



PEIMS EDIT+ User Technical Documentation

Tips for Calculating Chi Square for Special Education District Effectiveness

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Chi Square Calculation

Chi Square is calculated as part of the Special Education District Effectiveness and Compliance report (PRF5D021). The Chi Square calculation is made to determine the significance of differences between actual and expected number of students in certain groups.

SUMMARY

The *Special Education District Effectiveness and Compliance Report (PRF5D021)* statistically analyzes the student participation in the Special Education program for three student groups. A Chi Square value is calculated for three different compliance indicators:

- Ethnicity
- Low Socioeconomic / Economically Disadvantaged
- Limited English Proficient (LEP)

Chi Square analysis is useful in determining if the difference between observed data and expected data is statistically significant. It compares the observed data with results that would be expected randomly. The Chi Square result value is compared to a statistical distribution table that indicates the probability of finding such results by chance.

FORMULA

The Chi Square formula is:

$$\text{Chi Square} = \sum \frac{(\text{Actual Value} - \text{Expected Value})^2}{(\text{Expected Value})}$$

Where the actual values are the student counts for the group being analyzed and expected values are calculated using the actual values.

In order to calculate Chi Square to determine significance, all of the actual values and expected values for the formula need to be calculated. For this document, LEP Chi Square calculations are used. The same processes are followed for economically disadvantaged students and students by ethnicity.

Chi Square =

$$\begin{aligned} & \frac{[(\text{LEP students not in Spec Ed} - \text{Expected LEP students not in Spec Ed})^2]}{\text{Expected LEP students not in Spec Ed}} \\ & + \\ & \frac{[(\text{LEP students in Spec Ed} - \text{Expected LEP students in Spec Ed})^2]}{\text{Expected LEP students in Spec Ed}} \\ & + \\ & \frac{[(\text{Non LEP students not in Spec Ed} - \text{Expected Non LEP students not in Spec Ed})^2]}{\text{Expected Non LEP students not in Spec Ed}} \\ & + \\ & \frac{[(\text{Non LEP students in Spec Ed} - \text{Expected Non LEP students in Spec Ed})^2]}{\text{Expected Non LEP students in Spec Ed}} \end{aligned}$$

High Level Process Description:

Step	Description
1	Calculate Expected Results. a. Calculate remaining student population breakdowns. b. Calculate percentages of student population breakdowns. c. Calculate expected percentages of student population breakdowns. d. Calculate expected result values for student population breakdowns. e. Decide if Chi Square calculation is needed.
2	Calculate Chi Square. a. Calculate the components of the final Chi Square value. b. Sum the components to get the final Chi Square value. c. Use the Chi Square value to determine significance.

Detailed Process Description:

For this calculation, start with the following data available from a PEIMS data file:

Information	Name used to reference value
Total # of students not in Special Ed	TOTAL NON SPED
Total # of students in Special Ed	TOTAL SPED
# of LEP students not in Special Ed	NON SPED LEP
# of LEP students in Special Ed	SPED LEP

Part 1: Calculate Expected Results

Step	Description
1	Calculate remaining student population breakdowns. a. Calculate count of Non Special Ed Non LEP students by subtracting the Non Special Ed LEP count from the Total Non Special Ed count: $NON\ SPED\ NON\ LEP = TOTAL\ NON\ SPED - NON\ SPED\ LEP$ b. Calculate count of Special Ed Non LEP students by subtracting the Special Ed LEP count from the Total Special Ed count: $SPED\ NON\ LEP = TOTAL\ SPED - SPED\ LEP$ c. Calculate count of total LEP students by adding the Non Special Ed LEP count and the Special Ed LEP count: $TOTAL\ LEP = NON\ SPED\ LEP + SPED\ LEP$ d. Calculate count of total Non LEP students by adding the Non Special Ed Non LEP count and the Special Ed Non LEP count: $TOTAL\ NON\ LEP = NON\ SPED\ NON\ LEP + SPED\ NON\ LEP$ e. Calculate count of total students by adding the Total Non Special Ed count and the Total Special Ed count: $TOTAL\ STUDENTS = TOTAL\ NON\ SPED + TOTAL\ SPED$
2	Calculate percentages of student population breakdowns. a. Calculate the percent of Non Special Ed students to Total Students: $NON\ SPED\ \% = TOTAL\ NON\ SPED / TOTAL\ STUDENTS$ b. Calculate the percent of Special Ed students to Total Students: $SPED\ \% = TOTAL\ SPED / TOTAL\ STUDENTS$ c. Calculate the percent of LEP students to Total Students: $LEP\ \% = TOTAL\ LEP / TOTAL\ STUDENTS$ d. Calculate the percent of Non LEP students to Total Students: $NON\ LEP\ \% = TOTAL\ NON\ LEP / TOTAL\ STUDENTS$

3	<p>Calculate expected percentages of student population breakdowns.</p> <p>a. Calculate expected percent of Non Special Ed LEP students by multiplying the Non Special Ed percent by the LEP percent: $\text{EXP NON SPED LEP \%} = \text{NON SPED \%} * \text{LEP \%}$</p> <p>b. Calculate expected percent of Special Ed LEP students by multiplying the Special Ed percent by the LEP percent: $\text{EXP SPED LEP \%} = \text{SPED \%} * \text{LEP \%}$</p> <p>c. Calculate expected percent of Non Special Ed Non LEP students by multiplying the Non Special Ed percent by the Non LEP percent: $\text{EXP NON SPED NON LEP \%} = \text{NON SPED \%} * \text{NON LEP \%}$</p> <p>d. Calculate expected percent of Special Ed Non LEP students by multiplying the Special Ed percent by the Non LEP percent: $\text{EXP SPED NON LEP \%} = \text{SPED \%} * \text{NON LEP \%}$</p>
4	<p>Calculate expected result values for student population breakdowns.</p> <p>a. Calculate expected Non Special Ed LEP students by multiplying the Expected Non Special Ed LEP percent by the Total Student count: $\text{EXP NON SPED LEP} = \text{EXP NON SPED LEP \%} * \text{TOTAL STUDENTS}$</p> <p>b. Calculate expected Special Ed LEP students by multiplying the Expected Special Ed LEP percent by the Total Student count: $\text{EXP SPED LEP} = \text{EXP SPED LEP \%} * \text{TOTAL STUDENTS}$</p> <p>c. Calculate expected Non Special Ed Non LEP students by multiplying Expected Non Special Ed Non LEP percent by the Total Student count: $\text{EXP NON SPED NON LEP} = \text{EXP NON SPED NON LEP \%} * \text{TOTAL STUDENTS}$</p> <p>d. Calculate expected Special Ed Non LEP students by multiplying the Expected Special Ed Non LEP percent by the Total Student count: $\text{EXP SPED NON LEP} = \text{EXP SPED NON LEP \%} * \text{TOTAL STUDENTS}$</p>
5	<p>Decide if Chi Square calculation is needed.</p> <p><i>If one or more of the expected results < 10, there is no need to perform a Chi Square formula. Display 'N/C' in Chi Square report column.</i></p> <p><i>Otherwise: Continue with Part 2: Calculate Chi Square.</i></p>

Part 2: Calculate Chi Square

Step	Description
1	<p>Calculate the components of the final Chi Square value.</p> <p>Calculate PART A = $\frac{(\text{NON SPED LEP} - \text{EXP NON SPED LEP})^2}{\text{EXP NON SPED LEP}}$</p> <p>Calculate PART B = $\frac{(\text{SPED LEP} - \text{EXP SPED LEP})^2}{\text{EXP SPED LEP}}$</p> <p>Calculate PART C = $\frac{(\text{NON SPED NON LEP} - \text{EXP NON SPED NON LEP})^2}{\text{EXP NON SPED NON LEP}}$</p> <p>Calculate PART D = $\frac{(\text{SPED NON LEP} - \text{EXP SPED NON LEP})^2}{\text{EXP SPED NON LEP}}$</p>
2	<p>Sum the components to get the final Chi Square value.</p> <p>Calculate CHI SQUARE = PART A + PART B + PART C + PART D</p>
3	<p>Use the Chi Square value to determine significance.</p> <p>Compare Chi Square value to 3.841:</p> <ul style="list-style-type: none"> • <i>If CHI SQUARE => 3.841, display 'Significant' in Chi Square report column</i> • <i>If CHI SQUARE < 3.841, display 'Not Significant' in Chi Square report column</i>

EXAMPLE

For this example, start with the following data available from a PEIMS data file:

Information	Name used to reference value	PEIMS Value
Total # of students not in Special Ed	TOTAL NON SPED	67,154
Total # of students in Special Ed	TOTAL SPED	8,900
# of LEP students not in Special Ed	NON SPED LEP	10,484
# of LEP students in Special Ed	SPED LEP	954

Part 1: Calculate Expected Results

The following table has a similar layout to the *Special Education District Effectiveness and Compliance Report (PRF5D021)*. It is shown here with the values that are known at this point in the example. Values that have not yet been calculated are shown with their reference name and the step where that value is calculated. This example progresses through calculating all of the values in this table:

Student Group	Non Special Education	Special Education	Total
Total Students	67,154 NON SPED % (2a)	8,900 SPED % (2b)	TOTAL STUDENTS(1e) 100 %
LEP Student	10,484	954	TOTAL LEP (1c) LEP % (2c)
Non LEP Student	NON SPED NON LEP(1a)	SPED NON LEP (1b)	TOTAL NON LEP (1d) NON LEP % (2d)

Step 1: Calculate remaining student population breakdowns.

- a. NON SPED NON LEP = **67,154** - **10,484** = **56,670**
- b. SPED NON LEP = **8,900** - **954** = **7,946**
- c. TOTAL LEP = **10,484** + **954** = **11,438**
- d. TOTAL NON LEP = **56,670** + **7,946** = **64,616**
- e. TOTAL STUDENTS = **67,154** + **8,900** = **76,054**

Student Group	Non Special Education	Special Education	Total
Total Students	67,154 NON SPED % (2a)	8,900 SPED % (2b)	76,054 100 %
LEP Students	10,484	954	11,438 LEP % (2c)
Non LEP Students	56,670	7,946	64,616 NON LEP % (2d)

Step 2: Calculate percentages of student population breakdowns.

- a. NON SPED % = $67,154 / 76,054 = .88297788$
- b. SPED % = $8,900 / 76,054 = .11702212$
- c. LEP % = $11,438 / 76,054 = .15039314$
- d. NON LEP % = $64,616 / 76,054 = .84960686$

Student Group	Non Special Education	Special Education	Total
Total Students	67,154 .88297788	8,900 .11702212	76,054 100 %
LEP Students	10,484	954	11,438 .15039314
Non LEP Students	56,670	7,946	64,616 .84960686

Step 3: Calculate expected percentages of student population breakdowns.

- a. EXP NON SPED LEP % = $.88297788 * .15039314 = .13279382$
- b. EXP SPED LEP % = $.11702212 * .15039314 = .01759932$
- c. EXP NON SPED NON LEP % = $.88297788 * .84960686 = .75018406$
- d. EXP SPED NON LEP % = $.11702212 * .84960686 = .09942280$

Step 4: Calculate expected result values for student population breakdowns.

- a. EXP NON SPED LEP = $.13279382 * 76,054 = 10,099.50$
- b. EXP SPED LEP = $.01759932 * 76,054 = 1,338.50$
- c. EXP NON SPED NON LEP = $.75018406 * 76,054 = 57,054.50$
- d. EXP SPED NON LEP = $.09942280 * 76,054 = 7,561.50$

Note: The above four values added together result in the total student population of 76,054. These values and the original values from Step 1 are used in Part 2.

Step 5: Decide if Chi Square calculation is needed.

Since none of the expected results calculated in Step 4 are < 10, continue with the Chi Square formula calculation.

Part 2: Calculate Chi Square

Step 1: Calculate the components of the final Chi Square value, as follows:

- a. PART A = $(10484 - 10099.5)^2 / 10099.5 = (384.5)^2 / 10099.5 = 14.64$
- b. PART B = $(954 - 1338.5)^2 / 1338.5 = (384.5)^2 / 1338.5 = 110.45$
- c. PART C = $(56670 - 57054.5)^2 / 57054.5 = (384.5)^2 / 57054.5 = 2.59$
- d. PART D = $(7946 - 7561.5)^2 / 7561.5 = (384.5)^2 / 7561.5 = 19.55$

Step 2: Sum the components to get the final Chi Square value, as follows:

- a. CHI SQUARE = $14.64 + 110.45 + 2.59 + 19.55 = 147.23$

Step 3: Use the Chi Square value to determine significance, as follows:

- a. Compare CHI SQUARE value to 3.841
 $147.23 \Rightarrow 3.841$, so Chi Square report should display ‘Significant’.