

Subcutaneous Drug Delivery Implant

A Practice Understanding Task

Purpose: RTI International is an independent, nonprofit research institute dedicated to improving the human condition. They combine scientific rigor and technical expertise in social and laboratory sciences, engineering, and international development to deliver solutions to the critical needs of clients worldwide. Students will use given data to find the mean and standard deviation to determine which Excipient is better suited to use for the specific API.

Career Field:

Biopharmaceutical Technology

Lesson inspired by RTI International

WTCC Associate Program of Study and Contact Person:

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NC Math 4 Standards:

SP.1.2 – Comparative experiment

SP.1.4 – Data visualizations

Unit Alignment:

NC Math 4 - Unit 7 – Statistical Inference

WTCC Math 110, 121, 171, or 143 ??

Common Core State Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Prerequisite Skills

- Finding mean
- Finding Standard Deviation

Time Required

The time required to complete this activity is approximately ____90__ minutes.

Materials Needed

- [Student Activity Sheet](#)
- [Desmos Launch Activity](#) - student
- [Demos Launch Activity - teacher](#)
- [Data given in Excel](#)

The Teaching Cycle:

Launch:

Assign the Desmos activity as homework the night before to help students with new vocabulary and some practice with setting up a spreadsheet to find mean and standard deviation.

Warm-up: Talk about the ingredients of Aspirin and ask the students to list out the API and the excipient (new terms from the Desmos activity).

Play RTI Video

[link](#)

Ask students what they think of the following:

- What is the benefit of having an implant for needed medicine as opposed to taking pills?
- What would be the result if a patient was getting too little or too much of the medicine?
- In your words, why are statistics important here?
- From the video, what is the importance of the standard error?

Explore: Have students work in pairs to complete the Student Activity Sheet.

Students should be able to work through T1 on their own. They will be given the data in a spreadsheet and need to create the equations to find the mean, standard deviation, and standard error. They can then use that info to create line graphs in the spreadsheet. If they prefer, they can enter the data in their TI84 Plus CE.

Walk around to each group to see their progress. Once they have the calculations and graphs, they will be able to answer the questions on the Student Activity Sheet. Have them move on to T2. Again, they will be creating equations in the spreadsheet to find the mean, standard deviation, and standard error. They will then graph it and answer the questions.

Discuss – when you talk to each group after T1 – Have the group share which excipient best fits the limits for the API. Ask if they were able to eliminate an API. Discuss the other variables (you may need to guide them a little here to get them thinking about it). Once you are convinced with their understanding, they should move on to T2.

Other variables to keep in mind to further the curriculum

Material

What type of polymer the devices is made out of. We sometimes have about 7 types of polymers we are working on at this time

Length (Device)

How long can we make this device? If its longer will it release more?

Purity

When the API is mixed with a particular Excipient, will it lose its purity? Will it become ineffective?

Shelf Life

How long can this combination last on the shelf before it becomes obsolete? (expires)

Diameter and Thickness

How wide is the area that we can actually fill with the combination. Will the drug release from thicker devices that provide durability

Crystallinity

Once the API and the Excipient have been in the body at the body temp of 32 degrees. Will this change their form preventing them from releasing?

Time

Once more time has gone by, will the release rate drop below the Acceptable lower Limit?

Drug to Excipient Ratio

What happens when we have more drug than excipient? Will this allow for more drug to release? If another excipient is used more can we lower the daily release rate?

Solubility

How does the solubility of both the API and the excipients allow for faster release?

[Link the Answer Key](#)

Exit Ticket: For homework, have them make their conclusions for T2.

Two example assessments for testing: Students will be assessed on finding mean and standard deviation. They will also be tested on describing graphs using SOCS.