

# An Empirical Investigation of Wyoming Fourth Grade Math Assessment Scores

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## Abstract

Newspaper articles and school/district reports often give only descriptive information about scores on annual statewide assessments. Public data will be used to answer research questions and test hypotheses about fourth grade math scores for Laramie County School District #1 (LCSD#1) fourth grade students using chi-square analysis.

## Wyo. PAWS scores drop

STATEWIDE RESULTS SHOW DECREASES COMPARED TO 2014 FOR MOST GRADE LEVELS AND SUBJECTS. FIND YOUR SCHOOL'S SCORE. A6. LCSD#1 AND LCSD#2 RESULTS. A7. At a glance. The Wyoming Department of Education has released the results from the 2015 Proficiency Assessment for Wyoming Students, also known as PAWS. The statewide assessment showed...

## Problem

This is a newspaper headline from the Wyoming Tribune Eagle (2015, July 17).

The Wyoming statewide assessment is the Proficiency Assessment for Wyoming Students (PAWS).

Descriptive data was used to support the headline, but statistical analysis was not used to determine if changes were significant.

This headline led to asking if the decrease was statistically significant or not. Then, other research questions that could be answered using state and district level data were posed and tested.

## Purpose

The purpose of this study was to analyze publically available data to answer real-world questions about Math proficiency for fourth grade students in Laramie County School District #1 (LCSD#1), Cheyenne, Wyoming.

## Relevant Literature

Readers of mass media often do not understand statistics used or how to interpret the results indicating a need to verify and interpret printed information (Tal, 2016; von Roten, & de Roten, 2013; von Roten, 2016). This supports the need to analyze the PAWS data to check the accuracy of the newspaper headline.

Franke, Ho, and Christie (2012) analyzed articles that used chi-square analysis in four journals. Unfortunately, they found many instances where researchers “over interpret or incorrectly interpret the results” (Franke, et al., 2012). Thus, there is a need to show how to correctly use chi-square analysis.

Chandrakantha (2014, 2015) noted that people have a difficult time understanding hypothesis testing. Analysis of state and district data will show researchers how to use their local data for data driven decisions.

The Programme for International Student Assessment (PISA) noted that in several countries, including the US, “boys outperform girls by more than 20 score points, close to one-third of a proficiency level” in Mathematics (OECD, 2011). This led to the last research question.

## Research Questions

Local newspaper headlines and articles expressing concern about readers understanding of statistical information led to the development of the first two research questions.

**RQ1:** Was the distributions of PAWS Math scores in LCSD#1 in 2013-14 and 2014-15 significantly different or not?

**RQ2:** Was the distributions of PAWS 2014-15 Math scores for LCSD#1 and Wyoming state scores significantly different or not?

Reports about difference in math proficiency by gender led to the last research question.

**RQ3:** Is there a significant relationship between gender and 2014-15 PAWS Math scores in LCSD#1?

## Procedures

The Wyoming Department of Education (WDE) website lists proficiency information which can be filtered by district, grade level, and content area. Data use in the study is shown in Tables 1 and 2. The data shows a range of 10 for the number of students taking the assessment and the percent of students in each proficiency level.

Table 1. LCSD#1 and state fourth grade proficiency data from WDE website

	Location (Num. Stu.)	Below	Basic	Proficient	Advanced
2013-14	LCSD#1 (1090-1099)	13.14%	45.26%	33.58%	8.03%
2014-15	LCSD#1 (1050-1059)	13.54%	41.29%	35.89%	9.28%
2014-15	WYO (7330 – 7339)	11.71%	37.71%	37.72%	12.86%

Table 2. LCSD#1 fourth grade gender proficiency data from WDE website

Gender	Num. Stu.	Below	Basic	Proficient	Advanced
Female	530-539	13.81%	40.86%	37.69%	7.65%
Male	520-529	13.27%	41.73%	34.04%	10.96%

As needed, estimates of the number of students in each proficiency level was used in analysis.

## Data Analysis

Pearson chi-square tests:

- Test-of-homogeneity is used to test if the distribution of two different populations is the same; it was used for RQ1.
- Goodness-of-fit test is used to test the degree to which the distribution of a categorical variable differs from the hypothesized distribution; it was used for RQ2.
- Test of Independence is used to test if there is a relationship between two variables; it was used for RQ3.

## Limitations

This study is limited to Laramie County School District #1 in Wyoming and fourth grade math PAWS scores.

The techniques used in this study **can** only be used when the expected number, *not the percentage*, in one of the proficiency level categories is five (5) or more.

## Findings

**RQ1:** The fourth grade students showed no difference in Math PAWS scores proficiency distribution from 2013-14 to 2014 – 15,  $\chi^2(3, n = 2149) = 3.77, p = .29$ , which is also supported by a small effect size ( $V = 0.04$ ).

**RQ2:** The LCSD#1 fourth grade Math PAWS scores proficiency distribution were different than state scores,  $\chi^2(3, n = 1054) = 830.69, p < .001$ , with a small to medium effect size ( $V = 0.26$ ).

**RQ3:** The fourth grade Math PAWS scores proficiency for 2014 – 15 students showed that gender and proficiency level are independent,  $\chi^2(3, n = 1062) = 4.33, p = .29$ , which is also supported by a small effect size ( $V = 0.06$ ).

## Conclusions

The first conclusion was that the newspaper headline of a drop in scores was not supported by the data for fourth graders in LCSD#1.

The second conclusion was that PISA study indicating a difference in scores by gender was also not supported for fourth graders in LSCD#1.

However, the analysis did indicate that LCSD#1 fourth grade student scores were lower than the state scores.

## Social Change Implications

This study shows that data driven decisions should be made based on statistical analysis and not just descriptive data. When researchers and educators accurately analyzing their data for statistical significance, the quality of educational studies will be improved and have more credibility.