StudentLife Analysis

Exploring Student Mental Health

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Introduction

Analysing the lives of ordinary people has become much easier in the past decade as technology such as smart phones and social media have become so prevalent in society. One such endeavour was the StudentLife Survey[1], which aimed to analyse the lives of a class of students attending Dartmouth College during the Spring term of 2013. The overarching objective of the study was to find indicators of strong academic performance which could then help future students in pursuit of this goal. This report will utilize some of the data generated by the StudentLife project to answer two questions of exploratory nature.

Critical Discussion of Study Design

Volunteers were selected from the class "Smartphone Programming". Initially 60 students participated, however only 48 remained by the end of the study. The majority of the data was collected through their phones automatically, e.g. sleep habits, or through 'ecological momentary assessment' (EMA), which would occasionally ask students via their phone a question such as how stressed they were. This happened throughout the day. Furthermore, a pre-post survey was also conducted. They were offered Nexus 4 phones for the term (though many opted to continue to use their own phone as well) and a chance to win prizes as incentives to continue with the project. Prizes had the advantage of incentivising students while keeping costs lower than if everyone was offered a reward.

The study enabled the collection of data which can be otherwise difficult to obtain. Having to send out frequent manual surveys would be complicated and more expensive. Similarly large amounts of data, in particular different variables, could be collected - the researchers asked many different questions regarding stress levels, mood levels, number of deadlines etc. For some of the data, the use of an anonymous survey can be beneficial, for example when asking about student mood or well-being they may very well be more likely to answer honestly than had they been asked in person.

However the method was not without its limitations. The sample size is relatively small at only 48 students. The dataset becomes smaller still when you consider not everyone responded to every EMA request and only 41 completed the post survey. Similarly a class of computer scientists are likely to not be representative of an average student – perhaps inviting students from various classes and backgrounds would have been more appropriate. In fact there is a substantial gender bias with only 10 females compared to 38 males. I suspect this was an unfortunate result caused by the class used in the study. Nevertheless, females are underrepresented in this data.

Perhaps one of the biggest issues is missing and/or sparse data. The organisers admit that occasionally students would leave their Nexus 4 phones in their dorm and many may have found it burdensome to carry around two phones (had they elected to keep using their own). As a result, student participation dropped as weeks went by, to the extent it was necessary to send out emails to encourage user participation. That being said, overall participation still remained relatively high, with a 72% compliance rate of EMA among secondary users (those who used two phones) and 65% among primary users (those who used only the Nexus 4).

Question 1

How does the mood of students vary throughout the term and does this relate to their GPA?

A term at University can involve many different emotions for students. The excitement of studying new material, meeting new people or spending more time with friends are all ways in which students may enjoy the University experience. That being said, the stress of deadlines, heavy workloads as well as being away from home can cause distress and sadness at other times. I will explore the relationship between the moods of students at different times during the term. Furthermore, is there a relationship between a student's mood and academic achievement determined by GPA? Perhaps those who are happier socialise more and thus achieve lower grades? Or maybe achieving and coping with academic requirements make people happier? This question will explore what relationship, if any, exists.

Overview of Question 1

Question 1 uses the datasets "Mood" and "Grades". Mood was generated by the EMA responses, where students were asked firstly if they were happy or sad, then how happy or sad they were on a scale from 1 being "a little" to 4 being "extremely". This was done randomly throughout the term, however the researchers did schedule more questions, particularly on stress and deadlines, around mid-term. Upon exploring the data myself I found there were many more responses a week before and during mid-term exams, which leads me to believe this may also have been asked more frequently around then. However, this is purely speculation.

I had a few issues with this dataset. Firstly, the students were always asked how happy or sad they were, regardless if they answered "no" to "are you happy" or "are you sad". This meant students responding as "extremely happy" were in the same data point being recorded as "a little sad" which can make it slightly more difficult to compare the two. Similarly, students had no option to say "neither" which although may not be a response which is desirable for researchers, it seemed that perhaps students who felt this way responded with all 1's. That is, they responded "I'm a little happy and a little sad". The sheer volume of responses of this type leads me to think the students intentionally answered this way.

Similarly, it seems like bad design that students who answered "no" to "are you happy" were then forced to put 1 for "how happy are you" – leading to the oxymoron "I'm not happy", "I'm a little happy".
To remedy these problems I began working with the difference between the two variables "how happy" and "how sad". Hence, if someone said they were "extremely happy" and gave a response of 4, they (almost always) would have put a 1 for "how sad are you" and thus their new score would be 3. This has the added benefit of students who put a 1 for both "how sad" and "how happy" now having a score of 0 which I considered neutral.

One can argue it is entirely possible for people to be both sad and happy at the same time – which I would agree with. However, for this particular analysis it is appropriate to consider this as "neutral" to allow for comparison between just happy and just sad.
Furthermore, the "Grades" dataset only included undergraduate students, which further reduced the size of the data. This dataset was simply a csv file of undergraduates GPA (Grade point average) who took part in the study. There are no significant issues with the "Grades" dataset, however it is unclear if extenuating circumstances were made in the case of some students – something which could be important when considering the relationship with student mood (which could be related to mental health).

It should also be noted that one participant of the "Mood" dataset responded with 1's every time, and continued responding long after the other participants had stopped. Being unsure if this was intentional or not I opted to exclude this participant. Given that all their responses were neutral their omission does not influence my exploration either way.

Analysis of Question 1

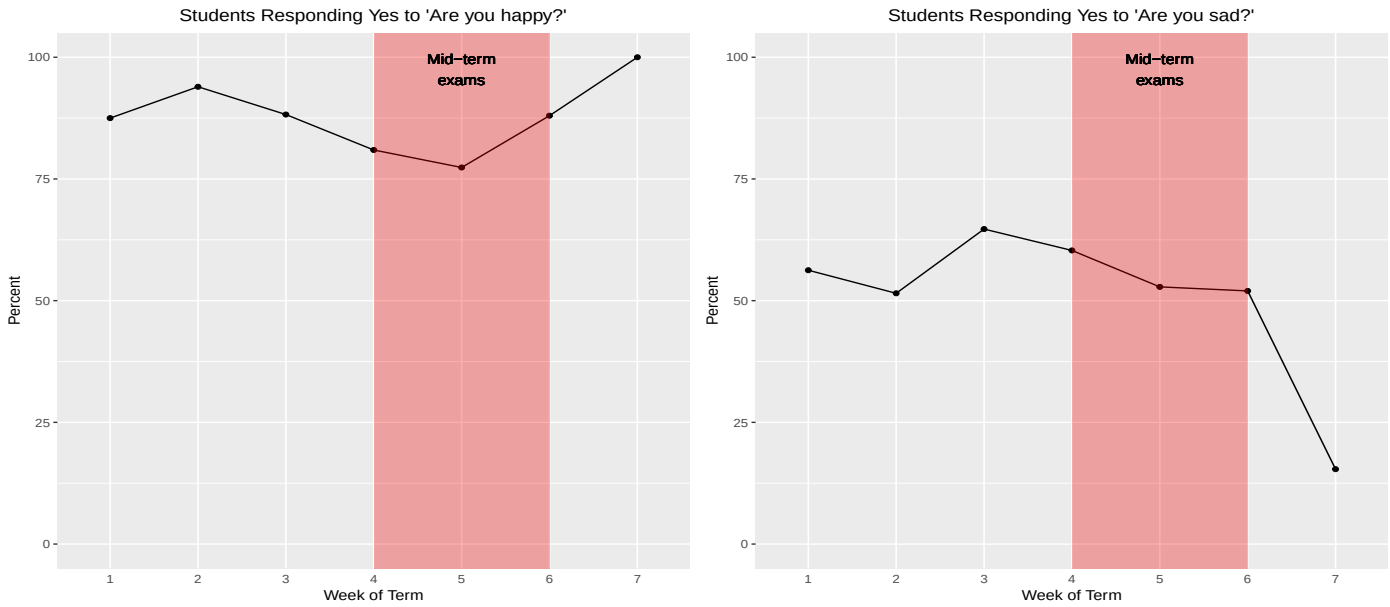

Figure 1: *Comparing no. of Happy students to no. of Sad*

Figure 1 shows how the percentage of students responding Yes to the EMA questions "are you sad" and "are you happy" changed throughout the term. Week 1 concerns days 1-7, week 2 days 8-14 and so on. The dataset ends after week 7. We can clearly see that students are overall more happy than sad, and that they begin the first week with 87.5% saying they are happy, and only 56% saying they are sad (these are not mutually exclusive, as detailed in the overview). As mid-term exams approach the percentage saying they are happy falls, to a low of 77%. Meanwhile one week before mid-terms, the percentage saying they are sad reaches it's highest of the term at 65%. It seems intuitive this is in part caused by the stress of mid-term exams. However, during midterms, as the percent saying they are happy falls, so too does the percent saying they are sad. Hence, although people are less likely to be happy during midterms, they are not necessarily more likely to be sad. Finally, once midterm exams end, the students are immediately saying yes to being happy and no to being say - as shown in weeks 6 and 7.

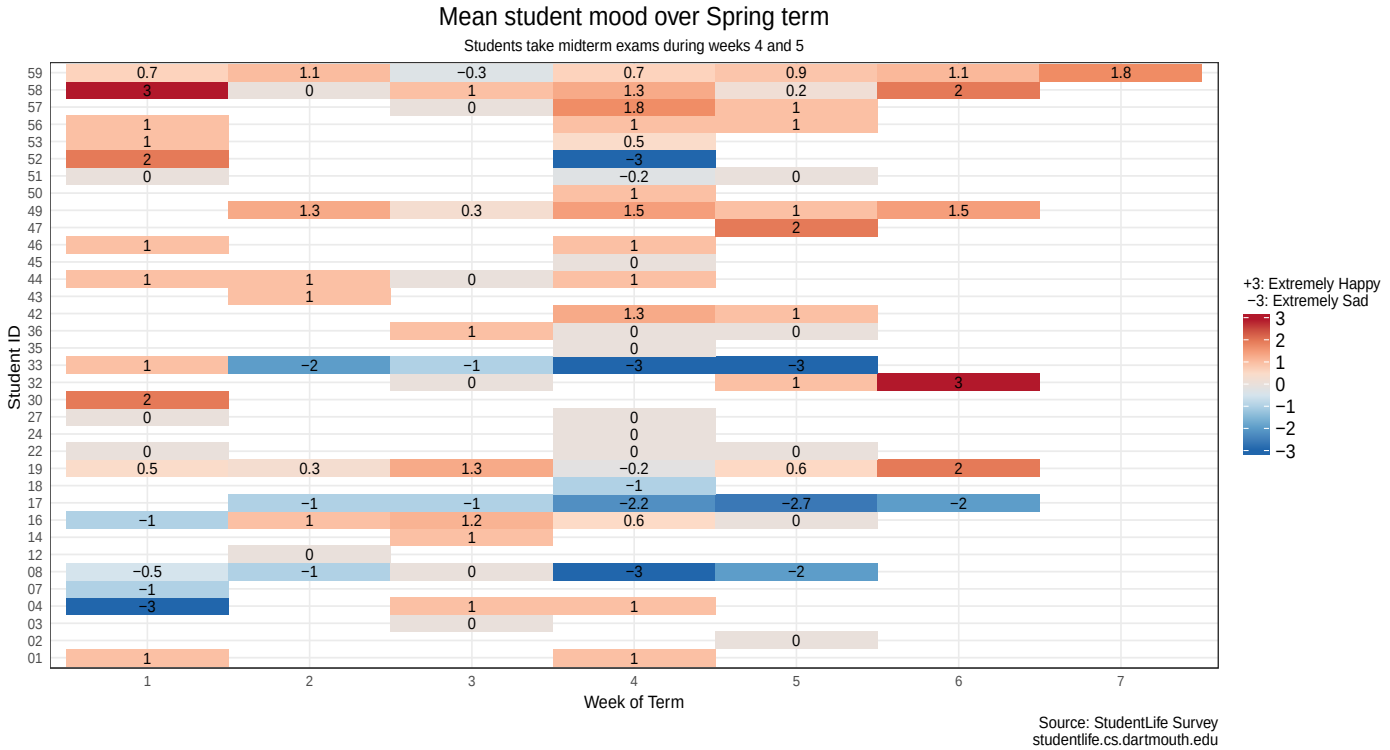

Figure 2: *Heatmap showing individual student responses*

Examining the responses to "how happy" and "how sad" can provide information on the extent of students' moods. Figure 2 shows that generally the students were happier than sad throughout the term - something backed up by Figure 1. Students were particularly sad in weeks 4 and 5, with multiple students responding they were "extremely" sad. Although there is clearly more red in the map than blue, only twice is "extremely happy" recorded. The prevalence of neutral feelings is also evident in the frequency of 0's. Also displayed is the lack of data, being a reminder that this study and this analysis should be taken with some skepticism. Interestingly shown is how some students, namely ID's 08, 17 and 33 feel more consistently sad than others. While candidates 49, 58 and 59 feel more consistently happy. Perhaps it is a flaw in study design that asking students how they feel at a random moment may frequently be met with a neutral "okay".

Relationship with GPA

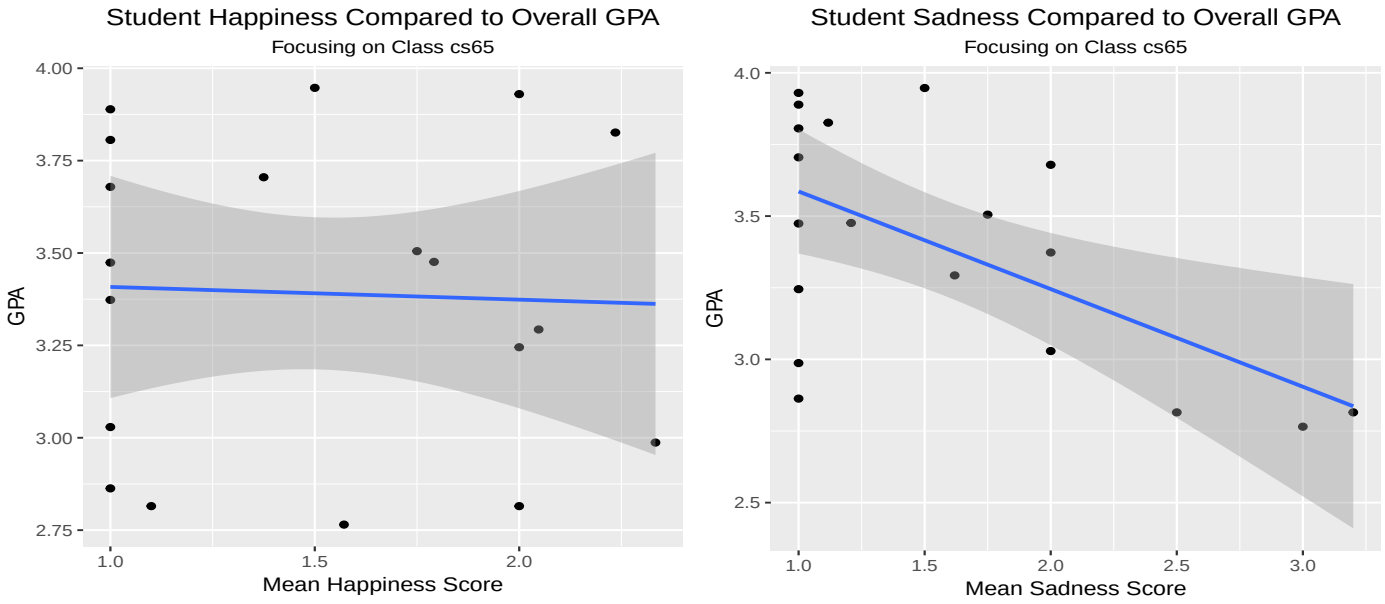

Figure 3: *Comparing GPA against mean and median mood scores*

Examining Figure 3, it appears there is little relationship between having a generally happier mood during the term and having a higher GPA. It seems possible that those who don't achieve high marks academically may pursue fulfillment in other aspects of University life, and are thus happy anyway. It could also be possible however that those who achieved lower marks did not know they had done so until after term ended - thus it had no effect on their happiness during the term.

That being said, looking at the graphs of GPA and feeling sad, there are possibly more takeaways. Although again correlation seems low, it is more noticeable that people who were moderately to extremely sad over the whole term received poorer results. There may have been an underlying mental health problem such as depression or anxiety which affected a student's ability to study.

Four simple linear regression models were examined as follows:

(1) $GPA = Mean.Happiness$ **(2)** $GPA = Median.Happiness$

(3) $GPA = Mean.Sadness$ **(4)** $GPA = Median.Sadness$

Happiness was not statistically significant for either model 1 or 2, however Mean.Sadness and Median.Sadness had p values 0.0084 and 0.00963 respectively.

The correlation for GPA and Mean.Sadness was -0.586, and -0.577 respectively. Although this suggests a negative correlation between feeling sad and a higher GPA, I am hesitant to be entirely sure of this. Judging by the Figure 3, it would appear that those who are extremely sad fail to achieve a high GPA. However even then, there are only 3 examples of this. Similarly, Figure 2 demonstrates the scarcity of the data, with some students average mood for the term being based off just one or two weeks. There is the issue that the majority of participants are men which not only creates a gender bias, but who have also been shown to be less likely to respond truthfully when asked how they feel. Further studies with more complete data is needed to be sure of a correlation - even though it may seem intuitive that someone extremely sad will perform worse in examinations.

Question 2

What impact does a term at University have on student mental health?

Student mental health is of critical importance. One recent study has shown that students experience lower levels of well-being than others in their age group. Students today are much more likely to experience a mental health problem than a decade ago, suicide rates are at a record high, and University counselling services are seeing increased demand over the past 5 years[2]. This question will explore whether a term at University has an impact on student mental health - good or bad.

Overview of Question 2

The data used in question 2 is a pre-post survey of the PHQ-9 depression scale. This survey asks people a variety of questions related to their lifestyle and gives each answer a score from 0-3, 0 being "not at all" and 3 being "nearly every day". A total score ranges from 0-27. These scores are then associated with different categories determining the extent at which someone has depression[3].

A point of frustration is that although 46 people took part in the pre survey, only 38 took part in the post survey. Hence finding the change over a term is not possible leading to 6 students being removed from the data. Another problem is that students may respond differently to surveys, particularly if not completed anonymously. This could be a particular problem considering the nature of the survey being around mental health. Furthermore the data has a male bias, and there is evidence to suggest men are less likely to admit to experiencing mental health problems, even within anonymous surveys[4].

Analyses of Question 2

Figure 4 illustrates how different categories change between the beginning and end of term. It shows that there is relatively little movement in fact - note that someone joining another category must necessarily leave another. Over a term students with no symptoms of depression rose, and those with mild to moderate symptoms fell also. However, those with moderately severe or indeed severe symptoms rose.

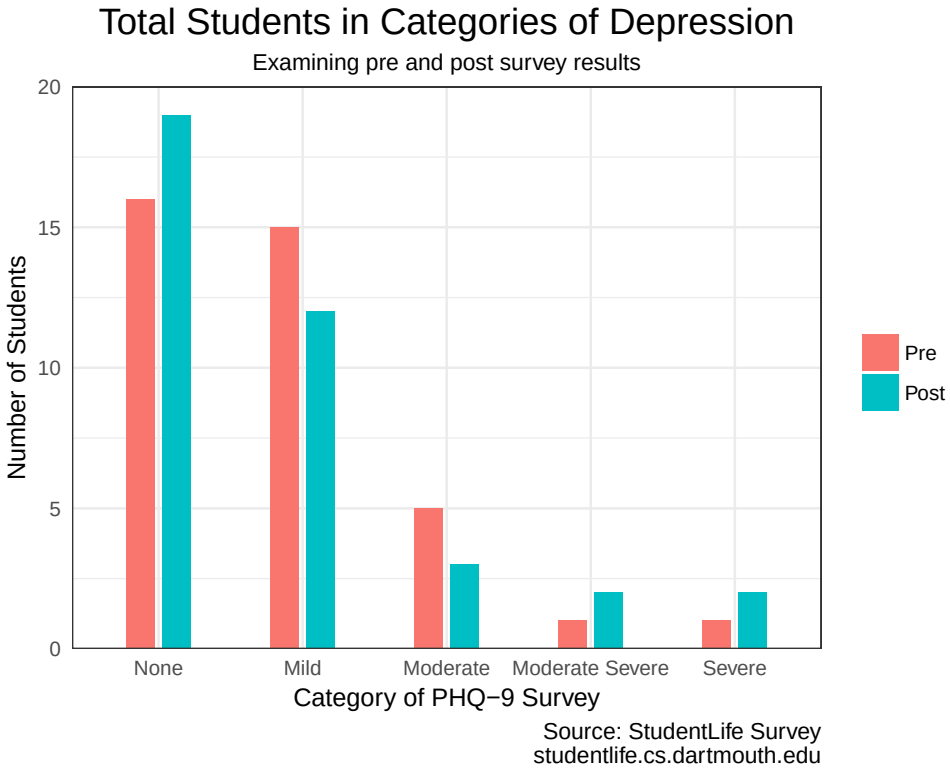

Figure 4: *Changes in PHQ-9 categories*

However, Figure 4 does not illustrate how individuals change over a term. To do this I calculated the difference between a students pre and post scores on the PHQ-9 survey. This is shown in Figure 5 (overleaf). Clearly there is a range of different impacts which a term at university has. In total 20 students PHQ-9 score increased in the post survey, while 16 fell and 2 stayed the same. In particular, the mean of the absolute value of the change was 2.76, with the mean for those whose score rose being -3 and 2.75 for those who fell. Given that the categories are designated 0-4, 5-9, and so on until 20-27, a change of 5 or more is a definitive change in a students mental health. Inspecting the data shows that 3 students had a score of +5 or more, meaning their mental health improved. Meanwhile 4 students had a score of -5 or less, meaning their mental health declined. Two students had a score of -10 and 8 respectively, demonstrating the scale of the difference for some, between the beginning and end of term.

Follow Up Study

The main problem with the current data comes in three parts:

1. Lack of a representative selection of students (both in gender and in subjects).
2. Relatively small sample size.
3. Lack of consistent responses across the whole term.

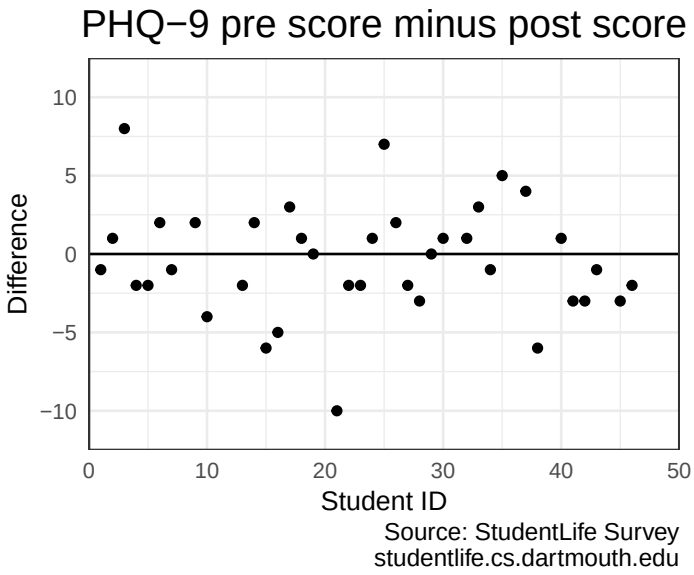

Figure 5: *Pre score minus post score*

I propose a follow up study in which, not unlike the StudentLife study, students are offered incentives to complete survey questions. Instead of giving students phones, they would instead download an app which similar to the EMA would ask them to respond to survey questions throughout the term. Students who completed a consistent number of responses across a certain time period, say, a month, would be rewarded with some small prize, for example a £5-£20 Amazon voucher/Google Play etc. This would of course have to be capped at a certain number of students, but if a term of university is only 3 months then expenses would not be greater than in the StudentLife survey. This will have the benefit of more options to get a representative sample from across the whole of the University, and a larger sample size due to smaller expensive per participant. This helps alleviate problems 1 and 2. Similarly, while some may drop out or stop responding, studies have shown people prefer a definite chance of some reward rather than a smaller chance at a larger one[5]. Students who have contributed for half a month are likely to continue as they are already invested, which should help alleviate problem 3.
Future analyses of Question 1 should remove the issues around the data explained in detail in the overview. Much of this would be fixed by more appropriate survey questions. More samples of GPA or % mark if done in the UK would be needed, as well as examining some potential control variables, such as exercise, previous year grades etc. However, control variables of this sort can be difficult to sort causality, e.g. does doing exercise make me happier or does being happy make me exercise more.
Question 2, again, would require much more data and also asking participants if they have a history of mental health problems, as this is likely to be an indicator of future problems. For example, are previous mental health problems likely to resurface at University could be an interesting question.

References

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