

Experiment Design

Metric Choice

Number of cookies: Chosen as invariant metric, as the change is after the page loads and user clicks “start free trial” it shouldn’t affect number of cookies, therefore cannot be used as evaluation metric

Number of user IDs: As the change would determine if the user would enroll or not, this cannot be used as invariant metric, also user ID doesn’t track students who did not enroll, moreover it has no denominator and will not normalize well to different experiment and control group sizes, on the other hand an increase in number of user IDs doesn’t necessarily mean less cancellation of subscription as it could mean increase of traffic, so it cannot be used as evaluation metric as well.

Number of clicks: Chosen as invariant metric, as the number of clicks on “start free trial” should remain the same, as the change is after clicking, for the same reason it cannot be used as evaluation metric

Click-through-probability: Chosen as invariant metric, as number of cookies and number of clicks shouldn’t change, the probability should not change as well, therefore as it’s not affected by the change, it cannot be used as evaluation metric.

Gross conversion: This metric will be used for evaluation, it would decrease if students realize the time they dedicate is not enough, and therefore don’t enroll, because it’s affected by the change it cannot be used as invariant metric.

Retention: This could be an evaluation metric as those would be students who determine they have enough time for the course and don’t cancel their subscription, except that it would need 4 months of exposure (with 100% of traffic exposed) to be able to evaluate it, and therefore it is not chosen as evaluation metric, and because it’s affected by the change it cannot be used as invariant metric.

Net conversion: This will be used as evaluation metric, as the number of user IDs to make one payment divided by number of clicks is expected to be affected by the change, so it cannot be used as invariant metric

To launch this experiment, we are looking for:

- 1- Statistically significant decrease of Gross conversion, as this means that we significantly reduced the number who left the free trial early.
- 2- Net conversion should stay the same or increase, as this means we did not significantly reduce the number of students who continue past the free trial.

Measuring Standard Deviation

	SD	Empirical SD
Gross conversion	0.0202	0.0270
Net conversion	0.0156	0.0313

Since gross conversion is number of user-ids to complete checkout and enroll in the free trial divided by number of unique cookies to click the "Start free trial" button.

And net conversion is number of user-ids to remain enrolled past the 14-day boundary (and thus make at least one payment) divided by the number of unique cookies to click the "Start free trial" button

In both cases the unit of analysis is a unique cookie

Gross conversion

- Unit of diversion is a unique cookie
- unit of analysis is a unique cookie
- the units match, so analytical and empirical variability are likely to match

Net conversion

- Unit of diversion is a unique cookie
- unit of analysis is a unique cookie
- the units match, so analytical and empirical variability are likely to match

Sizing

Number of Samples vs. Power

I will not use the Bonferroni correction

The number of page views needed is 685325

If retention was selected as evaluation metric, we would've needed 4741212 page views, which would need 119 days of exposure to 100% of traffic, which is not practical given that using Gross & Net conversion would require only 18 days.

Duration vs. Exposure

As we are not dealing with sensitive data, and there's no chance that someone gets hurt because of the experiment duration, it is considered not risky, and we can divert the entire traffic for 18 days that are needed to power the experiment properly.

Experiment Analysis

Sanity Checks

	Lower bound	Upper bound	Observed	Passes
Number of cookies	0.4988	0.5012	0.5006	Yes
Number of clicks on "Start free trial"	0.4959	0.5041	0.5005	Yes
Click-through-probability	-0.0013	0.0013	0.0001	Yes

Result Analysis

Effect Size Tests

	Lower bound	Upper bound	Statistical significance	Practical significance
Gross conversion	-0.0291	-0.0120	Y	Y
Net conversion	-0.0116	0.0019	N	N

Sign Tests

	p-value	Statistical significance
Gross conversion	0.0026	Y
Net conversion	0.6776	N

Summary

The Bonferroni correction was not used as we are not looking for statistically significant change in both of the evaluation metrics, as the criteria is decrease in gross conversion and no change or increase in net conversion, therefore both criteria's need to be satisfied in order to launch, because of that false negatives would have the greatest impact (type II errors). And since the bonferroni correction reduce type I error but increase the chance of type II, it is not appropriate for this experiment. .

Recommendation

We can see there's significant decrease in Gross conversion, as we expected, but on the other hand there's decrease in Net conversion of more than our practical boundary which means we significantly reduced the number of students to continue past the free trial and eventually complete the course, therefore I don't recommend launching the experiment.

Follow-Up Experiment

In the follow up experiment, after 7 days of pressing “start free trial button”, the student will be presented with a message reporting his progress and informing him that spending few minutes daily can help toward course completion.

The hypothesis is that this might ease the frustration a bit and encourage students who have limited time to dedicate. If this is true this could encourage students to continue even if slower but persistently and complete the course eventually.

The unit of diversion is user ID, which is stable unit of diversion, and the same user ID cannot enroll in the free trial twice.

Metric Choice

Invariant metrics:

- Number of user-ids

Evaluation metrics:

- Retention

To launch this experiment, we are looking for:

- 1- Statistically significant increase of retention, as this means that we significantly increased the number of students to complete the course