Lesson Plan (LP)	**Author:** Hannah McTier

Course: Basic Agricultural Science (02.47100)
LP Title: The Needs of Squash Seeds
Estimated Time: 45 minutes (will need to be revisited shortly for approximately 7 to 10 days)
Grade Level: 9th – 12th Grade

Materials, Supplies, Equipment, References, and Other Resources:
Materials: enough summer squash seed (yellow squash, zucchini, patty pan) for every student to have 2 seeds, class set of plastic sandwich bags and cotton balls, tape, permanent marker, window that gets sunlight, class set of seed germination observation charts, access to water, whiteboard with dry erase markers References: https://www.georgiaffa.org/curriculum2/topic.aspx?ID=6&TID=4
Standards:
AFNR-BAS-13 Explain and demonstrate basic plant science principles including plant health, growth and reproduction. **13.10** Demonstrate scarification, stratification, and planting seeds. **13.11** Outline germination steps and list conditions under which germination occurs.
Essential Questions/Objectives:
The student will be able to… 1. Demonstrate scarification, stratification, and planting of squash seeds by participating in a seed germination activity. 2. Outline germination steps and list conditions under which germination occurs by observing the germination of a squash seed over time.

Accommodations
For students with disabilities, the instructor should refer to the individual student's IEP to insure the accommodations specified in the IEP are being provided within the classroom setting. Instructors should familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation within any given instructional activity or requirement.

Interest Approach	**Estimated Time:** 5 minutes
Explain to the students that class today will be spent trying to determine what squash seeds truly need or like to have in order to sprout or germinate. Show students the following video of seeds germinating: https://www.youtube.com/watch?v=ECibetK2EYI (1:20). Once the video has ended, explain the process the students witnessed over and over again in the video was called germination, the process where a seed becomes a seedling. Then explain how everyone will get the chance to see this process in real life over the next week in class!	

Learning Activity 1	**Estimated Time:** 30 minutes
Instructor Directions/Materials/ Teaching Procedure	**Brief Content Outline**
Seed Germination Observations Acquire all materials Pass out materials Give instructions Walk around to answer questions Offer advice on various types of growing environments students could choose Remind everyone to fill in their germination observation chart Return to the lesson for a brief time over the next 7 to 10 school days to allow students to finish making observations in their chart	Pass out a plastic sandwich bag (serving as container), cotton ball (serving as soil), and two seeds of the same variety to each student. Pass the permanent markers around and instruct each student to write their name on the bag as well as the type of seed they were given. Try to have at least 3 kinds of summer squash seed (yellow squash, zucchini, patty pan). Tell the students to separate into groups based on the type of seed they were given. Each group will pick one person to be the control. The control person should write the word control on their bag. This person will dampen their cotton ball with water, place it inside the plastic bag, place the two seeds inside the bag up against the cotton ball, close the bag, and tape it to a class window that receives sunlight. The remainder of the group is encouraged to do something similar, but unique. For example, one person could dampen their cotton ball with dish soap instead while still following all of the other steps the control did or another could smash or scratch their seed, a method called scarification. After each person has decided on the type of growing environment they want to introduce their squash seed to, have them execute this, write a summary of this on their bag for easy identification later on, and tape their bags to the window. Everyone in the class should create a chart based on the decisions each individual student makes. The chart should list the various types of squash seed being used and then the types of environments they were placed in. As time passes, all students in the class will be responsible for making observations of the germination process the seeds go through.

For this extension, you will need space and/or containers to plant in, as well as, permission if planting on school grounds.	It will take, at most, 10 days for the seeds to germinate, although some will not due to imperfections in the seed/the chosen planting environment. Because of this, water, soap, etc. may need to be added over time due to evaporation and absorption by the seeds. *Once the seeds that are going to germinate do germinate, find a place outside where you can plant the new seedlings. The space could be in pots, it could be in the ground, or it could be in raised beds. Remember, do not separate the cotton ball from the root system because it will traumatize the plant – the cotton will eventually break down into the soil anyways after planting. Be sure to label what each plant is as you plant it so you can tell the difference between your varying species of squash. Depending on the number of survivors from your germination activity, the observation chart could be extended or expanded on to continue to make observations of any differences between the plants. For example, maybe the seed planted in soap did survive, but its' seedling is growing much more slowly than the control.

Summary (Reflection)	**Estimated Time:** 10 minutes
The class should work to create a list stating the main requirements of the seeds to germinate. Examples should include light, water, air, and nutrients. Then create several hypotheses surrounding the various types of environments they choose to plant their seeds in. For example, we hypothesize the control seeds will sprout into a healthy seedling because it was given everything it needed to grow. Have the students write these hypotheses down on the backs of their seed germination observation chart and revisit them once the seeds have had enough time to germinate.	

Assessment
Formative: Every student will be tasked with creating an environment for their seed to grow in. Creation of this environment is a formative assessment to ensure they are on task and participating.
Summative: N/A

Example Seed Germination Observation Chart

Germination is the process by which an embryo or seed changes into a seedling or growing plant. For germination to occur the following are necessary:

- Moisture
- Correct Temperature
- Air
- Some seeds need light, some don't
- Some seeds need help by way of scarification, but some don't

Germination Steps to look for and check off or date once seen:

1. Seed absorbs liquid and swells.
2. Water activates enzymes which help digest stored food and becomes energy.
3. Roots begin to grow.
4. Shoot emerges, eventually turning into stem and first leaves.

Yellow Crookneck		Zucchini		Patty Pan	
Control	1. 2. 3. 4.	Control	1. 2. 3. 4.	Control	1. 2. 3. 4.
Dish Soap	1. 2. 3. 4.		1. 2. 3. 4.		1. 2. 3. 4.
No water	1. 2. 3. 4.		1. 2. 3. 4.		1. 2. 3. 4.
Placed in Closet	1. 2. 3. 4.		1. 2. 3. 4.		1. 2. 3. 4.
Seed Scarred by Notching	1. 2. 3. 4.		1. 2. 3. 4.		1. 2. 3. 4.
Bag filled with water	1. 2. 3. 4.		1. 2. 3. 4.		1. 2. 3. 4.