I.   **Identify Contextual Factors**

School and Community Description

Billings, Montana, is the largest city in the state with a population of approximately 110,000, but is the center of a metropolitan area with a total population of 167,000. It is located in the south-central portion of the state. The population is approximately 90% Caucasian, 5% Hispanic or Latino, 4% Native American. The remaining 1% is divided between African American, Asian, Pacific Islander, and other minorities. Economically, the primary industries in this area are agriculture, energy, and retail sales.

Billings Senior High School has been in continuous operation since 1940, currently serving approximately 1,700 students from 9-12th grades. The school consists of one main campus building, and a separate career center located six miles away for students interested in trade school options. The high school currently employs 122 full-time staff members. It is a Title I designated school, with 32% of students designated as "economically disadvantaged". It also has the largest portion of special needs students of any school in the state, with 12% of students having an IEP in place. This school educates students from a wide variety of socioeconomic backgrounds fed from three local middle schools (Riverside, Lewis and Clark, and Will James) as well as from neighboring districts such as Lockwood. The graduation rate was approximately 80% in spring 2016, with a 19:1 student to teacher ratio.

Classroom Description

The classroom is located on the third floor of the building, near the northwest corner. The room is a rectangle, with north-facing windows. The north wall is lined with tables. The classroom is oriented facing the west, with a SMARTboard on a mobile stand against that wall.

There are cabinets along the western side of the room, including one labelled the "student resource center" where students are able to obtain free pencils, pens, paper, and notebooks as needed. This is also the side of the classroom where the instructor's desk and computer are located. In the classroom, there are 16 6-foot-long, narrow tables, each seating two students. The tables are arranged facing the SMARTboard in groups of two, making nested "L" shapes, allowing four students to be seated in a group at a time. On the east wall, there are two large whiteboard panels that are used to convey the topics that must be covered in each week's self-directed homework assignment. The classroom has colorful art pieces and diagrams pertaining to human anatomy covering approximately 60% of the free wall space. There is a bulletin board posted near the door with the schedule and all handouts for the week. The east side, or back of the classroom, has a deep double sink for use during labs, and two fish tanks holding the class pets: two aquatic frogs, and two box turtles. There is also a tortoise inside of a livestock tub against the north wall.

Student Description

The class contains 31 diverse students, with a nearly even split between males and females. The majority of students are Caucasian, with four students of Native American descent, three students of Hispanic descent, and one African American student. All of the students speak English as a first language. The students also vary widely when it comes to achievement and socioeconomic status. All of them own smartphones, and have internet access at home, but some come from economically disadvantaged backgrounds and take advantage of services such as the school's food pantry. Of the 31 students, six score 60% or lower consistently, 18 score between 60 and 80% on a consistent basis, and the remaining seven score above an 80%. The largest challenge with these students is attendance. The higher achieving students are heavily involved in extracurricular activities, and as a result, miss at least one class period every two weeks, but sometimes as many as three or more. The lower-achieving students also have difficulties with

attendance. One student works 40 hours a week in addition to going to school, so all work must be completed in class. There are three students with chronic medical conditions that require lengthy absences and frequent breaks from the classroom. Between all of these factors, it is not uncommon to be missing five or more students on any given day. There are two students with IEPs that indicate difficulties with reading and writing, however, half of the students have difficulties constructing written works on their own. For this particular class, there was one student who was brought in as a truant. This was his first day of school since the school year had started three and a half weeks ago. Another student is selectively mute, and I have only heard her speak on one occasion thus far.

COE Lesson Plan

Lesson Teacher: **Date: September 14, 2016**

Lesson Grade Level: High School 11/12   **Timeframe:** 11:18 to 12:15

Content Area: Science   **Grouping Strategy**: Whole Group

Anatomy and Physiology

Preparing for Lesson Development

1. **What does your pre-assessment observation indicate about your student's needs and current performance and educational needs?**

The pre-assessment observation indicates that the students have very little knowledge of epithelium, much less the eight types. The average score on the pretest was 2.4 out of a possible 8 points. The assessment is attached. This indicates that this subject area is unknown to them at this time, and any information given to the students will be new.

2. **How will you design the lesson to meet the needs of all learners in your classroom?**

The students in the class, although the majority are mid-level achievers (B-C range students), seem to work best with a combination of traditional instruction and hands-on interaction with

the material. With the exception of a few students, the class also performs better on project-based assessments, Based on this understanding, I chose to do a combination of traditional instruction for background knowledge, followed by an interactive modeling assignment in place of a paper assessment. I have two students in the class that have IEPs that indicate difficulties with reading and writing. Because of this, I made the decision to keep the writing required for this lesson to a minimum, and instead use practical application of skills as the graded component. There are also three more students who have chronic health problems that require them to leave the classroom frequently on request. This lesson was designed to have minimal direct instruction, and then self-guided working time. This allows the students to leave the classroom as is necessary without missing vital information. For the students that finish their assigned work early, the additional time can be used to work on their weekly homework or project assignments.

Lesson Plan Development

Lesson Title: Modelling the 8 types of epithelium

Standards:

Common Core Standards:
Science Standard 3.2: A proficient student will describe and explain the complex processes involved in energy use in cell maintenance, growth, repair and development.

Next Generation Science Standards:
Practice 2: Developing and using models.
Crosscutting Concept 1: Patterns. Observe patterns of forms to guide organization and classification, and the patterns prompt questions about relationships and the factors that influence them.
Crosscutting Concept 6: Structure and function. The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.
Disciplinary Core Idea 4, Life Sciences: Illustrate the role of differentiation in producing and maintaining complex organisms.

Lesson Objective: Students will be able to differentiate the 8 types of bodily epithelium depicted through images.	**Assessment of Learning:** This objective will be assessed by matching the name to the image as part of a weekly quiz assigned the following Friday.
Lesson Objective: Students will be able to differentiate the 8 types of bodily epithelium using models.	**Assessment of Learning:** Students will produce a labelled physical model of the 8 types of body epithelium made of marshmallows. This is marked out of twenty points on a rubric (attached).

Based on the lesson objectives, select an appropriate teaching model 5E		
Lesson Procedures/Activities	**Materials**	**Classroom Management Needs**
Engage Provide students with the "do now" assignment, having them collect the handouts for the day from around the room. Also have the students share, in their table groups, their ideas about what it means to secrete, absorb, and protect (the functions of epithelium).	Epithelium "Power Notes" Marshmallow Project Direction Sheet	The students tend to be very fidgety at the beginning of class, so having them walk around the room at the beginning of the period helps them settle and focus on the lesson. Sufficient room must be given between the desks to give the students space to move.
Explore Share the ideas that the students discussed with each other with the class. Explain the importance of all three of these functions are. All three of these are necessary for the successful functioning of the human body.	SMARTboard with presentation.	The students will raise hands to share their thoughts.
Explain Show the students the eight different epithelial types. Begin by showing images with simple versus stratified epithelium. Simple epithelium is only one layer thick, while stratified is multiple stacked layers. Then, show thee three types of epithelial cells: columnar, simple, and cuboidal, described by shape. Finally, move into the eight types, their location in the body, and their functions. This information will be used to help them fill out their Power Notes. During the lecture portion, they will be encouraged to work on the Power Notes, and when the direct instruction portion is over, if the students have any blanks left on their sheet, the answers will be provided.	SMARTboard with presentation. Epithelium "Power Notes"	During the direct instruction portion, students should be in their desks, working through the Power Notes.
Elaborate Students will use their new knowledge of epithelium to build models of each kind of epithelial tissue with marshmallows, toothpicks, and glue. This will be glued to a sheet of paper and labelled. Tell the students that it will be graded on completeness, and that they should work as a team, dividing up the work. They have the remainder of the class period to work on this.	Marshmallow Project Direction Sheet Marshmallows Paper Toothpicks Glue Colored Pencils	The students will be allowed to choose their own groups, of three or four students, provided that they are productive with their partners. Because the assignment is due at the end of class, this

		should not be a problem.
Evaluate Circulate around the classroom and check on the students' progress on the project. Informally assess the work, and collect the projects at the end of the class period. Answer any further questions about epithelial types, and ask if they need any further clarification. Remind the students of their quiz tomorrow.	Marshmallow Project Direction Sheet	The students should put their projects on the tables against the south wall to keep them safe while they dry.

II.   **Analysis and Assessment Data**

The pre- and post-test consisted of the same matching question, as well as a follow-up question, asking how confident the students were in their answers. This matching-based assessment was designed to test the comprehension of the shape and configuration of epithelial tissue, which was the major theme of the lesson. Figure 1 shows the pre-and post-test data for the class. Before the lesson, the average score was 2.4, out of a possible eight points. After the lesson, the average score rose to 7.1 points, again out of a possible eight points.
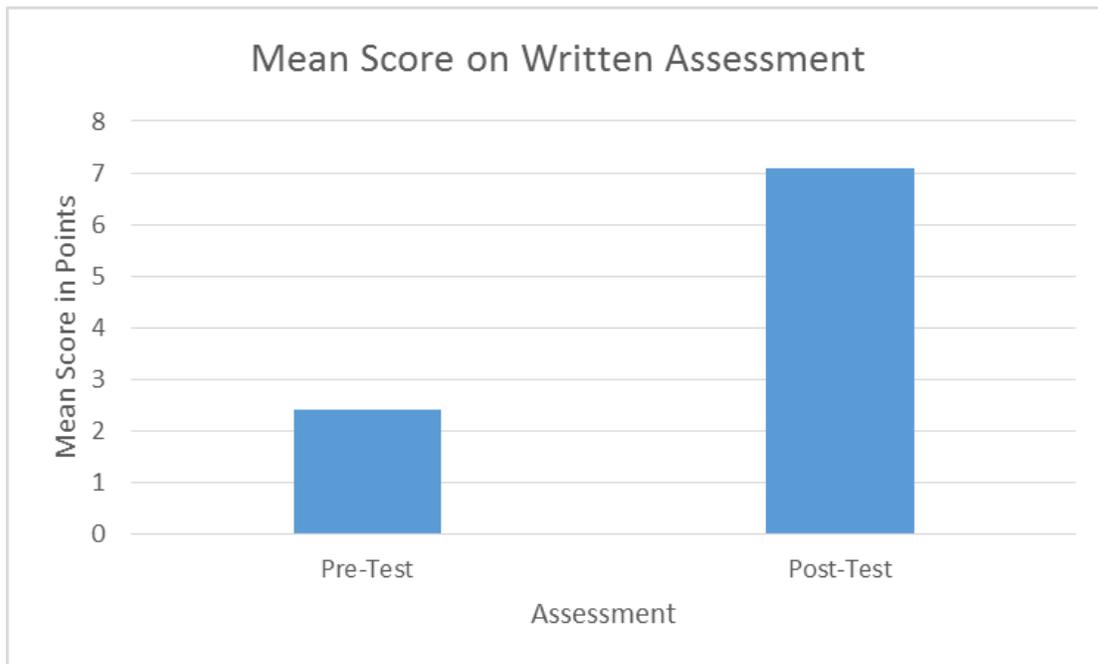

Figure 1: Mean score on written pre- and post-test assessment by a sample of 31 high school students.

The in-class modelling activity was graded as well, with all students present scoring the maximum of twenty points. This indicates that the students had great success with the modelling portion of the lesson.

Students were also asked to rate their confidence in their answers, indicated on a scale of one to five, ranging from "Not Confident at All" to "Very Confident", respectively. Before the lesson, the students rated their confidence on the test at 1.6, out of a possible 5. After the lesson, the students, on average, rated their confidence as a 4.2 out of a possible five, indicating a confidence increase of 2.6 points. This is indicated in Figure 2.
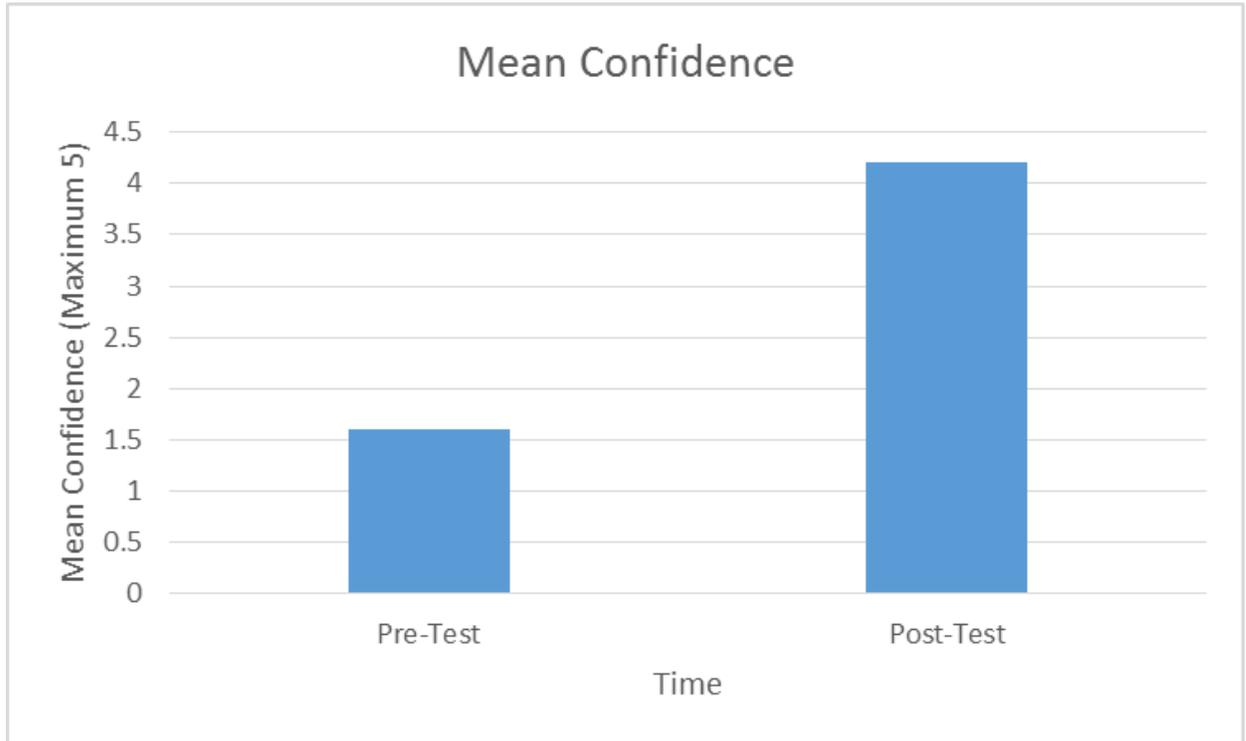

Figure 2: Mean confidence in knowledge rated on a scale of 1 to 5 on written pre- and post-test assessment by a sample of 31 high school students.

III.   Reflections

Insights on Effective Instruction

I believe that this lesson was effective in some areas, but less effective in others. In planning this lesson, I paid extra attention to planning the hands-on section that involved the marshmallows because I thought that this may be the most difficult part for me to accomplish. I had not done many hands-on demonstrations before, so I spent a lot of time practicing this. It went very well, but I felt like it may not have gone as well without such careful planning and practice. My cooperating teacher and I also discussed the importance of the art of the demonstration at length. It became extremely evident as the class went on that the key to an effective demonstration that attracts and holds attention, as well as provides an effective instructional experience, is being an entertaining presence. The students need to have a hands on component that attracts and keeps their attention. I felt that this was accomplished through the hands-on demonstration, followed by the independent work of making physical models to further get a grasp on the material ahead of the unit test.

I think that the section of direct instruction, although taking up only a third of the class time, was too long. The students, although focused and attentive, were more focused on copying down notes verbatim than considering the knowledge. I would have preferred that the students be thoughtfully considering or interacting with the material. Based on this, I would shorten the direct instruction portion, perhaps separating the material out over more than one class period so that the students were not as focused on taking notes. I would also give the students the direct information to not copy down notes at this time, and instead focus on understanding what they are being told and asking thoughtful questions. I found that when I was monitoring the individually working groups, I was repeating myself frequently. In shortening this section, I am hopeful that there will be fewer questions asked during the modelling portion, and I will repeat the same answers to questions less as a result.

The students began to lose focus a few minutes before the end of class, and became restless and unproductive. Although they had assigned homework and an assignment to work on, they chose not to do so. This is a trend that I have seen in various lessons that I have taught. To help solve this problem, implementing an exit ticket system may be the best option. Given that keeping the students very busy by piling on more assignments was not effective, I think that an exit ticket would prove to be the most effective. Having students complete a short assignment in these last few minutes and pass it in, they may continue to be productive through to the moment the bell rings.

Insights on Effective Assessment

I believe that the assessment was effective at measuring the listed objectives. The lesson was designed to teach the students how to visually identify the types of epithelium, as part of a larger unit on epithelium. The hands-on activity, as well as the written pre- and post-tests, showed that the students had grasped the material and could successfully identify the epithelium in a picture, and also in a physical model. While monitoring the class during the activity, I interacted with many of the students. Three noted that they felt the activity was helping them understand the shape of the cells better than using the PowerPoint alone.

This class also has several exceptional learners, including those with trouble reading, writing, and communicating verbally. Accommodating all of these needs when conducting an assessment can be very difficult. In combining two types of assessment, I could accommodate these different students by weighting the written or practical assessments differently depending on the needs of the learners if it was required. This was not needed, but I was happy to be able to offer that to them. With these diverse needs, the only issue that I ran into was that some students, including one with a 504 plan, did not finish the modelling activity by the end of the class period. I had allowed the students to choose their own groups, and this may have been an error, as it allowed students to stratify into achievement levels, putting several lower-achieving students in

the same group. This certainly contributed to this problem, as some groups had difficulty working together, assigning and dividing up work within the group, and using the time provided wisely. In future, I would assign the groups at random to prevent that from happening again. I allowed the students who did not finish to have more time during the following class period. This was not an issue because the two groups who did not finish needed less than ten minutes to complete the assignment. Next time that I assign a modelling assignment, I would ensure that there was enough time for all students to reasonable finish, regardless of their needs, even if that means reducing the length or complexity of the assignment.

Implications for Future Teaching

For future lessons, I would include more demonstrations, as well as modelling activities that allow the students to physically interact with the material. Anatomy and physiology is a subject that lends itself to modelling and physical movement very easily, so I plan on including it in more lessons. The students seemed to enjoy this part of the lesson the best and further demonstrations would allow more students to participate in the lesson in a hands-on way.

I would also be interested in giving the students more freedom as to the modelling. In this lesson, the students were very constrained. The students had access to a very limited number of materials, and the guidelines for the project were very discreet, with little room for individuality. For future modelling exercises, I may allow the students to have a wider array of materials available, as well as the ability for the students to insert their own ideas and personalities into the assignment.

Something that I have also been considering is the idea of changing the order of the lesson. Now that I have established the success of using models, I would like to use them as part of an inquiry-based learning lesson, where the students construct the models using knowledge they have discovered themselves using provided resources. I believe that encountering the hands-on learning first, before the students are given much, if any, background information, would help

the students interact with the material on a deeper level. I would be interested in whether or not this would increase long term retention of the information. I believe that this is the next logical step for my classroom when it comes to using modelling in education. I plan on integrating this idea into a future unit.

Evidence of Impact on Student Learning

I believe that the instruction was effective based on the marked improvement seen in scores for the students when comparing their pre- and post-test scores. Their confidence was also rated higher on their answers during the post-test, indicating that they felt the instruction was effective as well. I believe that this lesson could be improved through the changes that I had previously mentioned to become even more effective at communicating the lesson to the students.

I also felt like the impact on student learning was measurable in the depth of the questions that the students were asking. Towards the beginning of the class, the questions were about clarifying information, such as "can you explain that again". However, towards the end of the class, while the modelling portion of the questions begin to skew more towards expansion of knowledge. This indicates that students were beginning to understand the information on more than a superficial level.

Attachments:

Written assessment, used as both a pre- and post-test.

Match the name of the tissue to the picture.

1. Stratified Squamous
2. Transitional
3. Simple Columnar
4. Stratified Columnar

5. Stratified Cuboidal
6. Simple Squamous
7. Pseudostratified Columnar
8. Simple Cuboidal
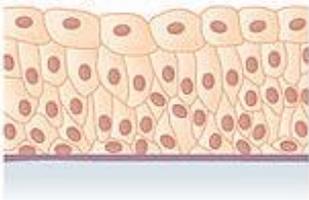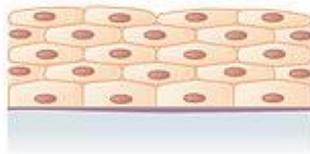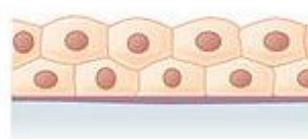
A   B   C   D
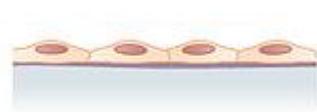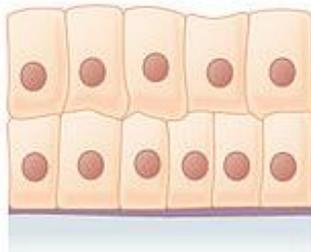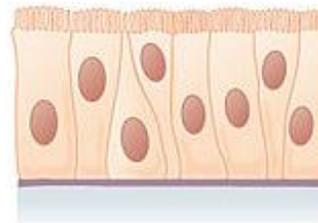
E   F   G   H
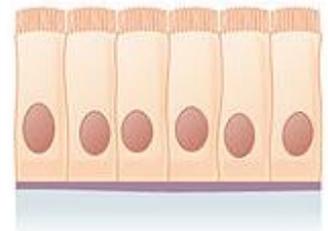
How confident are you in your answers? Circle one.

Not confident at all   Entirely confident

1   2   3   4   5

In-class modelling rubric

Epithelial Type	Present, accurate 2	Present, not accurate 1	Not present 0	Comments
Squamous Cell				
Cuboidal Cell				
Columnar Cell				
Simple Squamous				
Stratified Squamous				
Simple Cuboidal				
Stratified Cuboidal				
Simple Columnar				
Stratified Columnar				
Transitional				
Pseudostratified				
			Total:	**/20**