Changing the dots – Differences between abstract and concrete learning (#2017)

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1) Have any data been collected for this study already?
No, no data have been collected for this study yet

2) What's the main question being asked or hypothesis being tested in this study?
Is learning novel symbols with an abstract representation (dots) more effective than learning with a single or multiple concrete representations (pictures)?

3) Describe the key dependent variable(s) specifying how they will be measured.
The key dependent variable is accuracy on a symbolic comparison task.

Children will first complete a training phase during which they will be shown a symbol at the top of the screen and an array of dots or pictures (depending on condition) underneath for 1000ms. Children are asked to remember how many dots or pictures are associated with each symbol. There are five different symbols associated with the numerosities 5, 10, 15, 20 or 25. The association between symbol and numerosity will be counter-balanced across children. There will be 200 trials presented in random order. The nature of the array will differ depending on between-groups condition: abstract (stimuli are arrays of dots), same concrete (stimuli are arrays of a picture which does not differ across trials) and different concrete (stimuli are arrays of a picture which differs across trials).

Following the training phase, participants will complete a symbolic comparison task to assess whether they have formed associations between the symbols and non-symbolic arrays. Two symbols will be displayed, one on the right of the screen and one on the left until the participant responds by pressing a key on the keyboard to indicate which was associated with the greater numbers of dots/pictures. In this test phase the arrays are not presented. There will be a total of 80 test trials. The dependent variable will be accuracy.

4) How many and which conditions will participants be assigned to?
There will be three between subject conditions and participants will be assigned to one of three conditions (abstract, same concrete, different concrete).

5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.
The data will first be checked for normality and outliers. If appropriate we will use a one-way ANOVA to test if there are any significant differences in accuracy between the three conditions. If the ANOVA reveals a significant main effect of condition, then Tukey's post hoc tests will show where the differences between the conditions lie.

If the data is not appropriate for this analysis (i.e. does not met the conditions needed to conduct an ANOVA) the equivalent non-parametric tests will be used (Kruskal-Wallis one way ANOVA).

6) Any secondary analyses?

7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.
A power analysis using previous study data shows a sample of 120 children will be needed to have enough power to detect a medium effect.

8) Anything else you would like to pre-register? (e.g., data exclusions, variables collected for exploratory purposes, unusual analyses planned?)
Data Exclusions – Any outliers will be removed using the criteria that those who are 3 standard deviations above or below the mean accuracy will be removed.