5E Integrated STEM Lesson Plan- Template

Lesson Title: The Incredibly Amazing Wonderfully Fantastic Heart

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Topic: The heart as a pump
The heart and its reaction to exercise
The heart and its reaction to space and excitement
How does the heart work?
What is the heart made of?
How do we hear and measure heartrate/ heartbeat?

Targeted grade level: PRE K

Time Needed: 4-6 lessons

Subject Integration: Science- inquiring into something that occurs in the natural world (ie. the Heart)

Technology- Class is to make simple stethoscopes
Borrowed digital stethoscope where can see heartbeats on computer screen
Borrowed regular stethoscope
NASA film- authentic data gathered from APOLLO 11 Space Mission demonstrating cardiac reaction to first space Walk

Engineering- utilized to solve a problem- how to hear our heartbeats
Plan to construct a rudimentary stethoscope with aquarium tubing, PVC pipe 90 degree elbows, duct tape

Math- counting beats, comparing at rest and then after a short run, collecting real data for comparison and utilizing rubrics cubes to construct simple bar grafts for visualization of results

Physical Education- running- gross motor activity

Music- clapping the heartbeats, counting, rhythm

Social Science- history of APOLLO 11

Literacy- story time with age appropriate books

Drama and pretend- children can have the opportunity to dress up as scientists, cardiologists and astronauts and act out their roles in the activity
-this can help the children integrate the material

Justification: Children of this age are learning about the body and how to take care of it (brushing teeth, exercise, eating good food, etc.) Learning about the heart and how it functions supports this.

Integration of the above subjects helps foster relevance and meaning. As well, if more subject areas are integrated, there is a higher probability of "hooking" different students, depending on their interests and learning styles. It makes the subject matter more inclusive and levels the playing field so that all the children can relate to the subject matter in their own way. In this manner, the goal is to have the activity have meaning and value for everyone and promote excitement.

Standards: There are no NGSS or Common Core standards for the preschool age group as most states do not offer preschool as an option in the public- school system. However, I have found that West Virginia does now offer a four- year old program in the public schools and has devised standards addressing Pre-K. These standards have become effective as of July 1, 2019. Interestingly, there are standards set for initiative and curiosity, social and emotional development, English language arts, mathematics, science, health and physical development and the arts. However, none have been established for engineering and technology. I find this a serious omission that should be addressed, particularly since children of this age are "natural" engineers and love to build. As well, they are inherently curious about technology and how things work, from something as simple as a screwdriver to something more complicated as a cell phone or computer. I do find though that these standards are very important in that they are developmentally appropriate to the age group. They are not standards for older children that are simply being applied to the preschoolers.

NGSS Performance Expectation:

Science and Engineering Practices- 1 Asking questions- How does the heart work?
2 Defining problems- What can we do to hear the heart?
3 Developing and using models- making a stethoscope
4 Planning and carrying out investigations- heartrate at rest vs. after a run
5 Analyzing and interpreting data- resting vs. exercise

heartrates
astronaut's changing
heartrates- what happens

6 Using mathematical and computational thinking-
counting and comparing

Disciplinary Core Ideas- LS1 Life Sciences- From molecules to organisms: Structures and Processes- the heart, introduction into the circulatory System

ETS 1 and 2- Engineering, Technology and the Applications of Science- Engineering design- construct a stethoscope to solve the problem of How we hear heart beats

Links among engineering, technology, science and society

Crosscutting Concepts- 1 Patterns- heartbeats and their sounds- lub dub

2 Cause and Effect- resting heartrate vs. after exercise vs. when excited or nervous (Neil Armstrong on the moon)

Measurable Student Learning Objectives: Students will be able to understand how the heart works in a very elementary way and understand how the heart beats when at rest vs. after Exercise vs. excited
Webb's Depth of Knowledge will be applied in final essay

Nature of Stem: Science- investigating and asking questions about something that occurs in the natural world (one's body) to learn more about how it functions

Technology- utilizing a real stethoscope as well as a student made one

Engineering- design and build a simple stethoscope that works

Math- measuring and comparing heartrates at rest and after running and comparing this data with that of the astronaut sleeping and walking on the moon
The data can be bar graphed using unifix blocks so the children can Observe and compare easily

Engaging Context /Phenomena: The hook that I would use would be to have the children listen to Neil Armstrong's heart beating on his Apollo 11 mission. The children could guess what they think the sound is in a brainstorming session. Most children are fascinated by anything to do with space and astronauts.

Data Integration: raw data being collected by the students as well as auditory and visual data from the Apollo 11 mission. This allows the data to be concrete rather than

abstract which aligns with young children's cognitive processes. Comparisons are made of heartrates at rest vs. activity or excitement

Differentiation of Instruction: I am attempting to integrate many modes of instruction to reach all students- auditory, visual, kinesthetic/ tactile (the building and usage of the stethoscope), running
Simplifying any of the components of the lesson can also help by breaking down the activity to smaller parts

Real-life Connection: the heart and how it functions

Possible Misconceptions: the shape of the heart- I think most children will be shocked to learn That the heart is a muscle the size and shape of a fist and not shaped like a valentine

Lesson Procedure 5E Model

Engage: Anchoring Phenomenon- Listening to Neil Armstrong's heartbeat on Apollo11 and not telling them what it is they are listening to. This will facilitate student discussion

Objectives- Procedure- Asking the students to guess what it is they are hearing- brainstorming
Meets the criteria of an observable event in the real world
The phenomenon of the heartbeat becomes the center of

investigation.
Read about the heart in age appropriate books
Watch videos about the heart
Observe and touch a model of the heart

Modifications- By utilizing more than one medium, ie. auditory, visual, kinesthetic, etc. all students will be theoretically engaged

Standards Addressed- based on West Virginia Pre-K Standards (Ages 3-5) Resource Booklet for Universal Pre-K, July,2019:

1- Initiative and Curiosity-
AL.PK.5- inquire and investigate- What is the sound you are hearing?

2- Cooperation-
AL. PK.11- Initiate and engage in learning experiences and play with peers

3- Literacy Early Learning Foundations-
ELA.PK.15- With prompting and support, describe the relationship

between illustrations and the informal text in which they appear (e.g. what person, place, thing or idea in the text an illustration depicts)- pictures of the heart in the books as well as the videos

4- Science as Inquiry-
SC.PK.4- Make predictions and brainstorm solutions- What is that sound you are hearing?

Assessment- through observation and listening to answers

Webb's Depth of Knowledge-
Level 1- Recall elements and details of a story – the books read
- Describe the features of a place or people- the NASA tapes

Level 2- Identify and summarize the major events in a narrative- talk about the books and the videos
Describe the cause/effect of a particular event- What happened to Neil Armstrong's heartbeat when he was excited?

Resources- Grubb, Shaffer and Khan, Amina. (2019, July,17). The Apollo 11 Mission as Measured by Heartbeats [video]
La Times. http://latimes.com/projects/la-sci-apollo-11-mission-as measured-by-heartbeats/
AMA Heart. http://www.heart.org/idc/groups/heart-public/ @wcm@global/documents/downloadable/ucm_313198.pdf

American Heart Association. Kids Heart Challenge Facts. [You Tube Channel] YouTube. Retrieved November 18, 2020, from http://www.youtube.com/watch?v=2PFWpd_pxm8

KSPS Public TV. Fit Kids 7 healthy Heart. [You Tube Channel] YouTube. Retrieved November !8, 2020 from http://www.youtube.com/watch?v=9WBbE5EJj0

Lacey, Minna. (2020). The Usborne Big Book of the Body. Usborne Publishing Ltd. London.

Showers, Paul. (2001). Hear Your Heart. Perfection Learning. Logan, IA.

Webb, Norman L. (2006, February,2). Web Alignment Tool. Wisconsin Center for Educational Research. University of Wisconsin- Madison. http://www.wcer.wisc.edu./WAT/index.aspx>

West Virginia Pre-K Standards (Ages 3-5). Resource Booklet for Universal Pre-K. (2019). West Virginia Board of Education. http://wved.us/wpcontent/uploads/2019/05/PKStandardsBooklet UPLOADS-FINAL-MAY-2019.pdf

Explore: Using a real stethoscope as well as building their own will engage students in hands-on activities that are designed to facilitate conceptual change

Procedure- exploring heartrate at rest and after a short run

Modifications- helpers needed- Volunteer parents or older students in the upper grades would be fabulous so that the class can be ideally divided into pairs to make and try their stethoscopes. It is also a great way to engage parents in the learning process so that they can support the learning and continue engagement at home.

Standards Addressed-

1- Initiative and Curiosity-
AL.PK.5- Inquire and investigate

2- Persistence and Attentiveness-

AL.PK.5- Persist in completing tasks, activities, projects and experiences- Constructing the stethoscope
AL.PK.8- Engage in project or activity over an extended period of time
AK.PK.11- Initiate and engage in learning experiences and play with peers- working in pairs as well as everyone running together

3- Social Relationships-
SE.PK.7- Develop positive relationships with children and adults
SE.PK.9- Follow basic rules and routines
SE.PK.10- Use materials purposefully, safely and responsibly

4- Cooperation-
SE.PK.15- Take turns with materials and during experiences
SE.PK.17- Accept guidance and direction from a variety of familiar adults
SE.PK.18- Participate in a variety of classroom activities and tasks- both in the construction of the stethoscope and running activities

5- Science as Inquiry-
SC.PK.1- Ask questions that can be answered through active investigation
SC.PK.3- investigate cause and effect relationships through exploration- What happens to your heartrate when you run?
SC.PK.6- Explore observational tools (eg. magnifying glass , stethoscope) to extend the five senses
SC.PK.7- Engage in scientific talk by utilizing words (e.g. observe, compare, contrast, measure, etc.

6- Health Practices-
PH.PK.7- Participate in structured and unstructured physical activities in order to enhance fitness- running

7- Gross Motor-
PH.PK.10- Develop motor control for a range of physical activities

8- Fine Motor-
PH.PK.15- Demonstrate increased ability, strength, dexterity, and control to manipulate and use tools(e.g. scissors, staplers,,etc.) – This is an area where engineering is being used to solve a problem (How to we make the stethoscope? and simple technology solves the problem)

9- Mathematics-
Counting and Cardinality-
M.PK.4- understanding the relationship between numbers and quantities- when counting and comparing heartrates
Comparing and ordering numbers-

M.PK.6- Identify whether the number of objects in one group is more, less, greater Than, fewer, and or equal to number of objects in another group

9- Music-
AR.PK.2- Create music through a variety of techniques and tools- Clapping the heartbeats

Assessment- Through observation, participation and completion of the tasks

DOK-
Level 1-Conduct basic mathematical calculations
Level 2- Describe the cause/effect of a particular event- running on heartrate

Resources- Left Brain Craft Brain.(2017, January 19). Awesome DIY Stethoscope for Kids. http://leftbraincraftbrain.com/diy.

Webb, Norman L. (2006, February, 2). Web Alignment Tool. Wisconsin Center of Educational Research. University of Wisconsin-Madison http://www.wcer.wisc.edu/WAT/index.aspx>

West Virginia Pre-K Standards (Ages 3-5). Resource Booklet for Universal Pre-K. (2019). West Virginia Board of Education. http://wved.us/wpcontent/uploads/2019/05/PKStandardsBooklet UPDATE-FINAL-MAY-2019.pdf

Explain: Facilitate opportunities for students to explain their understanding of concepts and processes and make sense of new concepts though discussion and circle time

Procedure- Once the activity above is done, we can look at the data and have the kids hopefully figure out that the heart beats faster during activity than at rest. We can then compare what happened to Neil Armstrong's heart at rest and when he walked on the moon.

Modifications- If any children have trouble counting, counters can be used or hashmarks can be drawn on a paper and then compared
As well, in the Apollo 11 video, one can hear the pace changes in the heart and see it as well. There is a beating heart in the corner of the screen for anyone who might need audio or visual cues.

Standards Addressed-

1- Cooperation-
AL.PK.12- Relate and share knowledge with peers- through discussion of results and data collected

2- Social Relationships-
SE.PK.16- Use and accept negotiation, compromise and discussion to resolve conflicts – when discussing results

3- Speaking and listening-
ELA.PK.30- With prompting and support, participate in collaborative conversations about pre-k topics and texts with peers and adults through multiple exchanges

4- Science as Inquiry-
SC.PK.7 Engage in scientific talk by utilizing words (e.g. observe, comparing pare, measure, etc.)
SC.PK.8- Communicate results, solutions and conclusions through a variety of methods (e.g. verbal or visual presentation)

5- Science as Knowledge-
SC.PK.10- Explore and describe changes in materials and relationships (e.g. cause/ effect, etc) – Comparing resting and running heartrates

6-Mathematics-
Comparing and ordering numbers-
M.PK.6- Identify whether the number of objects in one group is more, less, greater Than ,fewer or equal to number of objects in another group
Measurement and Data-
M.PK.15- Represent and interpret data

Assessment- Through verbal participation

DOK-
Level 1- Conduct basic mathematical calculations
Level 2- Describe cause/effect of a particular event
Organize ,represent and interpret data

Resources- Grubb, Shaffer and Khan, Amina.(2019, July,17). The Apollo 11 Mission as

Measured by Heartbeats.[video]. LA Times. http://latimes.com/projects/la-sci-apollo-11-mission-as-measured-by-heartbeats/

Webb, Norman L. (2006, February 2) Web Alignment Tool. Wisconsin Center of Educational Research. University of Wisconsin-Madison. http://www.wcer.wisc.edu/WAT/Index.aspx>

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Elaborate: Provide applications of concepts and opportunities to challenge and deep ideas: build on or extend understanding and skills

Procedure- During this phase, the teacher can lead an open discussion and review with the children what they have learned. This can help with reinforcement of the important concepts that have been covered, as well as, lead to elaboration of the subject through new activities that the children might be interested in. For example- Is it good for the heart to exercise? What else can we do to keep our hearts healthy? What about a puppy's heart? Does it work the same? Do astronauts exercise in space?, etc. The children can then choose what they would like to explore next that can build on what they have just learned.

Modifications- Some children might prefer to draw about what they have learned or perhaps build a heart out of playdough. Others might want to pretend and dress up as an astronaut, or scientist or doctor.

Standards Addressed-
1.Initiative and Curiosity

AL.PK.4- Originate and combine ideas to learn and discuss a range of topics

2-Coperation
AL.PK.12- Relate and share knowledge with peers

3- Social Relationships-
SE.PK.7- Develop positive relationships with children and adults
SE.PK.18- Participate in a variety of classroom activities and tasks

4-Speaking and Listening-
ELA.PK.30- With prompting and support, participate in collaborative conversations About pre-k topics and texts with peers and adults through multiple exchanges
ELA.PK.31- With prompting and support, confirm understanding of a text read aloud or information presented orally or through other media by answering questions about details

5-Science as Inquiry-
SC.PK. 7- Engage in scientific talk by utilizing words (observe, compare, contrast, measure, etc.)
SC.PK.8- Communicate results, solutions, and conclusions through a variety of Methods

6- Mathematics-
M.PK.15- Represent and interpret data

7- Visual Arts-
AR.PK.8- Communicate ideas, experiences and knowledge through creative artwork
AR.PK.10-Describe one's own artwork

8- Dramatic Play-
AR.PK.12- Participate in a variety of pretend play to explore various roles

Assessment- Through any of the mediums the children use to explain what they have learned

DOK-
Level 2- Identify and summarize the major events in a narrative
Level 4- Analyze and synthesize information from multiple sources

Resources- Webb, Norman L. (2006, February 2). Web Alignment Tool. Wisconsin Center of Educational Research. University of Wisconsin-Madison. http://www.wcer.wisc.edu/WAT/index.aspx>

West Virginia Pre-K Standards(Ages 3-5). Resource Booklet for

Universal Pre-K. (2019). West Virginia Board of Education. http://wvde.us/wpcontent/uploads/2019/05/PKStandardsBooklet UPDATE-FINAL-MAY-2019.pdf

Evaluate: Assess student knowledge, skills and abilities

Procedure- It appears that based on the National Association for the Education Of Young Children and the National Association of Early Childhood Specialists in State Departments of Education, most evaluation of this age group is evidence based through observation and other documentation. In this particular activity one could utilize multiple mediums to gather the data necessary such as: discussion participation, drawings, models made, etc., to assess whether the objectives have been met and the children have learned the material.

Modifications- Adaptations to meet student needs as necessary would be made, particularly if a student is on an I.E.P. (individual educational program The more mediums used as stated above, the more diverse learners will be reached and the more relevant will be the data collected for assessment.

Standards Addressed- As previously discussed in the other sections above of the 5E Integrated STEM lesson plan

Assessment- As stated above as stated by the NAEYC

Resources-National Association for the Education of Young Children (2003). Early Childhood Curriculum, Assessment, and Program Evaluation Http://www.naeyc.org/sites/default/files/globally-shared/ Downloads/PDFs/resources/position-statements/CAPEexpand.pdf

Teacher Background- The teacher would need a basic knowledge of the heart and circulatory system

Resources- WebMD.(n.d.) How the Heart Works& Pumps Blood Through the Human Body http://www.webmd.com/heart-disease/guide/how-heart-work

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