FL Feedback Loops at a Glance (approximately 2-3 traditional class days):

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| Seg | Model Move | Est Time  (min) | Overview | Resources | What did we figure out? |
| 1 | **Q🡪P** | 5 | We ask how can a body continue to function even in extreme circumstances like intense physical exercise, extreme hot or cold? | * FL Doodle sheet | We understand that when you exercise your body responds in different ways. |
| 2 | **P** | 30-45 | We measure our heart rate at rest and after exercising so we can collect data and look for patterns. This will provide some personal phenomena. | * FL Doodle Sheet * Clock /timer | We collected data on our own heart rates before and after exercise and observed that heart rate is low before exercise, goes up after exercise, then goes down again after resting |
| 3 | **P🡪Q** | 5-10 | Now we have our phenomena and we ask, what questions would a scientist have about the patterns that you’ve identified*?* | * FL Doodle sheet | We have a driving question that will focus our model development. |
| 4 | **Q🡪M** | 5-10 | We ask for initial ideas about how our heart rate speeds up after exercise and then slow down. | * FL Doodle Sheet | We put our initial ideas on the table so that we can examine them in more detail. |
| 5 | **Q🡪M** | 10-15 | We guide the students through a series of questions to help us think about the heart and it’s connection to the body | * FL Doodle Sheet | We learned or perhaps reviewed the function of the heart which is to deliver food and oxygen to the cells for fuel for cellular respiration and thus energy. |
| 6 | **Q🡪P** | 5 | We ask how a body can maintain itself when it is put through extremes like the biggest loser did when he exercised. | * FL Doodle Sheet * FL 06 Ticket Out the Door: Hear Rate handout | We understand that the heart delivers food and oxygen to the cells and that when we exercise this delivery increases to provide more energy for the muscle cells. When we stop exercising the delivery can slow down because we do not need as much fuel for energy via cellular respiration. |
| 7 | **Q🡪M** | 55 | We have been focusing on why the heart rate increases when we exercise. Now we look at how it all happens. | * FL Doodle Sheet * FL 07 Control of Heart Rate Reading * FL 07 Control of Heart Rate Summary Sheet * FL 07 Manipulatives for Heart Rate * FL 07 Individual explanation Handout | We figure out that body has a series of systems that help regulate heart rate. |
| 8 | **M🡪Q** | 15 | We use our diagram from the manipulative activity on how the body controls heart rate, and our model to write an explanation to our driving question. | * FL 07 Individual explanation Handout | We wrote an explanation that explains how the body regulates heart rate. |
| 9 | **M 🡪 P** | 10 | Now we introduce the term “feedback loop”. The generic feedback diagram handout includes the general terms for the important components of feedback loops. Have students note on their handouts the specific structures in the heart rate feedback loop that plays the role of each of these components. | * FL 09 Generic Feedback Loop handout | We learned that this regulatory function is called Feedback Loops and that there is a general components to feedback loops that can be applied to different situations. |
| 10 | **M🡪P** | 5 | Now that we have a model for feedback loops, we ask students to map the phenomenon “when we get hot, we sweat” onto a blank loop. Students won’t know all the pieces but that is fine. We just ask them to do as much as they can so they will see that it works for examples. You could choose a different phenomenon, or do several. | * FL 09 Generic Feedback Loop handout | We can apply our model for feedback loops to other phenomena. |