

Travel, Clubs, and Connections

Build a two-way table and compare percentages within groups.

GRADE 8 • 8.SP.A.4

CCSS.Math.Content.8.SP.A.4 "Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?"

NAME _____

DATE _____

Keep the two categories paired

A two-way frequency table counts each person once in the cell for both recorded categories. Row and column totals are marginal frequencies. A conditional relative frequency divides by the named subgroup's total; compare the same outcome across groups to investigate association.

Worked example

Ten simulated library requests record format and book type. What fraction of print requests are novels?

Practice library requests

Format	Novel	Biography	Total
Print	2	3	5
Digital	1	4	5
Total	3	7	10

1. Restrict attention to the Print row: its total is 5 requests.

2. Use the Novel count in that row: $2/5 = 40\%$.

40% of print requests are novels. This differs from $3/10 = 30\%$ of all requests being novels.

Each record gives usual travel to school (walk or bus) and school-club membership. These 20 paired records are invented classroom data, not a real school survey. Use them for tasks 1-5. Tasks 6 and 7 supply separate data.

Each ID is one simulated respondent; paired categories stay together

Records	Records	Records	Records
01: Walk / Club	02: Walk / No club	03: Bus / No club	04: Walk / Club
05: Walk / No club	06: Bus / No club	07: Walk / Club	08: Walk / No club
09: Bus / No club	10: Walk / Club	11: Bus / Club	12: Bus / No club
13: Walk / Club	14: Bus / Club	15: Bus / No club	16: Walk / Club
17: Bus / No club	18: Bus / No club	19: Walk / No club	20: Bus / No club

1. Construct the frequency table

Tally each paired record into the table. Fill all joint frequencies and every row, column and grand total. Check that each respondent is counted exactly once.

Simulated respondent frequencies (complete every cell)

Travel	Club	No club	Total
Walk			
Bus			
Total			

2. Interpret counts

How many respondents walk and belong to a club? How many belong to a club altogether? Explain why these counts use different parts of your table.

3. Change the denominator

Use your frequency table to complete a row-conditional percentage table. Divide each joint count by its own row total. Each row represents 100% of that row's group; do not add a grand-total row.

Conditional relative frequencies within each row (%) (complete every cell)

Travel	Club	No club	Total
Walk			
Bus			

4. Reverse the condition

Among club members, what fraction walk? Among walkers, what fraction belong to a club? Calculate both and explain why the denominators differ.

5. Reason about association

Compare the club-membership percentages for walkers and bus riders. Does this sample suggest an association? Use both percentages and explain why raw club-member counts alone are less useful.

6. Equal counts, different rates

In a separate simulated survey, Group A has 20 people and 12 club members; Group B has 40 people and 12 club members. Construct the table. A student says membership is equally common because both groups have 12 members. Use conditional percentages to evaluate that claim.

A separate simulated club survey (complete every cell)

Group	Member	Not member	Total
Group A			
Group B			
Total			

7. Construct a comparison with no difference

In a new simulated group, 20 students walk and 10 ride the bus. Exactly 40% of each travel group belong to a club. Complete the two-way frequency table. Explain whether the club-membership rates suggest an association with travel in this new group, and why unequal club-member counts do not change that conclusion.

Construct equal conditional rates (complete every cell)

Travel	Club	No club	Total
Walk			
Bus			
Total			

TEACHER NOTES

Require both category labels, all joint counts and margins. Keep paired observations intact. Row-conditional tables use the row totals, not the overall total. Accept equivalent fractions and accurate explanations; percentages here are exact. Simulated classroom data describe only the supplied records. For a uniformly selected record, empirical probabilities can test independence within that sample space; they do not prove independence or causation in a wider population.

TASK 1

The completed table below counts every paired record once; both sets of marginal totals sum to the number of records.

Simulated respondent frequencies

TRAVEL	CLUB	NO CLUB	TOTAL
WALK	6	4	10
BUS	2	8	10
TOTAL	8	12	20

TASK 2

6 walk and belong to a club (one joint cell). 8 belong to a club altogether (the Club column total).

TASK 3

Each row uses its own group total as the denominator. The two percentages within a row sum to 100%.

Conditional relative frequencies within each row (%)

TRAVEL	CLUB	NO CLUB	TOTAL
WALK	60%	40%	100%
BUS	20%	80%	100%

TASK 4

Among club members: $6/8 = 3/4 = 75\%$ walk. Among walkers: $6/10 = 3/5 = 60\%$ belong to a club. The starting groups are all 8 club members versus all 10 walkers. Name the starting group before choosing a denominator; the joint cell stays the same when the condition is reversed.

TASK 5

60% of walkers and 20% of bus riders belong to a club. The different within-group rates suggest an association in this sample. Percentages describe membership relative to each group's size; counts alone omit that denominator. Compare rates that use the same outcome and explicitly name each denominator.

TASK 6

The claim is false: Group A has $12/20 = 60\%$ members, while Group B has $12/40 = 30\%$. Equal joint counts do not imply equal within-group rates when group sizes differ. Subtract each club count from its group total to find nonmembers, then divide club counts by the corresponding group totals.

A separate simulated club survey

GROUP	MEMBER	NOT MEMBER	TOTAL
GROUP A	12	8	20
GROUP B	12	28	40
TOTAL	24	36	60

TASK 7

Walk: 8 club and 12 no club; Bus: 4 club and 6 no club. Club-membership rates are both 40%, so there is no observed association here. There are more walking club members only because the Walk group is twice as large.

Construct equal conditional rates

TRAVEL	CLUB	NO CLUB	TOTAL
WALK	8	12	20
BUS	4	6	10
TOTAL	12	18	30