Portfolio Project

Scientific Reading, Data Analysis and Type 2 Diabetes

EDUC 765: Trends and Issues in Instructional Design

By: Julie Cabaniss

Submitted 4/17/18

Organization for Project:

- A suburban high school located in a University town.
- A high performing, first tier (just outside Milwaukee) suburban high school with a relatively high rate of diversity among the student body (for Wisconsin).
- Demographics – Please see chart below which is taken from the State Report Card generated by Wisconsin Department of Public Instruction.

School Information	
Grades	9-12
School Type	High School
Enrollment	651
Percent Open Enrollment	9.1%
Race/Ethnicity	
American Indian or Alaskan Native	0.2%
Asian	9.1%
Black or African American	16.6%
Hispanic/Latino	7.1%
Native Hawaiian or Other Pacific Islander	0.0%
White	66.1%
Two or More Races	1.1%
Student Groups	
Students with Disabilities	11.8%
Economically Disadvantaged	15.4%
Limited English Proficient	4.3%

The Problem:

- There is a large gap in achievement between White students and African American students. It seems to be getting worse despite continued efforts by staff to close the gap. See data on the next page.

Project Proposal

Sponsoring Organization

Suburban High School (name is kept out deliberately)

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Project Description

There is an achievement gap:

High School Data 2016-17

Subject	English Language Arts	Mathematics
% White students ≤ Basic	24.5%	28.7%
% Black students ≤ Basic	71.0%	77.4%

Aim

The aim of this module is to teach learners how to read and interpret different data sets in published scientific research as well as how to read and extract salient meaning from peer reviewed scientific papers when the learner may have limited understanding of much of the vocabulary and concepts. The aim is to raise their level of comfort, confidence and fluency in approaching scientific reading and research. After that, the aim will be to teach learners about diabetes including what it is, who is most at risk, and how our different body systems (circulatory, digestive, cardiovascular) are involved with the disease.

Target Audience

Low performing students in a high school Biology Concepts Class, with particular focus on engaging the African American students.

Delivery Options

This learning solution will be an online module (which this document will outline) that can be used by teachers in high school or college classes.

Front-End Analysis: Instructional Need

Instructional Need

The research conducted on site revealed a lack of engagement among the lower performing students which include all demographics. The students that were interviewed expressed interest in more “hands-on” activities and wanted to use technology in the lessons more frequently. This course fills many needs beginning with addressing the low performance on standardized tests, which involve extensive technical reading accompanied by data tables and graphs. Students need practice reading and analyzing scientific writing and data, which is almost nonexistent right now in the curriculum. In addition, to address the lack of engagement, the curriculum is focusing on issues that directly impact the students. The first unit deals with a health concern that is epidemic in nature and effects many families and friends. It is Type 2 Diabetes. In addition to learning about their own risk of contracting this disease and how to lower the probability, students will read and analyze data from peer reviewed research that addresses the disease. In this first module, students will focus on comprehending the data sets and reading. They will then practice interpreting the data and take some low stakes formative assessments to build their confidence.

Front-End Analysis: Learner Characteristics

Primary Audience

- Low performing, disengaged students in their sophomore or junior year of high school.

Secondary Audience

- Other science teachers that have to eventually teach these same students.
- Administrators who have to report to the Board of Education as to the status of the achievement gap between the white students and the African American students.

General Learner Characteristics

- Students' average reading ability is at the 7th-8th grade level.
- Students' math skills are also around the 6th-8th grade level.
- They will not do any homework.
- They do not study for tests.
- They have a difficult time getting down to business and getting work done in class.
- Students are very social and some of the kids in the class have some behavior issues. They are disruptive in terms of not being able to sit down and they blurt out frequently when I am trying to teach.
- They are very interested in real world issues that affect their family members like diabetes, cancer and heart issues.

Entry Characteristics

- Middle school reading level.
- Middle school math skills - if that - definitely cannot design data tables and have to be reminded how to calculate averages.
- Not interested in school or doing the school work.
- Do not know how to collect scientific data, make data tables or draw graphs without a lot of help and direction.
- Do not care about getting work done unless there is a possibility that their parents will be called.

Contextual Analysis

Orienting Context

- These students are forced to take Biology Concepts to graduate from high school.
- They think it's slightly interesting when it involves them or their environment.
- Accountability for these students starts and ends with their parents. It is extrinsic. Their parents have high expectations and all it takes is a text or phone call from the teacher and there is a turnaround in their effort level in class (for a while, then another call is needed).

Instructional Context

- 3rd hour in the morning.
- The room has huge windows and it's sometimes hard to see the screen because of the sun.
- The temperature of the room in this old building fluctuates tremendously.
- Students sit in individual desks towards the front of the room.
- Most of the students have IEPs and are Special Ed or have Emotional/Behavioral issues.
- There is an overhead projector hooked up to the computer which is used daily by the instructor.

Technology Inventory

- Students have their phones (but not all of them have phones).
- MacBook Pros that take 10 minutes to log on to and are almost a waste of time if you want to do something quick with technology.
- Two desktop computer labs that teachers are able to sign up for and use for any particular period. These computers are faster and more efficient.

Instructional Impact Based Upon Learner Characteristics

Application of Learning Theories

Cognitive Learning Theory will be applied in this module as I am most concerned with what is going on inside the learners' head versus simply baiting them to change their behavior (which is how I now see the Behaviorist Theory). The thought here is that simply employing the Behavior Theory is too superficial and will not address the underlying issues in the learners' intellectual performance gaps. With Cognitive Learning Theory, students will apply new learning to their current knowledge but also engage in problem solving, discussions, imagery to connect ideas and concepts. The cognitive approach to learning should change their knowledge, change what is stored in their memory and give them new perspectives and background with which to see the world.

Application of Motivational Theories

I will use John Keller's ARCS Model of Motivational Design Theory. This model employs the components of getting their "Attention" first, making it "Relevant" to the learner, setting up the learning environment so they have "Confidence" that they can succeed and then ending the experience with the learner feeling a sense of "Satisfaction", (thus the ARCS). The Conditions of Learning Theory by Gagne is nice, but too complicated to use in this situation, and I think that many of the steps in Gagne's process are inherent in the activities and design required for the ARCS model and just aren't picked apart. For instance. Gagne begins also with gaining their attention, but then his next three components (informing of objectives, stimulating recall and presenting the stimulus) are a fancy way to pick apart what you would naturally do to set them up for success - which is what the ARCS model does and includes showing students the relevance for what they will learn and giving them confidence that they can learn it with clear objectives and attaching the learning to their lives and what they already know, etc…..). From that point I will allow them to grow through small steps, little tasks, lots of feedback online, positive reinforcement, etc… This feedback and their many small accomplishments will build in a sense of satisfaction, I hope.

Impact of a Diverse Audience on Instruction

Students are from two racial demographics - White and African American. There are students from very different economic backgrounds in this class as well, from very low income to upper middle-class backgrounds. Also, while most parents are super supportive, their involvement and ability to be involved varies. Regardless, they all have high expectations for their students.

There is, according to some of the African American students, a social pressure placed upon them by their peers to *not* be a top student. There is active disruption or lack of buy-in to doing what is required to excel at school.

In addition, I think that the notion of employing user experience research methods with this demographic could be helpful, since most of the teachers are middle aged and Caucasian and they develop their own curriculum; which obviously will be representative of their cultural background and bias. There is almost no effort to involve the students in the design of instruction. It is possible that user research methods as outlined in the book *Understanding Your Users by Kathy Baxter, Catherine Courage and Kelly Caine* should be used at the high school level to better develop instruction that speaks to this generation.

So given this diversity, we are working against two huge barriers. One barrier is present for many of our African American students that feel social pressure from their friends to not “act white” and excel in school. The other barrier is the lack of instructional materials that actually relate to the kids!

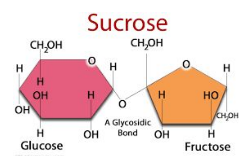
Task/Goal/Performance Analysis

Task Analysis Method

Both a topic and procedural analysis were done. The topic analysis involves really understanding what the content is that the SME needs the learners to understand including the order, or the structure of the components. A procedural analysis was used to look at what steps the students need to go through in order to achieve the desired goal of being able to analyze and interpret data. The method I used to order the tasks from both the topic and procedural analysis was to list them based upon level of difficulty and natural scaffolding sequence because they build upon the previous tasks.

Task Analysis

- Be able to read data tables and graphs taken from published, peer reviewed, research and answer questions correctly on the data.
- Be able to explain and demonstrate how to read peer reviewed scientific journal articles.
- Read and pull salient information from abstracts that are part of peer reviewed published research.
- Learn embedded vocabulary that is necessary to understand the abstracts.
- Be able to discuss the risk factors for diabetes after looking at data published in peer review journals.
- Determine their own risk of getting Type 2 diabetes as low, average or high after digesting the research.
- Be able to identify and categorize a glucose molecule as either a carbohydrate, lipid or protein.
- Explain how a carbohydrate differs from a lipid and protein.
- Explain how sucrose is related to glucose - table sugar
- Explain why fructose and high fructose corn syrup are as bad as table sugar



- Describe the function and parts of the Circulatory System.
- Label the different parts of the circulatory system.
- Describe and define the pancreas and its role in insulin production.
- Understand how a healthy body processes sugar in the blood starting with the place where sugar is absorbed into the bloodstream, continuing though the role of the pancreas and insulin.
- Contrast how a body affected with Type 2 Diabetes processes sugar differently than a healthy body.
- Summarize how too much sugar affects small blood vessels.
- Explain how the destruction of blood vessels manifests in disease symptoms of advanced diabetes.

Goal Analysis

The Goal Analysis document for one of the unit modules is found separately.

Instructional Objectives

Instructional Goal

The goal of this learning unit is for students to learn how to read and analyze research data from published peer review journal articles while at the same time learning about Type 2 Diabetes in an interdisciplinary way. What is meant by interdisciplinary here is that instead of the traditional high school biology curriculum that separates the study of the body systems *from each other* and treats biomolecule content (carbohydrates, lipids, etc…) as yet another separate unit to memorize, this unit slowly integrates all of these under one large topic of interest. Students will walk away with a holistic understanding of how the different systems of the body handle and respond to sugar intake as well as how they respond if the person has Type 2 Diabetes. Additionally, they will have read and analyzed various data involving the disease.

Terminal Objectives and Enabling Objectives

Terminal Objective: Students will read and assess multiple data sets from published research, in the form of graphs or data tables, on one general topic and be able to describe to peers at least four trends they see in the data.

- Students will be able to identify which data is supported by a bar graph showing rates of diabetes in the U.S. amongst five different ethnic groups and genders.
- Students will look at a graph that displays dietary intake data showing cause and effect relationships between certain types of food and diabetes risk factors and be able to compare and contrast at least two different trends.
- Students will look at a graph and some reading of an explanation of the graph regarding genes associated with Type 2 Diabetes risk and be able to state evidence supporting the notion that Type 2 Diabetes has a genetic component as well.
- Students will be able to identify the key concepts that are introduced in a video and article on the epidemic of Type 2 Diabetes.

Terminal Objective: Students will be able to read and identify the key points of a research study in a peer reviewed published journal article.

- Students will be able to identify and explain at least four steps or practices that can help them read a scientific paper.
- Students will demonstrate understanding of what the different parts of a scientific article are and what the parts tell the readers.

- Students will practice reading and extracting meaning from two real peer reviewed journal articles on diabetes.
- Students will create a guide for others to use regarding how to process a scientific journal article.
- Students will find their own research article that interests them and interpret it.
- Students will reflect on how they feel at this point in the program.

Enabling Objectives Matrix & Supporting Content

Julie Cabaniss

Title of the unit/module: Scientific Reading and Data Analysis

Brief description of target audience:

Lower performing high school sophomores and juniors. The students are both White and African American. The average reading level is about 8th grade, students will do no homework and will not study for tests.

Enabling Objectives are in green below:

Terminal Objective: Students will read and assess multiple data sets from published research, in the form of graphs or data tables, on one general topic and be able to describe to peers at least four trends they see in the data. (Comprehension, Application and Analysis)

- Students will be able to identify which data is supported by a bar graph showing rates of diabetes in the U.S. amongst five different ethnic groups and genders.
- Students will look at a graph that displays dietary intake data showing cause and effect relationships between certain types of food and diabetes risk factors and be able to compare and contrast at least two different trends.
- Students will look at a graph and some reading of an explanation of the graph regarding genes associated with Type 2 Diabetes risk and be able to state evidence supporting the notion that Type 2 Diabetes has a genetic component as well.
- Students will be able to identify the key concepts that are introduced in a video and article on the epidemic of Type 2 Diabetes.

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- Students will practice reading and extracting meaning from two real peer reviewed journal articles on diabetes.
- Students will create a guide for others to use regarding how to process a scientific journal article.
- Students will find their own research article that interests them and interpret it.
- Students will reflect on how they feel at this point in the program.

List Pre-Instructional Strategy:

- Dramatic diabetes data that allows learners to assess their risk of diabetes right away.
- Pre-test of their knowledge regarding Type II Diabetes - what it is, who gets it, how systems in the body are affected and also on their ability to read data charts and graphs.

Terminal Objective: Students will read and assess multiple data sets from published research, in the form of graphs or data tables, on one general topic and be able to describe to peers at least four trends they see in the data.

Enabling Objectives	Assessment	Absorb Activity	Do Activity/Connect Activity
Students will be able to identify which data is supported by a bar graph showing rates of diabetes in the U.S. amongst five different ethnic groups and genders.	Discussion with peers where they choose one of three different questions that require them to understand and analyze what they are seeing in the data.	What is Your Risk of Getting Type 2 Diabetes? After looking at the first bar graph, students submit their risk of getting diabetes based on ethnicity and gender as high, low or medium and get a game point for doing so.	**<u>Discussion Requirements:</u>** Students will review the three different sets of data - just the graphs and data tables and enter a discussion with their peers where they are given three options of what to do: 1. Write about three things that surprised them in the data. 2. Write about three things that they think everyone should know from the data. 3. Write about three things they are most worried about for their own family that relate to the data they just saw. **<u>Quiz</u>** Quiz that asks students to identify which multiple choice options are supported by the data they've been studying.
Students will look at a graph that displays dietary intake data showing cause and effect relationships between certain types of food and diabetes	Online quiz that asks students to identify multiple choice options that are valid per the data for at least		

risk factors and be able to compare and contrast at least two different trends.	four trends they see in the data.			
Students will look at a graph and some reading of an explanation of the graph regarding genes associated with Type 2 Diabetes risk and be able to state evidence supporting the notion that Type 2 Diabetes has a genetic component as well.			**Do Activity** A drag and drop matching game on information in the graphic. (I will be rewriting the technical summary to meet a 10th grade reading lexile)	
Students will be able to identify the key concepts that are introduced in a video on the epidemic of Type 2 Diabetes.	Online quiz about the video that students take after watching the video.	Students watch a video on diabetes (which I will need to make cc for and add alt tags(?) if possible) and then a real research abstract on diabetes risk.	Students watch the video about Type 2 Diabetes and the epidemic amongst children! Take an online quiz about the video afterwards.	

Terminal Objective: Students will be able to read and identify the key points of a research study in a peer reviewed published journal article.

Enabling Objectives	Assessment	Absorb Activity	Do Activity	Connect Activity
Students will be able to identify and explain at least four steps or practices that can help them read a scientific paper.		Students will be given a pre-quiz that asks them to identify good examples of what to do when reading a scientific paper.	Students conduct directed reading on an article that teaches how to attack a scientific article. S will read two articles about how to read scientific articles: http://www.sciencemag.org/careers/2016/03/how-seriously-read-scientific-paper http://www.owlnet.rice.edu/~cainproj/courses/HowToReadSciArticle.pdf	

Students will create a guide that teaches how to read scientific papers.	S will make a flyer or handout or graphic for their peers on how to read real scientific papers.		S will make a flyer or handout or graphic for their peers on how to read real scientific papers.	
Students will practice reading and extracting reading from two real peer reviewed journal articles on diabetes by reading the articles and being asked to identify the key points in each section of the papers. THey will also pick their own research article to read and interpret.	S will have a formative assessment that allows them to pick from four different multiple choice options for each section of the research article they read, asking them to choose the correct conclusion or concept from that section (pop up windows) S will also have an alternative summative assessment where they find their own research article, summarize it and say why they chose it.		S will have a formative assessment that allows them to pick from four different multiple choice options for each section of the research article they read, asking them to choose the correct conclusion or concept from that section (pop up windows)	Finally, students find a science research article about something that appeals to them personally, submit it and write one paragraph about its meaning and why they chose it.
Students will reflect on how they feel at this point in the program.	Exit ticket of sorts – ask students to write how it is going for them, how they feel about their progress and any suggestions about what they'd like to see change?		Exit ticket – ask students to write how it is going for them, how they feel about their progress and any suggestions about what they'd like to see change?	

References

References

Baxter, Kathy , et al. *Understanding Your Users: A Practical Guide to User Research Methods.* Morgan Kaufmann, 2015.

Black, Alison, et al. *Information Design: Research and Practice.* Routledge, 2017.

Final Project Rubric

Please see the final project rubric and the reflection paper rubric within the course content.