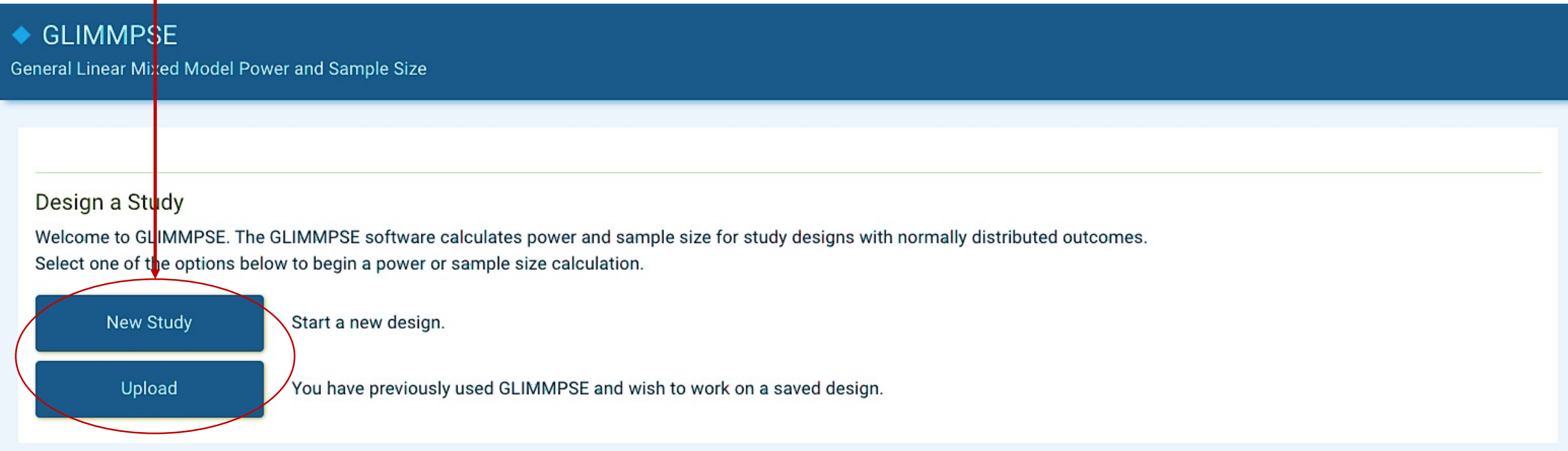
This document contains screenshots for the sample size analysis for Homework 2.

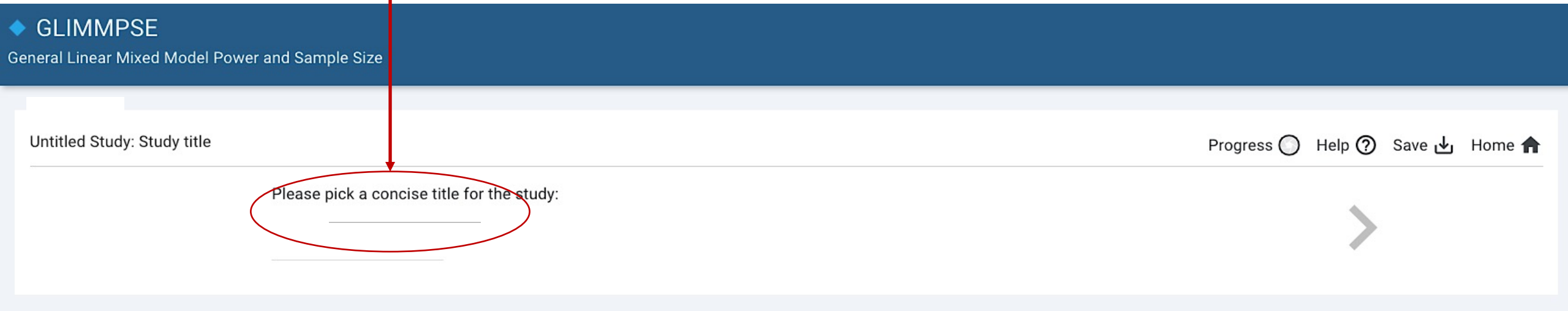
- Click the “New Study” button to start a new power and sample size analysis.

or

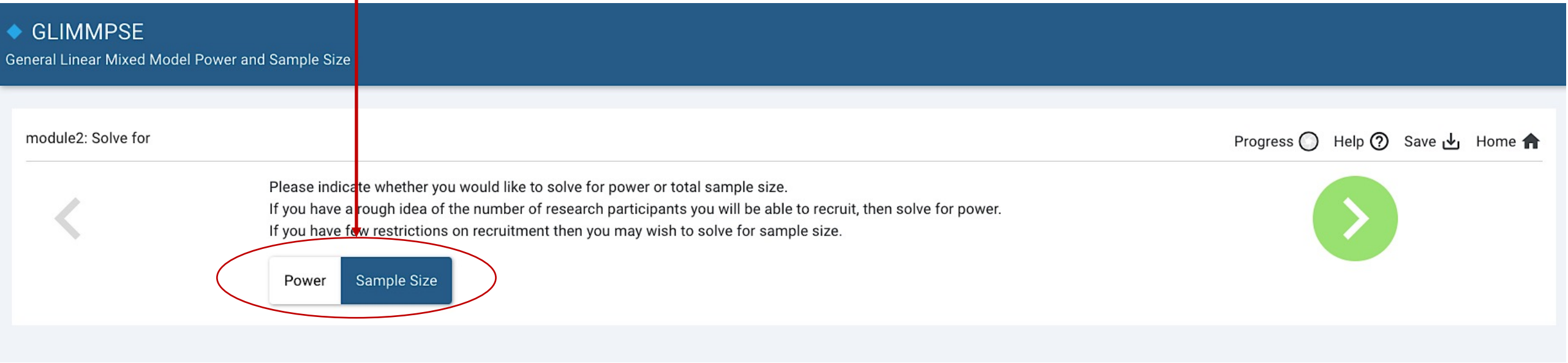
- Click the “Upload” button to upload a json file with a previous study design that you have saved.



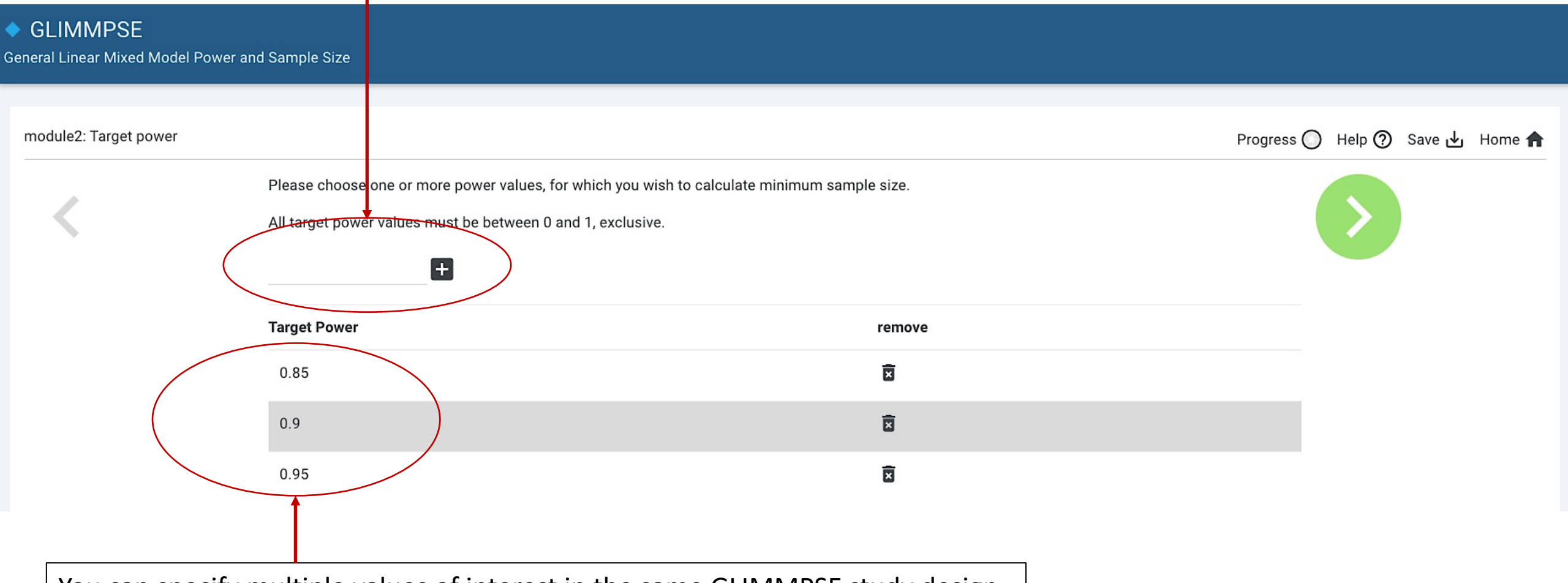
For a new study: Add title here



Click the “Power” or “Sample Size” button depending on what you want to solve for. In this case, we are solving for sample size.

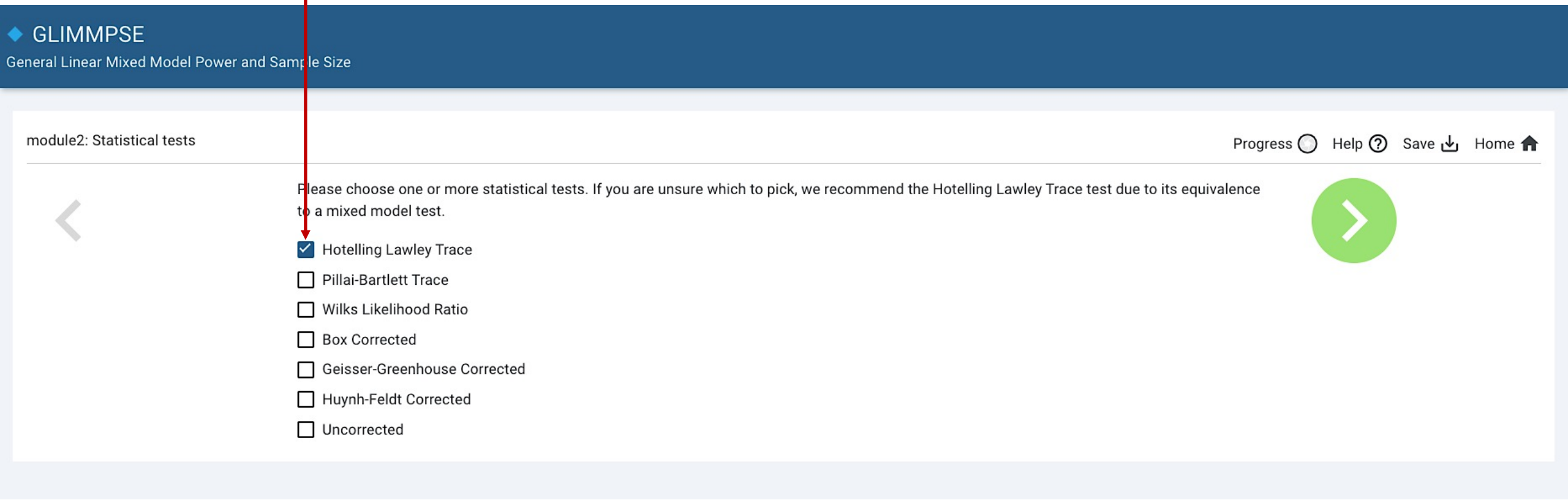


On the “Target Power” screen, we indicate that we want power values of 0.85, 0.90 and 0.95. Type each desired power value and hit enter after each.



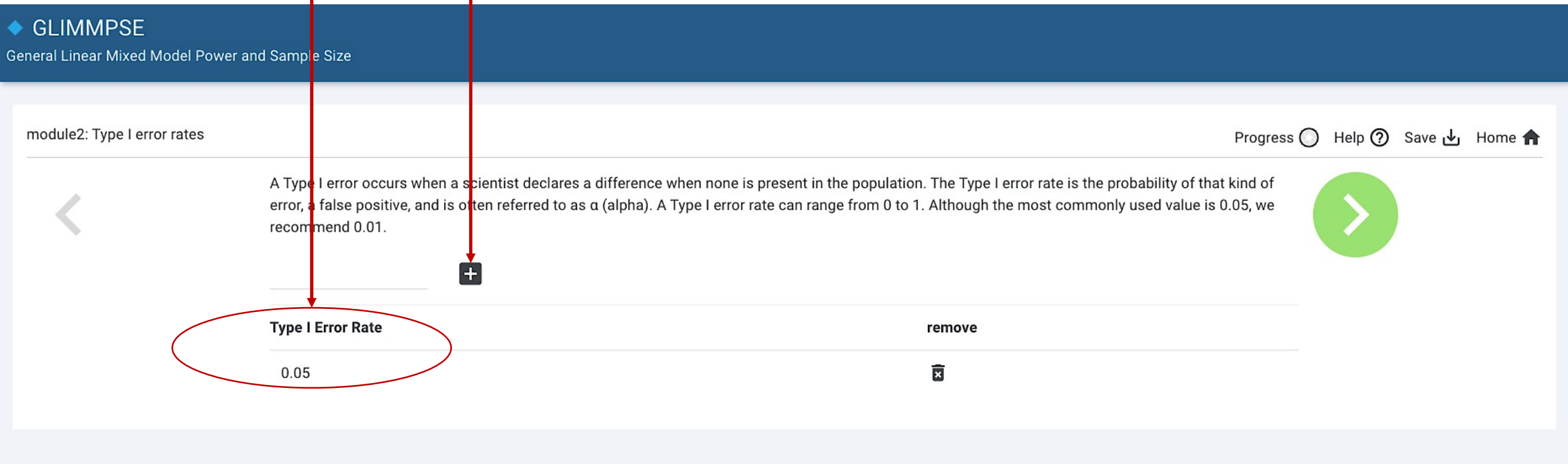
You can specify multiple values of interest in the same GLIMMPSE study design.

We now move to select the hypothesis test of interest. Thus, we click the Hotelling-Lawley trace.



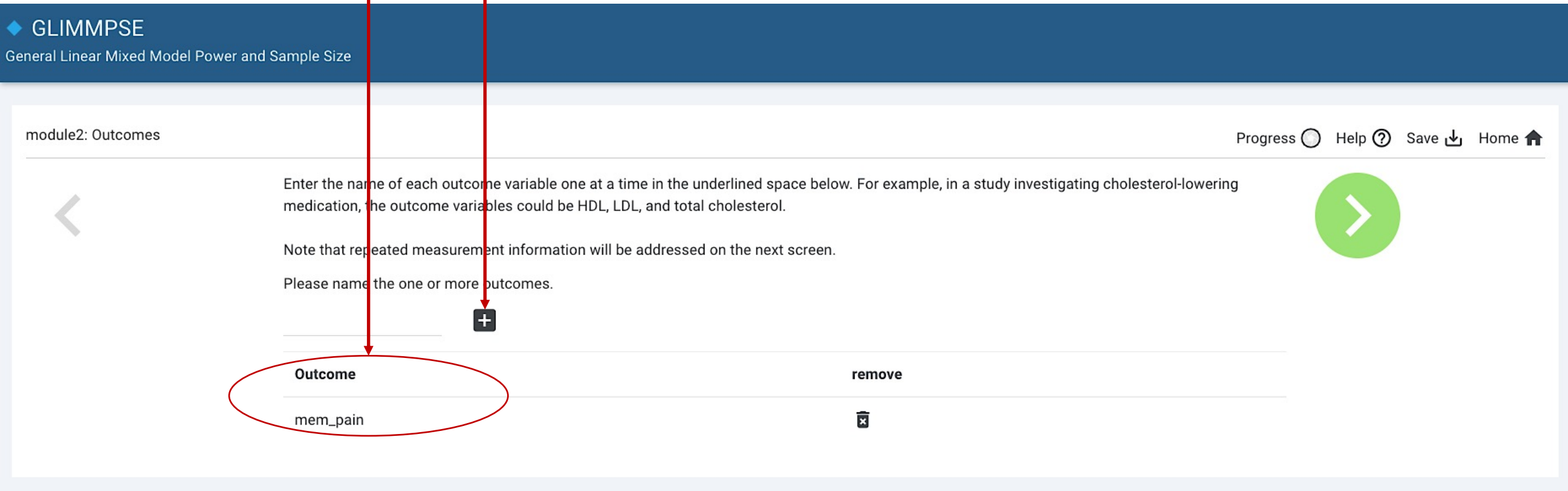
Now we choose the Type I error rate.

We type in 0.05 and then we click the plus sign to add this value to the design.

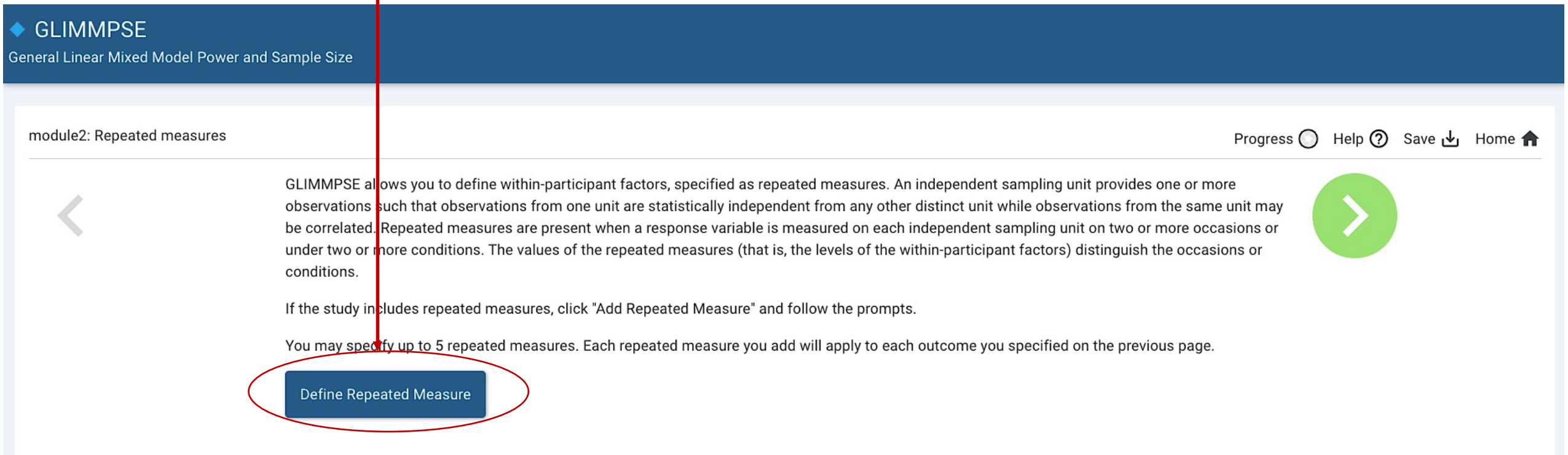


Enter outcome variables here.

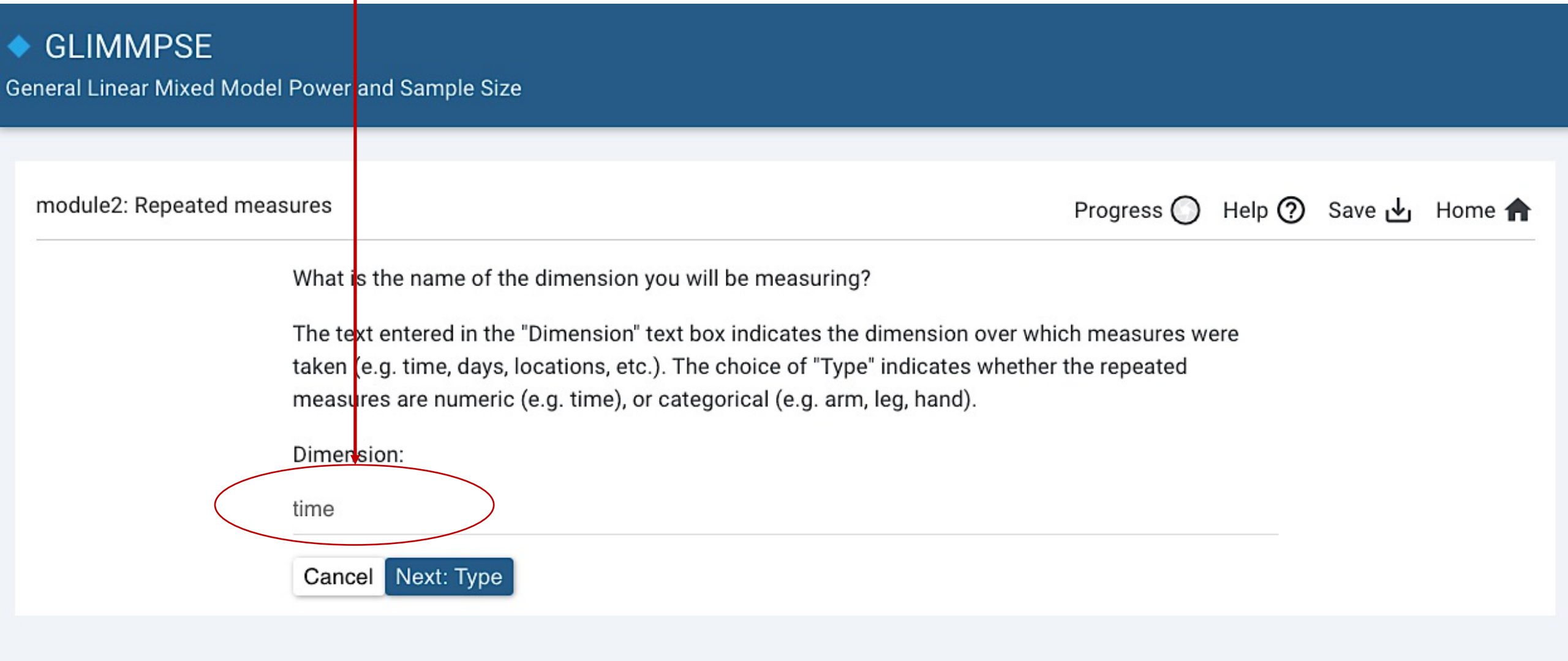
Then, click the plus sign to add the outcome entered to the design.



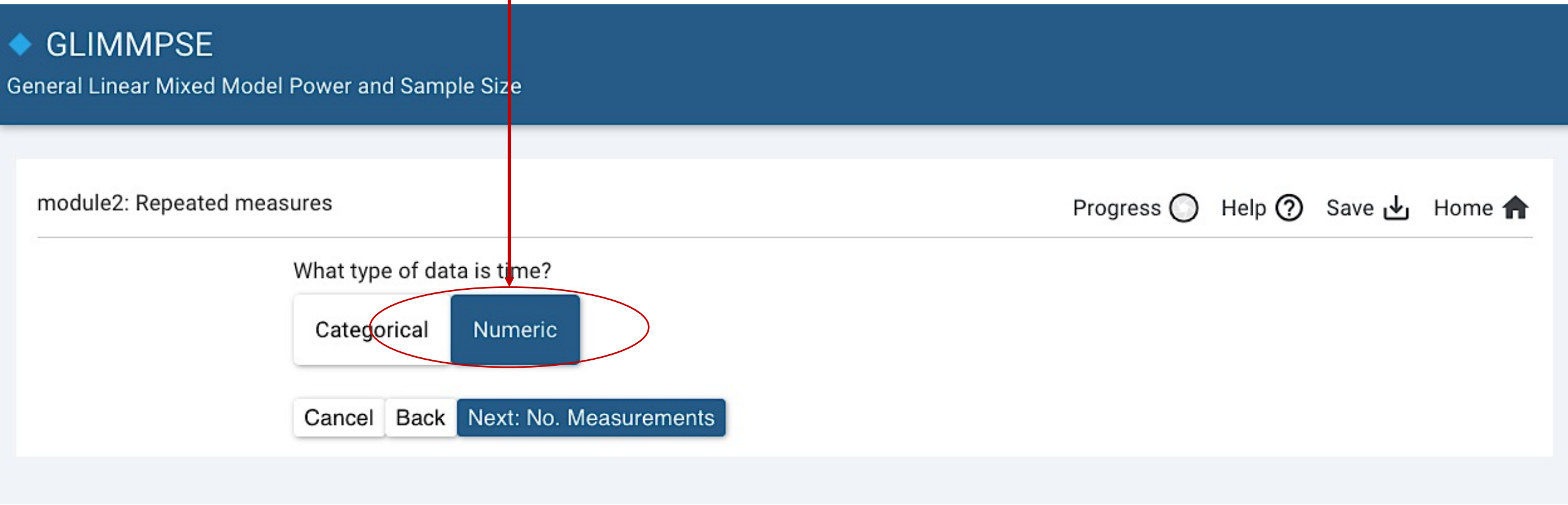
This is a longitudinal study with three repeated measurements of the response variable.



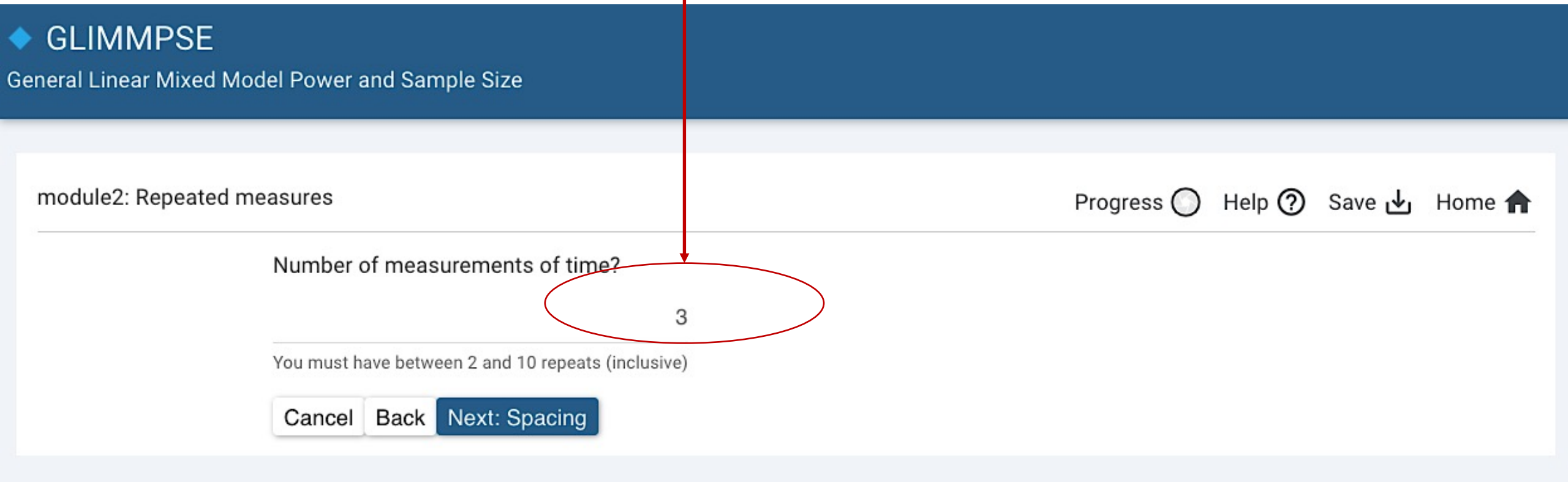
Here, we have named the dimension as time.



Here, we define the type of data that our dimension “time” represents



Enter the number of repeated measurements of the response variable.



Here, we enter the spacing values

GLIMMPSE

General Linear Mixed Model Power and Sample Size

module2: Repeated measures

Progress Help Save Home

Spacing

If the repeated measures are numeric, the spacing values must be unique nonnegative integers, in ascending order.

Set values myself | Select values by series

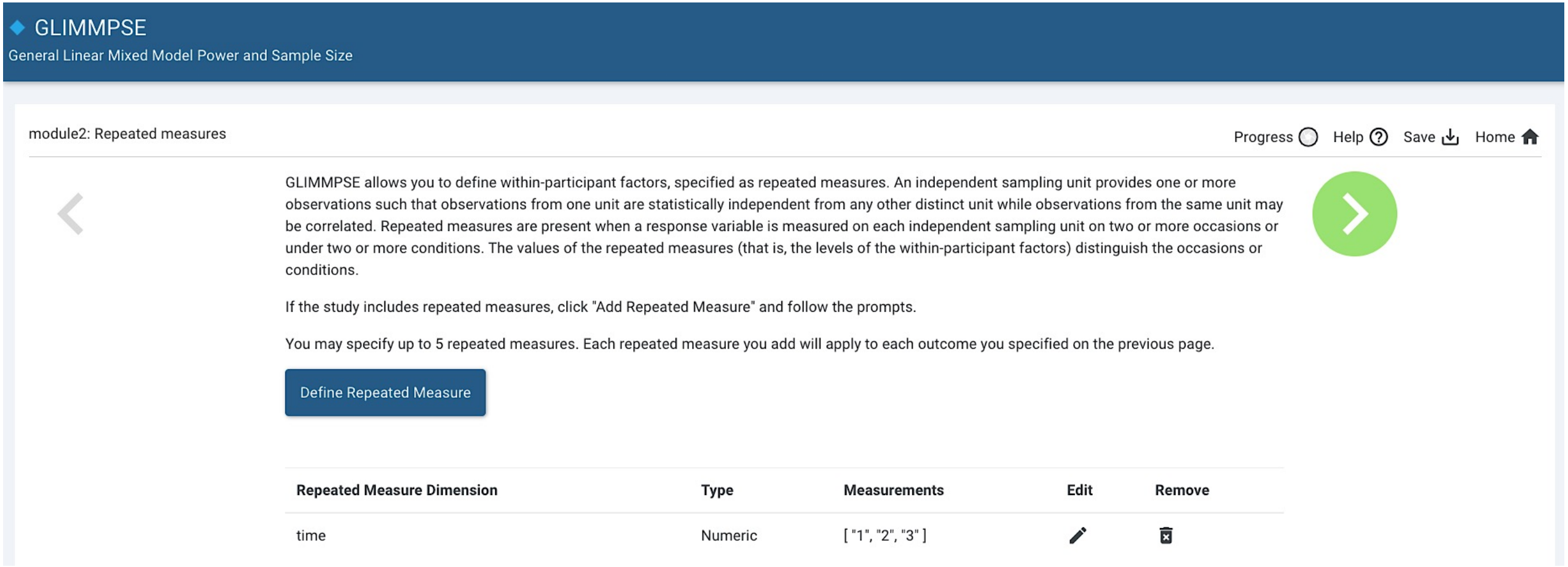
Measurement #1 at 1

Measurement #2 at 2

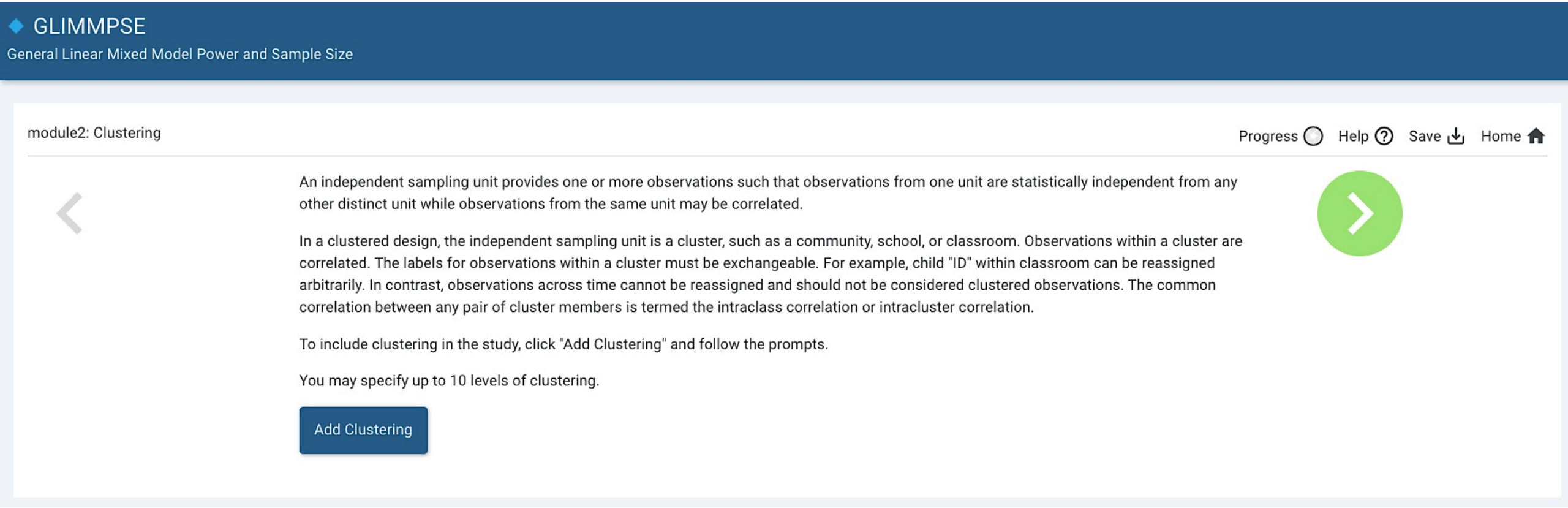
Measurement #3 at 3

Cancel Back Update repeated measure

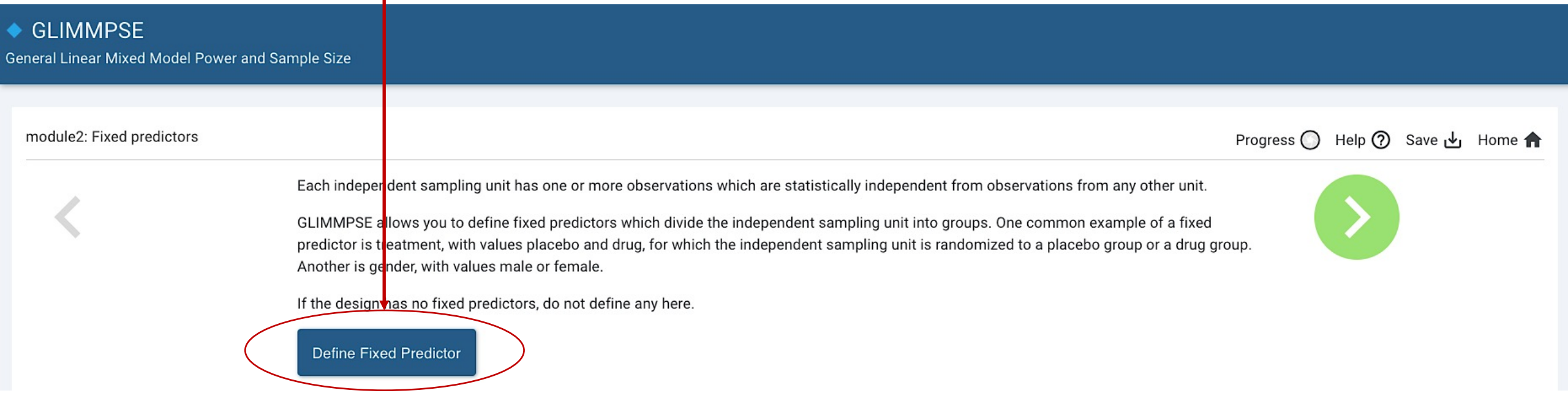
This screen shows a summary of the information entered for the repeated measures.
Additional note: GLIMMPSE can measure a given response variable up to 10 times.



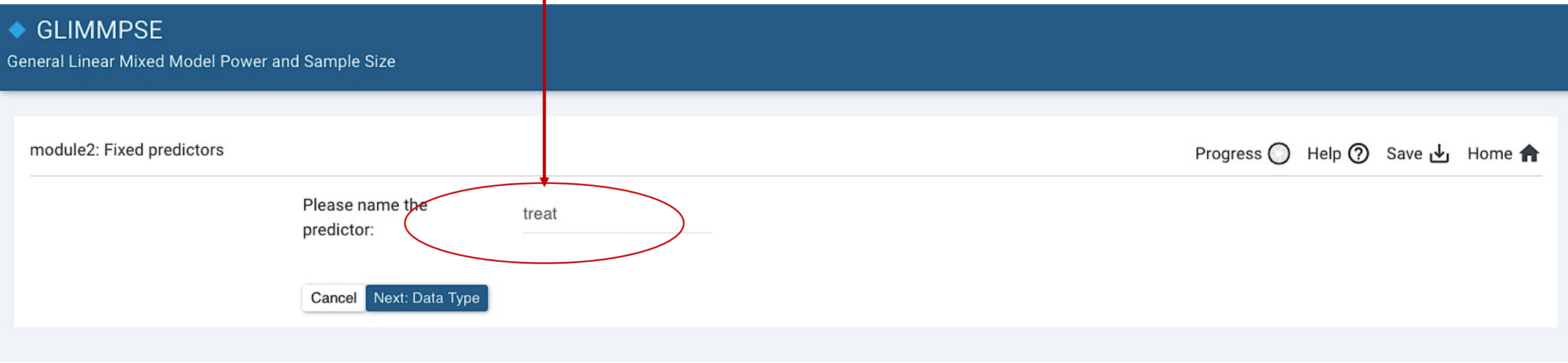
Here, there is no clustering, so we leave the clustering screen blank, and move on to the “Define Fixed Predictor” screen.



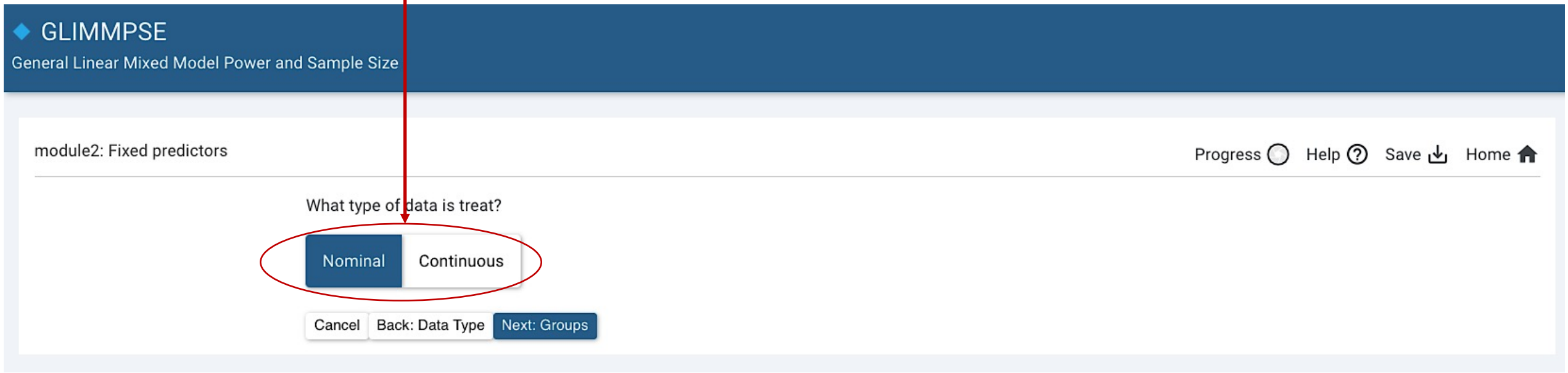
Here, we define the fixed predictor.



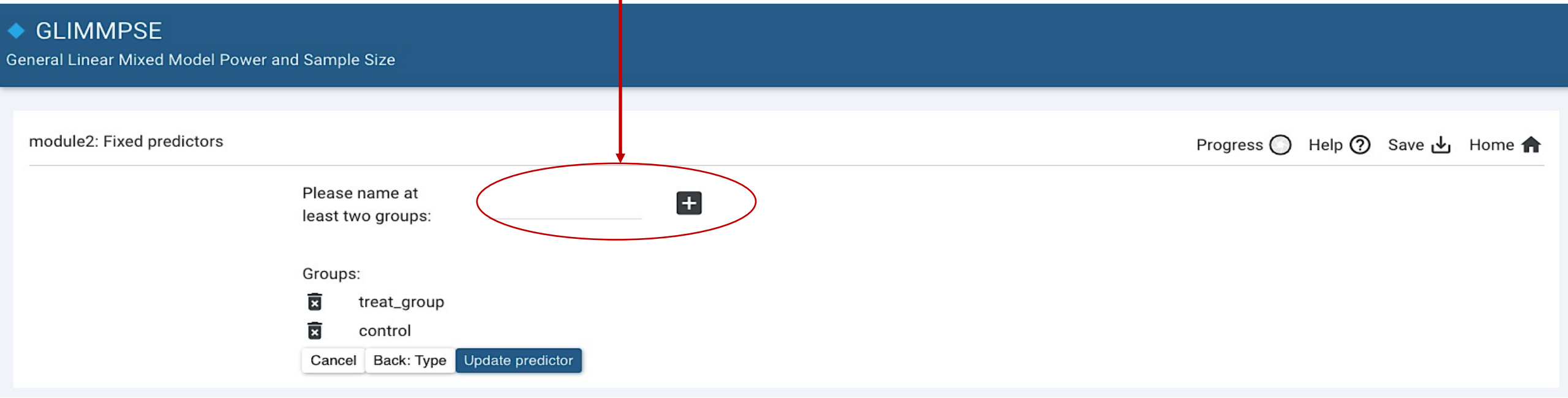
Now type in Treatment and hit enter. Remember, predictor variables are the same thing as between-ISU factors.



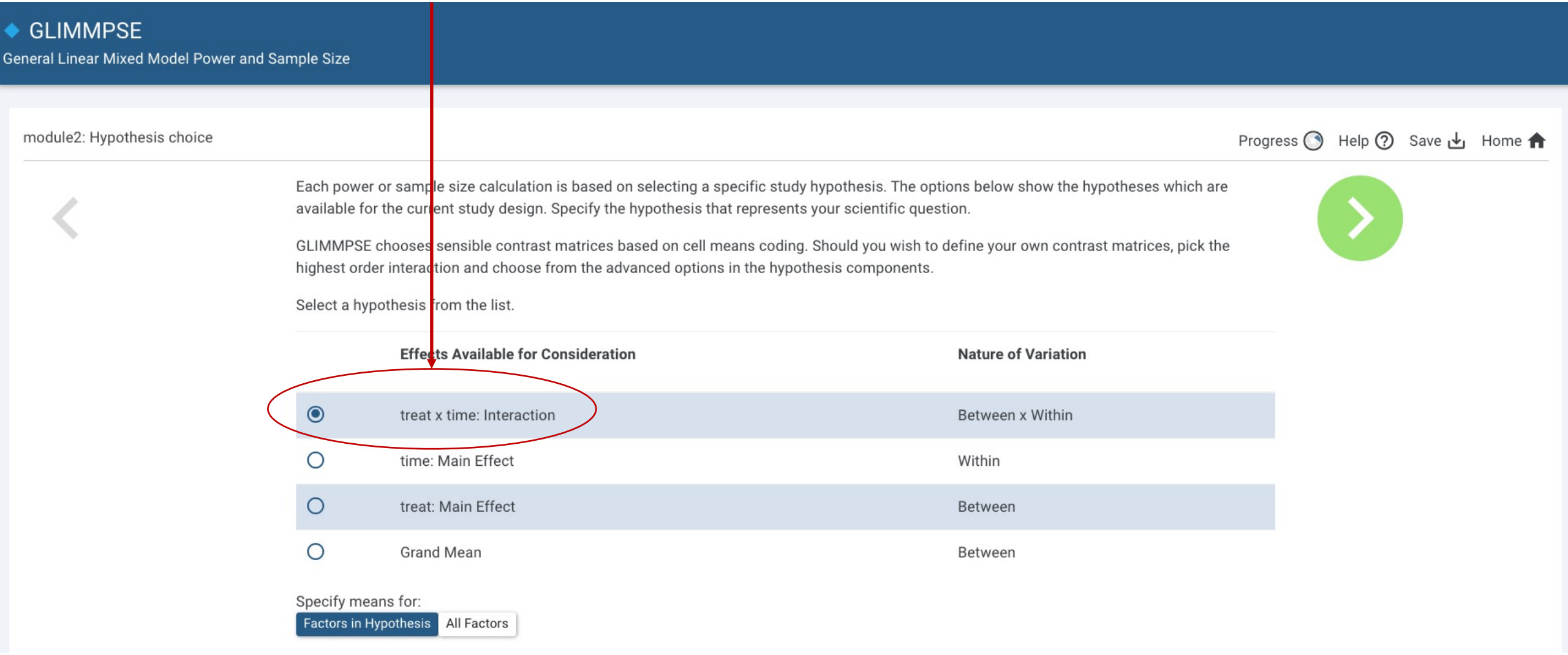
Here, we define what type of data and move on to define the groups.



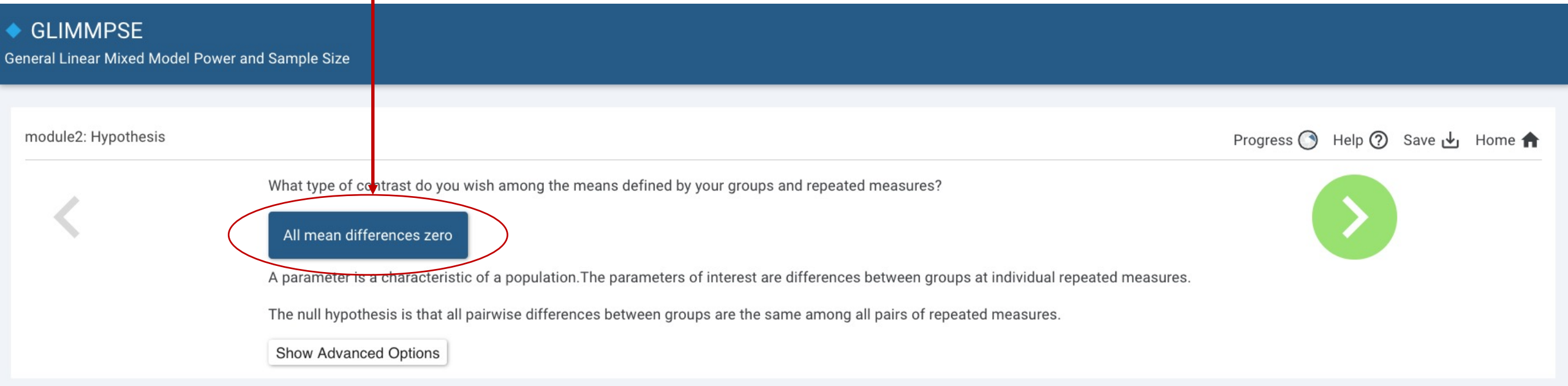
Here, we define the groups.



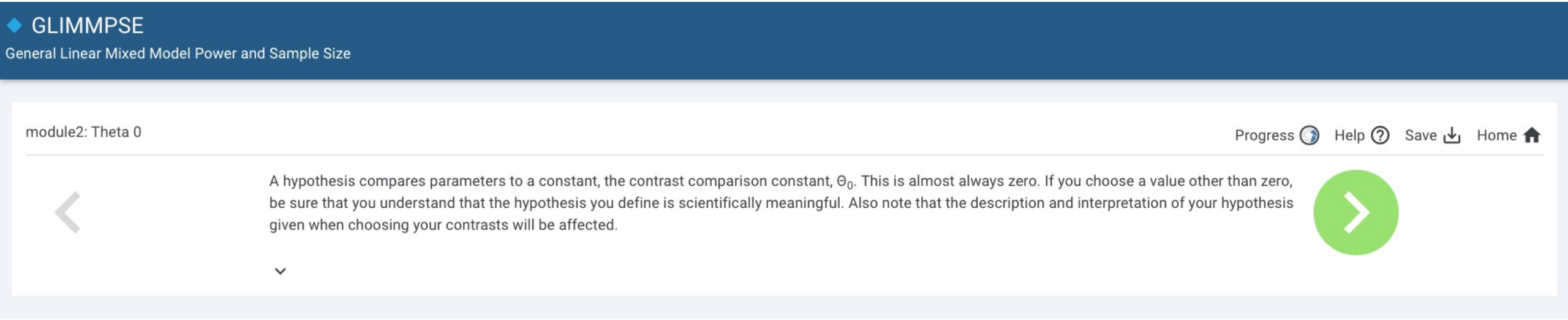
An interaction hypothesis is what we have described in lecture as a between-by-within independent sampling unit hypothesis. Interaction hypotheses allow us to ask questions about the effect of two or more factors or variables. In longitudinal studies, the interaction hypothesis of interest in frequently a time-by-predictor interaction, such as time-by-treatment or time-by-intervention. Click the treatment by time interaction.



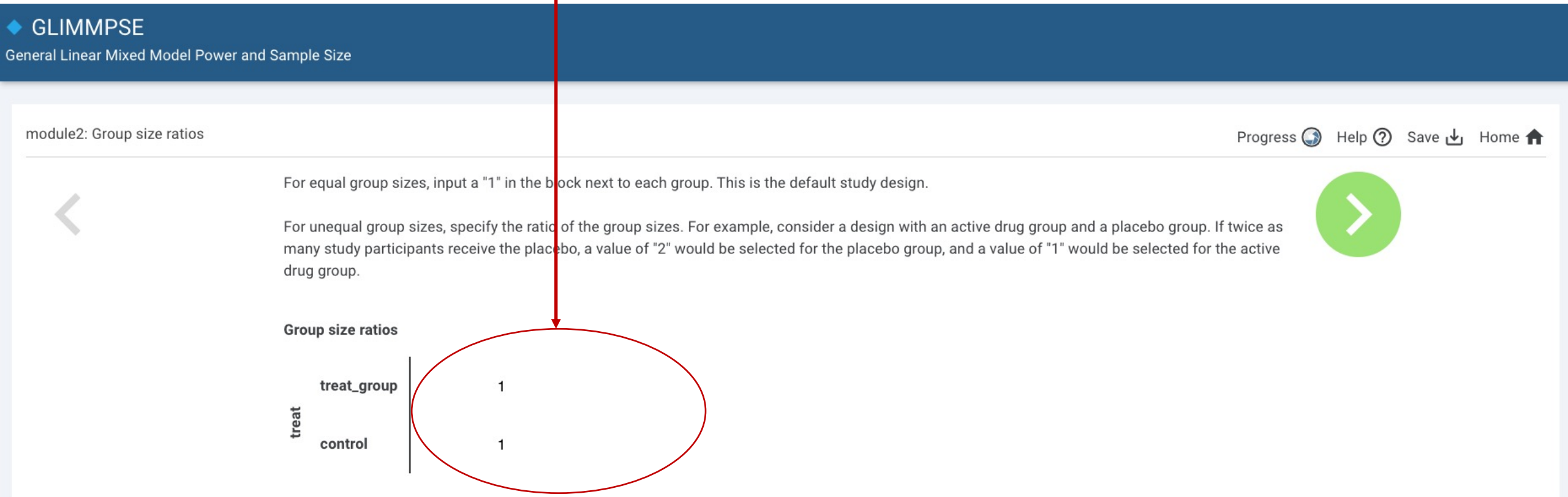
In this example, “All mean differences zero” was selected to indicate the type of contrast desired.



This screen gives you the option to select a value different than zero for the contrast comparison constant.



The next screen allows one to specify relative group sizes. Here, study participants are equally randomized to the two levels of treatment: sensory focus (treat) and standard of care (control). Thus, we leave the screen as follows.



Enter the mean values for the outcome variable within each group as shown below.

GLIMMPSE

General Linear Mixed Model Power and Sample Size

week2_nv: Marginal means

Progress Help Save Home

The table below shows the mean values for outcome **mem_pain** within each group in the study. Each group is represented by a row in the table, and each repeated measure dimension is represented by a column.

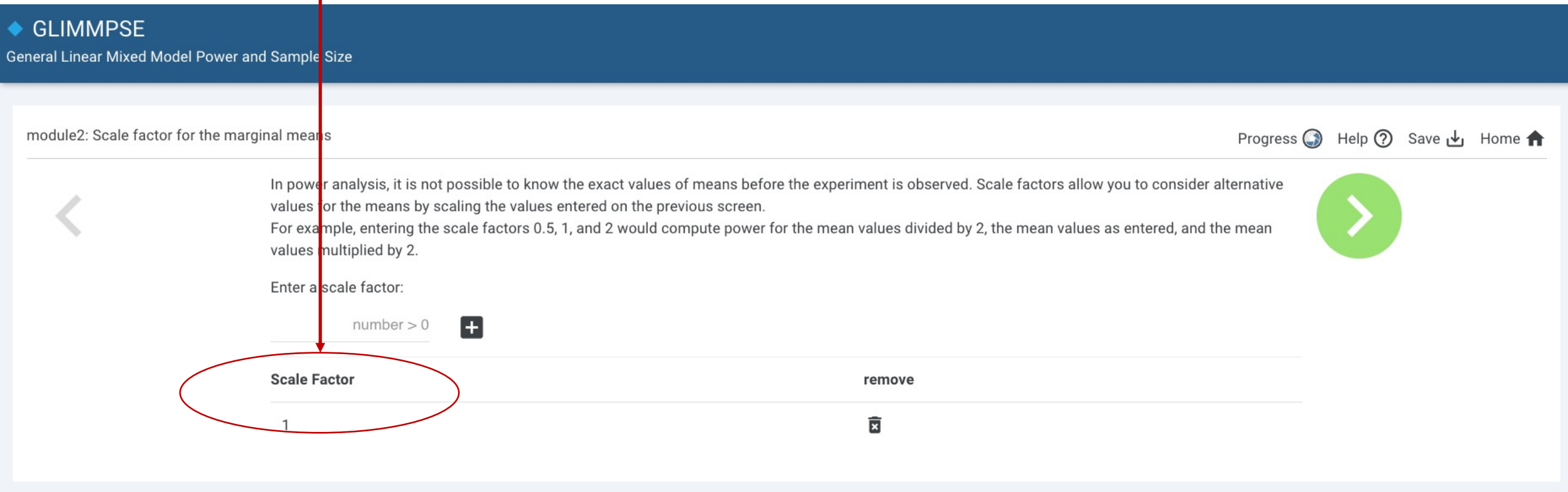
Enter the mean values you expect to observe for outcome **mem_pain** within each group. The table should contain at least one value that is non-zero. Also, at least two groups should have means which differ by a scientifically meaningful amount.

Expected mean values, per group, for *mem_pain*

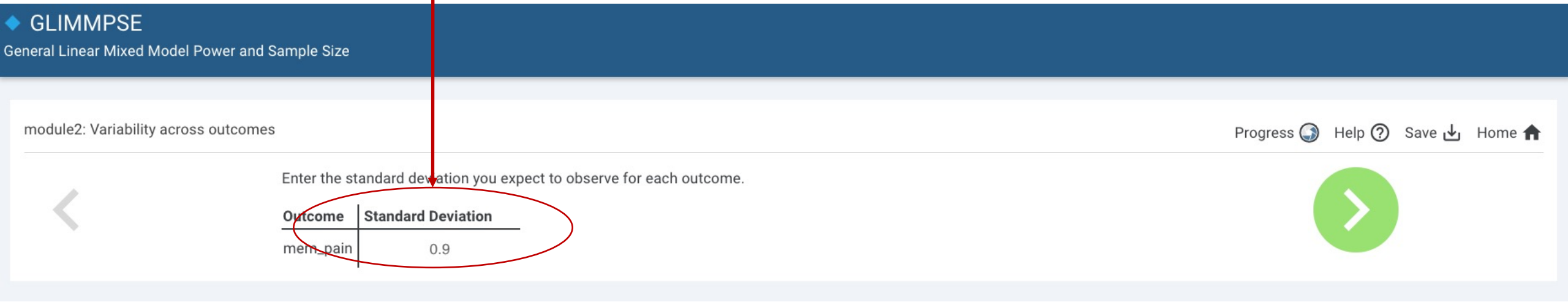
	time	1	2	3
treat	treat_group	3.6	2.8	0.9
	control	4.5	4.3	3

Set blank values to value

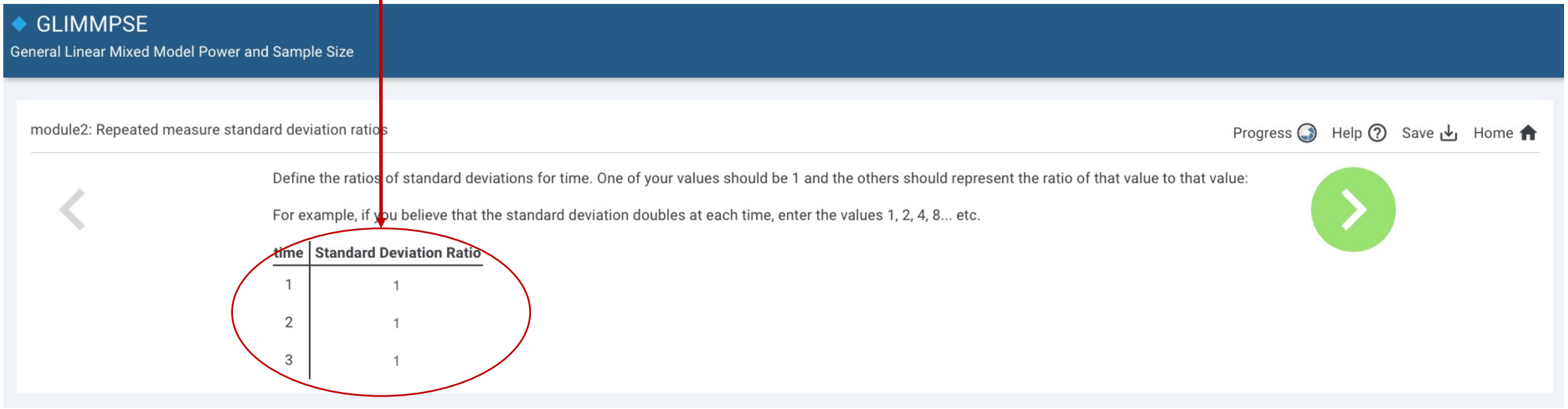
Often, in sample size analysis, it is useful to consider mean differences larger or smaller than our initial guess. Here, the initial guess is well supported by the literature review, so we type in 1 on the next screen, to indicate that our initial guess is the right size. The Scale Factors option in GLIMMPSE is one way of 'Accounting for Uncertainty' within GLIMMPSE.



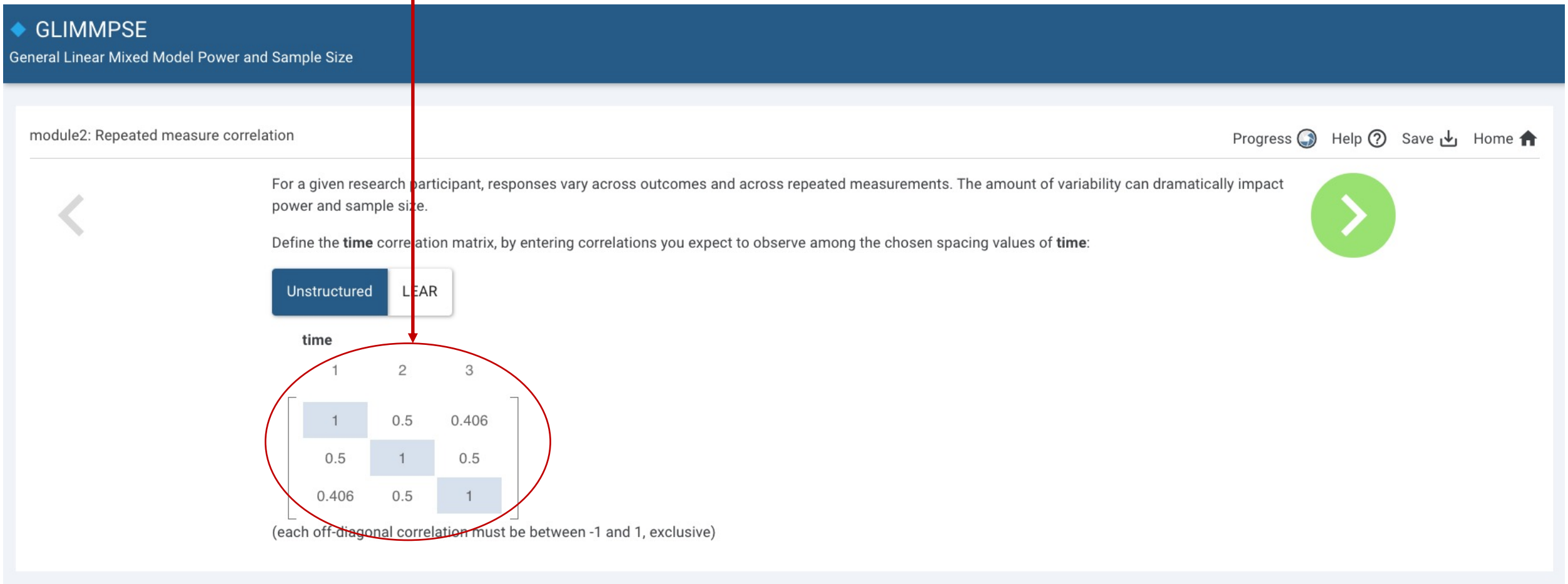
Enter the standard deviation as shown. We discussed variance in the lecture. Standard deviation is simply the square root of variance.



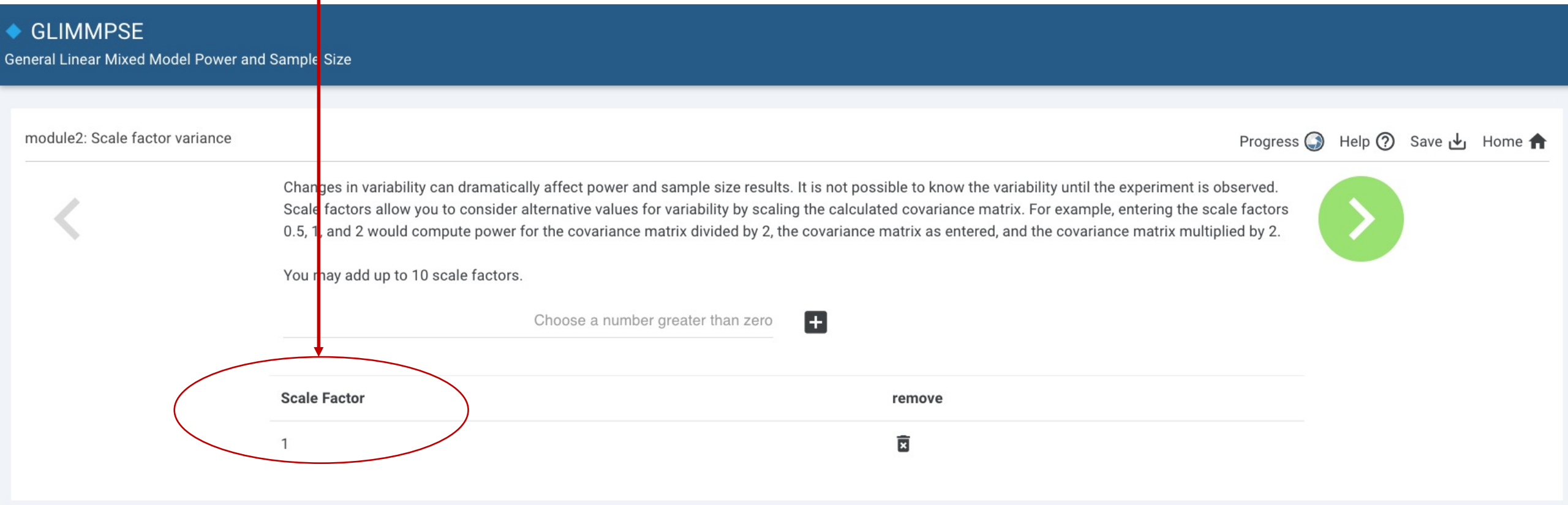
Enter the ratios of standard deviations for time.



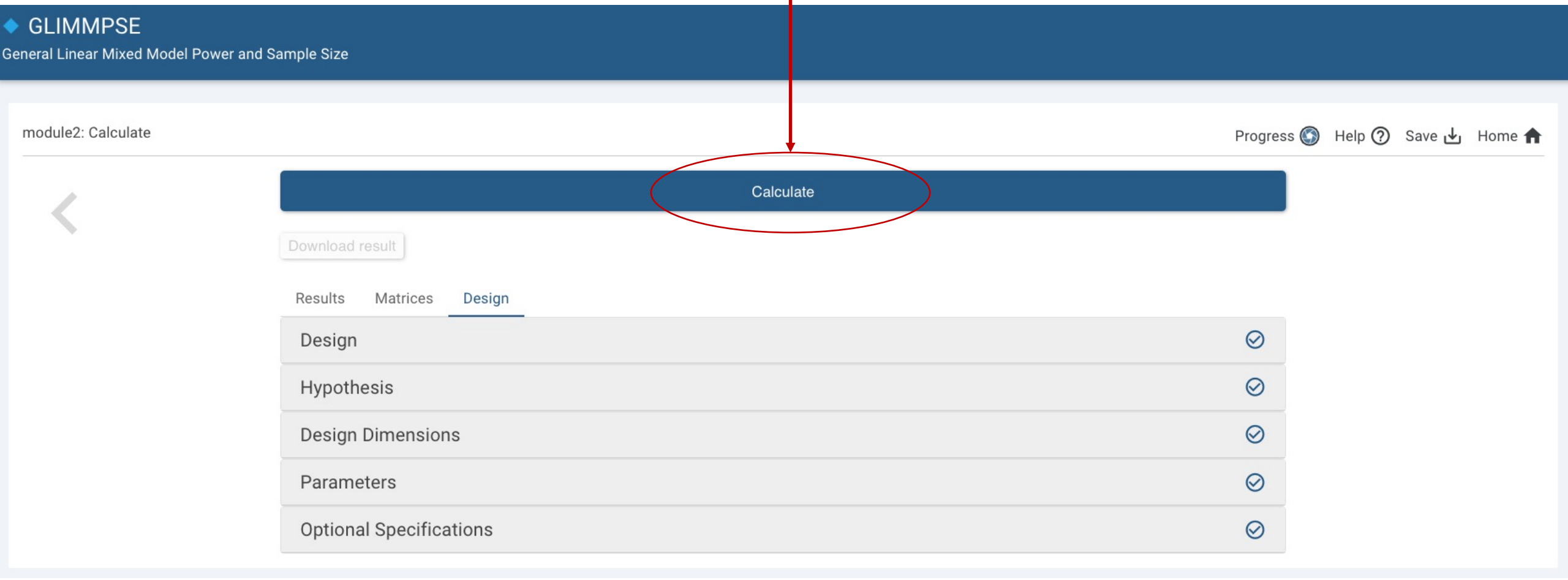
Enter the correlations you expect to observe as shown below.



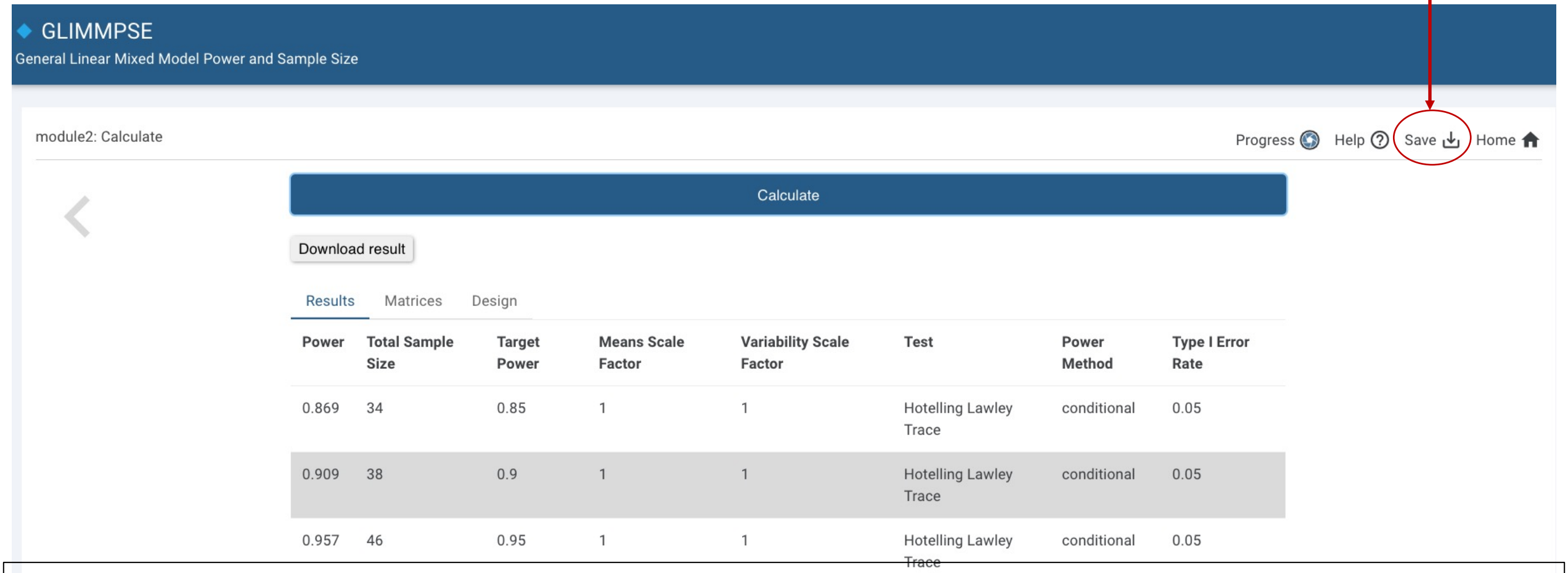
Again, because we have good evidence from the literature review for the variability and correlation, we enter 1 for the scale factor as shown below.



When we hit the “Calculate” button, the results are shown in the power results table.



We can save results and study design inputs by using the “Save” button.



Power	Total Sample Size	Target Power	Means Scale Factor	Variability Scale Factor	Test	Power Method	Type I Error Rate
0.869	34	0.85	1	1	Hotelling Lawley Trace	conditional	0.05
0.909	38	0.9	1	1	Hotelling Lawley Trace	conditional	0.05
0.957	46	0.95	1	1	Hotelling Lawley Trace	conditional	0.05

Note: We were trying to find a sample size large enough so that we had power values of 0.85, 0.9, and 0.95. Those numbers are shown as “Target Power.” They are called “Target Power” because that is what we were aiming for. You can see that we got power values slighter larger than the target values. In fact, the power values are 0.869, 0.909 and 0.957. The reason that the actual values are slightly larger is because sample size is discrete. This is because we can’t recruit a half or a third of a person. In addition, we need to have an even sample size, since we have equal randomization into two groups.

In case you are interested, here are the matrices that were used for the calculation.

Results | Matrices | Design

$$Es(\mathbf{X}) = \begin{bmatrix} 1.00 & 0.00 \\ 0.00 & 1.00 \end{bmatrix}$$

$$\mathbf{B} = \begin{bmatrix} 3.60 & 2.80 & 0.900 \\ 4.50 & 4.30 & 3.00 \end{bmatrix}$$

$$\mathbf{C} = \begin{bmatrix} 1.00 & -1.00 \end{bmatrix}$$

$$\mathbf{U} = \begin{bmatrix} 1.00 & 1.00 \\ -1.00 & 0.00 \\ 0.00 & -1.00 \end{bmatrix}$$

$$\mathbf{\Sigma}_* = (\mathbf{U}_o' \mathbf{\Sigma}_o \mathbf{U}_o) \otimes (\mathbf{U}_r' \mathbf{\Sigma}_r \mathbf{U}_r) \otimes (\mathbf{U}_c' \mathbf{\Sigma}_c \mathbf{U}_c)$$

$$= [0.810] \otimes \begin{bmatrix} 1.00 & 0.594 \\ 0.594 & 1.19 \end{bmatrix} \otimes [1.00] = \begin{bmatrix} 0.810 & 0.481 \\ 0.481 & 0.962 \end{bmatrix}$$

$$\mathbf{\Theta}_0 = \begin{bmatrix} 0.00 & 0.00 \end{bmatrix}$$

$$\alpha = 0.05$$

$$\mathbf{\Theta} = \begin{bmatrix} 0.600 & 1.20 \end{bmatrix}$$

$$\mathbf{M} = \begin{bmatrix} 2.00 \end{bmatrix}$$

$$\nu_e = 2$$

No. of replicated rows in design matrix: 1

$$Es(\mathbf{\Delta}) = \begin{bmatrix} 0.180 & 0.360 \\ 0.360 & 0.720 \end{bmatrix}$$

For notation details, please see

1. Glueck DH, Muller KE. Adjusting power for a baseline covariate in linear models. Statistics in Medicine. 2003;22:2535-2551.

2. Muller KE, Stewart PW. Linear Model Theory: Univariate, Multivariate, and Mixed Models. Hoboken, NJ: Wiley; 2006.