$M_a X_1 O$ $M_b X_0 O$ $M_c X_1 O$ $M_d X_0 O$

This design is required whenever the nature of the experimental variables is such that the effects are enduring and the different treatments must be applied to nonidentical content. The sampling equivalence of the two sets of materials is essential -- $M_a M_c$ in sampling terms, equal to the sample $M_b M_d$).

Statistical tests deal with establishing the generalization across the sample of lists or items and then computing an experimental effects score for a particular person (group) and employing this as a basis for generalizing across persons.

10. Non-equivalent Control Group Design

O X O

O O

The design involves an experimental group and a control group both given a pretest and a posttest, but there is no preexperimental sampling equivalence between the two groups. The more similar the experimental and the contro groups are in their recuitment, and the more this similarity is confirmed by the scores on the pretest, the more effective the control over the extraneous variables becomes. As a useful adjunct to randomization, matching of subjects in terms of pretest scores is effective. Due to the non-equivalent groups, application of ANCOVA is less plausible.

11. Counterbalanced Designs

	Time 1	Time 2	Time 3	Time 4
Group A	$X_1 O$	$X_2 O$	$X_3 O$	$X_4 O$
B	$X_2 O$	$X_4 O$	$X_1 O$	$X_3 O$
C	$X_3 O$	$X_1 O$	$X_4 O$	$X_2 O$
D	$X_4 O$	$X_3 O$	$X_2 O$	$X_1 O$

These designs involve the case where experimental control is achieved or precision enhanced by entering all respondents (or settings) into all treatments. The Latin-square arrangement is typically employed in which treatments are applied in a restrictively randomized manner in turn to the naturally assembled groups (or individuals).

12. Separate-Sample Pretest-Posttest Design

R O (X)

R X O