***WABS STEM PBL Diabetes Unit***

***2014-15***

grade level(s): 10-12 subject(s): Biomed/Biotech/Genetics

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**Problem Statement:**

*Students will be asked to investigate the question****: What is an action plan for decreasing the rates of Type II diabetes in the world?***

**Conceptual Storyline:**

*Students will develop an understanding of diabetes, feedback loops, and protein synthesis by studying the problem of increasing global diabetes rates.  Students will be asked:  “How can we decrease the prevalence of diabetes in the United States?”  In order to formulate a solution to this problem, students will investigate the different types of diabetes, genetic and environmental causes of diabetes, current treatment methods, protein synthesis, and feedback loops that are relevant to the disease.*

*Students will research and determine how the problem is currently being “solved” and determine a more effective way of solving it. They will have to use a Pugh Chart and evidence from research to support their claims.*

*Students will also be participating in various learning activities in class to help them understand the types of diabetes, protein synthesis, and feedback loops.*

*Students share their proposed solution in the form of either an infographic and/or grant proposal and a method they plan to use for measuring long-term success of the plan (~20 years). The class will then pick one or two solutions that they want to recommend to the funding agency to pursue this route of solving the problem. Throughout the duration of the unit, students will enhance their argumentation, data analysis, communication, explanation, and creativity skills.*

**Standards (NGSS, CCSS, CTE):**

*Standards targeted in Lesson:*

*HS-LS1-3 Feedback: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis*

*HS-LS1-1 Protein Synthesis and DNA: Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.*

*HS-ETS1-1 Solutions: Analyze a major global challenge to specify qualitative and quantitative  criteria and constraints for solutions that account for societal needs and wants.*

*HS-ETS1-3 Analysis of Possible Solutions: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.*

**21st Century Skills:**

*Students will be working together on Communication, Collaboration, Critical Thinking, Creativity.*

**Locally and/or Personally Relevant for Students:**

*How do students build on their understanding of their school community or on what matters to students? Are there ways to make a strong connection to women or underrepresented minorities in STEM fields – to increase proportionate representation of those groups in STEM?*

**Connections to career and educational pathways:**

*How will students learn about connections to career and educational pathways into the unit/lessons?*

**Table of Content/Overview of Unit**

*If you have one lesson, this section is not applicable. If you have more than one lesson, please provide the Table of Contents/Overview here.*

**Lesson 1: Diabetes: Introduction, What is the problem?**

**Lesson 2: Diabetes Research – What is the Diabetes?**

**Lesson 3: Understanding Diabetes: Positive and Negative Feedback Loops Activity**

**Lessons 4 and 5: Focused Group Research and Informal Info Sharing on aspects of the problem**

**Lessons 6, 7, and 8: Creation of an Infographic or Grant Proposal and Summary Reflection**

**Lesson 1 - Diabetes: Introduction**

**Problem Statement:** *How can we decrease the prevalence of diabetes in the United States in the next 20ish years?*

**Learning Objectives:**

* Students will understand the Basics of the two types of Diabetes

Standards targeted in Lesson:

* LS1.A: Structure and Function: Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

**Materials:**

* Choose one video: (Guide for the first video is attached)
  + Diabetes: The Constant Shadow[http://video.pbs.org/video/2288567717/](http://video.pbs.org/video/2288567717/" \t "_blank) (27 Minutes)
  + Diabetes and kids: <http://video.pbs.org/video/2365125189/> (27 Minutes)
* Video viewing equipment
* Video worksheet
* Teacher guide (answers to video worksheet)

**Lesson Preparation:**

Print video worksheet for each student and teacher

Review teacher guide and watch videos to determine video choice

**Time Required:** One class period

**Procedure:**

1. Introduce the problem statement: “We will be learning more about diabetes and the endocrine control of blood sugar. At the end of the unit you will be presenting information to the class about how you would answer the problem statement in the form of an infographic and a writing assignment. {Either a grant proposal or a summary statement of the work completed in this unit}
2. Have students create a T-chart on the back of their video worksheet to list things they “know” on one side and things they “wonder” (the other side) about diabetes. Give students 3-4 minutes to fill out the K & W section of the chart to assess student’s pre-existing knowledge of diabetes. Have students share with a partner and have a few students share out loud with the class.
3. Watch video. Students should complete the viewing guide as they watch the video.
4. After the first video discuss answers in small groups
5. Have students write a summary of their notes on the bottom of the back of their notes sheet to show what they’ve “Learned” about diabetes.
6. Have students turn to a table partner to discuss how diabetes is relevant to students’ lives and anything surprising from the video
7. If sub: Time remaining: Show the Kids with diabetes video- even though it is repetitious.

**Accommodations:** *The video is available with subtitles. Students can be provided with electronic and modified note sheets, as well as any personalized electronics required for their IEP or 504 plans.*

**Teacher Notes:** After a whole-class discussion of today’s work, transition to tomorrow’s work: “Now you have a broad overview of diabetes. Tomorrow you’ll be researching some more specifics about the different types of diabetes.”

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Diabetes: The Constant Shadow

How many Americans have Diabetes?

What percentage increase in number of cases has occurred over the last decade?

How does insulin function?

What are Type 1 and Type 2 Diabetes?

What is the #1 cause of new blindness in adults under age 74?

What percentage of people with Type 2 diabetes are overweight?

What are the best statistical predictors of diabetes?

Diabetes: The Constant Shadow Teacher Notes

How many Americans have Diabetes?

*24 million*

What percentage increase in number of cases has occurred over the last decade?

*90%*

How does insulin function?

*Insulin binds a receptor that promotes the entry of glucose into the cell*

What are Type 1 and Type 2 Diabetes?

*Type 1 Diabetes is usually diagnosed in childhood, insulin production is eliminated by autoimmunity, and accounts for 5-10% of all cases  
Type 2 Diabetes occurs most often in adults, can occur at any age, involves pancreatic defect, and is characterized by losing the capacity to produce insulin, and accounts for >90%*

What is the #1 cause of new blindness in adults under age 74?

*Also affects vision, #1 cause of new blindness in adults under age 74*

What percentage of people with Type 2 diabetes are overweight?

*85%*

What are the best statistical predictors of diabetes?

*Body Mass Index (BMI) and waist size*

**Lesson 2: Research**

**Problem Statement:** *How can we decrease the prevalence of diabetes in the United States within the next 20 years?*

**Learning objectives:**

1. Students will effectively research and understand Diabetes using credible sources
2. Students will demonstrate an ability to collaborate with group members
3. Students will assemble and share findings with peers

Standards targeted in Lesson:

* LS1.A: Structure and Function: Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)
* HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
* HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts

**Materials:**

* One computer for each student
* Guided note sheet for research and presentation (1 per student) on Moodle/GoogleDocs/Hard copy for student use
* Science notebook and writing utensil (only if worksheets are not electronic)
* Small whiteboards (1 per group)

**Lesson preparation:**

Students will work individually to research diabetes and fill out their guided note sheet, starting with the 3 sources listed from the CDC&P webpage:

* + CDC Homepage
  + Basics of Diabetes
  + Data and Statistics
  + At least 1 other credible source students will need to find

**Time Required:** 1 class periods (~50 mins)

**Procedure Lesson 2:**

*Introduction=* State to students, “Today we will each be researching more about Diabetes. Your goals are to research diabetes, specifically the items on the hand out. Directions are on {Moodle} for students. Tell the students to begin working on their computers.

*Exploration=* Students are completing the guided notes sheet while researching Diabetes. Students will look up the 3 required links to articles and come up with at least one other credible (and cited) article/video.  Teacher is circulating throughout the classroom, providing scaffolded assistance when required.

*Conclusion=* Students put computers away and finish their guided note sheets as homework if needed.

**Teacher Notes:** Teacher should circulate to check understanding AND check progress on guided note sheet. Students can “share” note sheet with the teacher to track progress. Inform students that since we’ve just learned more about diabetes and what happens when the endocrine system doesn’t work properly, we’ll spend tomorrow learning about how are bodies are supposed to work if working properly. We’ll be doing a lab that focuses on different kinds of feedback loops. You’ll need to be able to apply the idea of feedback loops to diabetes by the end of tomorrow.

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Diabetes Research Day 2:

Problem Statement/EQ: *How can we decrease the prevalence of diabetes in the US within the next 20 years?*

Use the information from the Centers for Disease Control and Prevention website to take notes on the current understanding Diabetes.

|  |
| --- |
| CDC Homepage: <http://www.cdc.gov/diabetes/home/> |
| Basics of Diabetes: <http://www.cdc.gov/diabetes/basics/index.html> |
| Data and Statistics: <http://www.cdc.gov/diabetes/data/index.html> |
| One other credible sources of Diabetes information: |
| It’s March! Make the Diabetes-Kidney Connection |

**Lesson 3: Positive and Negative Feedback Loops Activity**

**Problem Statement:** *How can we decrease the prevalence of diabetes in the United States within the next 20 years?*

**Teacher Notes:** Today, students will be paired to participate in 4 activities that will show both negative and positive feedback loops. They will be collecting and analyzing data and responding to reflective questions in their science notebooks. Remind them that we’ve just learned about diabetes and what happens when the endocrine system doesn’t work properly. We’ll be doing a lab today in which we collect data that focuses on different kinds of feedback loops. You’ll need to be able to apply the idea of feedback loops to diabetes class tomorrow.

**Standards targeted in Lesson:**

HS-LS1-3: Conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

**Learning Objectives:**

* Students will explore ways in which the human body reacts to different stimuli to maintain homeostasis
* Students will work collaboratively in partnerships
* Students will thoroughly understand the concepts of both positive and negative feedback loops
* Students will analyze data collected in data tables
* Students will make a connection between today’s activity and insulin as an example of a feedback loop.

**Materials:**

* Activity handout (one per student)
* 2 Flashlights
* 2 Buckets of Ice Water

**Lesson Preparation:**

* Copy handout
* Assign lab partners
* Prepare and assemble each activity station

**Time Required:**

* 1-1.5 class periods
* Day One – collection of data
* HW or Day Two (30 min. period) – analysis of data

**Procedure:**

1. Read the activity introduction aloud to students. Have students sit with partner and then count partnerships off by 4. Have students begin activity at the station number that corresponds to the partnership number.
2. Students will be given 5-7 minutes to complete activity and data collection for each station. Teacher is circulating to make sure students are engaged and is giving assistance when necessary.
3. Students will attach handout, with completed data tables into their science notebooks. Students will also complete analysis questions in their science notebooks.

**Assessment:**

Formative Assessment – Teacher checks with students to see if the data tables and analysis questions are completed and in science notebook.

**Accommodations:** Partnerships will be monitored to meet individual student needs.

**Teacher Notes:** In their science notebooks, have students reflect on the connection between insulin’s role in diabetes and insulin as an example of a negative feedback loop in order to help them tie the lab activities to our unit on diabetes.

**Life’s Balancing Trick: Homeostasis!**

What happens to your body when you get hot? How about when you get too cold? Your body has the ability to regulate its temperature, blood pressure, wastes, glucose levels, and much more! The ability of a life form to control and adapt to their changing environments is called **HOMEOSTASIS**. In other words, homeostasis is the process by which an organism tries to remain stable when it’s external environment changes. In order to maintain this balance organisms use **NEGATIVE FEEDBACK SYSTEMS**. A negative feedback system is a series of parts that are all about maintaining homeostasis. For example, when you get hot your brain will send a message to your sweat glands to release water on to the surface of your skin. The evaporation of the water on your skin will help to cool your body and bring your body temperature back down to normal. If we were to draw a loop of this process, it might look like this:

98.6 **°F**

Sweat glands release more sweat

Rise in temperature

Water evaporates off the skin

Temperature drops

**Objective:**

In this activity you will explore some ways in which your body tries to maintain balance and then will determine the negative feedback system for each station.

**Station 1: Eyes and Light**

1. In pairs, select one person to be the observer and the other to be the experimenter.
2. Have the experimenter hold a flashlight to the side of the observer head, at eye level.
3. Then, turn on the flashlight and slowly bring it to the front of the observer’s eye, holding it about 10 cm from their eye.
4. The experimenter should note what happens to the pupil of the eye. (The pupil is the black circle in the middle of the eye.)
5. Repeat this with the other eye and observe/record what happens.
6. Now, switch roles and repeat steps 2-6.

**Data Table:**

|  |  |
| --- | --- |
| **Subjects** | **Pupil Size (increase or decrease?)** |
| Person 1 – Left eye |  |
| Person 1 – Right eye |  |
| Person 2 – Left eye |  |
| Person 2 – Right eye |  |

**Station 2: Exercise and Breathing**

1. While sitting down and breathing normally, count how many breaths you inhale in one minute. (timers are provided)
2. Record the number of breaths per minute in the data table below.
3. Now, do jumping jacks for TWO minutes. Please make sure you have enough space for this!
4. Immediately, sit down and count how many breaths you inhale in one minute. Record again.

**Data Table:**

|  |  |  |
| --- | --- | --- |
| Subjects | Number of Breaths per minute at rest | Number of Breaths per minute after jumping jacks |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

**Station 3: Exercise and Heart Rate**

1. While sitting down record your pulse by counting the number of times your heart beats for 15 seconds and then multiplying that number by 4.
2. Record this value in the data table below.
3. Now, either run up and down the stairs or do jumping jacks for 5 minutes.
4. IMMEDIATELY following the exercise, take your pulse again as instructed in step number 1.
5. Record this value in the data table below.

**Data Table**

|  |  |  |
| --- | --- | --- |
| **Subject** | **Pulse Before Exercising (bpm)** | **Pulse After Exercising (bpm)** |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

**Station 4: Skin Color and Cold Water**

1. Note the color the palm of your hand and record it in the data table below. Use the scale below.
2. Place your hand in the cold bucket of water for at least one minute. (If you can keep it in there longer, great!)
3. Note the color of your hand when you take it out of the bucket and record it in the data table below.
4. If time permits, try your elbow as well and see if you get the same results!

**Palm Color code:**

1. whitish/yellow
2. slightly pink/slightly yellow
3. pink
4. very pink

**Data Table**

|  |  |  |
| --- | --- | --- |
| Subject | **Number for Color of Palm before ice water** | **Number for Color of Palm after ice water** |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

**Homeostasis Analysis Questions (Please answer in your journal.)**

1. Our mini experiments contained a few flaws. Identify one major flaw that affected our reliability of the data.
2. For one of the stations, create a negative feedback system loop like the example at the beginning.
3. Come up with your own analogy of a negative feedback system not used in class.
4. Positive feedback systems are rare in nature. Positive feedback systems occur when a stimulus causes an increase in the effector instead of trying to return it to normal. An example of this is when you get a fever. Certain immune system cells will release proteins called *pyrogens* (can you guess why they’re named this?), these proteins cause the thermostat of the body to keep raising it’s base temperature until the threat of a bacteria/virus is gone. Thus, you end up with an increased body temperature, aka a “fever”. **Is the diagram below an example of a positive or negative feedback system? Explain why you think so!**



**Lessons 4 and 5: Focused Group Research and Informal Info Sharing**

**Problem Statement:** *How can we decrease the prevalence of diabetes in the United States within the next 20 years?*

**Teacher Notes:**Today, the class will be divided into 8 groups. Each group will be assigned a topic and will research current methods that are used to solve diabetes through the lens of that specific topic. They will then share their findings with other groups via a short, 5 minute presentation. Introduce the lesson to students by reviewing that yesterday we looked at feedback loops and how our bodies are supposed to work. You’ll want to keep thinking about this as you research more about diabetes. Today we’ll spend time looking at what’s specifically going wrong in a person with diabetes.

**Learning objectives:**

* Students will effectively research a given topic using credible sources
* Students will collaborate with group members
* Students will understand my assigned research topic
* Students will assemble and communicate findings with peers

**Standards targeted in the lesson:**

* HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
* HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts

**Materials:**

* One computer per student
* Guided note sheet for research and presentation (1 per student)
* Science notebook and writing utensil (if worksheets aren’t electronic)
* Small whiteboards (1 per group)

**Lesson preparation:**

Have students assigned to groups based on mixed skill levels within each group. Assign a research topic to each of the 8 groups (2 groups per topic). Make sure that guided note sheets are copied (or are available to students electronically) and computers are reserved for your use.

**Time Required:** 2 class periods (~100 mins)

**Procedure Lesson 4:**

1. State to students, “Today we will each be focusing on a specific approach used to address the rising rate of diabetes in the US. Your goals are to… (refer to learning objectives)” Have each student access a guided note sheet and explain how to use it. Assign each student to a group and research topic (4 topics are: prevention, medical treatment, contributing factors, educational outreach). Tell the students to begin working on their computers (teacher choice: independent or small group student work).
2. Students complete the guided notes sheet while researching their assigned topic. Teacher is circulating throughout the classroom, providing scaffolded assistance when required.
3. Students put computers away and finish their guided note sheets as homework if needed.

**Procedure Lesson 5:**

1. State to students, “Today, you’ll share out your individual work with your group and your group will compile your findings with your group into a 5 minute presentation. We will begin presenting in 10 minutes. I will be coming around to check off your HW (if applicable).”
2. Students compile their information into a 5 minute presentation using whiteboards to make visible the important points they want to get across. Students should also decide who is presenting what (all students must talk).
3. Each group spends 5 minutes presenting their findings. When not presenting, each student will fill out the peer presentation section of the guided note sheet. This sheet will be taped into their notebook. Each group will need to come up with 1 question for each presenting group about their presentation and place it on a post-it. Each group will need to ask a question of each presenting group to expand their knowledge or clarify points.

**Assessment:**

* Formative= Teacher checks off each student’s research note sheet AND presentation note sheet.
* Formative= Teacher makes sure information being presented in the 5 minute talks is thorough and accurate.

**Accommodations:** Students can be provided with electronic and modified note sheets, as well as any personalized electronics required for their IEP or 504 plans. Student group placements can be very flexible based on individual student needs.

**Teacher Notes:** Check links. You may want to give some guiding questions for students or take away some structure of the handout depending on student needs. Also, youtube videos may not work on campus so have another plan for students (or they can watch them at home).

**Guided Note Sheet for Research**

Group Topic: Prevention

|  |
| --- |
| National Diabetes Prevention: <http://www.cdc.gov/diabetes/prevention/> |
| Kidney Disease: <http://www.ndep.nih.gov/am-i-at-risk/family-history/four-questions.aspx> |
| Vision Health: <http://www.who.int/blindness/causes/priority/en/index5.html> |
| Native Diabetes Wellness Program: <http://www.cdc.gov/diabetes/projects/diabetes-wellness.htm> |
| One additional really interesting site/video. |

**Guided Note Sheet for Research**

Group Topic: Medical Treatment

|  |
| --- |
| <http://youtu.be/RIyzUFCLbac> - diabetes, nurse’s perspective |
| <http://youtu.be/8z0RYdBSi90> – diabetes, doctor’s perspective |
| <http://youtu.be/BWQK2FFJwxE> – WHO perspective |
| WHO infographic: <http://www.who.int/nmh/publications/ncd-infographic-2014.pdf?ua=1> |
| One additional really interesting site/video. |

**Guided Note Sheet for Research**

Group Topic: Contributing Factors

|  |
| --- |
| [http://www.youtube.com/watch?v=Kp6Jk9vsqkM&am...](http://www.youtube.com/watch?v=Kp6Jk9vsqkM&feature=youtu.be) – diabetes, patient’s perspective |
| Screening test: <http://www.cdc.gov/diabetes/prevention/pdf/prediabetestest.pdf>  Family History Questions: <http://www.ndep.nih.gov/am-i-at-risk/family-history/four-questions.aspx> |
| Diabetes.org: Diabetes basics <http://www.diabetes.org/diabetes-basics/type-2/?loc=db-slabnav> |
| One additional really interesting site/video. |

**Guided Note Sheet for Research**

Group Topic: Educational Outreach

|  |
| --- |
| National Diabetes Education Program: <http://www.ndep.nih.gov/> |
| Programs and Research: <http://www.ndep.nih.gov/resources/index.aspx?SearchText=children+and+adolescents>  <http://www.diabetes.org/donate/how-your-dollars-make-a-difference/outreach.html> |
| <http://www.diabetesoutreach.org.au/default.asp> |
| One additional really interesting site/video. |

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Guided Note Sheet for Peer Presentations**

|  |  |  |
| --- | --- | --- |
| Topic | While listening to other groups present- What are we currently doing to solve the problem | Your ideas for improvement (scientifically reasonable but creative) |
| **Prevention** |  |  |
| **Medical treatment** |  |  |
| **Contributing Factors** |  |  |
| **Educational Outreach** |  |  |

**Lessons 6, 7, and 8: Creation of an Infographic or Grant Proposal and Summary Reflection**

**Problem Statement:** *How can we decrease the prevalence of diabetes in the United States within the next 20 years?* Today, each team will work to fill out the “Brainstorming a Grant Proposal/ Summary Reflection” worksheet independently. They will then process individually and complete the “Formulate a Grant Proposal/Summary Reflection” worksheet.

There are 2 options for the final product for this lesson:

1. a 2-page minimum formal grant proposal and poster.
2. An Infographic and a Summary-Reflection

Either way today’s lesson will be used as a stepping stone to consolidate the key points for the final product and visual in Lesson 7.

**Learning objectives:**

* Students will understand assigned research topic
* Students will individually create an action plan for addressing the problem statement
* Students will share an action plan with peers and provide supporting evidence
* Students will collaborate with group members to create a final product that incorporates all group members’ action plans.

**Standards targeted in the lesson:**

* HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
* HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
* HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts

**Materials:**

* Chromebooks available (if students want to use them)
* Brainstorming a worksheet (1 per student or electronically)
* Formulate a Grant Proposal/Summary Reflection template (1 per group with extras or electronically)
* Science notebook and writing utensil
* Choose an infographic creation website (we used piktochart.com)

**Lesson preparation:**

Make sure that worksheets and templates are copied/electronically available and computers are reserved for your use.

**Time Required:** 2 class periods (~100 mins)

**Procedure Lesson 6:**

1. State to students, “Today each group will formulate a new and improved plan for tackling the problem of rising diabetes rates in the US. Your goals are to… (refer to learning objectives)” Give each student a worksheet and explain how it should be filled out using information gathered from the informal group share-out session (Lesson 5). Also, hand out the “Formulate a Grant Proposal” template.
2. Students complete the worksheet and think critically about their action plan. Then, they reconvene with their group and work together (listening to all student action plans) to complete the Grant Proposal template. Teacher is circulating throughout the classroom, providing scaffolded assistance when required.
3. Students turn in their worksheets and grant template to the teacher.

**Procedure Lesson 7 and Lesson 8:**

1. If doing a grant proposal: State to students, “You will have the entire day today and tomorrow to complete your grant proposal template AND write the final grant proposal. The proposal should be typed, double-spaced, 12 pt. font, and 1 inch margins on each side. The grant will be due first thing two days from now.”
2. If doing an infographic and summary reflection state: You will have today and tomorrow to complete your template and individual summary reflection. You are to take your idea for answering your problem statement and SHOW it as an infographic and then summarize what you have decided. Each group can turn in one infographic but everyone needs to complete their own summary reflection.
3. Students compile their information into a final grant proposal (1 per group). Each student is responsible for one part of the grant (4 students=4 parts. Parts: Define problem and provide background, detail the action plan, explain methods for measuring success of plan, consolidate all parts into a cohesive conclusion). Or students will work on their infographic and summary.
4. Students establish what needs to be done to make sure the assignment can be turned in first thing in the class period on Lesson 9.

**Teacher Notes:**

Explain the worksheets/handouts. Go over piktochart.com briefly and encourage students to watch the “tour” and search for examples of infographics on google images.

**Assessment:**

Formative= Teacher checks off each student’s work and progress. Teacher reads and provides feedback on each group’s final grant proposal BEFORE the presentation poster/infographic is created.

**Accommodations:**

Students can be provided with electronic and modified note sheets, as well as any personalized electronics required for their IEP or 504 plans. Student roles when creating the final proposal can be very flexible based on individual student needs and abilities.

**Grant Proposal Template**

**Instructions:** *Work together as a group or independently to complete each section of this template. This will serve as the rough draft of your final grant proposal. Each individual student will need to complete a UNIQUE final grant proposal (1-2 pages in length). This template will help you accomplish that goal. Use your own words, not your group members’, when completing this. Use more paper if you need additional space!*

**Define the problem and provide background information:**

1. What is the problem you are addressing in your proposal?
2. What is Type II diabetes? How is it caused?
3. Insulin is produced through the process of protein synthesis. Explain how this works. Include a diagram.
4. Describe what kind of feedback loop is involved in glucose uptake.
5. Explain how this feedback system is disrupted in diabetes patients.
6. How are enzymes involved in the breakdown and utilization of glucose?
7. What are current prevention methods?
8. What are current medical treatments methods?
9. What are current educational outreach methods?

**Detail the action plan:**

1. What is the greatest limitation in the current methods of addressing the problem?
2. Why do you think this is the most important limitation to improve?
3. Outline your proposal for improving this limitation.

**Explain methods for measuring success of the plan:**

1. How would you measure your improvement to see if it is effective at solving the problem?
2. What are some possible reasons why your proposal/suggestion might not work?

**Consolidate all parts into a cohesive conclusion:**

1. Write a summary of everything above in about 5-6 sentences.

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Problem Statement**: How can we decrease the prevalence of Type II Diabetes in the United States in the next 20 years?

**Brainstorming Template for Summary Reflection and Infographic**

**Instructions:** *Work together as a group or independently to complete each section of this template. This will serve as the rough draft of your final mini-grant proposal and infographic. Each individual student will need to complete a UNIQUE final grant summary/reflection (1-2 pages in length). This template will help you accomplish that goal. Use your own words, not your group members’, when completing this. Use more paper if you need additional space!*

**Define the problem and provide background information:**

1. What is the problem you are addressing in your proposal?
2. What is Type II diabetes? How is it caused?
3. Insulin is produced through the process of protein synthesis. Explain how this works. Include a diagram.
4. Describe what kind of feedback loop is involved in glucose uptake.
5. Explain how this feedback system is disrupted in diabetes patients.
6. How are enzymes involved in the breakdown and utilization of glucose?
7. What are current prevention methods?
8. What are current medical treatments methods?
9. What are current educational outreach methods?

**Detail the action plan:**

1. What is the greatest limitation in the current methods of addressing the problem?
2. Why do you think this is the most important limitation to improve?
3. Outline your proposal for improving this limitation. Use evidence from your research to justify your answer.

**Explain methods for measuring success of the plan:**

1. How would you measure your improvement to see if it is effective at solving the problem?
2. What are some possible reasons why your proposal/suggestion might not work?

**Consolidate all parts into a cohesive conclusion:**

1. See Summary Reflection on the next page

**Infographic Checklist**

**Instructions:** In groups of 1-4, you are responsible for designing an infographic that will show your team’s solution to our problem statement. Use the following website (be sure to choose the FREE option): <http://piktochart.com> (if you’ve used another one you can use that instead)

**Include in your infographic:**

**Graphics that represent:**

1. The problem statement
2. Your group’s solution to the problem
3. Address all 4 topics from your research- Show what your group would change so the prevalence of Type II Diabetes in the United States will decrease.
   1. Prevention
   2. Contributing Factors
   3. Educational Outreach
   4. Medical Treatments
4. Include at least one statistic of interest or surprise – display statistics as a map, pie chart, or other graphic of your choice.

**Summary Reflection**

**Instructions:** Each student is responsible for submitting a written reflection of the work and research conducted during our study of Diabetes.

**Include in your summary:**

1. The problem statement
2. 5-6 sentences explaining your group’s solution to the problem. Include all 4 topics in your explanation.
3. Describe how you would measure the effectiveness of your solution in solving the problem. How would you know your solution worked to lower the prevalence of diabetes?
4. Explain how feedback loops are disrupted in diabetes patients.
5. Explain how protein synthesis fits into the discussion of diabetes.
6. Identify at least 2 constraints of implementing your solution. (What are some possible reasons why your solution to the problem might not work).
7. Identify at least 1 unintended consequence of your solution. (What is something you wouldn’t expect to happen as a result of your solution?).

Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CATEGORY | 4 | 3 | 2 | 1 |
| Solution to Problem | All 4 topics are clearly expressed and the explanation is creative and scientifically reasonable. | All 4 topics are expressed and the explanation is fairly creative and scientifically reasonable. | Less than 4 topics are expressed and the explanation is creative but not scientifically reasonable. | The solution to the problem is not expressed clearly. |
| Effectiveness of Solution | The method of determining the effectiveness of the solution is scientifically measurable. The data collected would be both reliable and valid. | The method of determining the effectiveness of the solution is measurable but data would not be reliable or valid. | The method of determining effectiveness of the solution is not measurable. | The method of determining effectiveness is not clearly expressed. |
| Feedback Loops | The description of feedback loops in diabetes patients is clearly stated and is scientifically correct. | The description of feedback loops in diabetes patients is stated and is somewhat scientifically correct. | The description of feedback loops in diabetes patients is stated but is scientifically incorrect. | The description of feedback loops is missing. |
| Protein Synthesis and Diabetes | The description of how protein synthesis relates to diabetes is clearly stated and is scientifically correct. | The description of how protein synthesis relates to diabetes is stated but is somewhat unclear. | The description of how protein synthesis relates to diabetes is stated but is scientifically incorrect. | The description of how protein synthesis relates to diabetes is missing. |
| Constraints to Solution | Two constraints are clearly expressed and are scientifically reasonable. | Two constraints are expressed and are somewhat scientifically reasonable. | One constraint is missing or the constraints are not scientifically reasonable. | Constraints to the solution are not stated. |
| Unintended Consequences | The unintended consequence is clearly stated and is scientifically reasonable. | The unintended consequence is stated and is somewhat scientifically reasonable. | The unintended consequence is not scientifically reasonable. | The unintended consequence is not stated. |
| Quality of Writing | The summary is well thought out, well written, easily read and clearly understandable. | The summary is somewhat thought out and well written but is, at times, difficult to read and understand. | The summary is not well thought out but is readable. It is often difficult to understand. | The summary is not well thought out and is difficult to understand. |