

### Explanation of Median for ACE results

The ACE evaluation response options are the whole numbers from 1 – 6. However, it is feasible that a student would want to respond with an answer between any 2 of these whole numbers. For example, a student may not want to endorse 6, but doesn't want to go as low as 5. Perhaps the student's satisfaction is really 5.4. If we had an infinitely precise instrument, we could actually determine this. However, we do not. To help compensate for this we must treat this data as continuous and not discrete.

The median for continuous data requires more arithmetic. The formula for this calculation is given below:

$$Median = L + \left( \frac{N/2 - \sum fb}{f_m} \right) i$$

where:  $L$  = lower limit of interval containing median  
 $\sum fb$  = sum of frequencies below interval containing the median  
 $f_m$  = frequency of the interval containing the median  
 $N$  = Number of students  
 $i$  = size of the interval containing the median

The steps to using this formula are as follows:

1. Divide the number of cases by 2 to find the median score.
2. From the lowest interval, sum the frequencies until the interval is found that contains the median score.
3. Subtract the sum of the frequencies below the interval containing the median score from  $N/2$
4. Divide the difference by the frequency of scores in the interval that contains the median score.
5. Multiply the quotient by the size of each interval.
6. Add the product to the lower limit of the interval containing the median score.

Worked example:

An instructor receives these scores on an ACE question: {1, 1, 2, 3, 3, 3, 4, 4, 4, 5, 5, 5, 5, 5, 5, 5, 5, 5, 6, 6}

This table summarizes the key pieces of data that are required:

Score	Real Limit	Frequency	Relative Frequency	Cumulative Frequency	Relative Cumulative Frequency
6	5.5-6.5	2	0.095	21	1.00
5	4.5-5.5	10	0.476	19	0.905
4	3.5-4.5	3	0.143	9	0.429
3	2.5-3.5	3	0.143	6	0.286
2	1.5-2.5	1	0.048	3	0.143
1	0.5-1.5	2	0.095	2	0.095

The steps to using this formula are as follows:

1. Divide the number of cases by 2 to find the median score.
  - The number of cases we have is  $N = 21$ . So, we divide 21 by 2.
2. From the lowest interval, sum the frequencies until the interval is found that contains the median score.
  - Here, the interval will be that contains the median will be 4.5 – 5.5 because the rcf is  $\geq 0.50$ .
3. Subtract the sum of the frequencies below the interval containing the median score from  $N/2$ 
  - The sum of the frequencies below the interval containing the median are:  
 $3 + 3 + 1 + 2 = 9$
4. Divide the difference by the frequency of scores in the interval that contains the median score.
5. Multiply the quotient by the size of each interval.
  - Here this is 1.
6. Add the product to the lower limit of the interval containing the median score.
  - Here the lower limit of the interval containing the median score is 4.5.

$$\text{Median} = 4.5 + \left( \frac{21/2 - 9}{10} \right) 1 = 4.65$$