Lesson 8: When should the school day begin?

I. Overview
During this lesson, students debate the most appropriate starting time of the school day using the relevant information learned throughout the unit as their evidence for claims they make. Students work in groups to create an argument for what they believe to be the best starting time for the school day, share their argument with the class in the form of a discussion/debate, and prepare a presentation to share their recommendation for school day starting time with a school administrator. Groups will be required to pull from knowledge they acquired from throughout the unit, including sleepiness scale data and experimental results, as well as information gathered from popular media and scientific journal articles, to formulate their argument.

Connections to the Driving Question
This final lesson has the students take what they have learned in Lessons 1-7, in regards to what makes us “tick...tock” and apply it to a real life situation, such as the start time of the school day. Their argument for when the school day should start bases itself on the ideas throughout the unit.

Connections to the Previous Lesson
In the previous lesson, students explored how lifestyle choices can affect the epigenome, or alter the structure of chromosomes. Now, the students take what they have learned from this lesson and apply it, along with ideas from Lessons 1-6, to construct an argument on what time school should start. Epigenetic changes are one piece of evidence the students can use to construct their argument for an earlier or later school start time.

II. Standards/Benchmarks

National Education Science Standards
Content Standard A: Science as Inquiry
• Students in school science programs should develop the abilities associated with accurate and effective communication. These include writing and following procedures, expressing concepts, reviewing information, summarizing data, using language appropriately, developing diagrams and charts, explaining statistical analysis, speaking clearly and logically, constructing a reasoned argument, and responding appropriately to critical comments. (9-12 A: 1/6)

Benchmarks for Science Literacy
The Nature of Science: Scientific Inquiry
• Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare theories. 1B/H

The Nature of Science: The Scientific Enterprise
• The dissemination of scientific information is crucial to its progress. Some scientists present their findings and theories in papers that are delivered at meetings or published in scientific journals. Those papers enable scientists to inform others about their work, to expose their ideas to criticism by other scientists, and, of course, to stay abreast of scientific developments around the world. 1C/H12** (SFAA)

Habits of Mind: Communication Skills
• Participate in group discussions on scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, and expressing alternative positions. 12D/H6

Habits of Mind: Critical Response Skills
• Notice and criticize claims based on the faulty, incomplete, or misleading use of numbers, such as in instances when (1) average results are reported but not the amount of variation around the average, (2) a percentage or fraction is given but not the total sample size, (3) absolute and proportional quantities are mixed, or (4) results are reported with overstated precision. 12E/H1*
• Check graphs to see that they do not misrepresent results by using inappropriate scales or by failing to specify the axes clearly. 12E/H2
• Notice and criticize claims that people make when they select only the data that support the claim and ignore any that would contradict it. 12E/H5*
• Notice and criticize arguments in which data, reasoning, or claims are represented as the only ones worth considering, with no mention of other possibilities. 12E/H6a*
• Suggest alternative trade-offs in decisions and designs and criticize those in which major trade-offs are not acknowledged. 12E/H6b

III. Learning Objectives

<table>
<thead>
<tr>
<th>Learning Objectives</th>
<th>Assessment Criteria</th>
<th>Location in Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply what they’ve learned about circadian rhythms and sleep-wake cycles to create a coherent argument for when the school day should begin.</td>
<td>Students use Internet and/or in-class resources to construct a claim in the form of a recommendation as to when school should start along with appropriate evidence and reasoning.</td>
<td>Activity 1</td>
</tr>
<tr>
<td>Support their argument in a class discussion/debate about the best school schedule.</td>
<td>Students participate in a discussion, sharing their claim, evidence, and reasoning with their classmates. They also refute their</td>
<td>Activity 2</td>
</tr>
</tbody>
</table>
peers’ arguments with research-based evidence and reasoning, ultimately helping in strengthening in each other’s arguments.

| Prepare a presentation to the principal (or other administrative official) either providing support for a change in school start time, or the current schedule. | Students revise their presentations based on their peers’ suggestions during the debate in Activity 2. They present their recommendation, with supporting evidence, to the administrator either in-person or in a video format. | Activity 3 |

**IV. Adaptations/Accommodations**

**Alternative Activity: Whole Class Jigsaw**
Prepare several different articles related to adolescent circadian rhythms and school start time from the list of resource materials. Each student would read only one article, but several students would read each article. After reading the articles, student will share with the rest of the class what they read (one article at a time). Student responses to the articles should be summarized on the board, power point, word document, etc. After all articles have been summarized. The class will discuss what the best school start time would be for their school. Students should also consider their schools current schedule, after school activities, other school start times in the district, bus schedules, health advantages/disadvantages, safety advantages/disadvantages, sleepiness scale data, data collected during the fruit fly experiment, etc. Students should take notes during the discussion to prepare for presenting the information to a school official. The class will use the information discussed to prepare a presentation to a school official - this can be done as a whole class activity, a small group activity, or a single student activity done outside of class.

**Alternative Activity: Small Group Jigsaw**
Similar to above, but done in small groups. Four-Five groups would each receive a different article to read. Students would read the article and then discuss within the group. Students would then split into new groups, so that their is at least one representative from each of the original groups. Students would share what they read in their respective articles with their group members, then formulate an argument for school start time using information from the articles and data collected throughout the unit, and then prepare a presentation. Each group would prepare their own presentation.

**V. Timeframe for activity:**

**Opening of Lesson**
- Introduction to Later School Start Times – 15 minutes
Main Part of Lesson
• Activity 1: Preparing your argument – 5-10 minutes
• Activity 2: Defending your argument – 5 minutes
• Activity 3: Reporting what you’ve learned – 5-10 minutes (or done as an assignment at home)

Conclusion of Lesson
• Wrap-Up Discussion – 5-10 minutes

VI. Advance prep and materials

Opening of Lesson

Materials:
• 1 copy of “Later School Start Times and Zzz’s to A’s” per student, found as U3_L7_Homework_LaterSchoolStartTimesandZzzsToA’s.pdf

Preparation:
• Make copies of “Later School Start Times and Zzz’s to A’s”

Activity 1: Preparing your argument

Materials:
• Internet access or access to printed research materials
• Student Investigation Sheet, found as U3_L8_StudentSheet_PuttingItAllTogether.docx
• Poster paper
• Colored markers

Preparation:
• Check and make certain the following links work:
  o http://www.mayoclinic.com/health/teens-health/CC00019
  o http://www.sciencedaily.com/releases/2008/06/080609071202.htm
  o http://www.sciencedaily.com/releases/2010/07/100705190532.htm
  o http://www.sleepfoundation.org/article/sleep-topics/teens-and-sleep
  o http://www.washingtonpost.com/wp-dyn/content/article/2006/01/09/AR2006010901561_2.html
  o http://www.sleepfoundation.org/article/hot-topics/eight-major-obstacles-delaying-school-start-times

• If Internet access is not possible, print out the above resources to be used as a set of “Research Files” for each presentation group. Similarly, the primary research articles found in Section VI,
Resources and References, as Supplement readings can be used as students’ research resources in place of Internet.

Activity 2: Defending your argument (Class Discussion/Debate)

Materials:
- Completed Student Investigation Sheet from Activity 1, U3_L8_StudentSheet_PuttingItAllTogether.docx

Preparation:
- Arrange the room to allow for easy movement between group tables

Activity 3: Reporting what you’ve learned

Materials:
- Tri-fold Poster Board
- Computer with printer

Preparation:
- Arrange for a school administrator to observe the presentations

Homework and Assessments
- Student Investigation Sheet, U3_L8_StudentSheet_PuttingItAllTogether.docx
- The final presentation is the summative assessment for this lesson.

VII. Resources and References
The following are primary research articles that can help the students defend their argument and/or act as a teacher resource:

- Adolescent Sleep Patterns, Circadian Timing, and Sleepiness at a Transition to Early School Days
- Adolescent Sleep, School Start Times, and Teen Motor Vehicle Crashes
- Sleep, Sleepiness, and School Start Times, A Preliminary Study,
- The Impact of School Daily Schedule on Adolescent Sleep,
- Changing Times: Findings from the first longitudinal study on later high school start times
VIII. Lesson Implementation:

Opening of Lesson:
Use the questions students answered when reading the article from The L.A. Times called “Later School Start Times and Zzz’s to A’s” (U3_L7_Homework_LaterSchoolStartTimesandZzzsToA’s.pdf) as homework to focus the opening discussion on making connections between the article and their own lives.

The following questions can be used to help guide the discussion:

- What was your general impression of the article?
- What did the article say about adolescent circadian rhythms?
- How do circadian rhythms in teenagers differ from circadian rhythms in adults?
- Do your experiences as a teenager coincide with the description of teenage circadian rhythms from the article?
- How does the sleepiness scale data collected in class compare to data represented in the article as it relates to circadian rhythms?
  - According to the sleepiness scale data, when were students in our class most sleepy?
- Do you believe the current school schedule takes into account the information provided in this article? Why or why not?
- This article recommends high schools starting later.
  - What are advantages to doing this?
  - What are disadvantages to doing this?

After discussing the article, introduce to the class the activities that will be done during this lesson. Notify the students that they will be working in groups for the next couple of days to prepare a practical argument to answer the driving question “When should the school day begin?” with the intent of presenting their findings to a school administrator.

Main Part of Lesson

Activity 1: Preparing your argument
Split the class into groups of about 4 students each. Each group will use information learned through out the unit (including their sleepiness scale data, the NetLogo fruit fly experiment), and information from both popular media and scientific journal articles to research answers to the driving question of the lesson: When should the school day begin?

Additionally, students should consider practical reasons for either changing or not changing the start time of the school day. Consideration should be given, but not limited to:

- Extracurricular activities
- Bus schedules
- Daylight hours
- Start times of schools within the district, city, and athletic conference
• Student employment afterschool

Tell students that they will create a poster that will aid them in sharing their findings with the class. Stress the importance of using both text and visual representations of data while students are preparing their presentations. Posters should at least include:

• The lesson driving question
• The recommended school start time (The claim)
• Summary of support for the proposed start time (the evidence)
• Identification of problems with changing the time, and proposed solutions
• Graphic representation of data (graph, table, etc.)
• Reasoning as to why this time is the “right” time to start (This would be the connection to the science, as well as the practical constraints that the school might need to address.

**Activity 2: Defending you argument**
Each group will present their posters in a format similar to a science conference.

• Situate the groups around the room with their posters
• Have each group assign one or two group members to remain with the poster
• The remaining group members will circulate throughout the room, looking at other posters.
• Encourage the circulating students to read the other posters, ask questions, and take notes
• After a 5-10 minutes, have the group member/s with the poster switch with the circulating group members

After the students have had sufficient time to circulate to each of the posters, return them to their seats and open-up a class discussion about what they saw during the conference.

During the discussion try to encourage a point/counterpoint format when students argue information presented by other groups. Students may feel uncomfortable with the term “argument” but explain to them, that scientists construct “arguments” to bolster their claims about a certain topic. Their arguments not only relate the evidence they have found to support their claim, but also refute other classmate’s claims in a respectful, professional manner.

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**Scientific Practices: Engaging in Argument from Evidence**

Scientists often engage in argumentation to improve upon and gather more support for a particular idea. Similarly, students engage in argumentation to identify weaknesses and limitations in a peer’s claim, evidence, and reasoning, to effectively improve their peer’s claim. This is a critical skill for students to develop: discussing their ideas openly, in a professional manner, and detecting an inaccurate claim based on the available evidence and reasoning.
Discussion questions could include:

- What poster interested you most? Why?
- What were some ideas presented by other groups that were different than your group’s ideas?
- What did you learn from the other posters?
- Did any of the other group’s poster change your mind about the start time your group decided on? Why?
- Are there any group’s posters that you disagree with? Why?
  - Allow the other groups to defend their posters

**Activity 3: Reporting what you’ve learned**

Students should use what they learned during the conference and discussion/debate to revise their argument in preparation to present it to a school administrator.

After revising their argument, students will prepare a presentation preferably in the form of a slide-show presentation or video presentation. The presentation could also be done with the aid of a trifold poster.

Have students give their presentations to a school administrator. The school administrator could serve as a judge, providing critique to each group of presenters, or merely as an attentive listener. Presentations should be short enough to allow for each group to present. Presentations will be graded, and the main assessment item for the lesson.

When the school administrator arrives to the classroom, introduce him/her to the class. Then, allow the students to take turns presenting their recommendations to the administrator. The school administrator can share his/her critique and comments with the class, and hopefully notify the students that their presentations will be considered.

**Conclusion of Lesson**

After students give their recommendations, ask the following questions:

- What aspects of the circadian rhythm unit did you find the most informative?
- Which aspects of the unit did you find most challenging? Most easy to grasp?
- If a friend or family member were having issues sleeping and/or staying awake, what would you tell him/her? How would you help him/her with the circadian disruption?

After a class discussion, or in place of a discussion, these questions can be answered on a separate “exit slip” to be used as an end of unit evaluation on students’ overall

**Assessment**

A variety of informal assessments occur throughout the lesson, with classroom discussions on the reading as well as during Activity 2 and lesson conclusion. The written explanations/arguments students create in Activity 1 and revise in Activity 2 to present in Activity 3 could all be used as assessments. The
final presentation to a school administrator is a formal summative assessment item created during this lesson. Finally, the optional “exit slip” questions in the Conclusion can be used as a quick assessment of what students gained from the unit.