



Mitigating the Effect of Selection Bias

What is selection bias?

Assessing and evaluating student success programs often includes challenges of mitigating the effects of student selection bias. Selection bias occurs when randomization of a sample or population being assessed is not achieved. Programs and services intended to support student success are not assigned randomly to students. Rather students self-select into participation or gain access given institutional policies or intentional recruitment of students. The result of these common conditions of program and services introduces selection bias.

It is most likely programs and services you seek to assess have selection bias which needs to be addressed within the assessment or evaluation. Failure to not address this issue will produce biased results. Fortunately, there are a strategies that are employed to mitigate these effects resulting in results that more accurately portray impacts of programs and services on student success.

Strategy: Propensity Score Matching

Propensity score matching (PSM) creates a statistical comparison group with similar characteristics to program participants to better assess the effectiveness of intended outcomes. Propensity scores are calculated with logistic regression, which accounts for student characteristics influencing self-selection in a program. Propensity score values therefore reflect the likelihood of students participating in a program and are used to match participants with non-participants to estimate a program's effect while reducing the role of selection bias.

In most cases, NN using a caliper width and a no replacement option is recommended to reduce bias when estimating program effects with the creation of a comparison group. A one-to-one NN matching approach with no replacement, meaning non-participants are matched only once, is supported in order to maintain independent data (Caliendo & Kopeinig, 2008). A caliper width (i.e. 0.2) limits the absolute distance of propensity scores suitable for matching in order to ensure a high quality comparison group.

A six step walkthrough to using PSM is available to UA community members: [HERE](#)

Caliendo, M. & Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys*, 22, 31-72.

Strategy: Heckman Sample Selection Model

The Heckman model provides a way to account for selection bias in evaluations of programs within a two-state estimation procedure. First, the selection equation using multiple regression predicts the actual group membership from a set of presumed factors. With a predicted group membership score, the second equation uses multiple regression to evaluate the impact of a program while including the newly created membership score as a covariate. This in return controls for selection bias that may be involved within the program evaluation.

Heckman, J. (1979). Sample selection bias as a specification error. *Econometrica*, 47, pp. 153-61.

Nonresponse Bias: Selection Bias when Using Surveys

Overview

Surveys are often utilized to evaluate the impact of participation in programs and services on student success outcomes. Response rates vary across student demographics which introduces a form of selection bias called nonresponse bias. To diagnose if selection bias exists, it is recommended to run a comparison of survey respondents to the population to see how representative they are. For example, one would compare the difference of survey respondents who are in-state residents to the population's in-state residents. If there is a statistical difference, there is nonresponse bias that should be mitigated. An example of this is within the [UA Student Services Fee and Green Fund Survey](#).

Strategies to reduce nonresponse bias:

- A proactive way to limit nonresponse bias is to follow-up with initiation non-respondents and enlist their response if identified group of students are not responding during data collection. In some cases, an incentive may be warranted to support their participation in a survey.
- Post survey adjustments can be used after data collection ends to reduce nonresponse bias. These include imputation and survey weighting procedures.

Contact [Assessment and Research](#) for a consultation on methods that reduce selection bias within your assessments.