

School absenteeism and academic achievement: Does the timing of the absence matter?

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ARTICLE INFO

Keywords:

School attendance problems
Academic achievement
Education policy
Secondary education

ABSTRACT

A large body of research demonstrates that school absenteeism is detrimental to learning, academic achievement and educational outcomes. However, questions remain whether this relationship varies according to the timing and reasons of absenteeism. Using time-stamped administrative school attendance data among 62,841 students enrolled in secondary education, this study examined whether the association between school absenteeism and student's examination results at the end of the school year varies with the timing and reasons of absenteeism. The findings show that unexcused absenteeism, sickness absenteeism and school exclusion all have a negative impact on student's academic achievement. In addition, the findings suggested that unexcused absenteeism is more harmful at the beginning of the school year and at the end of the school year. Sickness absenteeism seems also more harmful at the end of the school year. In the discussion I elaborate on the implications of these findings for policy and practice.

A large body of research demonstrates that school absenteeism is detrimental to learning, academic achievement, and educational outcomes. For instance, several studies have shown that missing school, even for a limited number of days and regardless of the reasons, negatively affects students' academic achievement (Gershenson et al., 2017; Kirksey, 2019; Klein et al., 2022). In addition, longitudinal research has found that for many students, non-attendance not only predicts subsequent absenteeism in later years, but is also related to many key academic and socio-emotional outcomes across high school and adult life (Ansari et al., 2020). Overall, these investigations demonstrate how absent students receive fewer hours of instruction, miss out on student-teacher, peer-to-peer and any other relevant interactions and activities that could stimulate their academic and psycho-social development, leading to negative consequences on the short and long term.

Many of these studies, however, have utilized measurements of school absenteeism from a limited number of time points (e.g., rates of absenteeism from the week or month prior to the questionnaire), or used subject-specific averages of absenteeism (sum, mean or proportion of absences across the school year), to estimate the effect of school absenteeism on achievement; overlooking the possibility that the association between school absenteeism and achievement might vary according to the timing. Although it is known that student's rates of school absences vary across different days, weeks, months, and semesters of the school year (Bos et al., 1992; Gottfried & Kirksey, 2017), there is dearth

of research examining the extent to which associations between absenteeism and achievement vary over time. As far as we know, only one study has examined the role of timing of absenteeism on academic achievement. Gottfried and Kirksey (2017) examined whether fall versus spring absenteeism among elementary students was linked to spring state exam scores and found that spring absences, and not fall absences, were associated with lower testing performances. However, this study examined the relationship with overall absences and achievement, while investigations have shown that associations between absenteeism and academic achievement also vary according to the reasons for being absent from school (Gottfried, 2009; Hancock et al., 2018; Klein et al., 2022). Moreover, Gottfried and Kirksey's study (2017) investigated - like most of the existing evidence of the impact of absences on achievement - the impact of absences on student's achievement among elementary students. Absenteeism in secondary education is likely to be different with that from in earlier grades, as older students have more agency over their school attendance habits.

The present study aims to advance our understanding of the association between school absenteeism and student's educational outcomes. Using a large and representative sample of youth enrolled in compulsory education ($N = 62,841$), this study investigates whether the association between student's absences and student's test performance varies across time. In addition, by differentiating between different reasons for absences (unexcused, sickness, and exclusion), this study investigates

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<https://doi.org/10.1016/j.learninstruc.2023.101769>

Received 5 July 2022; Received in revised form 10 March 2023; Accepted 13 March 2023

Available online 28 March 2023

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which of these reasons is more negatively associated with student's achievement and whether these unique associations differ according to the timing within the school year. As far as we know this is the first study to investigate the association between school exclusion and academic achievement, while also accounting for other reasons for school absenteeism (e.g., unexcused absenteeism, sickness absenteeism). Finally, this study investigates the association between absenteeism and student's certificates at the end of the school year. These certificates measure if a student can move to the subsequent school year, must repeat a grade, or must move to a lower track. These decisions rely on the teacher's judgements of their student's academic abilities and potential. As such, this study reports the association between absenteeism and an overarching construct for achievement (including test scores, teacher observations, and completion of other educational requirements).

The findings demonstrate that unexcused absenteeism, sickness absenteeism, and school exclusion all negatively relate to student's certificates at the end of the school year. Moreover, this study demonstrates how these observed associations differ according to the timing within the school year. In the discussion, I elaborate on the implications of these findings for understanding the causal link between absenteeism and achievement and for improving school attendance interventions at school.

1. School absenteeism and academic achievement

According to Faucet theory, students improve their skills through frequent exposure to schooling, and stop making educational gains once the exposure is turned off (i.e., the faucet is turned off). Students who receive fewer hours of instruction during the school year are disadvantaged in their learning, perform more poorly on exams, receive lower grades and at the end are more likely to drop out of school before reaching compulsory education (Attendance Works, 2022). Support for this argument comes from empirical studies showing that more time spent on instruction in the classroom is related with better academic achievement (Marcotte & Hemelt, 2008). Missing school will reduce the amount of time students can engage with instructional practices, which leads towards lower levels of academic achievement. Several studies have shown that missing school, even for a limited number of days and regardless of the reason, negatively affects students' student's test performances and grade point average (Gershenson et al., 2017; Kirksey, 2019; Klein et al., 2022). The effect of absenteeism on achievement is found to be linear and similar in magnitude across student and school subgroups. On average, each additional absence seems to lead towards a decrease in student's test performance. Kirksey (2019) showed how a one-unit change in school absenteeism (i.e., an increase of one day of school absenteeism) was related with a decline of 0.68 in grade point average.¹ Similarly, among secondary school students Liu et al. (2021) showed that missing 10 math classes reduces math test scores by 7% of a standard deviation, math course grades by 19% of a standard deviation, the probability of on-time graduation by 8%, and the probability of college enrollment by 7%. These effects were found relatively constant across student socio-demographic groups.

1.1. Absenteeism reason and student achievement

While these findings demonstrate strong support for Faucet theory, other studies suggest that-in addition to Faucet theory-other underlying

¹ A Grade Point Average is a numerical calculation, weighted by credit points, of the mean grades received over a defined study period (e.g., semester/teaching period/year) or program, and is usually calculated by dividing the grade points achieved by the credit points achieved for each term/year/program. In the study of Kirksey (2019), all course grades were transformed to fit a 4.0 scale, where A was 4 points, B was 3 points, C was 2 points, D was 1 point, and F was 0 points.

mechanisms might be at play when explaining the pathways from school absenteeism to lower academic achievement.

First, and building further on a parallel theoretical base, centered on general deviance theory and deviant affiliation theory (Battin-Pearson et al., 2000), absenteeism could interfere with lower academic achievement through a behavioral pathway (Klein et al., 2022). Within this behavioral pathway, school absences associated with *unexcused absences* are believed to lower academic achievement because unexcused absenteeism is known to exacerbate risky behaviors such as substance use, antisocial behavior, and other forms of externalizing problems (Henry et al., 2012; Heyne et al., 2019; Vaughn et al., 2013). In other words, unexcused absenteeism is expected to have more harmful consequences in terms of academic achievement due to what students are doing when they are missing school (Klein et al., 2022). Several studies indeed have shown that unexcused absenteeism - compared to other reasons for absenteeism - is more associated with academic achievement (Gershenson et al., 2017; Gottfried, 2009; Hancock et al., 2018; Klein et al., 2022).

School disengagement theory offers a second, and complementary theoretical base for explaining why unexcused absenteeism might lead to lower academic achievement. Unexcused absenteeism is known to be an important early warning signal in the process of school disengagement (Christenson et al., 2012; Fredricks et al., 2004; Henry et al., 2012; Keppens & Spruyt, 2020). Disengaged students might be less motivated to catch up on missed instruction time. Research also shows that teachers and fellow students report irritation and frustration towards students who miss classes due to unexcused absenteeism (Keppens & Spruyt, 2015; Wilson et al., 2008). As a result, students who miss classes due to unexcused absenteeism might also receive less support to catch up with missed lessons. Moreover, as students who miss classes due to unexcused absenteeism usually try to conceal their absences from their parents, parental support might also be lower compared to other reasons for absences.

Second, Klein et al. (2022) propose a health pathway between absenteeism and achievement by arguing that *sickness absences* might signal underlying (mental) health conditions that negatively affect educational achievement. The association between absenteeism and (mental) health problems is well known and has been widely documented in the literature (Finning et al., 2022; Pijl et al., 2021). For example, according to Pijl et al. (2021) sickness absence does not only affect student's academic achievement due to missed lessons and instruction time, but also because sickness absence might for many students be related to (mental) health conditions with a negative impact on student's academic and psycho-social development. However, compared to unexcused absences, student who missed school due to sickness might be more motivated to catch up on missed lessons due to higher school engagement. Moreover, teachers, classmates, and parents might be more motivated to support students with sickness absence to catch up on missed content (Klein et al., 2022). Research indeed shows that sickness absence, compared to other reasons for absenteeism, is less but still negatively related to student's academic achievement (Klein et al., 2022; Pijl et al., 2021).

Finally, school disengagement theory, the behavioral pathway, and the health pathway all could be at play when looking at the association between *school exclusion* and academic achievement. School exclusion refers to absenteeism that stems from school-based decision-making and may occur permanently (expulsion) or temporarily (suspension) (Heyne et al., 2019). Research shows that students who are sanctioned through out-of-school suspensions are more disengaged from school (McCarter et al., 2020; Pyne, 2019). Not surprisingly, these studies also report how students with unexcused absences are also more likely to be excluded from school. In addition, school exclusion is known to be related to student's externalizing problems (Degroote & Van Houtte, 2022), resulting in less willingness from teachers, fellow students, and parents to support on catching up on missed lesson content. Finally, John et al. (2022) showed an association between disciplinary exclusion and

psychopathology, indicating that school exclusion for some students might also be impacted by underlying mental health conditions that have a long-term impact on learning and achievement. Although research on the association between school exclusion and student's academic achievement is scarce, these findings suggest that absences due to school exclusion might affect student's academic achievement.

1.2. Timing of absenteeism and student achievement

Next to the reasons for absenteeism, the timing of absences might help us understand the causal mechanisms between school absenteeism and academic achievement. Using district data of elementary students, Gottfried and Kirksey (2017) observed that spring absences, compared to fall absences, were associated with lower scores on state-administered end-of-year exams for English language arts and mathematics. The 30-day window leading up to the test seemed to be the most critical period of absenteeism. Gottfried and Kirksey (2017) argue that hours of instruction closer to tests might focus more on test-taking skill building or on reviewing material and being absent at these time periods might have a more detrimental effect on achievement.

However, the effect of timing on student's achievement might also vary according to the reasons of the absence. At the beginning of the school year, many students in secondary education navigate their way through new classrooms, meet new students and teachers, and face new academic challenges. During these first month(s) of the school year, students and teachers size each other up and allow those first impressions to set the tone for the remainder of the year (Gehlbach et al., 2012; Gilbert, 1995). This is also supported by research showing how the quality of teacher-student interpersonal relationships, as well as student's school engagement decreases over the length of the school year (Gehlbach et al., 2012; Opendakker et al., 2012). Especially unexcused absences might be more harmful during the beginning of the school year, as these students will be less engaged to catch up on missed content, might miss opportunities to strengthen student-teacher and student-student closeness resulting in greater alienation and disengagement from their fellow students, teachers, and the school (Finn & Zimmer, 2012; Keppens & Spruyt, 2017; Rumberger, 2011). Moreover, unexcused absenteeism at the beginning of the school year might be more harmful because students and families might be forming habits in school non-attendance at the start of the school year which are maintained throughout the year. For instance, Gottfried (2017) showed how unexcused absenteeism among elementary school pupils in the beginning of the school year predicted higher levels of unexcused absenteeism later in the same school year. Similarly, autobiographic interviews with students in secondary education showed that for many students, habits in unexcused absenteeism are difficult to break (Keppens & Spruyt, 2017).

1.3. Purpose of the present study

Despite the possibility that the association between school absenteeism and academic achievement might vary according to the timing and reasons for these missed school days, few studies have investigated the possible role of timing and reasons of school absenteeism on achievement. Using a large and representative sample of youth enrolled in compulsory education ($N = 62,841$), the present study aims to address that gap in the literature by investigating whether the associations between student's absences and academic achievement vary according to the timing and reasons of absences. With regards to the reasons of absenteeism, this study aims to replicate previous research on the association between truancy, sickness absenteeism and achievement (Klein et al., 2022). Moreover, this is the first study to investigate the association between school exclusion and achievement, in relation to other reasons for absenteeism. This is also the first study to investigate whether the associations between student's absences and academic achievement vary according to the timing of absenteeism among

students in secondary education. Given the lack of research focusing on the timing of absences on achievement, this study will not postulate specific hypotheses but follows an exploratory approach asking the following research questions.

- 1) What is the association between school exclusion, sickness absenteeism and unexcused absenteeism and achievement?
- 2) Do these associations differ based on the timing of absences?

2. Methods

2.1. Data and sample

This study uses the administrative database on absenteeism collected by the Flemish (Dutch-speaking part of Belgium) Ministry of Education and Training. This dataset follows different cohorts of all students enrolled in compulsory education. In this study, I used the cohort of students that enrolled in the first year of secondary education in school year 2014–2015. As these data were contaminated from school year 2019–2020 onwards due to the COVID pandemic, the sample consists of all students enrolled in the fifth year of secondary education (which equates to students of ages 16–17 if they have followed a standard trajectory) in school year 2018–2019 ($N = 62,841$). The analysis of absenteeism and student achievement in this study is based on a comprehensive data set of student observations. The complete dataset comprises a cohort of the entire secondary school system population within Flanders. As such, there were no missing data. Ethical approval for this study was obtained from the (omitted for peer review) ethics committee.

In Flanders, school non-attendance is registered twice a day (during the first lesson of the day and the first lesson in the afternoon) by teachers or the school administration. Schools automatically report these registered absences to a centralised database (DISCIMUS), which is operated by the Flemish Ministry of Education and Training through unique student and school identification numbers. Each half school day of non-attendance is timestamped and linked to these identifiers. As such, the dataset contains information on student's school absences, student demographics, and student's course-level grades.

2.2. Measures

Four types of measures are utilized in this study: student's academic achievement as the dependent variable, reasons for absenteeism and timing of absences as our main independent variables, and a set of socio-demographic characteristics and other relevant covariates.

2.2.1. Academic achievement

Academic achievement refers to a student's success in meeting the standards set forth by the school or educational institution they attend. This includes test scores, grades, and completion of educational requirements. In this study, academic achievement is measured based on the academic certificates which students received at the end of the school year 2018–2019.²

In Flanders, education is compulsory until the age of 18. The Flemish school system can be classed as an explicit form of school-level tracking, which sorts students into different school types according to their academic performances. Flemish secondary education comprises six years, and from the third year onwards (14 years and older), students are divided over four tracks: vocational tracks which prepare for the labour market, technical tracks in preparation of the labour market and higher

² The Flemish educational system does not administer standardized student assessment tests among their students in secondary education. As such, student's certificates are the only available measure for gauging achievement within the used population.

technical training, general tracks where most pupils move on to higher education, and art tracks which prepares students for higher arts education. These different tracks are hierarchical, with the vocational tracks placed at the lower end. To move on to the next year within the same track, students receive a certificate based on teacher's judgements of their academic abilities and potential (Boone & Van Houtte, 2013). These different certificates are: 'A' which allows students to move on to the next school year within the same track, 'B' which allows students to move on to the next school year but in a lower track (e.g., from the general track to the vocational track), and 'C' which means the student needs to repeat the school year (i.e., grade retention) due to poor achievement during the school year. On top of these three types, we also have a group of students who received no certificate. This latter group mainly comprises students who left school due to school dropout. This latter group are students who were enrolled in secondary education in school year 2018–2019 but were no longer enrolled in school year 2019–2020.³ Due to the skewed distribution of these 4 categories (only 5.21% of the students received no certificate at the end of the school year and only 3.54% received certificate B at the end of the school year) we recoded our variable *student's end of year academic certificate 2018–2019* as a dummy variable, with students with an A-certificate as the reference category. 83.60% of the students in our sample received an A certificate at the end of school year 2018–2019.

2.2.2. Reasons for school absenteeism

Our first key independent measures of interest are the reported specific reasons for school absenteeism during school year 2018–2019. *Unexcused absenteeism* is measured by counting per pupil the number of half day's students were registered with an unexcused absence from school (i.e., provided no justified reason for the school absence). *Sickness absenteeism* refers to the number of half school days a student was absent from school due to sickness, which was justified by either a doctor's note or by parental consent. With regards to the latter, in Flanders a note from the parents is sufficient for an absence up to three consecutive calendar days. A medical certificate from the doctor is required in the following cases: (1) if the student is ill for four or more consecutive calendar days (e.g., Friday, Saturday, Sunday and Monday = medical certificate); (2) for every absence due to illness, no matter how short, if the student was already absent four times in the same school year legitimized through a parental note; and (3) if the student is ill during exam periods. *School exclusion* measures the number of half school days a student was suspended from school due to a disciplinary action. Finally, *Other absences* refers to all other school absences in school year 2018–2019 with exception of unexcused absences, sickness absences and school exclusions. This rest category mainly includes absences permitted by the school principal for personal reasons (e.g., family bereavement or funerals, but also participation in external sports, arts or other activities and family holidays).

In our sample, all students have the same total number of possible half school days (which is 324 half days of school). On average, students missed 5.68 half days of school due to unexcused absences ($SD = 16.31$), 12.31 half days of school due to sickness ($SD = 21.88$), 0.46 half days of school due to school exclusion ($SD = 5.14$), and 3.52 half days of school due to other absences ($SD = 14.86$). To ease the interpretation of the effect sizes of these variables in our models, the variables unexcused absenteeism, sickness absenteeism, school exclusion, and other

absenteeism were recoded as categorical variables: (0) no absences [reference category], (1) 1 to 10 absences, (2) 10 to 20 absences, (3) 20 to 30 absences and (4) more than 30 absences.

2.2.3. Timing of school absences

Our second set of key independent measures are the timing of unexcused absences, sickness absences, and school exclusion. For each of these reported reasons for student's absences, I constructed a variable indicating student's absences in September, October, November, December, January, February, March, April, May, and June for the school year 2018–2019. To account for differences in the number of school days between these different months, for each month I calculated the absenteeism proportion by dividing the total number of half days attended by the total number of available half school days. As the distributions of these time measures were right-skewed, I applied a square root transformation to fit normality assumptions. The frequency distribution of each of these measures is presented in Fig. 1.

2.2.4. Covariates

A first set of covariates include the socio-demographic characteristics. I included gender, socioeconomic background, foreign language status and migrant status. To capture the different dimensions of socioeconomic background, I considered maternal education, low income, and neighborhood grade retention. The covariates 'parental education', 'household income', and 'neighborhood deprivation' are used by the Flemish Ministry of Education and Training to mark whether students come from disadvantaged home backgrounds. Identification of these students is important as schools with high percentages of disadvantaged students receive additional funding. *Maternal education* is measured using the educational qualification of the mother (1 = mother does not have a secondary school diploma). *Low income* is measured whether the student receives an education allowance⁴ (1 = student receives an education allowance). *Neighborhood grade retention* is measured based on the percentage of 15-year-olds in the neighborhood where the student lives with at least 2 years of grade retention. After ranking all students, only pupils in the highest quartile are coded as living in a neighborhood with a high concentration of students experiencing grade retention (1 = family lives in a neighborhood with a high concentration of students experiencing grade retention). When interpreting this variable, it is important to note that in our administrative database this variable is reported as a student-level variable, and we do not have information on the group-level (to account for possible neighborhood-level variation). In this study, we use this measure as a proxy for neighborhood deprivation. Next, *foreign language status* measures whether a respondent speaks a language in his household which differs from the formal language of instruction (which is Dutch) (1 = speaks a foreign language at home). *Newly arrived migrant student status* refers to the group of students between 12 and 18 years old who have recently migrated to Belgium and are enrolled in a separate programme aimed at teaching the language of instruction.

In our sample, 50.80% of the participants are boys, 15.91% speak a foreign language at home, 2.12% are newly arrived migrant students, 22.67% have a mother with a low level of education (did not finish secondary education), 37.93% receives an educational allowance and 23.63% lives in a neighborhood with a high concentration of students that had to repeat a school year.

A second set of covariates are included to test the robustness of our results and to reduce the chance on spurious correlations for our key variables. I included a variable measuring all absences in academic year 2017–2018 and a variable measuring Student's End of Year Academic

³ The calculation of this school dropout indicator is based on the enrollments that are registered in the administrative database of the Flemish Ministry of Education and Training on February 1st of each year. The school dropouts in academic year 2018–2019 were still enrolled in February 2019, but no longer in February 2020. Some unenrollments might not be related to school dropout. This might be the case when a student has moved to home education (less than 1% of the student population is enrolled in home education), has moved abroad, or is deceased.

⁴ In Flanders, the educational allowance is an annual support for families with school-aged children with a maximum annual income limit of €53,816 (which equals approximately \$60,000). This income limit however further depends on the family size and family situation.

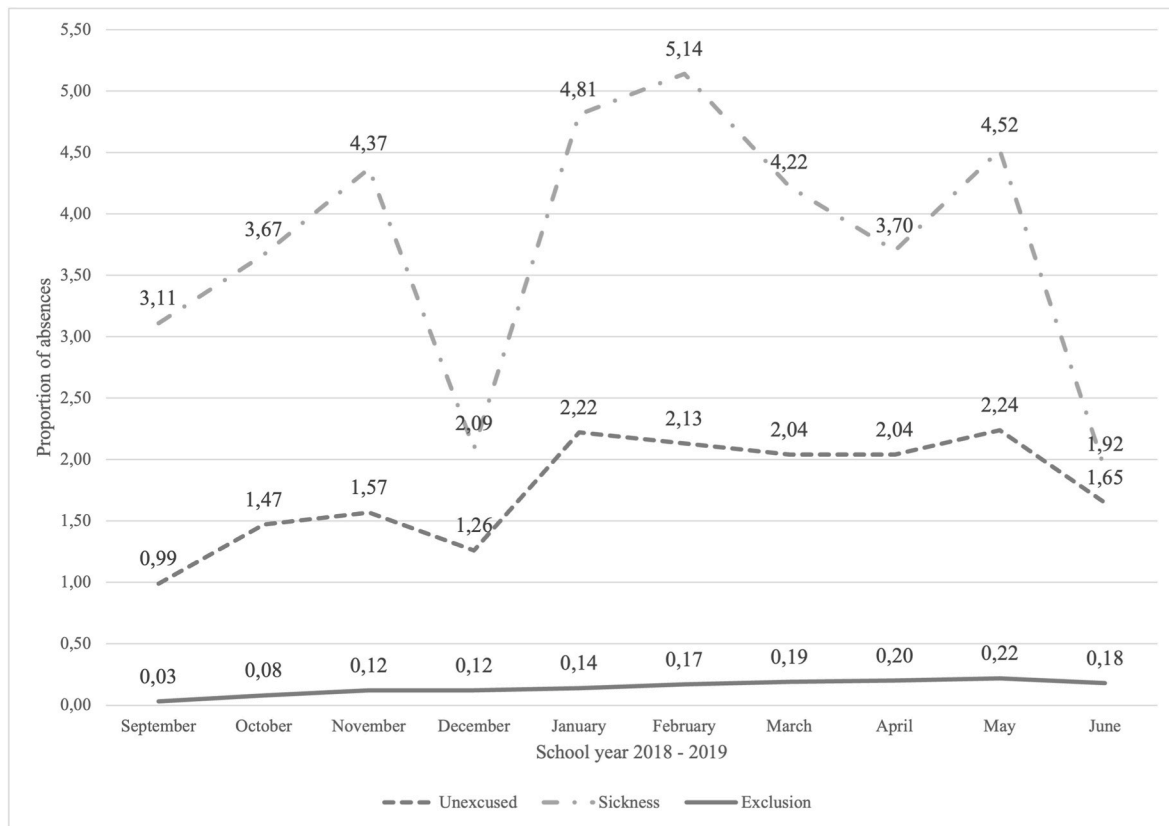


Fig. 1. HERE (Frequency distribution of total number of half days attended by the total number of available half school days per absenteeism type and for each month of academic year 2018–2019).

Certificates for all previous school years in secondary education as research has shown that these variables predict academic achievement (Gershenson et al., 2017; Kirksey, 2019; Klein et al., 2022). *Absences 2017–2018* measures all half days of school absences in the previous academic year. 98.32% of the students in our sample were absent from school in school year 2017–2018 ($M = 23.73$, $SD = 32.52$).

Student's End of Year Academic Certificates for the previous school years indicates whether students followed a standard trajectory including the following categories coded as a set of dummy variables: *1 year ahead of the normal track*, *standard trajectory* (which is used as the reference category), *1 year behind the normal track*, *2 years behind the normal track*, and *3 or more years behind the normal track*. As in the Flemish school system grade retention is commonly used to deal with low achievers, being behind normal track refers to students who received at least one certificate C during their previous school years in compulsory education. The category of students who are 1 year ahead of the normal track refers to students with exceptional academic achievement which are allowed to skip one year of schooling. Among the students in our sample, 1.32% is 1 year ahead of the normal track, 67.97% is in the standard trajectory, 24.07% is 1 year behind the normal track, 5.44% is 2 years behind the normal track, and 1.19% is at least 3 years behind the normal track.

Finally, I controlled for *academic track* (0 = general track, 1 = vocational education track, 2 = arts education track, 3 = technical education track). 41.27% of the students in the sample are enrolled in general education, 22.74% in vocational education, 2.57% in arts education, and 33.42% in technical education.

2.3. Analytic strategy

The analyses proceeded in several steps. First, and to answer the first research question, I conducted Logistic multilevel regressions to assess the impact of the *reasons* of school absenteeism on academic

achievement (N students = 62,841; N schools = 715). Logistic regression gives the conditional probability that an outcome variable equals one at a particular value of our included predictor variables (e.g., the likelihood of obtaining not a certificate A at the end of school year 2018–2019 for a pupil with a total of 10 half school days of unexcused absenteeism in that school year). As the students in my sample are nested within schools, multilevel analysis is needed. First, I estimated an unconditional null model to determine school-level variance in academic achievement. Then, I added the variables sequentially as explained above through constrained (i.e., which assessed the variation of the log-odds from one cluster to another) and augmented intermediate models (i.e., which assessed the variation of the lower-level effects from one cluster to another) and performed likelihood ratio tests to identify the optimal model fit. Finally, I ran a final model to answer the research questions. The final model is displayed in equation 1:

$$\text{Logit}(\text{odds}) = \beta_0 + \beta_1 Uabs_{ij} + \beta_2 Sabs_{ij} + \beta_3 Eabs_{ij} + \beta_4 Z_{ij} + u_j$$

where the log-odds of not receiving certificate A at the end of the school year for student i in school j was modeled as a function of unexcused absenteeism ($Uabs$), sickness absenteeism ($Sabs$), and school exclusion ($Eabs$) for student i in school j , covariates (Z), and school fixed effects (u_j). School fixed effects control for possible differences at the school level such as school composition, school climate, and school culture effects.

In a second step, I conducted Logistic multilevel regression analysis to assess the impact of the *timing* of school absenteeism on academic achievement (the second research question). This model is based on the same equation and strategy as above, except I considered separate effects of monthly exposure in academic year 2018–2019 for unexcused absenteeism, sickness absenteeism and school exclusion instead of the total number of absences in that academic year. To estimate the independent effects of exposure during each month, I fitted a single

simultaneously adjusted multilevel regression model that includes repeated measurements of all months as separate predictor variables (Welten et al., 2018). Hence, the second model estimates whether specific reasons of absenteeism occurring at different months of the school year are uniquely associated with student achievement.

3. Results

The unconditional null model showed that 38% of the variance in academic achievement occurs between schools. The Wald test statistic ($W_T = 208.18$; $p < 0.001$) was also significant, indicating a significant variation between schools in academic achievement, and thus warranting multilevel regression analysis. Next, I added our explanatory variables stepwise through random intercept models. After including these variables, the variance in academic achievement that occurs between schools decreases to 12%. Model fit statistics of this final model reported a good model fit ($LL = -19965.3$; $AIC = 39970.59$; $BIC = 40151.56$) and could not be further improved. Table 1 presents the final model, estimating the association between the reasons of absenteeism and academic achievement in academic year 2018–2019 when adjusting for covariates and school fixed effects. Parameter estimates were transformed into odds ratios to allow for the interpretation of effect sizes.

Table 1 illustrates that unexcused absenteeism, sickness absenteeism, school exclusion, and other absences during school year 2018–2019 all have a unique impact on academic achievement. Compared to students without *unexcused absences*, students with 1–10 unexcused absences are 1.74 times more likely of not getting certificate A, students with 10–20 unexcused absences are 3.03 times more likely of not getting certificate A, students with 20–30 unexcused absences are 4.65 times more likely of not getting certificate A, and students with more than 30 unexcused absences are 17.19 times more likely of not getting certificate A.

Next, compared to students without *sickness absences*, students with 10–20 sickness absences are 1.15 times more likely of not getting certificate A, students with 20–30 sickness absences are 1.35 times more likely of not getting certificate A, and students with more than 30 sickness absences are 2.25 times more likely of not getting certificate A. The results showed no difference in receiving certificate A between students without sickness absenteeism and students with 1–10 half school days of sickness absenteeism.

In addition, compared to students without *school exclusion*, students with 1–10 half days of school exclusion are 1.80 times more likely of not getting certificate A, students with 10–20 half school days of school exclusion are 2.17 times more likely of not getting certificate A, students with 20–30 half school days of school exclusion are 5.37 times more likely of not getting certificate A, and students with more than 30 half school days of school exclusion are 10.84 times more likely of not getting certificate A.

Finally, compared to students without *other types of absences*, for students with 1–10 half days of other absences there is a 14% decrease in the odds of not getting certificate A. In other words, students with 1–10 half school days of other absences are more likely to receive certificate A compared to students without half school days of other absences. Students with 20–30 half days of other absences and students with more than 30 half days of other types of absences are, compared to students without other absences, respectively 2.39 and 3.43 times more likely of not getting certificate A.

Second, the results show that boys and students from socio-economically disadvantaged families achieve less in schools. Gender ($OR = 1.888$, $p < 0.001$), neighborhood grade retention ($OR = 1.165$, $p < 0.001$), maternal education ($OR = 1.167$, $p < 0.001$) and foreign language status ($OR = 1.201$, $p < 0.001$) all are independently associated with academic achievement. Finally, our results demonstrate a strong association between grade retention and academic achievement. Being 1 year behind the normal track ($OR = 1.570$, $p < 0.001$), 2 years

Table 1

Logistic multilevel regression analysis: Reasons for school absences in school year 2018–2019 and examination results at the end of the school year (1 = no certificate A).

Effect	Estimate	SE	95% CI		p
	OR		LL	UL	
Fixed effects					
Unexcused absenteeism (0 half school days of unexcused absenteeism)					
1–10 half school days of unexcused absenteeism	1.749	.057	1.640	1.865	.000
10–20 half school days of unexcused absenteeism	3.058	.160	2.760	3.389	.000
20–30 half school days of unexcused absenteeism	4.685	.351	4.046	5.425	.000
30 or more half school days of unexcused absenteeism	17.045	1.291	14.697	19.775	.000
Sickness absenteeism (0 half school days of sickness absenteeism)					
1–10 half school days of sickness absenteeism	1.036	.045	.940	1.118	.568
10–20 half school days of sickness absenteeism	1.153	.058	1.045	1.272	.005
20–30 half school days of sickness absenteeism	1.345	.132	1.197	1.511	.000
30 or more half school days of sickness absenteeism	2.248	.132	2.003	2.522	.000
School exclusion (0 half school days of school exclusion)					
1–10 half school days of school exclusion	1.801	.131	1.562	2.077	.000
10–20 half school days of school exclusion	2.170	.316	1.631	2.887	.000
20–30 half school days of school exclusion	5.370	1.269	3.380	8.533	.000
30 or more half school days of school exclusion	10.838	2.330	7.111	16.517	.000
Other absences (0 half school days of other school absences)					
1–10 half school days of other school absences	.863	.027	.811	.918	.000
10–20 half school days of other school absences	1.150	.111	.951	1.390	.150
20–30 half school days of other school absences	2.395	.425	1.692	3.390	.000
30 or more half school days of other school absences	3.433	.450	2.655	4.440	.000
Gender (1 = boy)	1.888	.056	1.782	2.000	.000
Neighborhood grade retention (1 = lives in neighborhood with a high concentration of students with grade retention)	1.165	.040	1.090	1.246	.000
Maternal education (1 = mother did not obtain diploma secondary education)	1.167	.040	1.092	1.247	.000
Low income (1 = receives school allowance)	1.018	.030	.960	1.079	.554
Language status (1 = speaks foreign language at home)	1.201	.047	1.111	1.297	.000
Migrant status (1 = newly arrived migrant)	.769	.034	.638	.926	.006
Educational track (general track)					
Vocational track	.514	.153	.462	.572	.000
Arts track	1.204	.153	.939	1.554	.143
Technical track	1.361	.061	1.236	1.477	.000
Half days of school absenteeism in school year 2017–2018	1.005	.001	1.004	1.007	.000
Student's End of Year Academic Certificate previous school years (1 = standard trajectory)					
1 year ahead of the normal track	0.968	.133	.740	1.268	.815
1 year behind the normal track	1.570	.051	1.474	1.674	.000
2 years behind the normal track	1.839	.010	1.657	2.041	.000
3 years behind the normal track	2.627	.292	2.112	3.267	.000
Random effects					
Variance individual level	/	/	/	/	/
Variance school level	.466	.037		.399	.543

Note. Number of students = 62,841, number of schools = 715. CI = confidence interval; LL = lower limit; UL = upper limit. OR = odds ratio.

behind the normal track (OR = 1.839, $p < 0.001$) and 3 or more years behind the normal track (OR = 2.627, $p < 0.001$) all relate to lower achievement.

The findings reported in Table 2 indicate that the timing of unexcused absences, sickness absence and school exclusion relate to student's academic achievement. Moreover, these findings show that the effect of timing on achievement differs for unexcused absences and sickness absences. First, with regards to unexcused absenteeism the findings demonstrate that unexcused absenteeism, regardless of the month of the school year, negatively impacts academic achievement. In addition, the negative impact of unexcused absences on achievement is highest at the beginning (September OR = 1.115, [1.082, 1.148]) and at the end of the school year (June OR = 1.126, [1.097, 1.156]), compared to the middle of the school year (e.g., December OR = 1.049, [1.019, 1.080], January OR = 1.042, [1.018, 1.067] and April OR = 1.057, [1.035, 1.080]). Second, our results show that, apart from absences in January (OR = 1.003, $p = 0.73$), sickness absences have a negative impact on academic achievement. Moreover, compared to the other months of the school year, sickness absences are most harmful at the end of the school year, in June (OR = 1.133, [1.112, 1.156]). Finally, our results suggest that school exclusion has little impact on academic achievement during the first semester of the school year. For instance, we found no association between school exclusion and achievement during September (OR = 0.979, $p = 0.77$), October (OR = 1.033, $p = 0.47$), and December (OR = 1.029, $p = 0.45$).

4. Discussion

Using a unique administrative longitudinal dataset on student's school absences, this article investigates whether the association between school absenteeism and academic achievement varies according to the timing and reasons of absences.

First, we found that the association between school absenteeism and achievement varies according to the reasons of the absence. Unexcused absenteeism, sickness absenteeism and school exclusion all have a unique and negative impact on academic achievement. In line with previous research, these findings confirm that almost each additional absence - irrespective of the cause and socio-economic background of the absent student - leads towards a decrease in student's academic achievement (Gershenson et al., 2017; Kirksey, 2019; Klein et al., 2022). These negative associations of absences with achievement are usually interpreted from Faucet theory. Children are expected to make educational gains as a function of school exposure (e.g., the faucet is on), and will stop to make educational gains when this exposure (e.g., due to school absenteeism) is 'turned off'. Accordingly, the findings show that absenteeism -irrespective whether these are due to unexcused absences, sickness absences, school exclusion, or any other reason - lead towards lower academic achievement. However, our findings also demonstrate unique associations between different reasons for school absenteeism and student's academic achievement indicating that in addition to explanations driven from faucet theory, other mechanisms might be at play. For instance, in line with research from Klein et al. (2022), the association between unexcused absenteeism and achievement might point towards a more behavioral pathway, interfered by lower school disengagement, school alienation, and risky and antisocial behaviors.

In addition, the relationship between sickness absence and achievement might point towards a more health pathway interfered by underlying (mental) health problems (Klein et al., 2022; Pijl et al., 2021). The findings also suggest that there might be a certain threshold for sickness absenteeism to have detrimental effects on student achievement. Only for students with more than 10 half school days of sickness absenteeism, the results show a negative impact on academic achievement. This threshold is also observed with regards to absences

Table 2

Logistic multilevel regression analysis: Timing for school absences in school year 2018–2019 and examination results at the end of the school year (1 = no certificate A).

Effect	Estimate	SE	95% CI		p
	OR		LL	UL	
Fixed effects					
Unexcused absenteeism					
September	1.115	.016	1.082	1.148	.000
October	1.084	.015	1.056	1.113	.000
November	1.102	.015	1.073	1.131	.000
December	1.049	.016	1.019	1.080	.001
January	1.042	.012	1.018	1.067	.000
February	1.098	.013	1.072	1.125	.000
March	1.078	.013	1.053	1.104	.000
April	1.057	.012	1.035	1.080	.000
May	1.096	.013	1.071	1.122	.000
June	1.126	.015	1.097	1.156	.000
Sickness absenteeism					
September	1.027	.009	1.009	1.045	.004
October	1.033	.009	1.015	1.051	.000
November	1.026	.009	1.009	1.044	.002
December	1.057	.010	1.037	1.077	.000
January	1.003	.008	.987	1.019	.73
February	1.034	.008	1.018	1.050	.000
March	1.026	.008	1.010	1.043	.001
April	1.027	.008	1.011	1.043	.001
May	1.018	.009	1.002	1.035	.03
June	1.133	.011	1.112	1.156	.000
School exclusion					
September	.979	.071	.850	1.129	.77
October	1.033	.046	.946	1.128	.47
November	1.182	.048	1.09	1.280	.000
December	1.029	.039	.955	1.109	.45
January	1.147	.041	1.070	1.230	.000
February	1.086	.034	1.022	1.155	.008
March	1.179	.040	1.104	1.260	.000
April	1.077	.034	1.012	1.146	.02
May	1.136	.038	1.064	1.212	.000
June	1.102	.039	1.028	1.182	.006
Gender (1 = boy)	1.955	.058	1.844	2.072	.000
Neighborhood grade retention (1 = lives in neighborhood with a high concentration of students with grade retention)	1.141	.039	1.067	1.220	.000
Maternal education (1 = mother did not obtain diploma secondary education)	1.132	.039	1.058	1.210	.000
Low income (1 = receives school allowance)	.998	.030	.941	1.058	.94
Language status (1 = speaks foreign language at home)	1.162	.045	1.075	1.255	.000
Migrant status (1 = newly arrived migrant)	0.77**				
Educational track (general track)					
Vocational track	.476	.026	.427	.531	.000
Arts track	1.153	.149	.895	1.485	.27
Technical track	1.322	.061	1.208	1.446	.000
Half days of other absences in school year 2018–2019	1.017	.002	1.014	1.020	.000
Half days of school absenteeism in school year 2017–2018	1.002	.002	.028	.034	.000
Student's End of Year Academic Certificate previous school years (1 = standard trajectory)					
1 year ahead of the normal track	.955	.133	.727	1.254	.74
1 year behind the normal track	1.530	.050	1.435	1.631	.000
2 years behind the normal track	1.740	.094	1.566	1.933	.000
3 or more years behind the normal track	2.620	.296	2.010	3.270	.000
Random effects					
Variance individual level	/	/	/	/	/
Variance school level	.485	.038	.416	.565	

Note. Number of students = 62,841, number of schools = 715. CI = confidence interval; LL = lower limit; UL = upper limit. OR = odds ratio.

due to 'other' reasons. Only for students with more than 20 half school days of other absences, there is a negative impact on academic achievement. Moreover, students with 1–10 half school days of other absences seem more likely to receive certificate A, compared to students without other types of absences. This effect might be the result of a selection effect. School principals are probably more likely to accept absences as excused (e.g., school holidays) for students with good grades.

Third, our results demonstrate a negative impact of school exclusion on student's academic achievement. This novel finding warrants further attention as school exclusions are a type of school absenteeism that stem from school-based decision-making, often initiated as a disciplinary measure. Moreover, we know that school exclusions are disproportionately more used among students from socio-economically disadvantaged backgrounds and among minority students (Gregory et al., 2010; Hwang et al., 2022). By showing that school exclusions have a negative impact on student's achievement, these findings further give proof how disproportionate discipline might contribute to lower achievement among students with difficulties at school or in the home environment. School exclusion seems to push students away from school rather than improve school attendance when these disciplinary measures are not accompanied by actions to tackle the underlying reasons of the school attendance problem. Moreover, students tend to rebel against sanctions or try to avoid them and in this way avoid contact with teachers and mentors (Ekstrand, 2015). A recent literature review showed that interventions that are based exclusively on the rewarding of punishing of students do not work or are counterproductive. While a temporary suspension seems to lead towards a decrease of unexcused absenteeism for the first time, it appears to encourage and increase unexcused absenteeism when repeated (Keppens & Spruyt, 2020).

These findings further emphasize the need for schools to address the underlying reasons for unexcused absenteeism and school disengagement. The identification of reasons and causes of unexcused absenteeism is often considered a prerequisite for absenteeism interventions to work. Identifying these underlying causes, however, is often difficult as disengaged students often have little confidence with their school representatives. With regards to the latter, schools that invest in more warm and trustful relationships with their students (and the parents of these students) seem to be more successful with addressing these underlying factors (Keppens & Spruyt, 2020).

More in general, these findings seem to fit within a broader picture where schools are increasingly held accountable for their absenteeism rates, with new technologies (e.g., daily monitoring) further increasing the pressure on schools (Childs & Lofton, 2021; Spruyt et al., 2016). In that way, however, these registration systems risk to become an end rather than a starting point to critically reflect on and gain more insight into the meaning of school attendance problems within a particular case.

A second key finding of this study is the impact of the timing of school absenteeism on academic achievement. First, and in line with research from Gottfried and Kirksey (2017), this study shows that sickness absenteeism and unexcused absenteeism are most harmful at the end of the school year, in June, which is the month when the end-of-year examinations are organized. Since hours of instruction closer to tests focus more on test-taking skill building or on reviewing material, being absent at these time periods has a more detrimental effect on achievement. However, with regards to unexcused absenteeism, our results also indicate that unexcused absenteeism is more harmful at the beginning of the school year. Research has shown that unexcused absenteeism is strongly related to school disengagement (Keppens & Spruyt, 2020; Vaughn et al., 2013). Previous research also showed the importance of the first month of the school year for building social ties and strong relationships with teachers and fellow students (Gehlbach et al., 2012; Gilbert, 1995). Both are identified as crucial components for strengthening school engagement among youth (Jimerson et al., 2003).

4.1. Implications for policy and practice

The findings reported in this study have implications for policy and practice. First, due to the adverse consequences of school absenteeism for youth, families, school, and broader communities, more research is conducted on early identification and interventions. Interventions are evaluated through assessments; however, the assessment process is hindered by a lack of reliable criteria to differentiate between problematic and non-problematic school absenteeism (Heyne et al., 2019, 2020). These criteria are relevant for the identification of accurate thresholds and demarcations between different levels of absenteeism severity which are important for multi-tiered system of support (MTSS) models for responding to school absenteeism (Kearney, 2020; Kearney & Graczyk, 2014). However, the thresholds, or 'cut-offs', that are currently used vary considerably, and there is insufficient scientific support to justify one set of absenteeism cut-offs over another (Heyne et al., 2020). In addition, so far only variations in the number of absences have been considered as possible cut-offs. The findings reported in this study, however, demonstrate that in addition to the number of absences, the timing and reasons students miss school should be accounted for. For instance, a student who misses 10 days might not necessarily be worse of in terms of his academic achievement than a student who only has 6 days of school non-attendance if the latter reported mostly unexcused absences at the beginning or/and at the end of the school year.

Second, by focusing on the role of timing when investigating how absenteeism predicts achievement this study sheds further light on the time of the year that matters most for targeting school attendance interventions. In many countries and regions, interventions are targeted during the early months, considering that September has been designated as National Attendance Awareness Month (Attendance Works, n. d.). This is the first study that finds empirical support for this policy emphasis on early-year attendance among students in secondary education. However, given that school absences are also more harmful at the end of the school year (i.e., before exams), preventative resources should also be focusing on the end of the school year, for example by incentivizing school attendance toward the end of the school year. However, these considerations should also consider that unexcused absenteeism, on any other month also relates with lower academic achievement. Appointing resources to prevent absences at the beginning and end of the school year should thus rather be supplementary than replacing. There is a rich literature on how schools can prevent absenteeism through improving school engagement among their students (Christenson et al., 2012; Keppens & Spruyt, 2020). Other studies also show how focusing on academic buoyancy (i.e., the ability to respond adaptively to minor academic adversities) might protect lower achievement after being absent from school (Putwain et al., 2020).

In sum, these findings demonstrate that schools should work continuously on the underlying dynamics of school absenteeism as well as on protective mechanisms (e.g., improving school engagement), rather than focusing on the absent behavior itself through separate and siloed interventions at specific time intervals.

Third, our findings emphasize the need to provide support at school for children to recover lost learning time due to school absenteeism. Schools should appoint tutoring for children to catch up on instruction time and could inform parents on how to help their children with catching up on missed lessons (Klein et al., 2022). Previous research has shown that nonpunitive school-based interventions like tutoring and peer support are effective strategies to intervene among absent youth (Keppens & Spruyt, 2020). In addition, technological innovations accelerated by means of the COVID-pandemic might offer new opportunities for online tutoring and student-teacher interactions with students absent from school or returning to class. At the same time, however, we know that teachers and fellow students report higher irritation and frustration among students who miss classes due to unexcused absenteeism (Keppens & Spruyt, 2015; Wilson et al., 2008). Research on perceptions of non-truanting students on truants, for

example, illustrated that many regular attenders disapprove truancy and perceive truants as outcasts (Keppens & Spruyt, 2015). Other research showed that poor attenders form fewer friendships with better attenders (Carroll, 2011). Classmates and teachers might be less willing to support students who miss school due to unexcused absenteeism which might hamper efforts from school to support students to catch up on missed lesson content.

Finally, over the next decades school attendance and its related problems will be increasingly seen as a wicked problem that affects communities and generations in a persistent and intricate manner (Childs & Lofton, 2021; Kearney et al., 2022). This will require shared alliances among local and national educational administrations, as well as connections with other agencies (e.g., youth mental health and social services, youth offending responses). Unfortunately, current approaches to school attendance and its related problems are isolated across disciplines and agencies. Recently, however, there has been a steady progress towards more shared alliances among agencies and stakeholders to solve the intricacies involved in school attendance and its problems. According to Kearney et al. (2022) these shared alliances include (1) multi-agency tracking of students, (2) coordinated early warning and intervention systems, and (3) community asset mapping coupled with long-range intercession planning across generations. Moreover, in recent years several interdisciplinary partnerships have emerged in the field of school attendance. The recently established International Network for School Attendance (INSA) works to promote school attendance, and to respond to school attendance problems (www.insa.network; Heyne et al., 2020). One of its objectives is to bring together the different stakeholders in the field and to ensure that all these stakeholders have access to current developments in the field.

4.2. Limitations and directions for further research

Although we attempted to solve the main caveats in investigating the role of timing and reasons of absenteeism on academic achievement, this study is not without limitations. First, our administrative data does not include indicators gauging students' engagements, motivations, and relationships in class and at school, nor on any possible underlying health issues. Second, although we can control for maternal education and some basic income proxy for the family, we know that student's resources are highly predictive of educational outcomes. Hence, there might be spill-over effects since these environment variables might not be capturing the total variance of student's background on achievement.

A third limitation of the used dataset is that it does not permit to test possible variation at the classroom level, the neighborhood level, or the family level. This study provides evidence as to whether the observed variables are related to student achievement, holding constant unobserved student and school effects. However, these estimates of absenteeism coefficients might be biased due to unobserved family, neighborhood, or classroom factors, of which we know also have an influence on school absenteeism and student achievement (Gottfried, 2009, 2019). Unfortunately, this is a limitation of the used dataset.

A final drawback of this study is that the outcome measure is not a sensitive measure of achievement - only whether a student has achieved well enough to continue at school in the following year (which comprises 83% of the sample) or not. A well-rounded understanding of a student's achievement typically comes from considering multiple measures, such as standardized test scores, grades, and classroom observations. The used measure for achievement - which represents the decision to grant students access to the subsequent school year - relies on the teacher's judgements of their student's academic abilities and potential. The latter has two implications. First, this study is not able to differentiate within the category of students that is permitted to move on to the subsequent school year. Second, this outcome variable might be influenced by teacher competency and potentially confounding variables such as idiosyncratic teacher grading styles and teacher perceptions. Further research should continue refining the insights from the

administrative findings reported in this study.

5. Conclusion

In conclusion, the current study provides further evidence that more detailed attendance awareness is needed. Although all absences seem to have a negative impact on achievement, unexcused absences - in particular at the beginning and end of the school year - seem to be most harmful. These findings urge the importance of providing additional school support for students who are absent to catch up on missed instruction time to improve overall achievement rates.

Author statement

Gil Keppens is the only contributor of this manuscript.

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Gil Keppens is an assistant professor at Tilburg University. This study has received funding from the FWO under the Postdoctoral Fellow - grant agreement No 12Z9121N.