



PRIFYSGOL
BANGOR
UNIVERSITY

 **AdvanceHE**

Don't Disturb The Student

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ADVANCEHE SURVEYS 2018

Introductions

- ▶ Cameron Gray, FHEA
- ▶ Teaching Assistant and Ph.D. Candidate in Computer Science at Bangor, studying Learning Analytics.
- ▶ Part of the Learning Analytics Initiative at Bangor, in partnership with our Centre for Excellence in Learning and Teaching (CELT)
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How This All Started...

- ▶ Doctoral work surrounds using Data Science methods to add an 'Early Warning System' to our Learning Analytics platform.
- ▶ To assist with the earliest possible identification of students in potential difficulty, we discounted data sets that could not be provided from day one.
- ▶ The prime data set we identified is student attendance at scheduled events, such as lectures, tutor meetings, employability sessions, etc.

Why Attendance?

- ▶ Anecdotally, teachers and lecturers have correlated attending with academic achievement for years. Usually in the form 'show up and do the work, you pass'.
- ▶ Multiple studies have shown this correlation to be correct [1- 3] and visible across institutions and cohorts.
- ▶ Institutions start to collect this data from the very first activity/session.

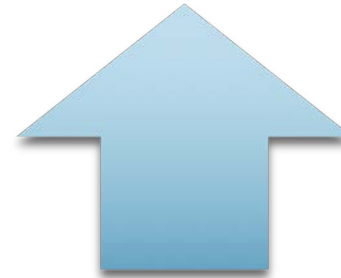
[1] J. R. Rodgers, "A Panel-Data Study of the Effect of Student Attendance on University Performance," *Australian Journal of Education*, vol. 45, no. 3, pp. 284–295, 2001.

[2] D. R. Marburger, "Does Mandatory Attendance Improve Student Performance?," *The Journal of Economic Education*, vol. 37, no. 2, pp. 148–155, 2006.

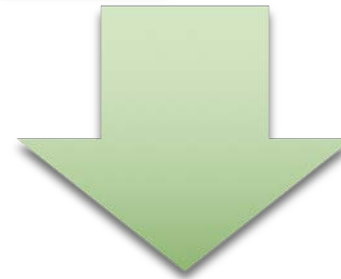
[3] M. Credé, S. G. Roch, and U. M. Kieszczynka, "Class attendance in college: A meta-analytic review of the relationship of class attendance with grades and student characteristics," *Review of Educational Research*, vol. 80, no. 2, pp. 272–295, 2010.

Making Sense of the Data

- ▶ We explored various options to summarise all of the attendance information into a single metric.
 - ▶ Ratio of Sessions Attended.
 - ▶ Raw Counts.
 - ▶ Derivatives
 - ▶ Etc.
- ▶ With help from CELT, we defined a summary metric.



+1 Point for attending a session.

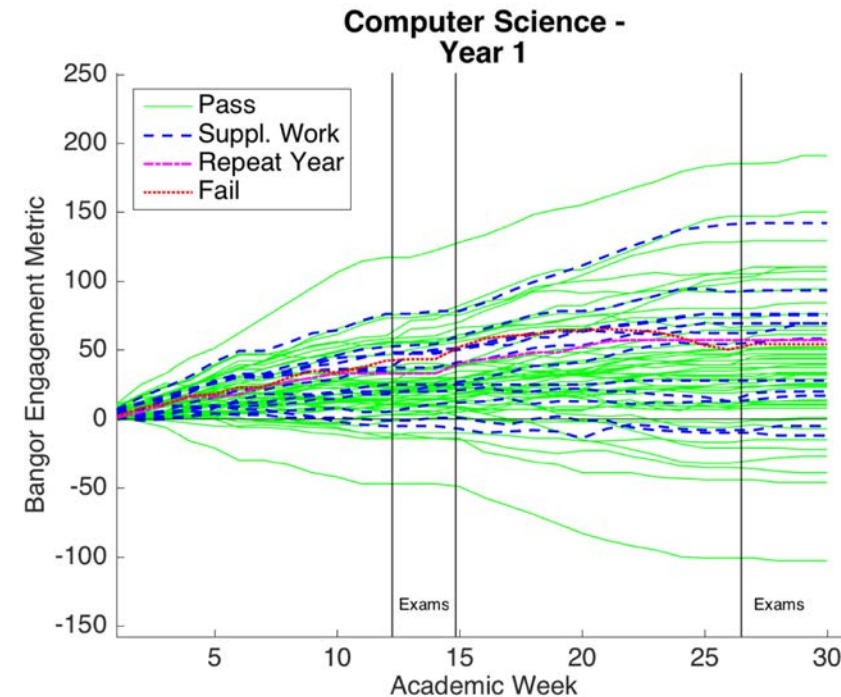


-1 Point for missing a session.

Definition The Bangor Engagement Metric

Predictive Model

- ▶ We conducted a series of Machine Learning experiments to determine the best settings to maximise identification of poor outcomes, at the earliest possible juncture.
- ▶ The results prove in both seen and unseen data, that we can predict the outcome of students from the first 3 weeks' attendance values of the BEM.
- ▶ 84.79% Identical Match Accuracy
- ▶ 97.33% 'On-Mission' Accuracy.



'On Mission' Accuracy

- ▶ Our guiding principle is a reworking of Blackstone's Formulation (applying to Criminal Justice).
- ▶ "It is better to intervene with 10 students that would pass unaided, than to miss one student that would fail."
- ▶ The model is designed to minimise the number of would-be failing students that get missed.



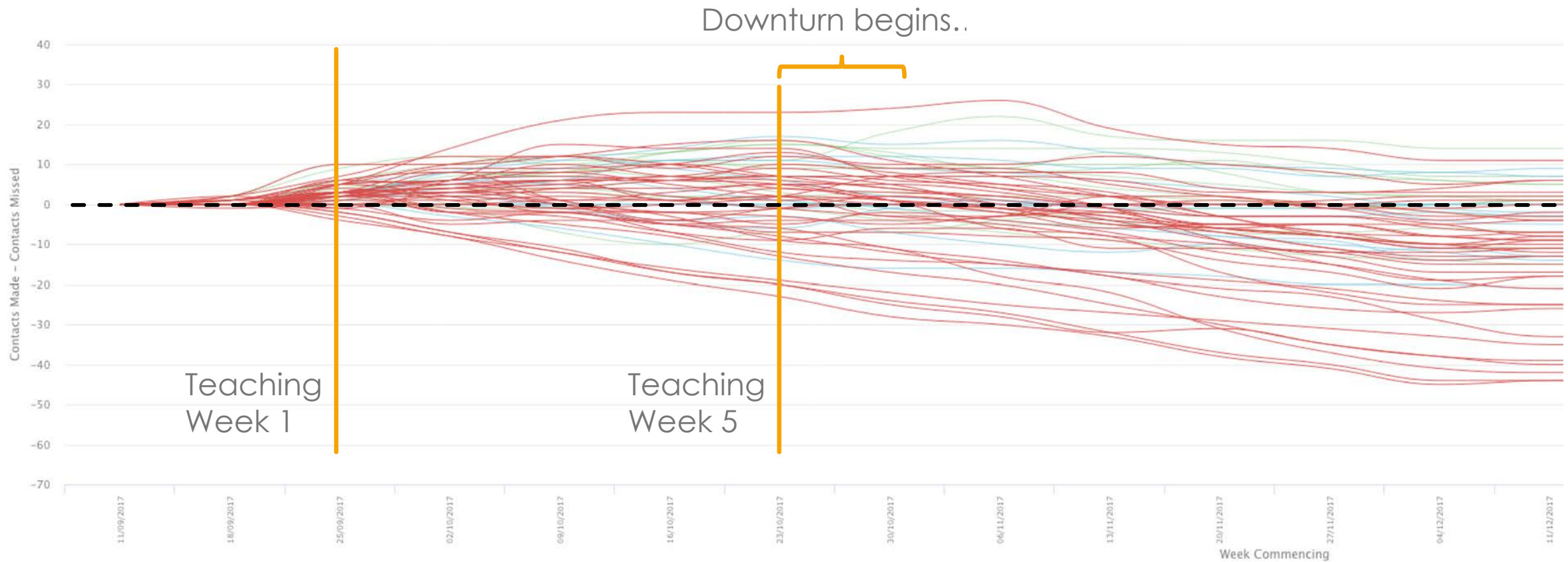
Courtesy NASA, Photo Number: S69-34038 Date: May 18, 1969

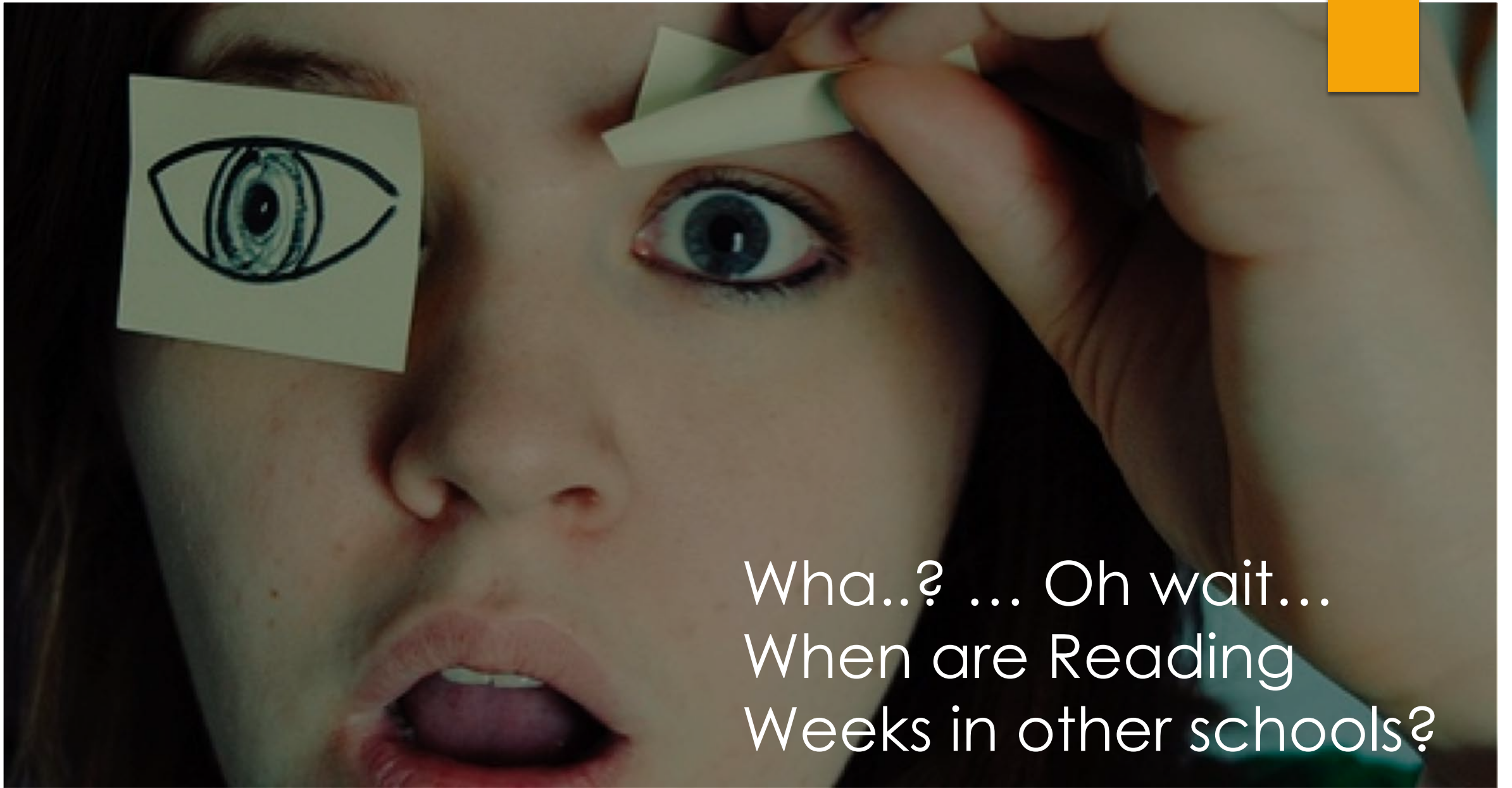
'Real World' Model Testing

- ▶ We conducted a 'Field Trial' during semester 1 A/Y 2017/18.
- ▶ The predictions from our model were compared against the previous 'Low Engagement Report' used at Bangor.
- ▶ The report showed an additional 63 students (within the School of Computer Science) with low rankings, that were not identified as 'at-risk' by Week 3.



How'd That Happen..?





Wha..? ... Oh wait...
When are Reading
Weeks in other schools?

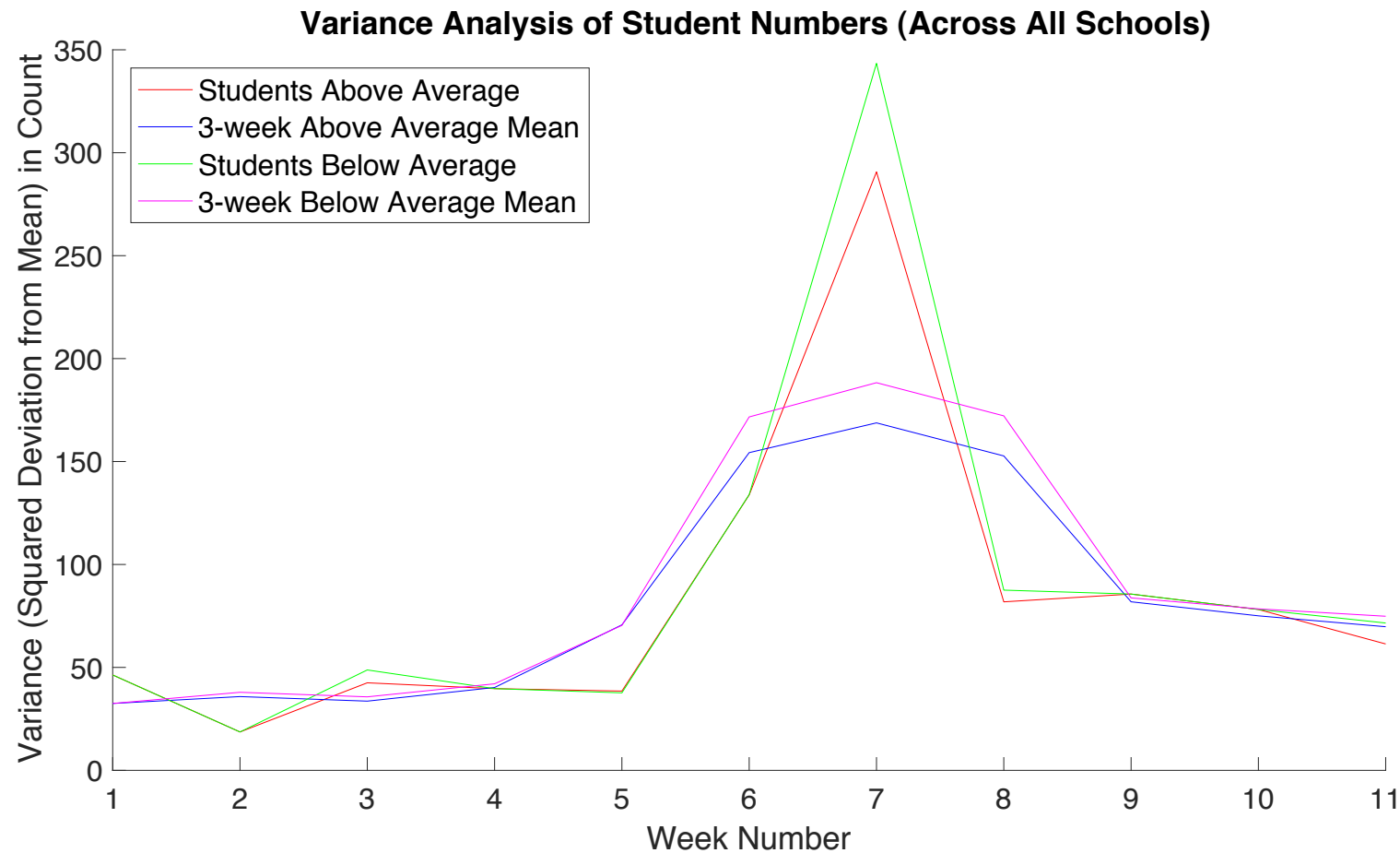
Playing 'Spot the Reading Week'

- ▶ At this point we knew that Reading Weeks occur, but as a School that doesn't use them we had no idea when they fall in the calendar.
- ▶ We set about using the data set we already had to try to find this event prior to obtaining the actual dates.
- ▶ As a side benefit, this work provided an answer to 'can we spot disturbances that may impact student achievement?'

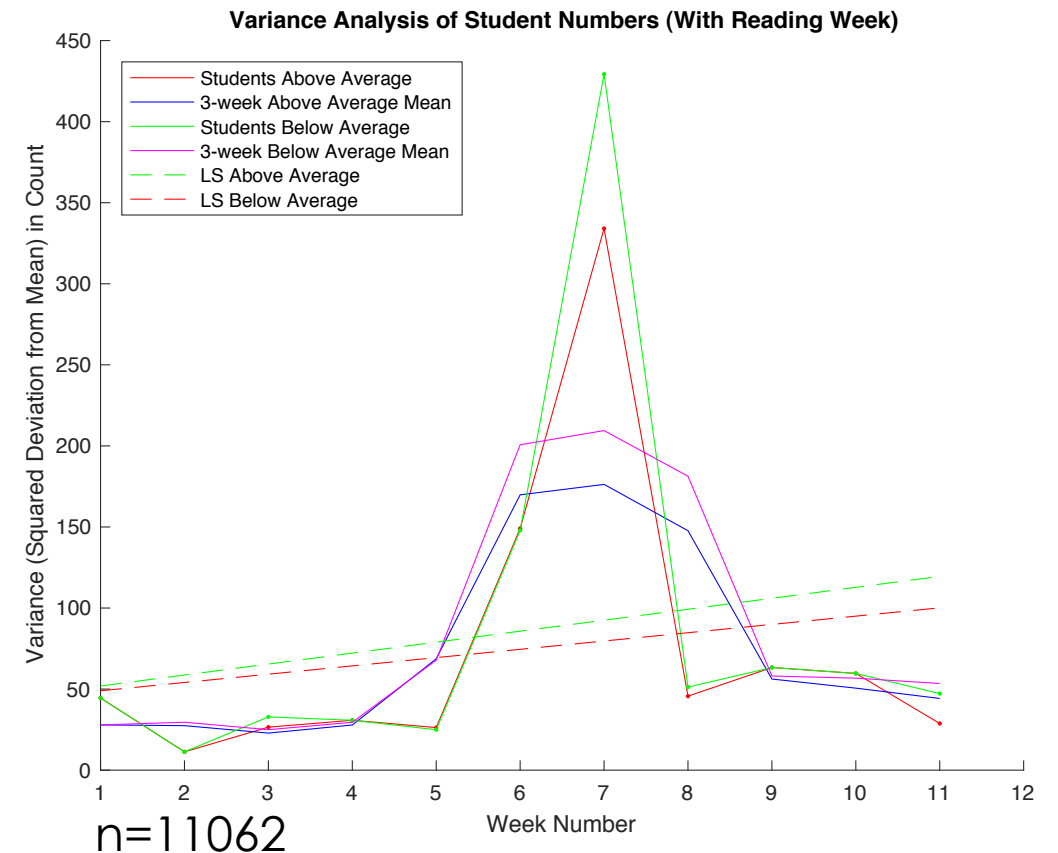
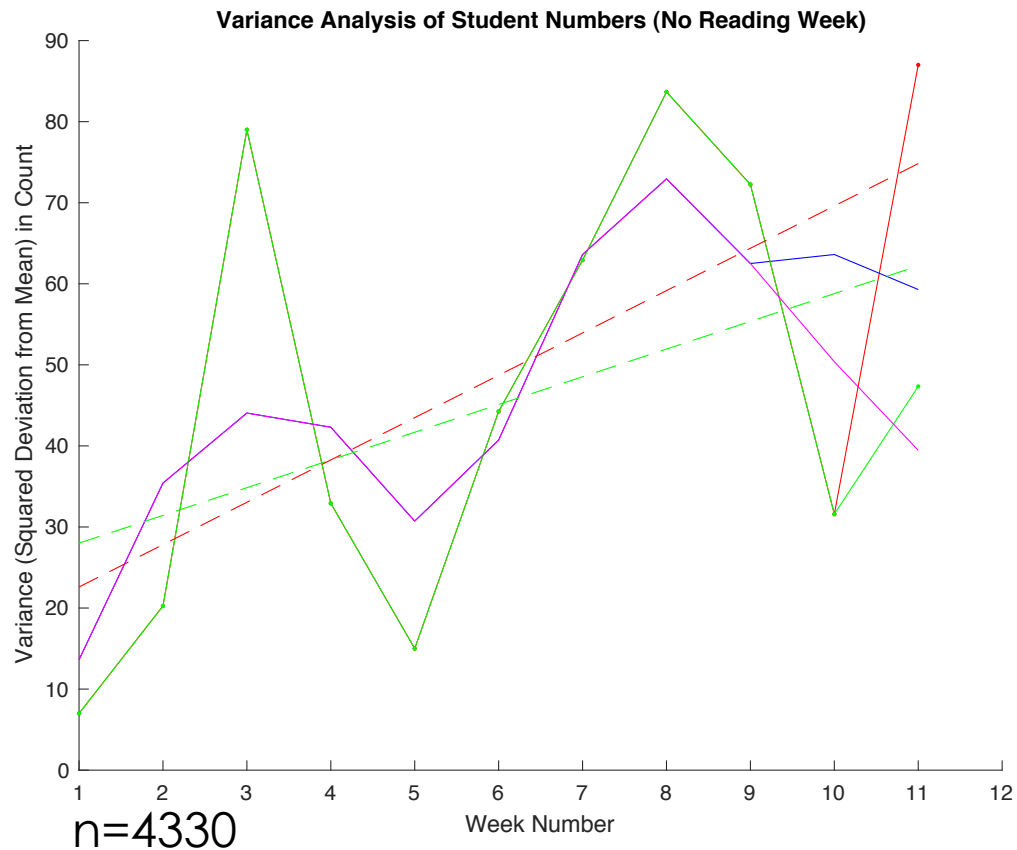
Methodology for Detecting Disturbances

- ▶ We examined all students as a whole population and school by school.
- ▶ First, we calculated the number of students above and below the average BEM measure for each population (at that week).
- ▶ Next, we calculated the variance of those counts between adjacent weeks.
- ▶ We then included a 3-value rolling average, to deal with any extreme outliers.

Detecting Disturbances Results (1)



Detecting Disturbances Results (2)



Observations

Overall Observations

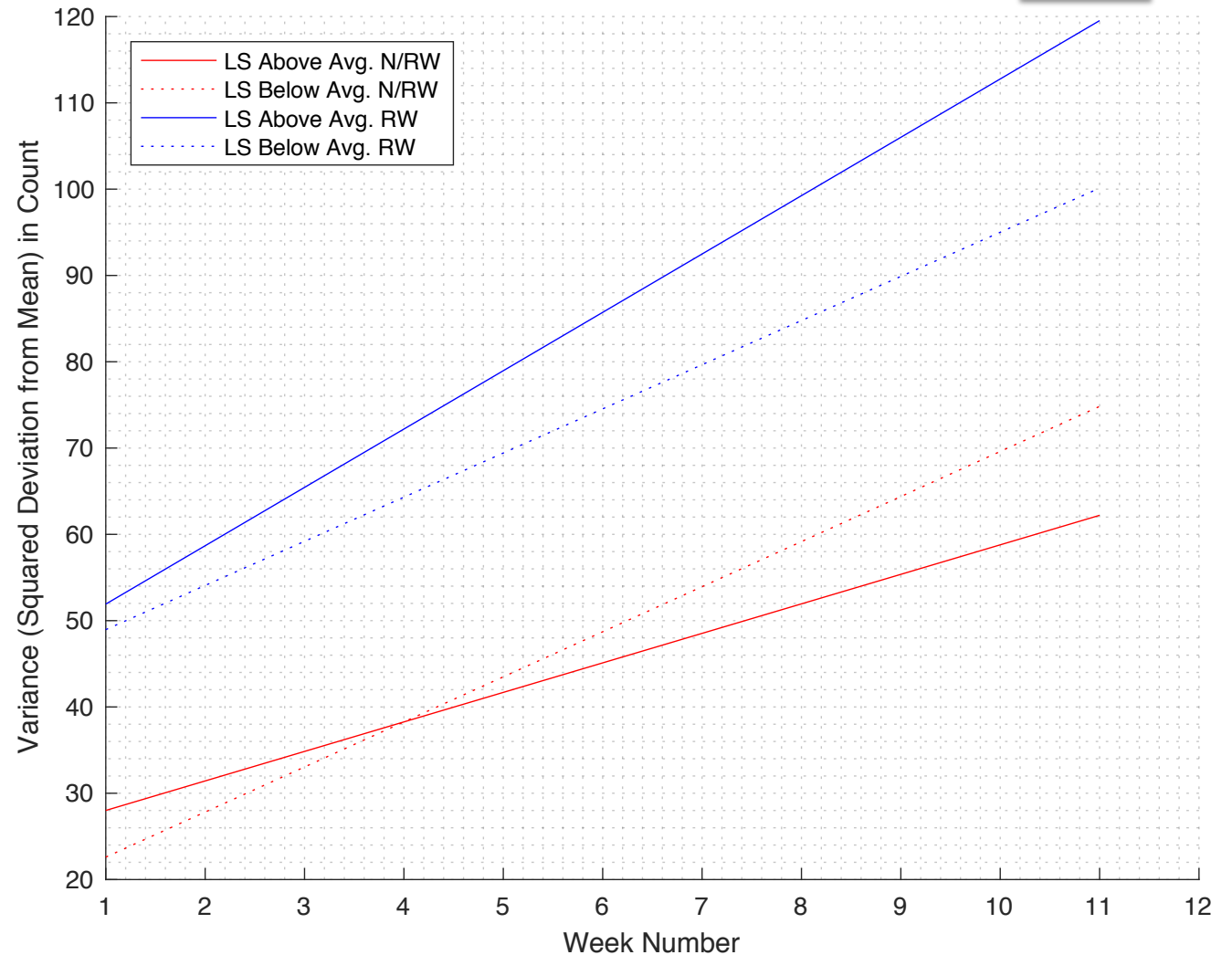
- ▶ Attendance patterns stabilise at teaching week 3 and 4.
- ▶ Once that pattern is interrupted, the same level of variance never returns, implying that the interruption has introduced change.

Split RW/NRW Observations

- ▶ In schools without a reading week, there is natural tendency toward non-attendance by the end of a semester.
- ▶ The cross over point between the two trends for NRW schools is week 4. This week seems to be significant in student attendance patterns.

Analysing the Trend

- ▶ By adding a Least Squares Trend Line over both populations, we arrive at these trends.
- ▶ This graph reveals:
 - ▶ Students that are below average attendance do not seem affected (roughly the same gradient).
 - ▶ Above Average gradients diverge significantly.



What the Trend Tells Us

Student Type	Effect
High Flyers	Always attend irrespective of outside influences.
Volatile	Highly susceptible to outside influences, only requires a nudge to fall either way.
Average	<i>Generally keeps up, may benefit from occasional interventions.</i>
Below Average	Likely immune to interventions unless very specific.

- ▶ The difference in gradients allow us to infer structure in student achievement groups.
- ▶ The lower end appears to be largely immune to retention efforts, but cannot be ignored.
- ▶ The higher end are also likely to perform no matter what efforts or disturbances occur.
- ▶ The important group is the one just above average, but below the high flyers. These students are the ones most affected by changes.

Behavioural Economics and 'Nudging'

- ▶ Nudge Theory [1] holds that reinforcement and indirect suggestion can vastly alter the decision making processes of groups or individuals.
- ▶ Students without reading weeks are affected disproportionately than students that do. We hypothesise that this is a nudge effect of students not keeping to their pattern.
- ▶ The observation that following a reading week student attendance doesn't immediately return to pre-break levels, would also imply there is a nudge effect present.

Escaping Negative Nudges

- ▶ We observed that there are three Schools at Bangor that have been affected far less significantly.
- ▶ Those schools either have a very structured set of reading week activities (just not normal lectures), or a very insular community.
- ▶ Negative nudges, such as peer pressure, changing patterns of classes, etc. need to be considered when designing any 'non-standard' or pattern-breaking element of a course.

Decisions, decisions...

- ▶ In order to confirm our observations, a longitudinal study is required.
- ▶ In the mean time, our data provides a wealth of insight in order to make better decisions; Data Driven Decisions (D3) [1].
- ▶ We're not proposing scrapping reading weeks, but we as educators need to determine if the break in routine serves our students best.
- ▶ Potentially, different forms of activity could enhance the experience without the negative nudging effect.

If you would like to know more...
Contact Us

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