

**Discipline:** Mathematics

**Standard Category:** Statistics and Data Analysis

**Lesson Focus** To find the variance and standard deviation of a set of data

**Suggested**

**Level:**

High School

<b>PA Standard(s):</b>	<b>Related TESOL Standard(s):</b>
2.6.11A Design and conduct an experiment using random sampling. Describe the data as an example of a distribution using statistical measures of center and spread. Organize and represent the results with graphs. (Use standard deviation, variance and t-tests.)	Goal 2: To use English to achieve academically in all content areas. Standard 2: Student will use English to obtain, process, construct, and provide subject matter information in spoken and written form.

**Lesson Focus:**

To find the variance and standard deviation of a set of data

**Teaching**

**Strategies:**

Whole group instruction

**Key Objectives in Accordance with TESOL Level:**

Peer work

<b>Pre-Conversational/ Beginning</b>	<b>Intermediate</b>	<b>Advanced</b>
Students will be able to: <ul style="list-style-type: none"><li>• Find the mean, standard deviation, and variance of a given set of data.</li></ul>	Students will be able to: <ul style="list-style-type: none"><li>• Use mean, standard deviation and variance to analyze given situations.</li></ul>	Students will be able to: <ul style="list-style-type: none"><li>• Solve problems collect data and use statistics to analysis it.</li></ul>

Question for understanding

**Assessment**

**Strategies:**

Evaluate math process, not language

**Materials:**

1. Paper
2. Pencil
3. Graphing calculator (optional)
4. Data (either given or collected)

Simplify language of problem

Question for understanding

**Procedures:** (ESL suggestions are written in italics)

1. Define terms through examples:
  - A. Standard deviation ( $s$  or  $\sigma$ )- a statistic used to describe a set of data the positive square root of the variance.
  - B. Variance ( $s^2$  or  $\sigma^2$ ) –a statistic used to describe a set of data; the average of the square of the deviations from the mean
  - C. Mean ( $\bar{X}$ )– the arithmetic average of a set of data
  - D. Data
2. Introduction:
  - A. Statistic is a number that describes some characteristic of a set of data. *Simplify language for ESL student; he might not know what data is.*
  - B. Two statistics used to describe the spread of data about the **mean** are called the **variance** and the **standard deviation**.
  - C. The variance, denoted  $s^2$  or  $\sigma^2$  (sigma squared), is the mean (average) of the square of the deviations from the mean. *(Define terms as you explain – they might know average but not mean)*

**(Introduce the formulas for variance – see below.)**

- D. The standard deviation, denoted  $s$  or  $\sigma$ , is the positive square root of the variance. **(Introduce the formula for standard deviation-see below)**
- E. We use these terms to talk about a set of data. They indicate the amount of variability in the data. The smaller the standard deviation indicates that the data is packed closely around the mean

**Examples:**

A.

Set 1: 5 5 5 5 5  $\bar{X} = 5$

Set 2: 7 5 5 5 3  $\bar{X} = 5$

Set 3: 9 7 5 3 1  $\bar{X} = 5$

Set 4: 9 9 5 1 1  $\bar{X} = 5$

All sets have the same mean ( $\bar{X}$ ). Step through finding  $\sigma$  for each set and it becomes clear that  $\sigma$  is way of describing these and distinguishing sets.

B.

Find the variance and standard deviation of the data 3, 5, 6, 7, 9.

We first find the **Mean**:  $\bar{X} = \frac{3+5+6+7+9}{5} = 6$

Find variance and standard deviation:

Data	Data - Mean	(Data - Mean) <sup>2</sup>
$X_i$	$X_i - \bar{X}$ (mean)	$(X_i - \bar{X})^2$
3	(3 - 6) -3	(-3 <sup>2</sup> ) = 9
5	-1	1
6	0	0
7	1	1
9	3	9

20 = sum

$$\text{Variance} = s^2 = \frac{\sum (x - \bar{x})^2}{n} = \frac{20}{5} = 4$$

$$\text{Standard Deviation} - s = \sqrt{4} = 2$$

Once background knowledge has been established, introduce the following, depending on level of student and progress:

**Problem Solving:**

*Pair an ESL student with a student who might be able to help him, either with primary language or through motions.*

1. What does the following information tell you about two different basketball teams?

Team A: mean height = 192cm, standard deviation = 4 cm

Team B: mean height = 192 cm, standard deviation = 8 cm.

2. Compare the mean and standard deviation for row A and B below:

Row A	1	2	3	4	5
Row B	11	12	13	14	15

3. Estimate the mean and standard deviation of the numbers 21, 22, 23, 24, 25.

**Technology:**

Introduce the graphing calculator. Demonstrate how to enter data in a data table and how to find statistical data, depending on which calculator they are using. This will make collection and analyzing data easier giving you more time to explore statistics.

**Assessment:**

**Beginner**

Questioning for understanding. *Simplify language of problem,*  
Example: Explain that *mean* in mathematics means the arithmetic average of a set of data.

Correctives (Remedial activities) Return to concrete examples, and re-teach areas unlearned.

**Intermediate/Advanced**

Have students set up an experiment by collecting data, and use collected data to find the mean and standard deviation. *Have student explain what standard deviation means for his data using symbols or diagram.*

**Notes:**

1. Do not “water down” the context.
2. Use simplified language, and speaking slowly might bring your point across. Even the simple words like “mean” might confuse the student.
3. Remember the student is working in a different language. Try to connect to math language he might know.
4. Do not ask individual student if he understands, but as students work in pairs, listen and observe as the student works with peers