How to calculate and interpret the 95% confidence interval for a proportion.

While you can use SPSS to determine proportions, you will need to calculation the confidence interval by hand. This table was produced using Analyze-Descriptive Statistics-Frequencies and selecting edu as the variable:

<table>
<thead>
<tr>
<th>edu</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value 1</td>
<td>50</td>
<td>8.5</td>
<td>8.5</td>
<td>8.5</td>
</tr>
<tr>
<td>2</td>
<td>85</td>
<td>14.5</td>
<td>14.5</td>
<td>23.1</td>
</tr>
<tr>
<td>3</td>
<td>122</td>
<td>20.9</td>
<td>20.9</td>
<td>43.9</td>
</tr>
<tr>
<td>4</td>
<td>271</td>
<td>46.3</td>
<td>46.3</td>
<td>90.3</td>
</tr>
<tr>
<td>5</td>
<td>57</td>
<td>9.7</td>
<td>9.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>585</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

If you want to hand calculate the proportions you divided each frequency by the total. Here SPSS has already done that for you and listed it in the percent but you can do the calculations yourself to confirm. For example 50/585 = .085 or 8.5% as stated. The proportion can be expressed as either the absolute number or the percent.

**Calculating the 95% confidence interval of a proportion using the plus-four method:**

Use the proportion of students in edu 5 to do this calculation:

In the plus-four method the n is the total number of people in the sample, while the x is the number of people in edu 5.

So \( n = 585 \) and \( x = 57 \)

To use the method you add 4 to the n to get \( n^* = 585 + 4 = 589 \)
and you add 2 to the x to get \( x^* = 57 + 2 = 59 \)

You also need \( p \) which is \( x^*/n^* \) or \( 59/589 = .100 \)

And \( q \) which is \( 1 - p \) or \( 1 -.10 = .90 \)
Now you plug these numbers into the following equation to get your confidence intervals:

$$SE_p = \sqrt{\frac{pq}{n}}$$

And then you need to calculate the parts in the correct order:

1. Multiply p x q: \(.1 \times .9 = .09\)
2. Divide the product of this by 589: \(.09 / 589 = .000153\)
3. Get the square root of the answer from step 2: \(\sqrt{.000153} = .012\)
4. Multiply this by 1.96 to get the SEp (this is the multiplier associated with 95%): \(1.96 \times .012 = .0235\)
5. Add and subtract the SEp to/from .100 (the proportion for edu 5 you calculated earlier) to get the confidence interval associated with the proportion: \(.100 - .0235 = .0765\) and \(.100 + .0235 = .1235\) so the 95% confidence interval for the proportion of students in edu 5 is \(.0765, .1235\).

Interpretation: This gives you a range of possible values within which the true population proportion of students in edu 5 might fall. If we take 100 samples of the same size, and construct 100 confidence intervals, then 95 of them would contain the true population proportion, and 5 of them would not.