STUDENT ABSENTEEISM AT ENGINEERING DEGREES: A CASE STUDY AT BARCELONA SCHOOL OF INDUSTRIAL ENGINEERING

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ABSTRACT

In recent decades, the issue of university class attendance has gained significant attention due to its impact on institutional reputation and the need to enhance student engagement, especially in light of the European Higher Education Area's establishment in 2015. Extensive analyses of absenteeism determinants underscore its complexity, highlighting the necessity for tailored interventions to effectively address this issue. This study, conducted by a team of educators from Barcelona School of Industrial Engineering affiliated with the Universitat Politècnica de Catalunya · BarcelonaTech (Spain), aims to assess absenteeism rates and propose mitigation strategies by examining factors influencing attendance and educators' perspectives.

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The study employs a mixed-method approach, incorporating surveys from students and educators, daily attendance records, as well as interviews and discussions.
Preliminary findings indicate elevated absenteeism rates, particularly in mass enrollment programs featuring more expositive teaching methodologies, attributed to perceptions of redundant class material and dissatisfaction with teaching methods. Notably, undergraduate students often seek supplementary instruction from private academies. Promising strategies include adopting contextualized teaching approaches and transitioning exams to non-standardized formats. However, the long-term effectiveness of these measures necessitates further evaluation.
The methodology and insights derived from this study have the potential to inform strategies aimed at addressing absenteeism in engineering-focused institutions and beyond.

1 INTRODUCTION

In recent decades, attendance in university classes has become a concerning issue, as noted by St. Glair and St. Clair in 1999, who highlighted the potential decline in institutional reputation if students could earn degrees without attending classes. The establishment of the European Higher Education Area in 2015 further emphasized the importance of enhancing student engagement and adopting a student-centered learning approach (European Commission 2015). Absenteeism not only hampers the learning process but also represents a misuse of economic resources, particularly in public university systems. Despite these concerns, a comprehensive global analysis of absenteeism remains elusive. Only specific studies provide insights into absenteeism rates. For example, Kousalya, Ravindranath, and Vizayakumar (2006) found absenteeism rates ranging from 30-50% in an Indian engineering college, a figure mirrored by Summers, Higson, and Moores (2021) among nearly 2000 undergraduate STEM (Science, Technology, Engineering and mathematics) and business students in the UK.
Similarly, research conducted at a chemical education program in Nigeria (Nja, Cornelius-Ukpepi, and Chinyere Ihejiamaizu 2019) revealed absenteeism rates ranging from 25% to 45%. Conversely, in a study by Vicéns Moltó, Hervás Avilés, and Zamora Parra (2019), absenteeism rates were reported to be as high as 70% during the initial year of an engineering degree, steadily escalating throughout the program and peaking at nearly 80% in the final year. These few cases of study highlight the widespread nature of the issue.
The correlation between attendance and attainment has been extensively studied, with literature suggesting a significant link (Credé, Roch, and Kieszczynka et al. 2010; Kassarnig et al. 2017; Keyser 2019; Moores, Birdi and Higson 2019; Rendleman 2017; Shaaban and Reda 2021). However, the causal relationship between attendance and attainment remains debated, with some researchers suggesting that poor attainment can lead to low attendance, and vice versa (Credé, Roch, and Kieszczynka 2010; Kahu 2013). Indeed, attendance alone does not imply active participation (Kassarnig et al. 2017; Moores, Birdi, and Higson 2019). This is the reason why mandatory policies do not have a clear positive impact on attainment (Rendleman 2017).
Various factors influence students' attendance decisions, including institutional policies, psychological factors, and socio-demographic characteristics. These factors interact in complex ways, producing sometimes apparently inconsistent results. For instance, research findings vary depending on the country, funding system, publication year, student demographics, class size, and discipline (Moores, Birdi, and Higson 2019). For instance, in a study carried out in an Indian engineering college (Kousalya,

Ravindranath, and Vizayakumar 2006) and based on a multicriteria decision-making method, parents' involvement and counselling were the most relevant factors for absenteeism, followed by peer pressure and punishments for absence, in front of making lecture more attractive, improve the infrastructure or increase the coherence between the curriculum and the assessment. In (Al-Labadi et al. 2022), a quantitative study of roughly 15200 students in a Canadian university showed that the main reason for absence in class was to study and prepare for other courses, followed by the students' mental health and poor sleeping habits. In a Spanish study with nearly 1900 students from the Business Administration, Economics and Sociology degrees (Triado-Ivern et al. 2020), the main reasons for the absenteeism are student's own planning, teaching methodology, learning methodology, course characteristics and external sources.

In Qatar, difficulty reaching the learning center has been identified as a primary reason for absenteeism, prompting the implementation of measures like mandatory attendance rates and transportation services (Shaaban and Reda 2021). Gender differences in absenteeism have also been noted, with male students typically exhibiting higher rates (Al-Labadi et al. 2022; Nja, Cornelius-Ukpepi, and Chinyere Ihejiamaizu 2019). Other factors, such as balancing work and study or the availability of online materials, also impact attendance (Moores, Birdi, and Higson 2019; Rutherford and McGrath 2022).

The study reported by López-Bonilla and López-Bonilla (2015) states that the quality of teaching is a crucial factor influencing absenteeism, with students citing educators' teaching methods and competence as primary reasons for their absence. However, while poor-quality lectures may discourage attendance, high-quality lectures do not necessarily increase it. Aligning teaching and assessment practices may enhance the perceived value of classes (Moores, Birdi, and Higson 2019).

Social factors, including peer interactions and educator-student relationships, also influence absenteeism. Students tend to attend classes more if their peers do, particularly high achievers (López-Bonilla and López-Bonilla 2015; Kassarnig et al. 2017). In a study performed by Leufer and Cleary-Holdforth (2010) it was observed that large class sizes and perceived lack of interest from lecturers can discourage attendance, highlighting the importance of personalized attention and a sense of belonging in reducing absenteeism (Moores, Birdi, and Higson 2019; Webb and Cotton 2018).

In conclusion, absenteeism is a complex issue influenced by various contextual factors, necessitating tailored interventions for effective reduction strategies.

1.1 Aim and research questions

The Barcelona School of Industrial Engineering (ETSEIB) is one of the 17 schools of the Universitat Politècnica de Catalunya · BarcelonaTech (hereafter UPC), a Spanish public institution of research and higher education specializing in engineering, architecture, sciences and technology. ETSEIB's facilities accommodate more than 3,400 students, and 350 educators. The school offers 2 bachelor's and 13 master's degree programs, in addition to 5 InnoEnergy master's programs, which can be categorized into either mass enrollment or specialized degrees. Notably, mass enrollment programs are the bachelor's degree in Industrial Technology Engineering (GETI), and the master's degree in Industrial Engineering (MUEI), with about 1900 and 680 enrolled students each, while specialized degrees typically have less than 120 enrolled students.

Absenteeism rates at ETSEIB have been steadily increasing, causing concern among educators. The first attempt to evaluate absenteeism occurred in 2022 through a survey distributed to all students, yielding a 33% participation rate with 1060 valid responses (ETSEIB 2022). Analysis of GETI students' responses, with a participation rate of 67%, revealed that 78% of students do not attend all subjects equally, their attendance being contingent on perceived class relevance. Additionally, it was observed that a majority of the 22% who attend subjects equally do so for all subjects. The underlying reasons for the high absenteeism rate among the 78% of students need further investigation. Furthermore, the survey highlighted that absenteeism is notably higher in mass enrollment programs like GETI and MUEI, though this observation requires further validation due to the survey's approximate nature and the post-Covid-20 pandemic adjustment to in-person attendance. The survey's impact led to absenteeism becoming the central theme of the third ETSEIB teaching conference in 2023.

This study aims to assess the current absenteeism situation and propose mitigation strategies by addressing the following research questions (RQ):

1. What is the extent of absenteeism at ETSEIB, and which degree programs are most affected?
2. What are the underlying causes of absenteeism at ETSEIB?
3. Is there a correlation between attendance and attainment at ETSEIB?
4. Which teaching strategies do ETSEIB educators deem most effective in improving attendance?

Given the universality of absenteeism, the methodology and findings of this study may offer insights applicable to other institutions, particularly those specializing in engineering studies.

2 METHODOLOGY

The study is part of the ASAP-UPC teaching innovation project initiated in 2023. The project aims to identify active methodologies that promote a significant and in-person learning process. Fourteen educators are participating in the project, nine of whom teach at ETSEIB, with the others teaching at the Barcelona School of Nautical Studies. The educators at ETSEIB are involved in teaching the mentioned mass enrollment degrees (GETI and MUEI), as well as the bachelor's degree in Industrial Technologies and Economic Analysis (GTIAE), the master's degree in Automotive Engineering (MAUTO), the master's degree in Nuclear Engineering (MUEN), and the master's degree in Energy Engineering (MUEE). This wide coverage across various degrees enables the team to gather substantial information from enrolled students and provide a comprehensive overview of absenteeism at ETSEIB.

A diverse set of data is gathered and analyzed to address the research questions. This includes surveys from both students and educators, daily attendance records, interviews, and discussions. The processing of this information follows a mixed methodology, combining quantitative and qualitative analyses. The main data from the surveys are detailed in the following sections. Interviews with students include both scheduled sessions with those who consistently miss classes and spontaneous discussions during or after lessons. Educator's perceptions are gathered through surveys and supplemented with informal discussions among colleagues and debates during ASAP-UPC project meetings. Daily attendance is tracked for subjects taught by ASAP-UPC members and analyzed alongside students' grades at the end of the first semester of the 2023-24 academic year.

2.1 Students' survey

A survey was designed to identify the factors contributing to students' absenteeism, strategies educators could employ to enhance attendance, the skills they deem most relevant for their profession, being this latest driven by the potential disparity between contents and students' perceived relevance. The survey targeted students enrolled in subjects taught by members of the ASAP-UPC project during the second semester of the 2022-23 academic year. This encompassed 6 bachelor's and 7 master's subjects, totaling 563 students, constituting approximately 18% of ETSEIB's student body. Students were prompted to complete the survey either during the final lessons of the semester or via the subjects' online learning platform. The participation rate of 22.7% reflects a relatively low level of engagement, indicative of either students' limited interest or a saturation of surveys and emails from the institution.

2.2 Educator's survey

Educators' perceptions were collected through a survey where they were asked to focus on a single subject they teach. Initially, basic questions were posed regarding the subject type, whether attendance is compulsory, and the evolution of absenteeism over the years. Subsequently, more specific questions concerning potential actions to improve attendance were presented as open-ended inquiries, necessitating a thorough examination of responses and subsequent clustering. The survey was distributed to ETSEIB faculty by email, facilitated by the ETSEIB director. Eighty-eight educators responded, constituting 25% of the teaching staff at ETSEIB. Similar to the participation rate observed in the student survey, this relatively low level of engagement is noteworthy in itself. Among the responses, 67% correspond to GETI subjects, with MUEI subjects accounting for 10%, aligning with the distribution of enrolled students.

A second survey was conducted among the members of the ASAP-UPC project to collect information regarding ongoing modifications of their subjects aimed at boosting attendance. This survey presented a list of potential actions to implement, including new methodologies and assessment methods, which were selected based on team debates held during the initial months of the project. The participation rate for this survey was notably higher, reaching 93%.

3 RESULTS

3.1 Attendance rate

Results for each degree are presented in Table 1. In general terms, it can be asserted, and this is supported by the week-by-week data obtained, that absenteeism tends to be higher in the case of mass enrollment degrees and undergraduate courses. Notably, both MUEE and MAUTO exhibit very high attendance levels, attributed to their status as specialized masters' programs with a single group, fostering high student motivation. Regarding MUEI, a mass enrollment master's program, attendance levels vary depending on the specific subject, ranging from 65% to 22%. In the case of undergraduate degrees, absenteeism is more pronounce in mass enrollment programs such as GETI, compared to programs with a single group like GTIAE. Similarly to MUEI, attendance rates for undergraduate degrees depend on the specific subject analyzed but consistently remain below 60% across all studied subjects. These findings align with previously obtained data from 2022 (ETSEIB 2022).

Table 1: Attendance rates for each degree, 1st semester 2023-24

GETI	GTIAE	MUEI	MAUTO	MUEE
44.29%	65.13%	43.18%	96.67%	95.92%

3.2 Students' opinion

According to results presented in Figure 1, the primary reasons for absenteeism among students in mass enrollment bachelor's and master's degree programs are their preference for self-study and the perception that class materials are redundant as they are readily available online. In the case of bachelor's degree students, a third common cause of nonattendance is the need to retake the subject, while for master's degree students, it is dissatisfaction with educator's methodology. Consequently, students who do not attend classes perceive them as not being beneficial to their learning.

Specialized bachelor's degree students share the same primary reasons as mass enrollment students, with the addition of external work commitments emerging as a significant factor influencing absenteeism. Conversely, work commitments are the primary reason for non-attendance among specialized master's degree students, distinguishing them significantly from their mass enrollment counterparts.

The percentage of students selecting the 'other' cause for absenteeism in Figure 1 is notable. Through in-person interviews and informal discussions with students, it has been observed that one of the most common reasons is the perception that certain subjects are too challenging. Consequently, students opt to attend private academies to supplement their studies. Further research is necessary to delve deeper into and analyze these reasons comprehensively.

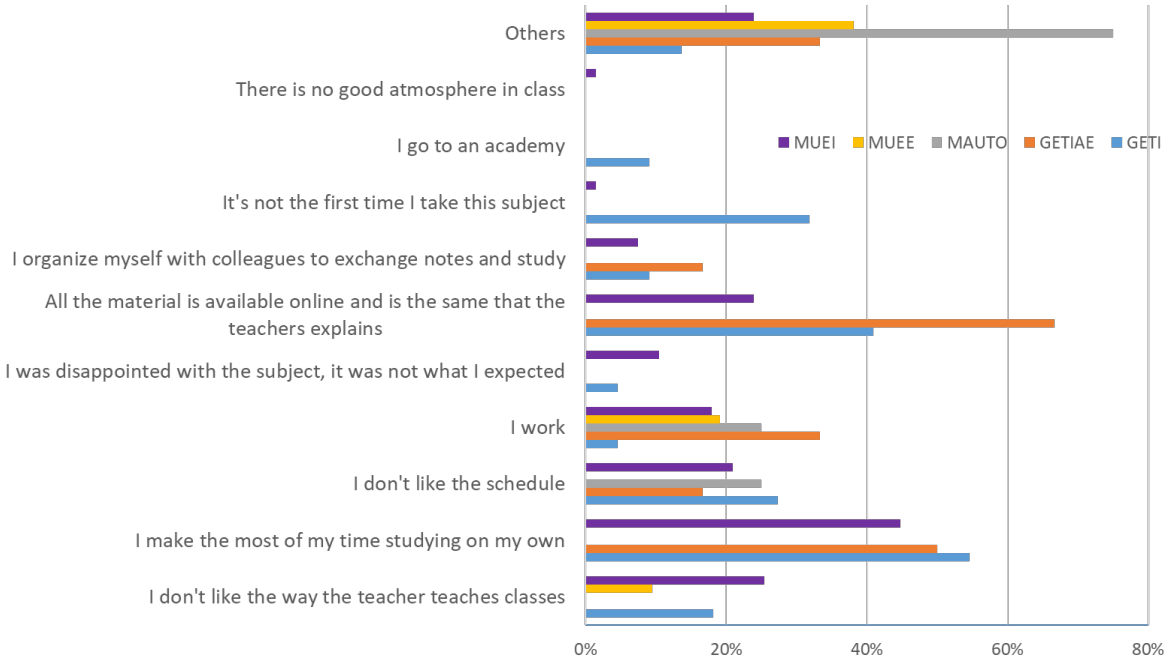

Fig. 2: Causes of absenteeism (according to students' responses)

Figure 2 illustrates factors that could potentially increase students' attendance. Contrary to expectations, methodologies aimed at increasing cooperative work or social interactions, utilizing ICT resources, or fostering connections with the degree

program's environment are not perceived as motivating factors for students. Instead, students are primarily motivated to attend classes when they perceive them as contributing to their subject's approval and learning process.
Hence, there is a need to investigate and adjust methodologies and lesson content to encourage students to attend classes effectively.

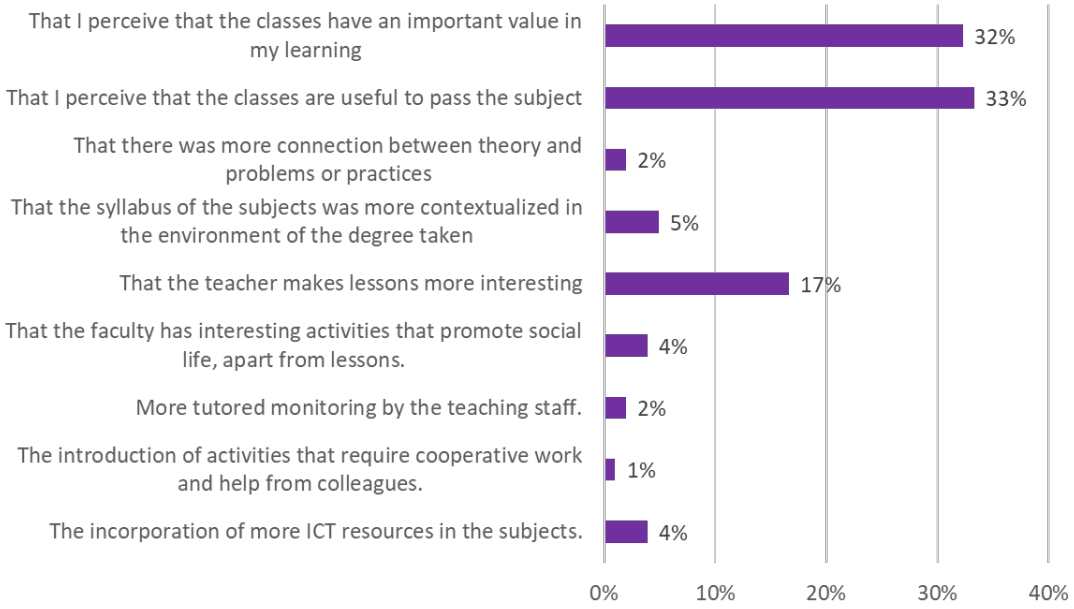

Fig. 3: Factors that could increase students' attendance (according to students' responses)

3.3 Educators' opinion

Across all responses, it was found that 61% of lessons primarily focus on delivering theoretical knowledge, 25% are centered on problem-solving or exercises, and 14% involve laboratory experiences. However, this proportion varies among different degrees, being GETI, GTIAE and MUEI the ones with a higher proportion of expositive lessons. A surprising finding is the elective nature of the attendance, with 94% of expositive lessons, 92% of the problem-solving sessions, and 63% of laboratory experiences being non-mandatory.
Seventeen percent of educators have made adjustments to their teaching based on student satisfaction survey results at the end of the semester. The most common modifications (33%) include increasing the number of exercises solved during sessions and discussing the current absenteeism situation and the relevance of attending lessons. Additionally, 20% of educators focus on enhancing the relevance of learning outcomes to students' professional lives.
In the subsequent survey conducted among members of the ASAP-UPC project, the proposal of exercises or problems to be done during the sessions is the most feasible mitigation strategy identified. In fact, 71% of ASAP-UPC members already incorporate student-solved exercises into their classes, a significantly higher percentage compared to the first survey. Furthermore, 91% of subjects include exercises resolution as part of the assessment system, with many educators planning to further enhance this aspect. Laboratory experiences are included in 65% of subjects, and 77% of educators aim to increase their number. Interestingly, only 50 % of the laboratory experiences are mandatory, even among ASAP-UPC members. Another noteworthy finding is that 35% of subjects are revising exams format to avoid standardized exams that can be solved without a deep understanding of the topic.

3.4 Absenteeism and attainment

Figure 3 depicts Gaussian curves representing the probability of achieving a particular grade based on attendance. A typical Gaussian shape is obtained for those students attending at least 50% of the lessons, with a mean grade of 7.5±1,01 out of 10. However, for students attending less than 50% of the lessons, an almost flat curve is obtained. This suggests that while attendance increases the likelihood of obtaining a higher grade, it is not the sole determinant of subject approval.

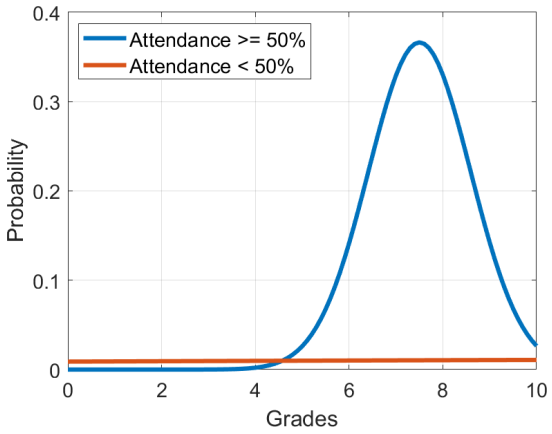

Fig. 4: Gaussian curves of the students' grades based on their attendance

4 DISCUSSION

The findings indicate that absenteeism rates vary significantly across subjects, with an absenteeism higher than 40% in mass enrollment programs and undergraduate degrees. In these cases, students often skip lessons because they perceive them as unhelpful for passing exams. Coinciding with Triado-Ivern et al. 2020 and López-Bonilla and López-Bonilla (2015) results, this perception stems from the believe that the material covered is already available online or dissatisfaction with the educator's methodology, leading some to opt for attending private academy to complement their learnings. These findings seem to demonstrate the existence of a casuistry typical of Spanish culture. Moreover, it has been demonstrated that attendance increases the likelihood of obtaining a higher grade also in the ETSEIB context.

Considering that (1) teaching is recognized in the same way regardless of the number of students enrolled, and (2) a direct proportion is associated between the educator's workload and the number of students enrolled, it is common to find a majority of expositive lessons in mass enrollment programs in the ETSEIB context. However, absenteeism tends to be more pronounced in expositive lessons, what indicates that a key absenteeism mitigation strategy is to minimize expositive lessons and maximize hands-on activities without increasing excessively the educator's workload. According to the results of the study, interesting mitigation strategies are: (i) the presentation of exercises or problems to be solved during class, with the specific guidance of the educator, (ii) the introduction of mandatory attendance at laboratory experiences, and (iii) the transformation of exams to a non-standardized format. All activities must be implemented so as the active participation of the students is considered in the assessment methodology. Also, if standardized exams are avoided, the fact that online materials are available, including a compendium of solved exams, should not penalize attendance.

These are the measures that ASAP-UPC members will implement. However, the effectiveness of these measures will ultimately be determined over time.

5 ACKNOWLEDGEMENTS

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REFERENCES

Al-Labadi, L., Advani, H.K., Holder, B., and Lim, K. “Education Influential Factors of University Attendance.” Journal of Educational and Developmental Psychology 13, 1 (2022): 29. https://doi.org/10.5539/jedp.v13n1p29.

Credé, M., Roch, S.G., and Kieszczynka, U.M. “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 (2010): 272–95. https://doi.org/10.3102/0034654310362998.

ETSEIB. “Absentisme ETSEIB.” Report (2022) https://etseib.upc.edu/ca/lescola/esdeveniments-anuals/jde/3ajde/Absentisme_ETSEIB.pdf.

European Commission. “ECTS Users’ Guide.” (2015)

Kahu, E.R. “Framing Student Engagement in Higher Education.” Studies in Higher Education 38, 5 (2013): 758-775. https://doi.org/10.1080/03075079.2011.598505.

Kassarnig, V., Bjerre-Nielsen, A., Mones, E., Lehmann, S., and Lassen, D.D. “Class Attendance, Peer Similarity, and Academic Performance in a Large Field Study.” PLoS ONE 12, 11 (2017). https://doi.org/10.1371/journal.pone.0187078.

Keyser, R.S. “A Correlation Between Absenteeism and Course Grades in a Third-Year Industrial Engineering Class.” Research in Higher Education Journal 37 (2019). http://www.aabri.com/copyright.html.

Kousalya, P., Ravindranath, V., and Vizayakumar, K. “Student Absenteeism in Engineering Colleges: Evaluation of Alternatives using AHP.” (2006) https://doi.org/10.1155/JAMDS/2006/58232.

Leufer, T., and Cleary-Holdforth, J. “Reflections on the Experience of Mandating Lecture Attendance in One School of Nursing in the Republic of Ireland.” All Ireland Journal of Higher Education 2, 1 (2010). https://ojs.aishe.org/index.php/aishe-j/article/view/18.

López-Bonilla, J.M., and López-Bonilla, L.M. “The Multidimensional Structure of University Absenteeism: An Exploratory Study.” Innovations in Education and Teaching International 52, 2 (2015): 185–95. https://doi.org/10.1080/14703297.2013.847382.

Moores, E., Birdi, G.K., and Higson, H.E. “Determinants of University Students’ Attendance.” Educational Research 61, 4 (2019): 371–87. https://doi.org/10.1080/00131881.2019.1660587.

Nja, C., Cornelius-Ukpepi, B., and Chinyere Ihejiamaizu, C. “Educational Research and Reviews The Influence of Age and Gender on Class Attendance plus the Academic Achievement of Undergraduate Chemistry Education Students at University of Calabar” 14, 18 (2019): 661–67. https://doi.org/10.5897/ERR2019.3805.

Rendleman, C. M. “North American Colleges and Teachers of Agriculture (NACTA) Do Attendance Policies Improve Student Performance? The Relationship among Attendance, Class Policies, and Grades.” Journal 61, 4 (2017): 347–49. https://doi.org/10.2307/90021486.

Rutherford, P., and McGrath, D. “Supporting Student Attendance Institute for Teaching and Learning Innovation.” Institute for Teaching and Learning Innovation, The University of Queensland (2022).

Shaaban, K., and Reda, R. “Impact of College Provided Transportation on the Absenteeism and Academic Performance of Engineering Students.” Eurasia Journal of Mathematics, Science and Technology Education 17, 3 (2021): 1–7. https://doi.org/10.29333/ejmste/9727.

St Glair, K.L, and St Clair, S.L. “A Case Against Compulsory Class Attendance Policies in Higher Education.” Innovative Higher Education 23, 3 (1999).

Summers, R.J., Higson, H.E. and Moores, E. “Measures of Engagement in the First Three Weeks of Higher Education Predict Subsequent Activity and Attainment in First Year Undergraduate Students: A UK Case Study.” Assessment and Evaluation in Higher Education 46, 5 (2021): 821–36. https://doi.org/10.1080/02602938.2020.1822282.

Triado-Ivern, X., Aparicio-Chueca, P., Elasri-Ejjaberi, A., Maestro-Yarza, I., Bernardo, M., and Presas, P. “A Factorial Structure of University Absenteeism in Higher Education: A Student Perspective.” Innovations in Education and Teaching International 57, 2 (2020): 136–47.

Vicéns Moltó, J.L., Hervás Avilés, R.M., and Zamora Parra, B. “El absentismo escolar, un problema en la Enseñanza de la Ingeniería. Análisis de la UPCT” in Redes de Investigación en Docencia Universitaria (2019): 189-201.

Webb, O.J., and Cotton, D.R.E. “Early Withdrawal from Higher Education: A Focus on Academic Experiences.” Teaching in Higher Education 23, 7 (2018): 835–52. https://doi.org/10.1080/13562517.2018.1437130.