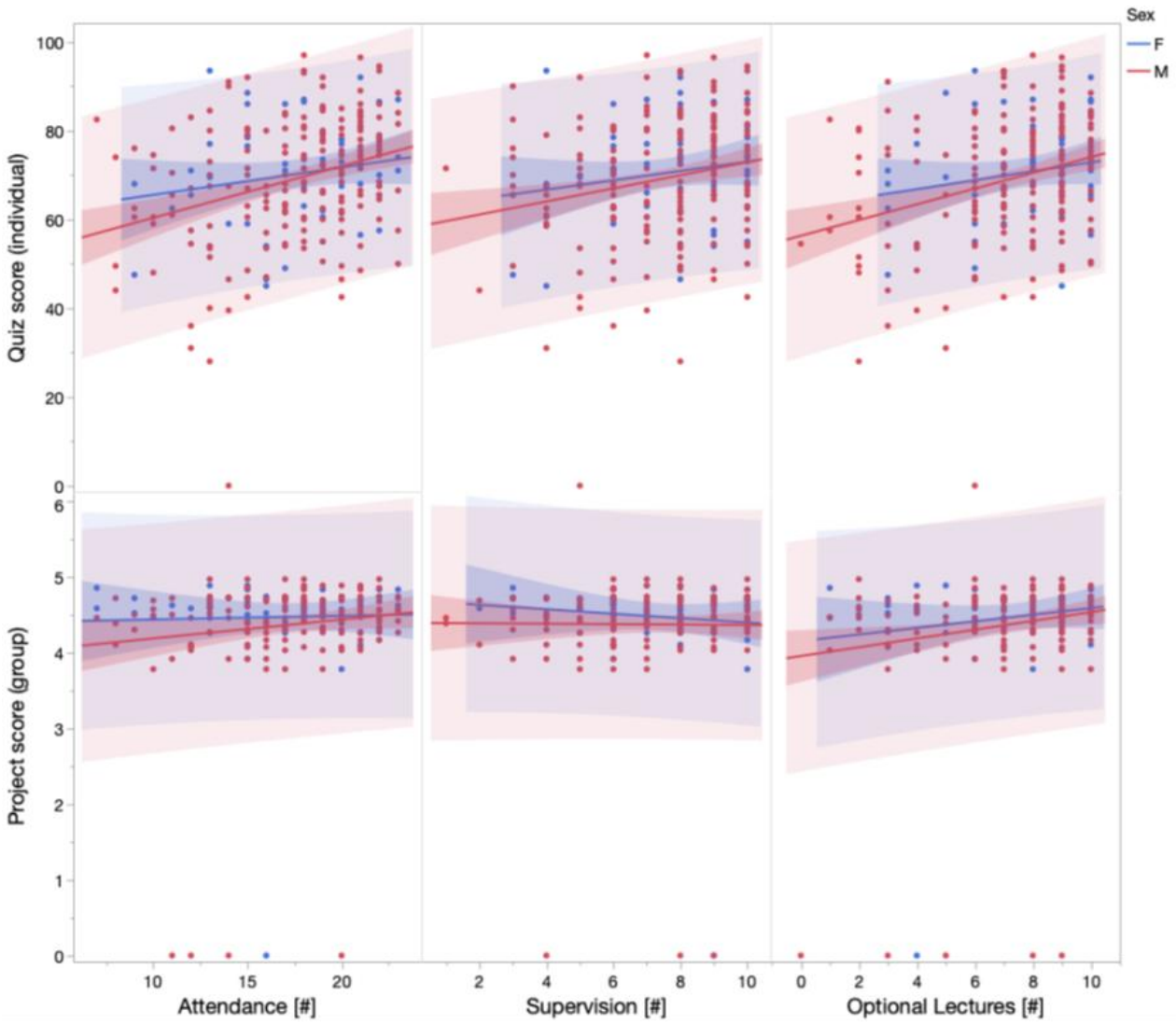

Figure 2. Quiz score and project score as a function of attendance, stratified by legal gender. Solid lines represent fitted linear regression models

Figure 3 illustrates an example of the type of visualization that can be produced from the collected data. The figure allows for an examination of different performance intervals on both the quiz and the group project. By following the lines extending from each performance interval, the corresponding attendance patterns can be traced. The visualization shows that teams with lower project scores tended to have lower attendance at supervision sessions compared to teams with higher project scores.

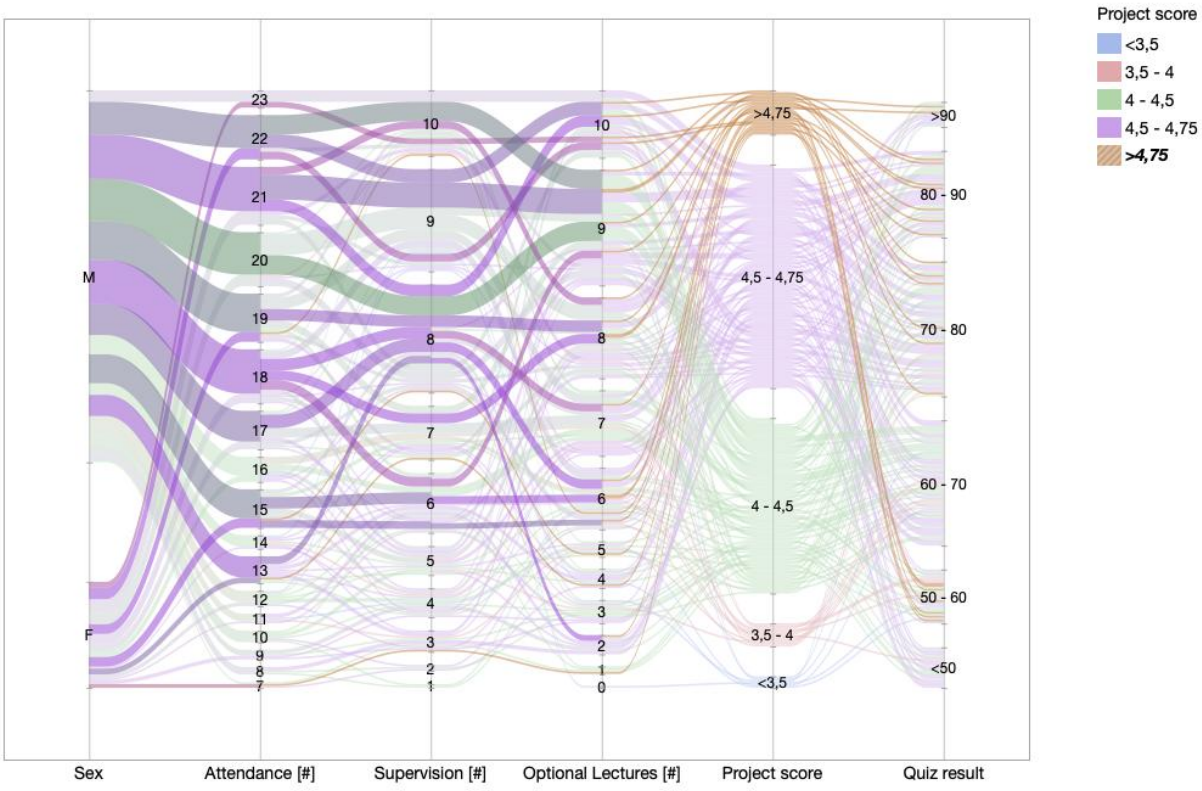

Figure 3. Exploratory visualization of attendance patterns and performance outcomes, highlighting project score. Each line represents a student, with color indicating project score. The figure illustrates tendencies between overall attendance, supervision, optional lectures, and both project and quiz performance

DISCUSSION

The results show a weak positive correlation between both quiz score and group score and overall attendance. Which is consistent with previous findings by Credé et al (2010) and Gudjonsdottir (2024). In most age groups (18–23), higher attendance was associated with higher quiz scores. In contrast, the 23–30 age group showed a negative association between supervision attendance and quiz performance.

This pattern should be interpreted with caution, as the 23–30 group comprised fewer students and exhibited wider confidence intervals, indicating higher uncertainty and sensitivity to individual observations. Rather than suggesting that supervision has a negative impact, the observed pattern may be explained by strategic attendance behaviors. As described by Nilsson et al. (2025), students may deliberately prioritize certain activities while using supervision selectively to address specific challenges, meaning that supervision attendance does not necessarily indicate higher overall engagement.

This type of exploratory data analysis can serve as a tool for reflection and course development rather than for evaluating individual activities, as the findings primarily reveal tendencies. The opportunity to visualize how activities relate to student performance may support productive discussions among teachers and examiners, as well as help identify areas of interest for deeper analysis and identify activities that matter the most for students' performance. By visualizing how course activities relate to student performance, it becomes

possible to first adopt a course-level overview and then zoom in on local patterns where specific activities appear to be more closely associated with learning outcomes.

Repeated tracking of courses could therefore make it possible to more confidently identify key activities where attendance is most important for learning outcomes. Such as during early concept lectures, supervision in critical project phases, or sessions close to deadlines. This could enable evidence-based decisions about scheduling, sequencing, and allocation of teaching resources, placing instructional effort where it appears to provide the greatest learning support.

No causal conclusions can be drawn regarding the effect of the tool on overall attendance levels, as no baseline data from previous course iterations are available in the studied course. Nevertheless, these observations point to an underexplored aspect of attendance research, where attendance tracking may function not only as a measurement tool but also as a behavioral intervention. During the course there have been occasions when students have actively requested to register attendance even when it was voluntary. Other students reported monitoring their attendance status and aiming to maintain a high attendance record. Teachers also noted that more students than expected were present during scheduled class time. While these observations are anecdotal, they suggest that making attendance visible may affect how students perceive and engage with course activities.

These results are limited to first-year students and were obtained in one of the first courses in the program, which makes the findings specific for this group. Conducting a similar analysis in second-year courses to examine how increased experience in university studies affects the results would therefore be valuable. Additionally, analyzing different types of courses could provide a better understanding of how participation in learning activities relates to learning outcomes.

The findings should also be interpreted in relation to the relatively homogeneous study context, as all participants belonged to the same programme, year, and course. The present analysis only considered age and legal gender, while factors such as cultural or ethnic background, socioeconomic conditions, commuting situation, previous educational experience, and study habits were not examined. Although the cohort may be relatively homogeneous in several of these respects, including such variables in future studies could help explain and provide a more nuanced understanding of student attendance.

CONCLUSION

Our analysis indicates a weak correlation between attendance and performance on both quizzes and project work in the course. More importantly, the study demonstrates the value of having a reliable tool that enables systematic measurement of attendance across different learning activities. This provides a foundation for future investigations into how specific pedagogical components influence student learning and, in the longer term, may support the evaluation and refinement of instructional practices.

A notable outcome is the seamless implementation of the attendance tool: none of the 250 students enrolled in the course expressed concerns or objections, suggesting that the method is unobtrusive and easily reusable from an instructor’s perspective. The main effort going forward will lie in analyzing the growing body of data and, crucially, in translating these insights into actionable improvements for teaching and learning.

ACKNOWLEDGEMENTS

The authors received no financial support for this work.

REFERENCES

Credé, M., Roch, S. G., & Kieszczynka, U. M. (2010). Class attendance in college: A meta-analytic review of the relationship of class attendance with grades and student characteristics. *Review of Educational Research, 80(2)*, 272–295. https://doi.org/10.3102/0034654310362998

De Andres Rubio, A., Macias-Guarasa, J., Ros, G., Rojas, E., Palazuelos-Cagigas, S. E., Miguel-Jimenez, J. M., Hernanz, M. S. E., Rodriguez, J. M. A., Ochaita, M. C. B., Sanchez, J. L. M., Arroyo, S. L., Garrido, M. A. G., & Moreno, H. G. (2024). Class attendance and study focus: Influence on student performance. *Proceedings of the 2024 XVI Congreso de Tecnología, Aprendizaje y Enseñanza de la Electrónica (TAEE)* (pp. 1–6). https://doi.org/10.1109/TAEE59541.2024.10604945

Freyhult, L. (2017). Students' views on attendance. *EuroSoTL 2017, The 2nd European Conference for the scholarship of teaching and learning* (pp. 1-7). Lund, Sweden, June 8-9 2017

Gal, B., Busturia, I., & Garrido, C. (2011). To be or not to be: the importance of attendance in integrated physiology teaching using non-traditional approaches. *BMC research notes*, *4,* Article 360. https://doi.org/10.1186/1756-0500-4-360

Gudjonsdottir, M. (2024). First-year engineering students at Reykjavik University: Relation between class attendance and final exam grade. *Proceedings of the 20th International CDIO Conference* (pp. 57-64). ESPRIT, Tunis, Tunisia, June 10-13 2024

Heru, M.J., Jatimi, A., Sulfiyan, W., Nisa'Fiddaroini, F., Munir, Z., & Dewi, N.E. (2024). The impact of implementing a web-based e-attendance system on enhancing student learning motivation in vocational high hchools. *2024 10th International Conference on Education and Technology (ICET*) (pp. 52-58). doi:10.1109/ICET64717.2024.10778456

Nilsson, S., Bolander Laksov, K., Samuelsson, J., & Regnér, S. (2025). *Students' reasons for absence in first-cycle engineering education - an interview study*. Media-Tryck, Lund University, Sweden. https://www.lth.se/fileadmin/cee/genombrottet/web_version_rapport_nr_4.pdf

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