He Whakaaro
EDUCATION INSIGHTS

What is the relationship between attendance and attainment?

Introduction

School attendance is a key measure of student engagement and wellbeing. Previous research has also found that it is strongly linked with student attainment. This paper describes the nature of this relationship across a range of year levels and attainment outcomes, and investigates whether this relationship looks different for different student groups or different types of absences.

Key findings

The report finds:

» The overall relationship between attendance and attainment can be best described by a straight line, especially at attendance rates over about 70 percent.

» The first 1.5 days of justified absence across Term 2 is the only 'safe' level of non-attendance (where there is a minimal impact on a student's attainment) we could find evidence for.

» This implies that any other absence from school is associated with substantially lower attainment – that is, every day matters.

» The first few unjustified absences in a term are associated with the largest drops in attainment.

» Attendance is more strongly related to attainment at higher year levels (particularly NCEA), and for mathematics, as opposed to reading.

» For some student groups (like students in low decile schools), attendance appears to be particularly important.

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Attendance is an important indicator of student wellbeing, engagement in learning, and connection to school in its own right. But attendance is also a key driver of learning outcomes.

What is this paper about?

School attendance is the most crucial prerequisite for quality education – students cannot learn if they are not in school. Attendance is included as a key educational measure of wellbeing in the government's Child and Youth Wellbeing Strategy (DPMC, 2019), and Indicators Aotearoa New Zealand (Statistics NZ, 2019). Attendance is an important indicator of student wellbeing, engagement in learning, and connection to school in its own right. But attendance is also a key driver of learning outcomes. Previous research has established that there is a strong relationship between attendance and student attainment (Gottfried, 2010; Ministry of Education, 2019a). This paper explores the nature of that relationship in more detail.

Figure 1 shows three potential relationships between attendance and attainment. In the first panel, attainment increases at a decreasing rate with increased attendance. There is relatively little difference in attainment between students with full attendance and students with high but not quite full attendance. This might imply that some level of non-attendance is 'safe' – students can miss some schooling and later catch up, without harming later attainment (until they reach a threshold point). In the second panel, attainment increases with attendance at an increasing rate. This means that for students with low attendance, small increases in attendance aren't associated with much difference in later attainment, whereas for students with almost full attendance, small increases in attainment matter a lot. This relationship could be consistent with students becoming disengaged from their learning after a key amount of non-attendance, at which point the main damage to learning has been done, and further absences have little effect. In the third panel, there is a consistent relationship between attendance and attainment – an additional missed day of school is predicted to have the same effect on learning, regardless of how many days the student has already missed.

Figure 1: Three hypothetical relationships between attendance and attainment
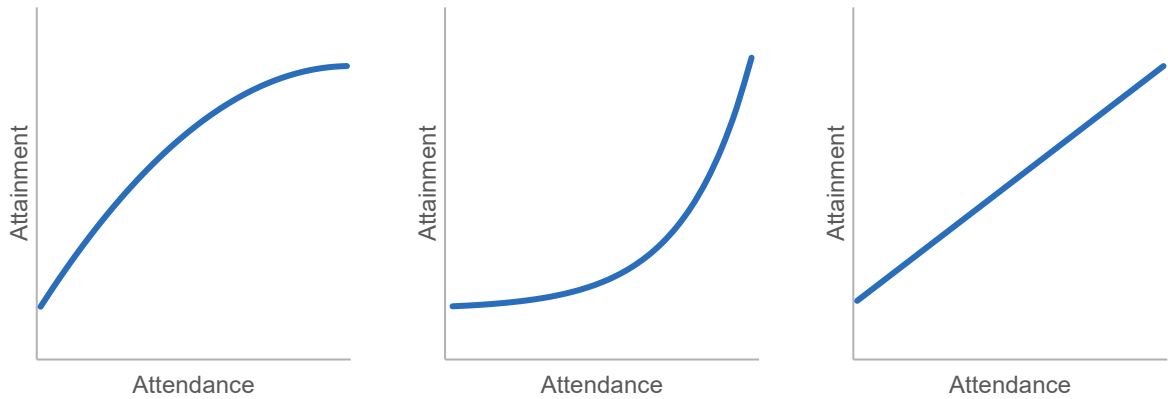
Previous research by the Ministry indicates that the relationship between attendance and attainment may look most like the first panel, with a 'safe' amount of non-attendance (Ministry of Education, 2019). The relationship between Year 11 attendance and the probability of attaining NCEA Level 1 is relatively flat from about 95-100 percent attendance, and drops off below 95 percent. However, the statistical technique that was used to determine this relationship (logistic regression) assumes a relationship that looks like the first panel, meaning this finding could be an artifact of the technique used to analyse the data.

2   *In the same way, another popular statistical regression technique – ordinary least squares – assumes a relationship that looks like the third panel of Figure 3 (a straight line).*

To determine the actual relationship, we followed analysis by Hancock and colleagues (2013) of school attendance in Western Australia by using generalised additive models. These statistical models do not pre-assume any particular shape of the relationship – the algorithm chooses the shape that best conforms to the data.[3] We ran these models on outcomes relating to NCEA at the end of schooling, as well as e-asTTle assessments of reading and maths undertaken from Year 4 to Year 10. We also examined whether we could find different relationships for different types of non-attendance, or whether attendance had a different relationships for different groups of students.

About the data we used

The attendance data we used comes from the New Zealand Schools Attendance Survey, which is an annual collection of attendance data for students in Term 2. The 2018 survey includes data from 86.6 percent of all schools and represents 92.5 percent of enrolled students in New Zealand (Ministry of Education, 2019). This report uses pooled attendance data from 2011 to 2018. In this report, we define attendance rates as the proportion of total time in Term 2 attended for each student. This differs slightly from the calculations used in regular attendance reporting, which calculates percentages of half-days.[4] This report distinguishes between 'attendance', 'unjustified absences', and 'justified absences'. The attendance codes that make up these categories are the same as in the official attendance reporting.

We separately looked at the relationship between attendance and several different outcomes:

» The number of credits attained at NCEA Level 1, 2 and 3

» The number of credits attained at NCEA Level 1, 2 and 3, weighted by result[5]

» e-asTTle reading and maths scores for each of Years 4 to 10

We estimated the relationship between the NCEA outcomes and attendance in Year 10. We used Year 10 for the attendance measure even though NCEA is typically undertaken by students in Years 11-13 for two reasons. The first is that most students turn 16 in Year 11, which marks the end of compulsory schooling. The second reason is that students typically undertake NCEA assessment throughout Year 11. This may mean that when students get to Term 2, they have already undertaken and received feedback on NCEA assessments, and may be modifying their attendance on this basis. This increases the chances that NCEA attainment is causing attendance, rather than attendance driving attainment.

We compared attendance in each of Years 4 to 10 with e-asTTle scores in Term 4 of the same year. These scores are derived from reading and mathematics assessments taken using the e-asTTle assessment tool.[6] This is a voluntary tool that is used in some schools and classrooms but not others. Further, teachers can opt to assess some students in their class but not others. Of all students with attendance data, about 15-20 percent also have e-asTTle scores over Years 4 to 6, increasing to about 40 percent in Year 10.

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3 *With some restrictions; for example, the relationship must still be a 'smooth' function. For more on the technical detail behind generalised additive models, see Liu (2008).*

4 *This means, for example, that if a student is coded as present for two hours and truant for one hour for a particular morning, for the purposes of official reporting, the half-day will be coded as present, and the information about the truant period will be ignored.*

5 *The weightings used for this measure are: not achieved=0; achieved=2; merit=3; excellence=4.*

6 *For more information on e-asTTle, see: e-asttle.tki.org.nz*

This is evidence against the idea of a 'safe' level of non-attendance, where students do not experience negative impacts.

What is the high level attendance-attainment relationship?

Figure 2 visualises the relationship between overall attendance rate for students in Term 2 of Year 10 and the number of Level 1 credits they subsequently obtain. Although the statistical technique we used allows the relationship to take any form, the result was – at least in the range of attendance above 70 percent – essentially a straight line. This implies that each additional absence predicts the same reduction in number of credits subsequently attained – whether that is the student moving from 100-99 percent attendance, or moving from 71-70 percent attendance. This is evidence against the idea of a 'safe' level of non-attendance, where students do not experience negative impacts. This is consistent with the findings of research on attendance in Western Australia, summarised by the title of that research: *Every Day Counts*.

Figure 2: Overall relationship between attendance and attainment (Level 1 credits)
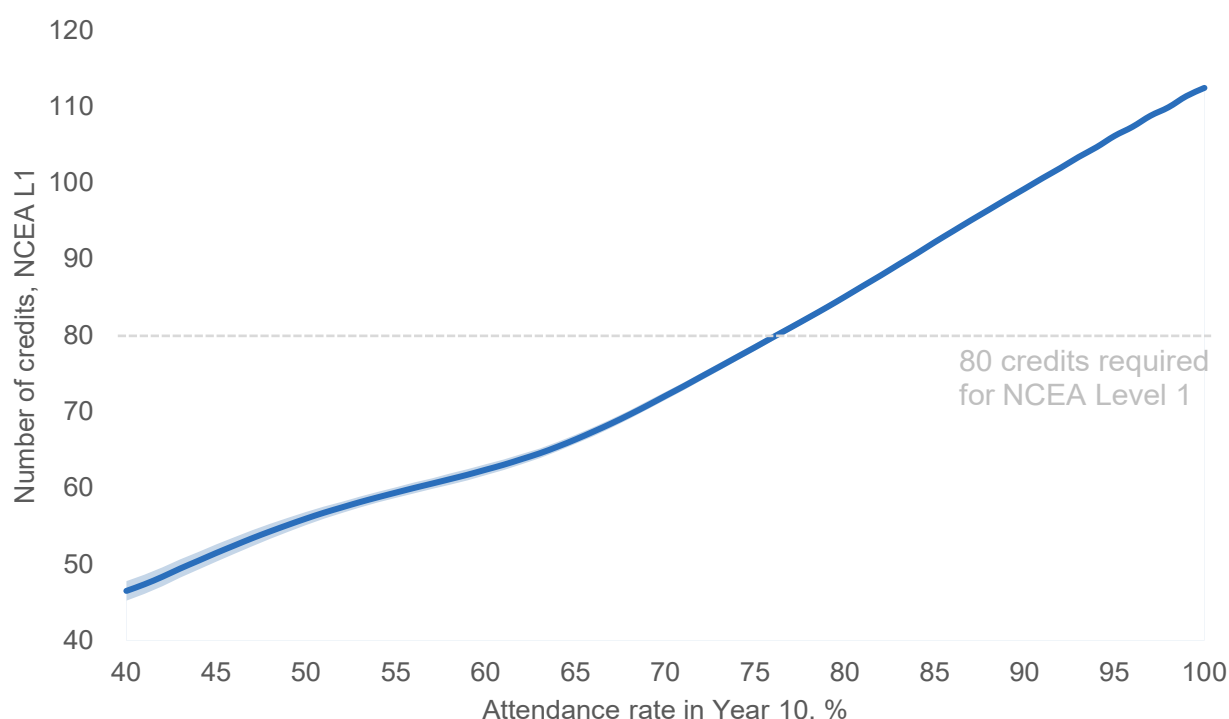
Note: The light blue shaded area around the line indicates the 95% confidence interval.

This relationship also supports the idea that a large amount of the cost of non-attendance is because students miss out on opportunities to learn, as opposed to effects on their engagement (though engagement likely also matters). The engagement of students who attend school 95-99 percent of the time is likely to not be all that different to the engagement of students 100 percent of the time. The exact amount of time away from school is likely to be somewhat randomly determined by factors such as illness. Yet this analysis indicates that these groups of students have noticeably different attainment outcomes.

For attendance rates below about 70 percent, the line flattens off, appearing to indicate that, after a certain point, further instances of non-attendance have limited additional effect. However, this flattening off applies to very few students. According to the regular attendance reporting, only an average of 7 percent of students have attendance rates below 70 percent from 2011 to 2018.

The relationships between attendance and other NCEA and e-asTTle attainment outcomes are shown in the Appendix. Broadly, these relationships can be best described by either the second or third curves in *Figure 1*. At higher levels of

attendance (above 80 percent), the relationship is a fairly straight line, with the same implication as with NCEA Level 1: each day of non-attendance predicts a similarly negative effect on attainment.

Each curve in the appendix points to a level of non-attendance at which attainment flattens out, where additional absences predict smaller changes in attainment. The level of attendance at which this flattening occurs – as well as the degree to which the curve flattens – depends on the exact attainment outcome. For NCEA outcomes, the curve flattens at about 60-70 percent attendance, but continues declining to the minimum 40 percent attendance. For many of the e-asTTle outcomes, the relationship flattens at a higher level of attendance – between 70-80 percent. At some year levels, attainment appears to increase at very low attendance rates, although this is based on relatively few students, and so these estimates are more prone to error.

The consistent pattern of strong negative relationships with attainment at the top end of attendance implies that although the Ministry treats all students with attendance above 90 percent as 'regularly attending', this category hides substantial variation. *Figure 3* shows the predicted difference in each type of student outcome between students with 90 percent and students with 100 percent attendance rates. To compare across the different measures, we have converted each outcome into effect sizes.[7] Students with 100 percent attendance have attainment that is higher than students with 90 percent attendance by an average of between 0.15 and 0.42 standard deviations, depending on the measure. For NCEA outcomes, this translates to 13 to 15 credits. There are particularly large effects for maths and NCEA, and stronger effects for secondary school students than primary school students. To put these effect sizes in context, the difference in NCEA results shown in *Figure 3* are approximately equivalent to the difference in NCEA outcomes between decile 5 and decile 10 schools.

Students with 100 percent attendance have NCEA achievement that is higher than students with 90 percent attendance by an average of 13 to 15 credits.

Figure 3: Effect size associated with changing attendance from 90-100 percent


How do these relationships differ by student groups?

We can also separately estimate these relationships for individual student groups to determine whether the dynamics of school attendance depend on the characteristics of students. Note that this is a slightly different question to whether attendance rates differ between groups. For example, boys have similar levels of attendance in Year 10 to girls, but absences from school might predict a different change in attendance for one group or the other. The actual relationship for NCEA Level 1 split by gender is

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7   An effect size is an estimate that does not depend on the scale of a particular assessment, and so it is easier to compare across studies. For a more detailed explanation of effect sizes in education, see Hattie (2009).

shown in *Figure 4*.[8] For attendance rates higher than about 60 percent, these lines are parallel, with the higher line for female students reflecting that girls have higher NCEA attainment. The fact that these lines have a very similar slope suggests that non-attendance is equally harmful for both boys and girls.

Figure 4: Relationship between Year 10 attendance and Level 1 NCEA, by gender
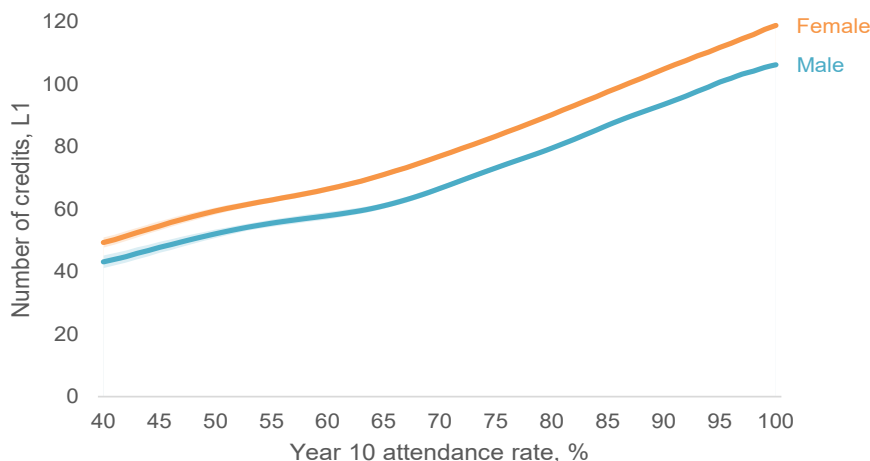
This may indicate that the learning of students with more disadvantaged socio-economic backgrounds is more impacted from even small absences from school.

In contrast, *Figure 5* shows the relationship split by school decile. Again, the higher line for decile 10 reflects the educational advantage associated with higher socio-economic background. However, particularly at attendance rates between 90-100 percent, the line for decile 1 is noticeably steeper than the line for decile 10. This may indicate that the learning of students with more disadvantaged socio-economic backgrounds is more impacted from even small absences of school, and these students are less likely to be able to catch up on content they have missed. Also of note is that the average number of credits for decile 10 students does not go below the 80 credits required for NCEA Level 1 until attendance drops below 45 percent across Term 2. However, decile 1 students drop below this 80 credit threshold at 90 percent attendance.

Figure 5: Relationship between Year 10 attendance and Level 1 NCEA, by decile

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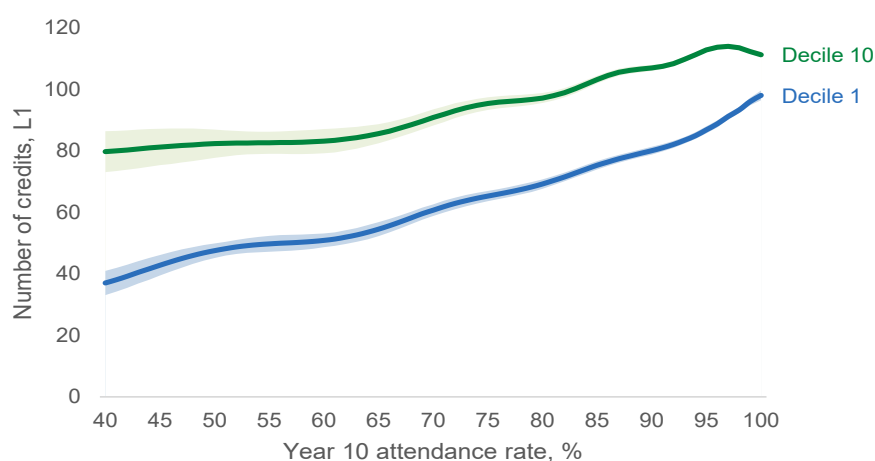
8   *Relationships for other NCEA outcomes are not presented here but are broadly similar to the relationship at Level 1.*

Figure 6 shows the attendance-attainment relationship split by ethnic group.[9] Differences in heights of the lines largely reflect known inequities in the education system (reported, for example, in Ministry of Education, 2019b). However, this figure also shows differences in the slopes of these lines: relationships for Asian and Pacific students are noticeably flatter than the corresponding relationships for Pākehā and Māori students. This might indicate that absences (even when they occur at otherwise high rates of attendance) might be particularly harmful for Pākehā and Māori students.

Figure 6: Relationship between Year 10 attendance and Level 1 NCEA, by ethnic group
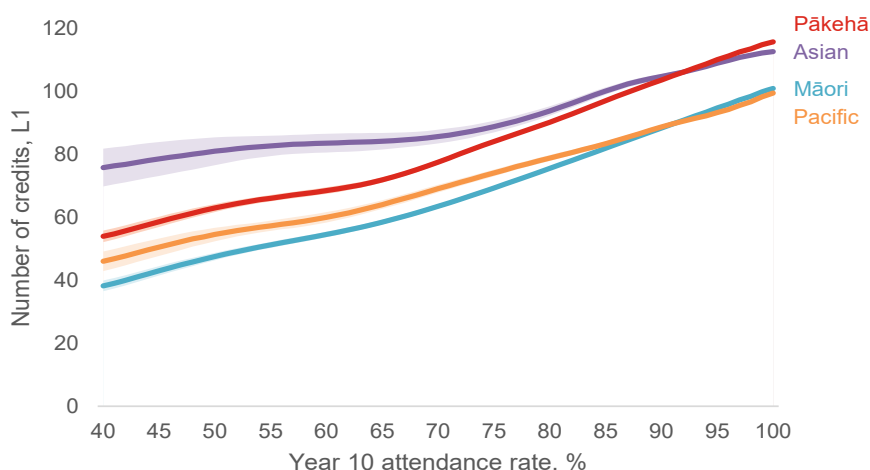
Is the relationship different between types of non-attendance?

So far in this report we have been looking at the relationship between attending school and later attainment. However, it is plausible that different types of non-attendance have different effects. For example, absences due to appointments or illness represent a loss of learning time for students, whereas truancies represent an additional drop-off in engagement and connection to school. To explore this in more detail, we have split non-attendances into justified absences and unjustified absences (see *Figure 7*). Note that this graph is flipped compared to the previous figures – full attendance occurs on the far left side of this curve, as opposed to the far right.

Figure 7: Relationship between justified/unjustified absences and Level 1 NCEA

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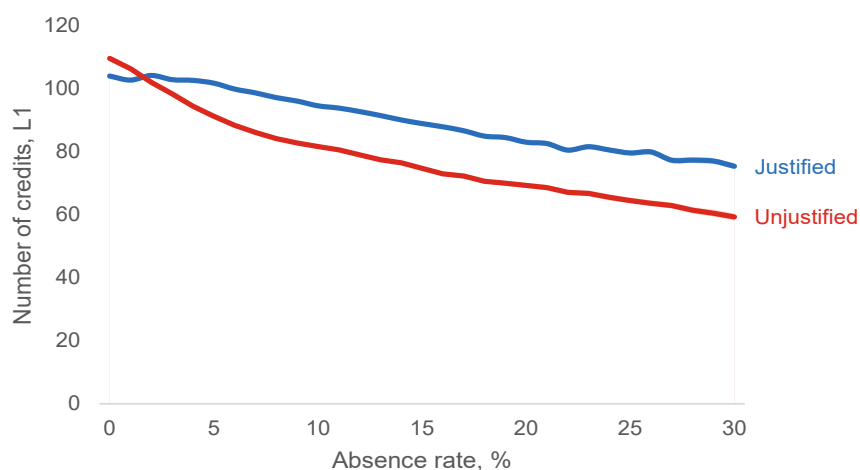
9   *Students can belong to multiple ethnic groups, and in those cases are included in multiple lines.*

The first unjustified absences in a term are associated with particularly large drop-offs in attainment.

The relationship between unjustified absences and attainment is initially sharply downwards-sloping, and then flattens off slightly at around 7-10 percent of Term 2. This indicates that the first unjustified absences for students are associated with larger drop-offs in attainment than additional absences for students who are already not attending school regularly. In contrast, the relationship between justified absences and attainment is relatively flat until about 3 percent, at which point it declines at an approximately constant rate.[11] This provides some evidence for a 'safe level' of non-attendance, but only if the absence is justified and only for the first few absences in a term (up to 3 percent, or about 1.5 days across Term 2).

What does this mean?

This paper has taken a detailed look at the relationship between school attendance and later student attainment. While previous research on attendance in New Zealand appears to have suggested a 'safe' level of non-attendance, we found little evidence of this. In general, all absences from school are associated with a lower level of subsequent attainment, from Year 4 to NCEA. The only possible exception to this is very small amounts of justified absences, which amount to approximately 1.5 days per term. These drops in attainment can be large, with absences of up to 10 percent of Term 2 (still not enough to categorise students into 'not regularly attending') associated with 13 to 15 fewer credits attained in NCEA. These relationships also differ by student group, with some school deciles and some ethnic groups having stronger relationships between attendance and attainment than others.

While this paper has described the overall relationship between attendance and attainment, it does not give us conclusive evidence as to what might drive this relationship. One straightforward explanation is likely to be the loss of learning time that results in not being physically present in school. A more complex mechanism could be a loss of engagement in learning or connection to school. This may be self-reinforcing: students may be absent from school because of a lack of engagement, and this absence from learning is likely to make it difficult to later catch up, as well as making it difficult to maintain strong connections to teachers or regularly attending peers, thereby causing a further loss in engagement.[12] A third type of mechanism could be aspects that drive both attendance and attainment (for example, socio-economic background).[13]

Although we cannot yet isolate the exact causal relationships between attendance and attainment, it is likely to be the case that improving attendance outcomes will have a positive impact on learning, and the knowledge, skills and qualifications that students ultimately bring with them to later life. Improvements in attendance are likely to come through a combination of improvements to support at the system level, as well as local action by teachers, schools, and whānau (Jacob & Lovett, 2017; McCauley & Chappell, 2018).[14] Some research (Gershenson, 2016) finds that teachers who are most effective in improving test scores are not necessarily the same as the teachers who are most effective in improving attendance, suggesting that supporting attendance and engagement as a separate (but related) dimension of teacher quality to imparting skills and knowledge. However, there are also likely to be strategies that can improve both of these outcomes. For example, evaluations of the Te Kotahitanga approach to improve cultural responsiveness in schools indicated positive benefits on both attendance and student learning, particularly for Māori students (Meyer et al., 2010).[15]

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11   *This pattern also appears in the relationship between attendance and other NCEA and e-asTTle outcomes (not shown here).*

12   *For more on the complex relationships between student engagement and school attendance, see McGregor and Webber (2019).*

13   *However, this analysis has also shown that within each school decile, higher levels of attendance is associated with substantially higher attainment.*

14   *Where local attendance issues are caused by factors such as poverty, solutions focused on improving these conditions (for example, greater availability of school buses, or the recently announced free school lunch programme – see Ministry of Education, 2019c) might be more effective than more educationally-focused interventions.*

15   *A refreshed version of Te Kotahitanga – Te Hurihanganui – is currently being rolled out more broadly across schools (Ministry of Education, 2019d).*

Further effort in improving attendance is likely to benefit from more detailed research on the dynamics of attendance. This includes exploring the effects for the 26 different attendance codes, examining the history of a student's attendance longitudinally across year levels, and potentially identifying the impact that schools can have on attendance rates. It also includes summarising what we know from existing research (and conducting evaluations to generate new evidence) on specific strategies that are effective in improving attendance.

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For further information, questions or discussion around additional analysis and potential topics for an Education Insights please contact **Requests.EDk@education.govt.nz**

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Appendix – Other attainment outcomes

Figure A1 – Credits (NCEA 2)
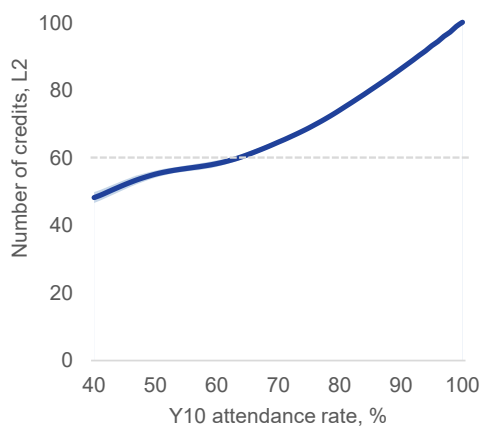
Figure A2 – Credits (NCEA 3)
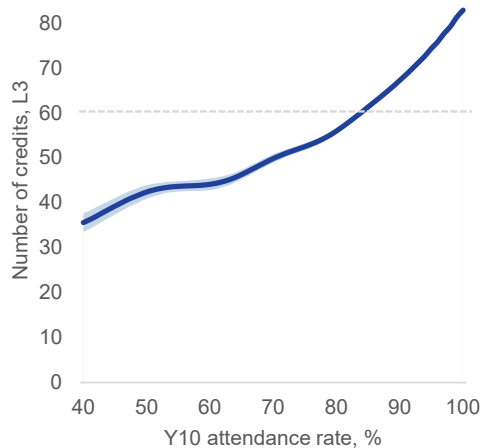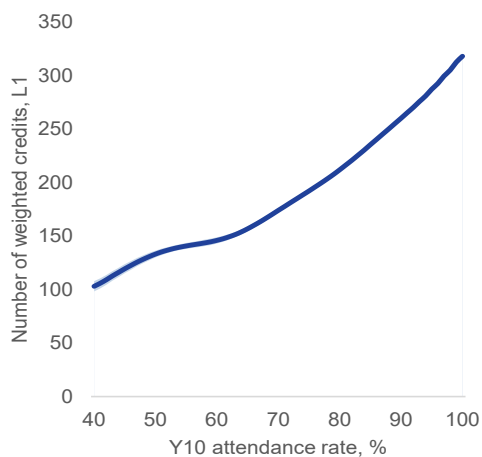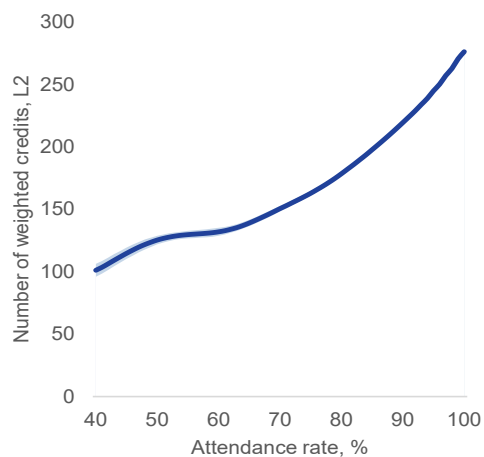

Figure A3 – Weighted credits (NCEA 1)

Figure A4 – Weighted credits (NCEA 2)

Figure A5 – Weighted credits (NCEA 3)
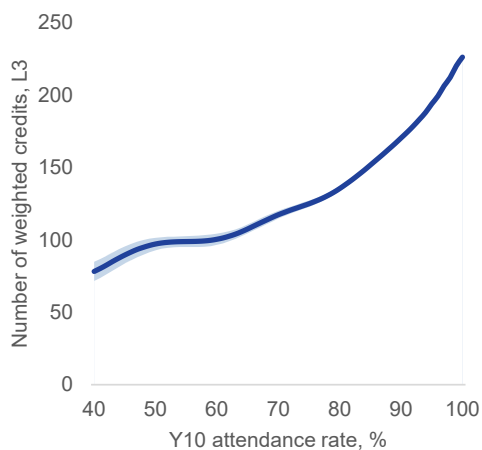
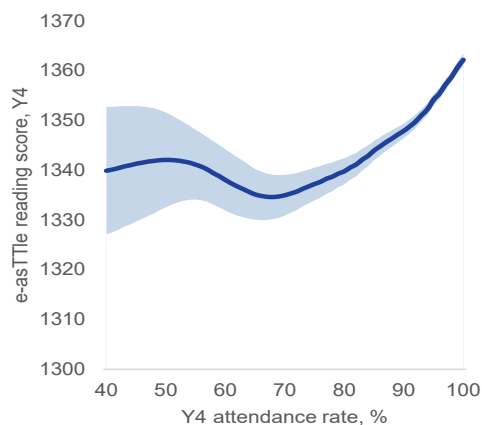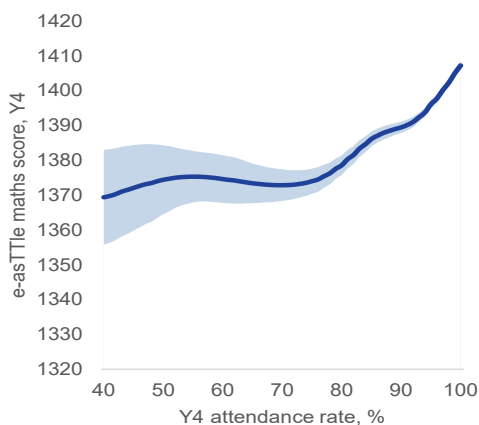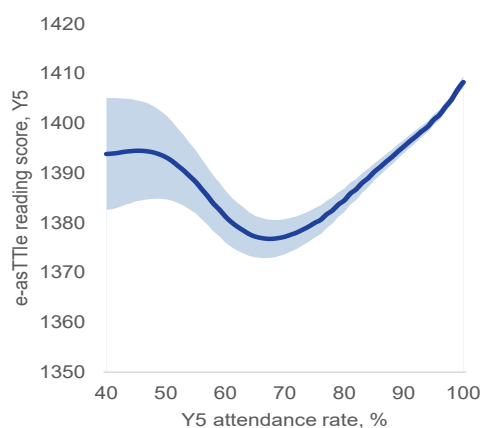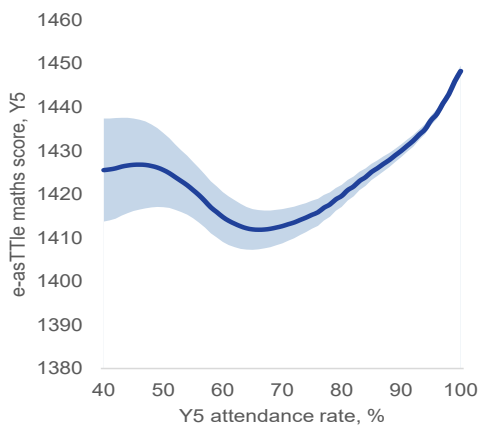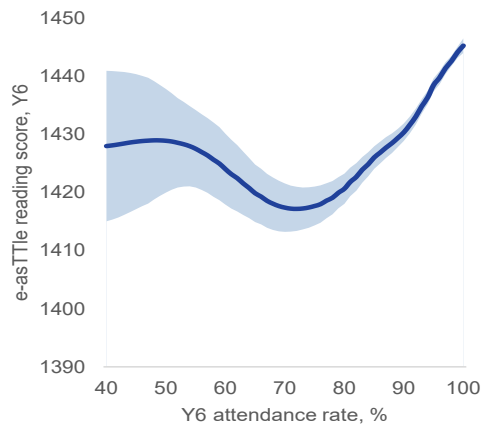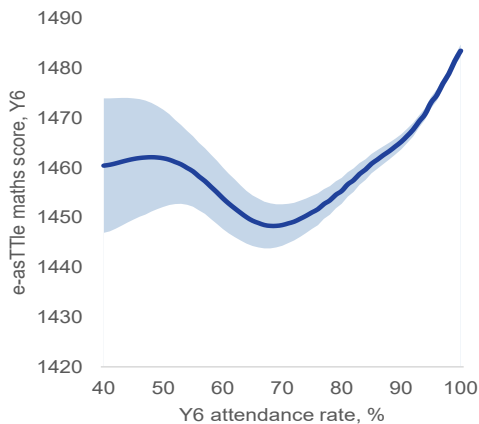**Figure A6 – e-asTTle reading (Year 4)**

Figure A7 – e-asTTle maths (Year 4)

Figure A8 – e-asTTle reading (Year 5)

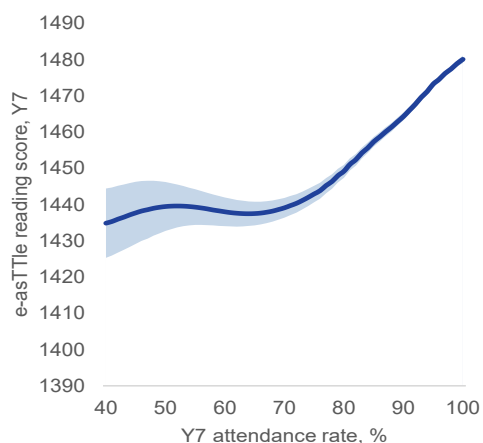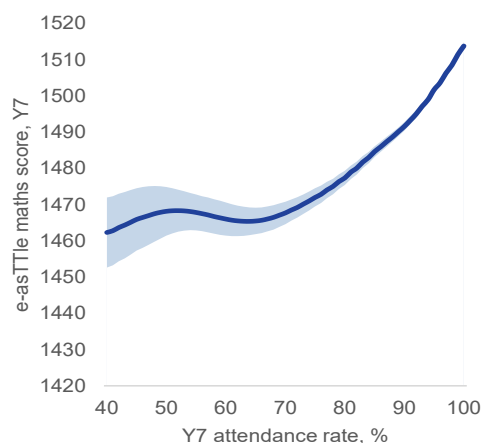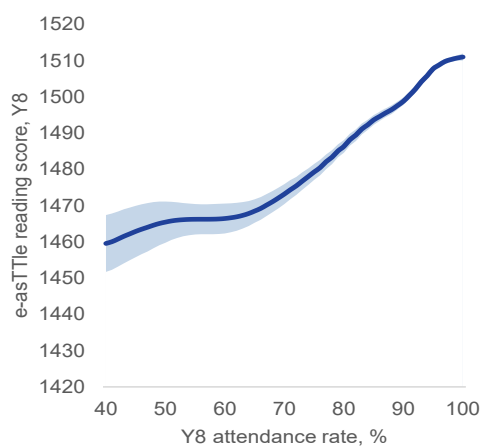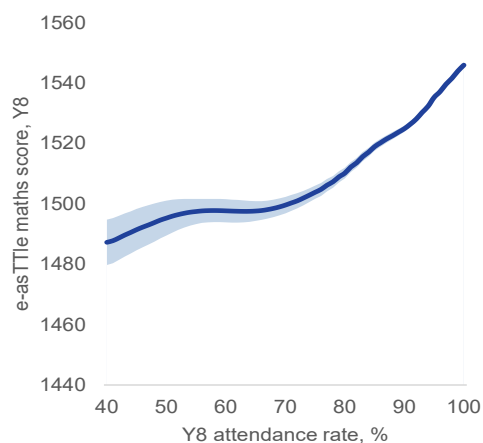
Figure A9 – e-asTTle maths (Year 5)

Figure A10 – e-asTTle reading (Year 6)

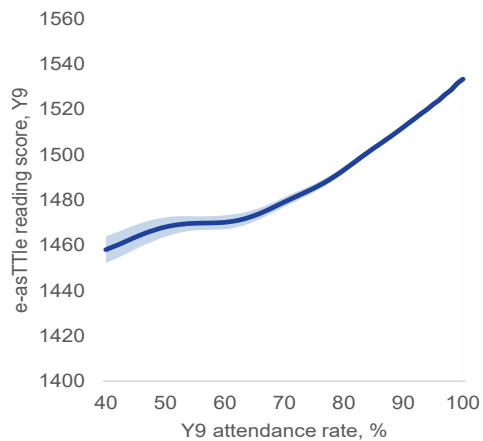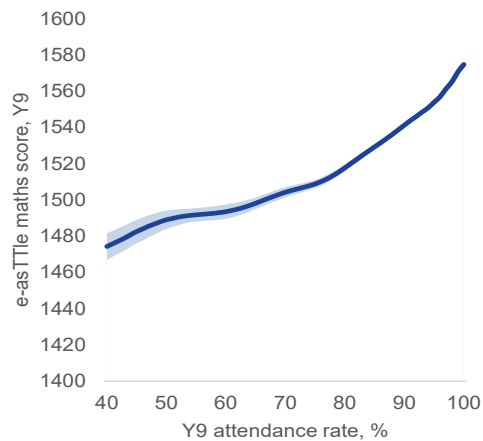**Figure A11 – e-asTTle maths (Year 6)**

Figure A12 – e-asTTle reading (Year 7)

Figure A13 – e-asTTle maths (Year 7)

Figure A14 – e-asTTle reading (Year 8)

Figure A15 – e-asTTle maths (Year 8)

Figure A16 – e-asTTle reading (Year 9)

Figure A17 – e-asTTle maths (Year 9)
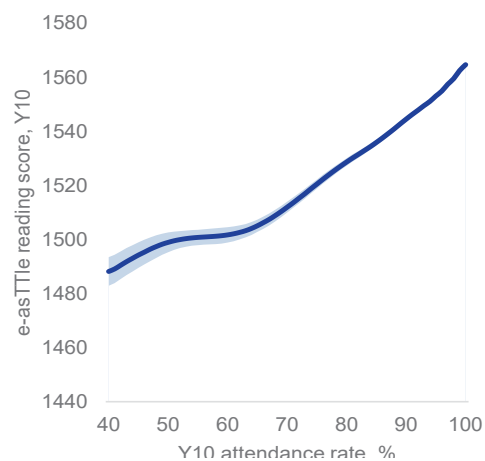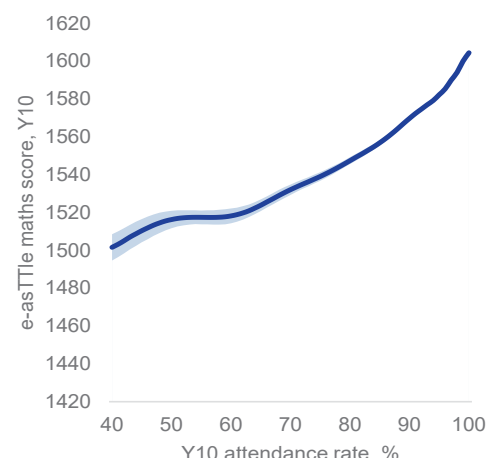
Figure A18 – e-asTTle reading (Year 10)

Figure A19 – e-asTTle maths (Year 10)

Note: The light blue shaded area around the lines indicate the 95 percent confidence intervals. The dashed lines for NCEA Level 2 and 3 indicate the 60 credits required to be achieved at this level to attain NCEA Level 2 and 3 qualifications (at least 20 additional credits from Level 1 or higher are also required, as is achieving the literacy and numeracy requirements).