

WWC STANDARDS Brief

The What Works Clearinghouse (WWC) is an initiative of the U.S. Department of Education’s Institute of Education Sciences. The WWC evaluates research studies that look at the effectiveness of education programs, policies, and practices, which the WWC calls “interventions.” WWC Standards Briefs explain the rules the WWC uses to assess the quality of studies. For more information, visit the WWC’s webpage at <https://whatworks.ed.gov>.

Confounding factors

What is a confounding factor?

An aspect of a study is considered a **confounding factor** if it is not possible to tell whether the difference in outcomes is due to the intervention, the confounding factor, or both.

In WWC study reviews, certified reviewers look for a specific type of confounding factor: those that occur when a component of the study design or the circumstances under which the intervention was implemented are **perfectly aligned** with either the intervention or comparison group. That is, some factor is *always* present for members of one group and *never* present for members in the other group.

Confounding factors can occur in any study design, even when group members are assigned to the intervention and comparison groups at random.

Why do confounding factors matter?

When a confounding factor exists, it is not possible to determine if the intervention, the confounding factor, or a combination caused the difference in outcomes. As a result, the WWC cannot assert that the intervention alone is responsible for the observed difference.

Exhibit 1 illustrates the problem that occurs when a confounding factor is present. Both the intervention and comparison groups scored the same on a pretest, and the intervention group scored 10 points higher on the posttest than the comparison group. The observed difference in outcomes could have been caused by (1) the intervention being tested, (2) the confounding factor, or (3) some combination of the two. In this case, we cannot say that the intervention alone caused the difference.

Exhibit 1: Example of a confounding factor in the intervention group

Group	Pretest	Study Period		Posttest
Intervention	50	Intervention	Confounding factor	80
Comparison	50			70

Exhibit 2 shows a similar situation, but the confounding factor only affects the comparison group. Again, both the intervention and the confounding factor could have affected the outcomes.

Exhibit 2: Example of a confounding factor in the comparison group				
Group	Pretest	Study Period		Posttest
Intervention	50	Intervention		80
Comparison	50		Confounding factor	70

In both of the cases illustrated in Exhibits 1 and 2, the presence of the confounding factor makes it impossible to tell whether differences at posttest were due to the intervention or the confounding factor. Therefore, in both cases, the WWC cannot be confident that the intervention caused all, or even part, of the observed differences between the groups.

What types of confounding factors commonly occur in WWC-reviewed studies?

Exhibit 3 presents examples of some common types of confounding factors found in studies reviewed by the WWC.

The first example has a confounding factor because the teachers in the intervention group are all new and those in the comparison group are all experienced.

In the second example in Exhibit 3, the effect of the tutoring program cannot be separated from the effect of the math curriculum. That is, the study authors can only estimate the impact of the combined intervention, which includes both tutoring and the math curriculum. Depending on the purpose of the review, the WWC may consider the study to have a confounding factor if the authors sought to examine the impact of the math curriculum alone, but not if they were interested in the joint impact of the curriculum and the tutoring.¹

The last example illustrates the most common type of confounding factor, a **single-unit confounding factor**. This type of confounding factor occurs when, within the sample used to examine outcomes, either the intervention group or the comparison group contains only one student, classroom, teacher, or school. In this example, all of the students in the comparison group were taught by Mrs. Smith, so there is no way to distinguish between the effects of the intervention and Mrs. Smith. If there was no observed difference in spelling test scores for the two groups, it could be because the intervention didn't work, or it could be that it worked, but Mrs. Smith is such an outstanding teacher that her students score just as well.

Exhibit 3: Examples of potential confounding factors		
Example	Intervention	Potential confounding factor
In a study of a new reading curriculum, three new teachers volunteer to try the new program, while three teachers with 20 or more years of experience stick with the curriculum they've used for years.	New reading curriculum	Teacher experience (intervention group)
Intervention group students receiving a new math curriculum also receive additional tutoring that is not part of the curriculum. Comparison group students use the standard curriculum and receive no tutoring.	New math curriculum	Tutoring (intervention group)
All of the students in Mrs. Jones's and Mr. Wright's classes use a new software package to work on spelling (the intervention group), while Mrs. Smith's students continue to work only with pencils and paper (the comparison group).	New software package	Single teacher (comparison group)

¹ Some studies that examine combined interventions will not be considered eligible for review. In particular, if a review effort is interested in a specific intervention, and that intervention is combined with another intervention, the study will not be reviewed for that particular review effort. (For more details on the WWC study screening process, see the [WWC Process Brief](#) on screening.)

Note that a single unit is not a confounding factor if it is present in both groups. For example, if Mrs. Smith taught all students in a study—and half of them used the software package and half did not—having a single teacher in the comparison group would not be a confounding factor.

In certain cases, it may be impossible to evaluate an education intervention without there being a single-unit confounding factor. For example, a study may be interested in analyzing the effect of attending a specific charter school. In this case, it would be reasonable for all students in the intervention group to attend the same school. These studies are still eligible to *Meet WWC Design Standards* and are considered on a case-by-case basis based on the scope of the review effort.

Additionally, the WWC does not consider there to be a confounding factor if the intervention group in a quasi-experimental design study includes students, teachers, or schools who volunteered to receive the intervention, while the comparison group includes those who did not volunteer. Volunteering is just one example of the types of unmeasured differences between groups that are often present in quasi-experimental design studies. The WWC accounts for these issues by not allowing quasi-experimental design studies to receive the highest rating.

How does a confounding factor affect a study's WWC rating?

WWC reviewers must decide whether there is sufficient information to determine that the only difference between the two groups that is not controlled for by design or analysis is the presence of the intervention. If not, there may be a confounding factor, and the reviewer must determine if that factor could affect the outcome separately from the intervention.

In each example above, the confounding factor may have an effect on the outcome separate from the intervention and cannot be eliminated by the study design. Because it is impossible to separate the degree to which an observed effect was due to the intervention and how much was due to the confounding factor, a study with a confounding factor cannot *Meet WWC Design Standards*.

Glossary

- A **confounding factor** is an aspect of a study that makes it impossible to tell whether the intervention or that factor is responsible for the difference in outcomes.
- A factor is **perfectly aligned** if it is always present for members of one study group and never present for members of the other group.
- A **single-unit confounding factor** refers to a confounding factor resulting from having one individual or entity (for example, one student, one teacher, or one school) either provide or receive the intervention (or comparison).

For more information about the review process, please download a copy of the [WWC Procedures and Standards Handbook](#).