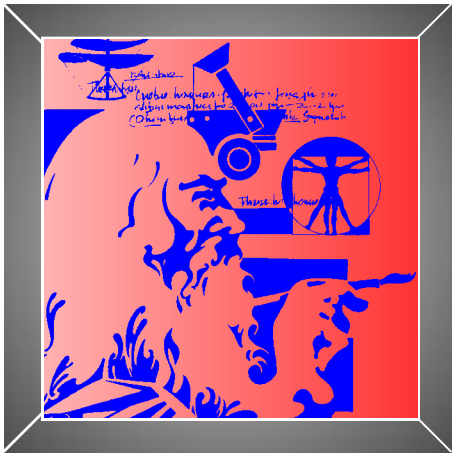


Mathematics, Science & Technology

PART II.1

Seedlings

NOTE: This document is a work in progress. Parts II and III, in particular, are in need of further development, and we invite the submission of additional learning experiences and local performance tasks for these sections. Inquiries regarding submission of materials should be directed to: The Mathematics, Science, and Technology Resource

NEW YORK
THE STATE OF LEARNING

http://www.nysed.gov

INTERMEDIATE

SEEDLINGS

Standards & Performance Indicators

MST 1
- ▲ formulate questions
- ▲ construct explanations
- ▲ make further observations
- ▲ interpret organized data
- ▲ modify understanding

MST 4
- ▲ variation in organisms
- ▲ species competition
- ▲ developmental patterns
- ▲ living/nonliving environment

MST 6
- ▲ determine best decision
- ▲ decision making graphs

MST 7
- ▲ work effectively
- ▲ gather/process information
- ▲ generate/analyze ideas
- ▲ present results

A suggestion for how the assignment can better meet the needs of ALL learners is to provide a practice session of categorizing seeds according to their method of seed dispersal as a pre-activity to the learning experience.

Teacher

Seedling A: Seed Bingo

Joyce G. Valenti
Windham-Ashland-Jewett Central
School
P.O. Box 429
Main Street
Windham, NY 12496
(518) 734-3400 (518) 734-6050 FAX

Grade 7

Students collect and classify seeds on the basis of five methods for seed dispersal. These methods include:

1) wind carried
2) floats
3) pops out or shoots out
4) catches on animal fur
5) attracts an organism

This learning experience emphasizes the skills of observation and classification and the ability to compare and contrast.

Through the observations of seed structures and methods of seed dispersal, students will construct knowledge on:

- adaptive advantages for seed dispersal to distribute seeds away from the parent plant
- adaptive advantages to intermittent dispersal of seeds as opposed to dispersing seeds all at once
- the beneficial impact of humans and animals on seed dispersal
- the close relationship between structure of seed and its function for seed dispersal

Students are divided into small groups to examine real seeds brought in by teacher. Individual students should also view pictures and illustrations from reference materials provided by the teacher. Student groups should focus on the various seed examples in terms of structure and how the structure fits the means of seed dispersal method. After the observation activity, a teacher-directed class discussion will focus on the similarities and differences among the seeds. Emphasis will be placed on how the structure of the seeds helps to determine the method of seed dispersal. At the end of the class discussion, the seed dispersal field study assignment, *Seed Bingo* will be introduced to the class. Acopy of the *Seed Bingo* template will be distributed to each student. The assignment requires each student to reach "bingo" either horizontally, vertically, or diagonally. Aminimum of ten seeds are to be used. Extra credit will be awarded for more than ten seeds. "Jackpot" occurs when the entire card is filled with seeds. This encourages students to reach for higher expectations of the assignment.

Note: It is an excellent opportunity for inclusion of gifted and talented students to extend the assignment to the "Jackpot level."

Under teacher discretion, you may assign all students to reach "Jackpot Level" for a more vigorous and challenging activity. Rubrics would have to be modified.

Students must design their own display for the *Seed Bingo*. The seeds may be glued or taped on poster board, wood, Styrofoam, cardboard, etc. If the seeds need more reinforcement, Saran wrap may be used to enclose the seeds before gluing or taping down to the display.

The four supplementary questions to the assignment are reviewed. Students are informed that these questions may be answered in the regular "question-answer format" or answers may be incorporated in an essay form. Academically challenged students may tape record answers.

The collecting, organizing, classifying, construction of the *Seed Bingo* display, and prepa-

SEED BINGO RUBRICS

Seed Bingo Display

1. Appearance of Display	
-overall neatness and quality of presentation	4 pt
-headings clearly stand out	4 pt
2. Contains minimum of ten seeds (1 pt for each seed)	10 pt
3. Accomplishes Seed Bingo	10 pt
4. Accuracy of Seed Bingo —-classifies seed to proper seed dispersal method (1 pt for each seed)	10 pt

Supplementary Questions

1. Format Selected _____ written answers
_____ written essay
_____ tape recording

—-communicates logically	2 pt
—-full development of ideas	2 pt
—-clear articulation/concise	2 pt
—-uses science-appropriate language	2 pt
—-few mechanical/communication errors	2 pt

2. Demonstrates a thorough understanding of the major biological concept asked

Question #1	3 pt
Question #2	3 pt
Question #3	3 pt
Question #4	3 pt

SEED BINGO TEMPLATE

	Seed Sample 1	Seed Sample 2	Seed Sample 3	Seed Sample 4	Seed Sample 5
Wind Carried					
Floats					
Pops Out or Shoots Out Free Space					
Catches on Animal Fur					
Attracts An Organism					

ration of written material are done at home by the students. Learning resource and basic academic teachers can assist students in school.

It is highly recommended that the students be allowed to decide on the nature of the display material and the format for answering the four supplementary questions. This will allow the accommodation for the range of abilities and meet the diverse learning styles of all students.

The Ifs . . .

- **If** students do not have access to the natural world due to living accommodations and environmental factors, the *Seed Bingo* may be accomplished by using seeds from store-bought foods, household and garden plants, and certain spices or flavorings.
- **If** Lyme disease is a consideration for your area and you wish to still use seeds from the natural world, then it is highly recommended for the teacher to gather many samples of seeds from non-Lyme disease areas or purchase seeds from a horticultural society.
- **If** weather is a limiting factor in your area, then you must schedule the learning experience to coincide with the best time for seed formation in your area.
- **If** the classroom has space limitations, then the teacher may distribute the material to be used for the mounting of the seeds. Suggestions are: 8" by 11" cardboard or construction paper, manila folders, or small gift boxes. **NOTE:** This is also an excellent opportunity for students to pursue a wood project in a technology class. Students could design and build their bingo boards.

ASSESSMENT

Students are assessed on the two final products:

- the *Seed Bingo* display
- the written or oral answers to the four supplementary questions.

The assessment is based on the rubrics attached.

Note (optional):

1) Students present *Seed Bingo* displays to peers and teachers during a two-minute informal oral presentations. Separate oral presentation rubrics may be included in the final assessment of the project. This action allows for two modes of communicating the knowledge constructed during the learning experience.
2) *Seed Bingo* displays are set-up for a school display in the library for all students to view. In our case all students in the K- 12 school have a chance to view the student works.

SEED BINGO
SUPPLEMENTARY QUESTIONS

1. What are some advantages of seeds getting away from the parent plant?

_____

_____

2. Why do plants not drop all their seeds at exactly the same time ?

_____

_____

3. What would happen if all seeds dropped together and fell in the same spot?

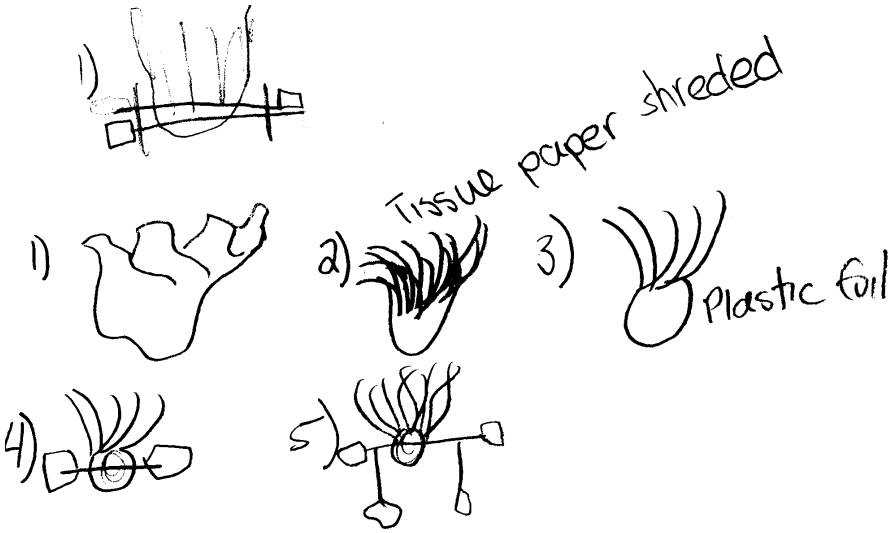
_____

_____

4. How might humans and animals help disperse seeds?

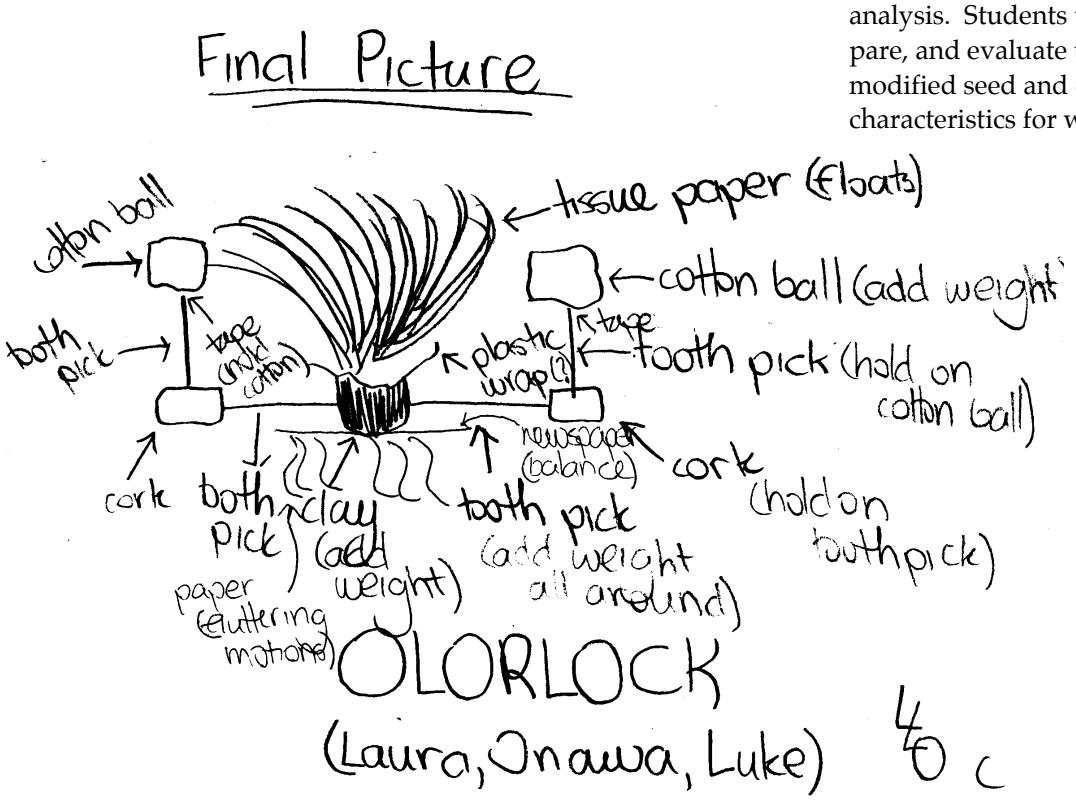
_____

_____



Seedling B: Seeds by Design

After examining samples of naturally-occurring wind-dispersed seeds, student will design, construct, and test student-designed "artificial wind-dispersed" seeds under a controlled environment. After analysis of data collected from trial runs, students will then assess and determine modifications for a "redesign" of their artificial seeds. Modified seeds will then be tested under the same controlled environment and data will be recorded for analysis. Students then interpret, compare, and evaluate the original to the modified seed and determine desirable characteristics for wind-dispersed seeds.



It is a learning experience that supports the creative spirit and curious nature of students.

Teacher

Through this learning experience, students will construct knowledge by being able to:

- identify desirable characteristics of wind-dispersed seeds and explore the different structures and how each plays a role in the flight of the seeds
- choose the "best" of these desirable characteristics and indicate how they enhance the distance dispersed
- discuss the concept of competition and natural selection in terms of wind-dispersed seeds.

DAY 1 Pre-activity of sample seed packet:

For the pre-activity of this learning experience, the teacher needs to have a sample of naturally-occurring wind-dispersed seeds. It is highly recommended that the teacher collects samples of seeds throughout the year and stores them for later retrieval. Examples of seeds include: dandelion, cottonwood, milkweed, maple tree, and grass seeds. Any park or woodland area will provide seeds as well as most backyards.

Sample seeds should be distributed to cooperative teams consisting of three students in each team. Each team should select students to serve in each of the following roles: the "facilitator" whose task is to keep the team members focused on each of the tasks; the "recorder" whose task is to record all observations, notes, final draft of design, and data collection; the "materials handler and timer" whose task is to keep track of materials used in the design and manage time to complete all phases of the task.

CIRBM Seed Dispersal Lab modified to adapt to the Life Science and High School Biology classes and emphasize the learning standards.

Each team should examine the seeds within the teacher-prepared packet of seeds. Students should be reminded to handle the seeds *gently*. Observations should be recorded in terms of the following: general shape; length, width, and depth of seed; mass of seed; surface area characteristics; description of any attachments; and other characteristics.

DAY 2 Trial test runs of sample seed packet:

Students will take part in the class activity of gathering data of wind-dispersed seeds from the seeds examined on **Day 1**. Data collected will be the drop time of the seeds and the time and distance traveled by the seeds when "artificial wind" is applied to them. During this teacher-directed activity, each team will take turns collecting data for the entire class on each seed type. All students should record the data collected on each seed type.

NOTE: The distance measured by how far the seeds travel will be the horizontal distance traveled from point of release to point of contact on the classroom floor. The parabolic distance is not used as a measurement in the learning experience as outlined. However, teachers may adapt the learning experience for this purpose.

Protocol 1:

1. Measure a distance of 2 meters above the classroom's floor. Mark this distance by placing tape on wall, hanging string from the ceiling, etc.
2. Hold seed at the measured distance. Using a stop watch, record the time it takes to reach the ground upon release.
3. Repeat 2 more times and calculate the average from all three timings. Record average in data chart.
4. Repeat procedures #1-3 by having each team alternate and come forward to perform steps on a new seed type.
5. After all seeds have been tested, a general class discussion should occur. Some possible questions to pose are:
    - Does the mass of a seed affect the time it takes to reach the ground?
    - How does the surface area affect the time it takes to reach the ground?
    - What factors might have contributed to the fastest seed time? Slowest seed time?
    - Is there any relationship to the data collected and how seeds are adapted for competition and natural selection in the natural environment?

I would like to acknowledge, Mr. Patrick Haines, a regional biology mentor, who inspired me with the topic of seed dispersal.

OBSERVATIONS OF NATURALLY-OCCURRING
WIND-DISPERSED SEEDS

	Seed Sample 1	Seed Sample 2	Seed Sample 3	Seed Sample 4	Seed Sample 5
general shape					
length (mm)					
width (mm)					
depth (mm)					
mass (g)					
surface area characteristics					
descriptions of attachments					
other characteristics					

Protocol 2:

1. Measure a distance of 2 meters above the ground. Place a fan on a support structure at this height. Depending on the power of the fan and the amount of wind you desire for this activity, you will have to determine the speed adjustment of the fan and whether more than one fan is needed. Whatever you determine suitable, make sure this "wind speed" stays consistent throughout the extent of the learning experience.
2. Turn fan(s) on. Each team will then alternate with one seed type and follow steps 3-6.
3. Release the seed at the 2 meter height above the floor. Record time the seed takes to reach the ground in the data chart. Determine the distance traveled by the falling seed by measuring the distance traveled from the "marked tape" on the floor to where the seed landed. Record distance traveled in the data chart.
4. Repeat 2 more times and calculate the average.
5. All members of class should record data from each of the team's trial runs.
6. After all seeds have been tested, a general class discussion should occur. Some possible questions to pose are:
    - Is there any relationship between the mass of a seed and the distance traveled from point of release?
    - How does the surface area affect the distance traveled from the point of release?
    - What factors might have contributed to the farthest distance traveled? Shortest distance traveled?
    - Is there any relationship between time traveled to distance traveled?
    - Is there any relationship to the data collected and how seeds are adapted for competition and natural selection in the natural environment?

Only the teacher should touch the fan(s) used. All students should be careful around any electrical devices.

Have students analyze and interpret data for conclusions to share with class. Format can either be written or discussed orally.

To address different student learning styles and heterogeneous groupings, individual students or cooperative teams can:

- construct spreadsheets on data collected from *Protocols 1* and *2*
- construct line-graphs:
  - √ drop time (seconds) from *Protocol 1* on the x-axis and the distance traveled (meters) from *Protocol 2* on the y-axis
  - √ drop time (seconds) from *Protocol 2* on the x-axis and the distance traveled (meters) from *Protocol 2* on the y-axis
- construct bar graphs:
  - √ seed type to drop time from *Protocol 1*
  - √ seed type to drop time from *Protocol 2*
  - √ seed type to distance traveled from *Protocol 2*.

DAY 3 AND 4 Student-designed "artificial wind-dispersed" seeds:

Students group into cooperative teams formed at beginning of the learning experience. *Teacher's discretion:* Teacher may wish to reassign individual task roles within cooperative teams to give students a chance to practice a new role. Each cooperative team is given a packet of human-made materials.

It is highly recommended that student teams be given *Seeds By Design* rubrics ahead of time. This will guide them through the design process and can allow for on-going evaluation of their product. *Teacher's discretion:* Teacher may want to give student teams "steps to procedure" in written form as an aid instead of relying on verbal directions.

Procedure:

1. Design the best possible "artificial wind-dispersed" seed using any of the materials provided to you in the packet. You do not have to use all the materials found in the packet, nor the entire amount of any specified material(s) chosen.
2. Each cooperative team must submit:
   - a graphic representation of the seed design with labeling of materials used
   - lab notes recording the materials used and the amount of materials used
   - reasons for using the designated materials for seed construction.
3. Each cooperative team builds the artificial seed for testing purposes.
4. Each cooperative team constructs a data chart for recording three trial runs of drop time (refer to *Protocol 1*) and three trial runs of distance time and distance traveled (refer to *Protocol 2*). Averages for both protocols are calculated.
5. Each cooperative team studies data collected and interprets results in relation to the "artificial seed design." Teams should indicate whether the trial runs support or refute the seed design and suggest ways to refine or redesign the experiment for further investigation.

NOTE: When all teams have constructed and tested seeds using *Protocol 1s and 2*, a "time-out" should occur where all groups can share: 1) first design of seed, 2) test results, and 3) conclusions and reflection.

DAY 5 and 6 The redesign of "artificial wind-dispersed" seeds:

1. Each cooperative group will now modify their "artificial seed." Some of the modifications may include: varying mass, varying surface area, varying shape. Anew packet of materials will be given to each team.
2. Each team must submit:
   - a new graphic representation of the seed design with labeling of materials used
   - lab notes recordings "modifications" made to original design in terms of type and amount material.
   - reasons for these "modifications" for the redesigned "artificial seeds."
3. Each cooperative team builds "artificial seeds" for testing purposes and constructs data chart for new trial runs on the redesigned seed.
4. Perform trial runs.
5. Data is recorded on each team's chart.
6. Feedback and suggestions are recorded on bottom of chart given by team members and peer team members.

POST-ACTIVITY

After all teams run trial tests, each cooperative team will write a conclusion from the data collected on the modifications of the redesigned seed. Emphasis should be placed on the performance level of this seed in comparison to that of the original design. Each individual member of the cooperative teams will reflect on the learning experience by writing comments on *Student Self-Evaluation Worksheet*.

MATERIALS

for the student

- sample packet of naturally-occurring wind-dispersed seeds
- packet of artificial materials suggestions:

1 small cork	6 small post-its (38 mm X 50 mm)
3 rubber bands	sheet of composition paper
sheet of newspaper	2 feathers
4 paper clips	piece of Saran wrap (12 cm X 12 cm)
2 cotton balls	3 sheets of Kimi wipes
1 ft. sewing thread	1 ft. fishing line
ball of clay	2 tags(1cm x 3cm) with string attached
1 piece of tissue paper	

- stopwatch
- metric ruler
- unlimited use of glue/masking tape/scotch tape

for the teacher:

- fan(s)

DROP TIME OF NATURALLY-OCCURRING WIND-DISPERSED SEEDS (in seconds)

	Trial 1	Trial 2	Trial 3	Average
Seed 1				
Seed 2				
Seed 3				
Seed 4				
Seed 5				

HORIZONTAL DISTANCE TRAVELED BY NATURALLY-OCCURRING WIND-DISPERSED SEEDS (in meters)

	Trial 1	Trial 2	Trial 3	Average
Seed 1				
Seed 2				
Seed 3				
Seed 4				
Seed 5				

TIME TAKEN FOR HORIZONTAL DISTANCE TRAVELED BY NATURALLY-OCCURRING WIND-DISPERSED SEEDS (in seconds)

	Trial 1	Trial 2	Trial 3	Average
Seed 1				
Seed 2				
Seed 3				
Seed 4				
Seed 5				

ASSESSMENT

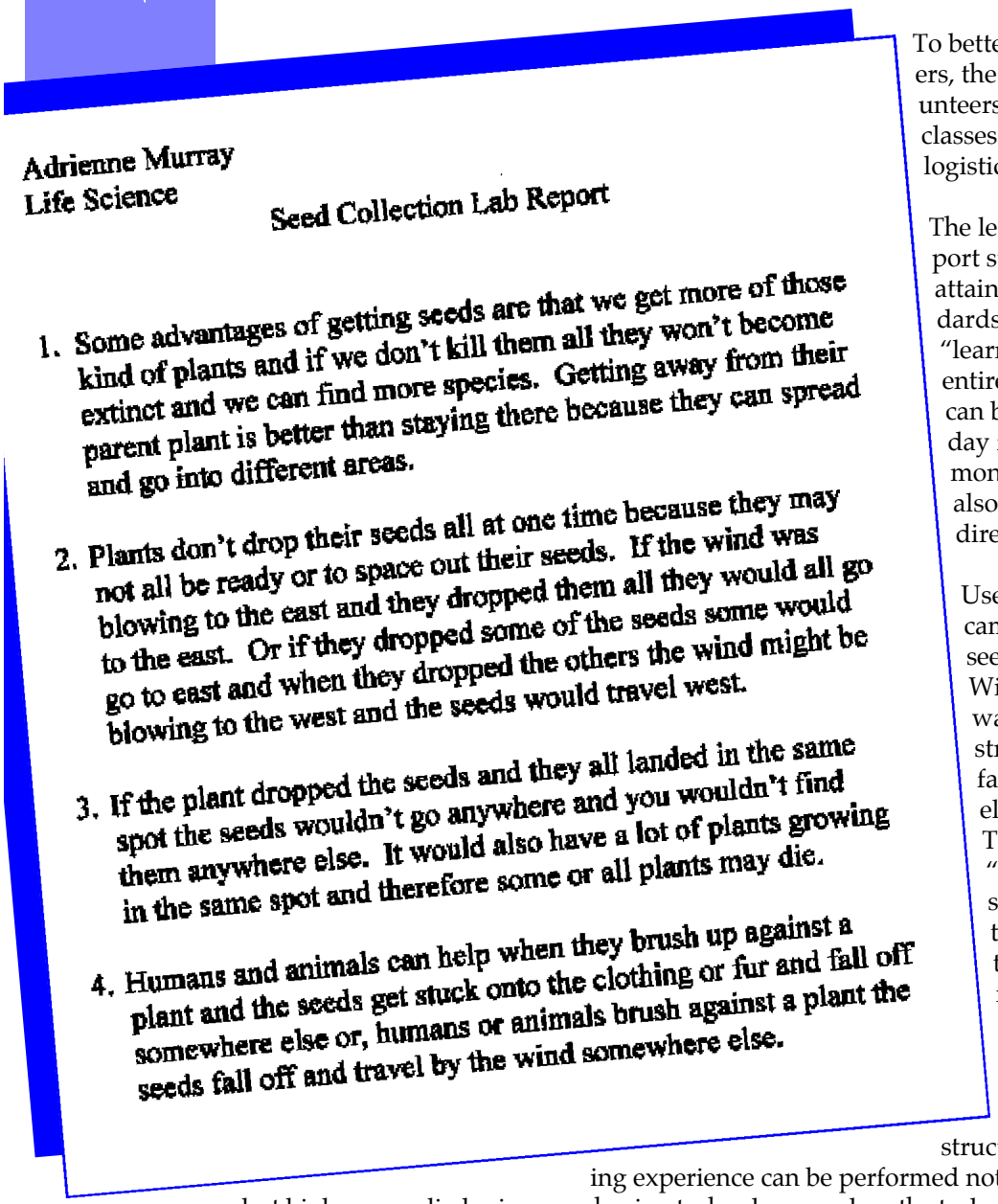
- Students are assessed for Pre-activity (**Day 1** and **2**) by *Class Participation Criteria Checklist*.
- If graphs are assigned, students are assessed by *Graphing Rubrics Checklist*.
- Students are assessed for student-designed "artificial wind-dispersed" seeds by *Seeds By Design* rubrics worksheet.
- Students are assessed as cooperative workers within the teams.
- Students are assessed for level of impact and meaning to them by the *Reflection-Self Evaluation Sheet*.

REFLECTION: *REFLECTION:*

REFLECTION

The learning experience can accommodate all learning styles and all academic levels. It also can provide gender equity. I found the girls were just as engaged as the boys in all aspects of the activity.

The learning experience is an excellent way to integrate math, science, and technology. I found that my seventh-graders and tenth graders thoroughly enjoyed the entire experience and the heterogeneous grouping of my students was fine for the learning experience. The fact that students work in cooperative teams and that there is a diversity of activities within the learning experience helps to meet the needs of all learners. The activity certainly engaged students' interest and press them toward learning.



Adrienne Murray
Life Science

Seed Collection Lab Report

1. Some advantages of getting seeds are that we get more of those kind of plants and if we don't kill them all they won't become extinct and we can find more species. Getting away from their parent plant is better than staying there because they can spread and go into different areas.

2. Plants don't drop their seeds all at one time because they may not all be ready or to space out their seeds. If the wind was blowing to the east and they dropped them all they would all go to the east. Or if they dropped some of the seeds some would go to east and when they dropped the others the wind might be blowing to the west and the seeds would travel west.

3. If the plant dropped the seeds and they all landed in the same spot the seeds wouldn't go anywhere and you wouldn't find them anywhere else. It would also have a lot of plants growing in the same spot and therefore some or all plants may die.

4. Humans and animals can help when they brush up against a plant and the seeds get stuck onto the clothing or fur and fall off somewhere else or, humans or animals brush against a plant the seeds fall off and travel by the wind somewhere else.

To better meet the needs of all learners, the teacher may need parent volunteers or students from high school classes to come and assist in the logistics of the trial runs.

The learning experience can support student progress toward attainment of the learning standards by having students keep a "learning log," throughout the entire time. The "learning log" can be collected at the end of each day for the teacher to read to monitor students' progress and also modify or further expand on directions given.

Use a digital camera or video camcorder to record actual seeds to computer memory. With the help of digitized software, students can analyze structure of the seeds (e.g.. surface area and the distance traveled for wind seed dispersal). Test runs of student-designed "artificial wind-dispersed" seeds could also be videotaped. This would allow teams to view "instant replay" trial runs for further observations and comments.

The entire learning experience allows students to construct their knowledge. The learning experience can be performed not only by life science students, but biology, applied sciences, physics, technology, and math students. Modifications can be made to any level. It can be a stepping-stone for other connections between "mother nature" and technological applications. It is a learning experience that could relate to a future bioengineering problem in the real world. It provides the process for real-world application and problem-solving strategies.

STUDENT REFLECTION AND SELF-EVALUATION

1. Describe the purpose of this learning experience.

_____

_____

_____

2. What new learning occurred for you as a result of doing this learning experience?

_____

_____

_____

3. If you could continue working on the Seeds By Design learning experience, what would you do next?

_____

_____

_____

4. Explain two new understandings that you learned from doing Seeds by Design.

_____

_____

_____

5. What skills did you use in this project that you will be able to use in other ways in your life?

_____

_____

_____

SEEDS BY DESIGN RUBRIC

CRITERIA	*SCORING*			
PROCEDURE FOR DESIGN OF SEED				
• submits labeled graphic of seed design	4	3	2	1
• submits lab notes which include:				
—-detailed list of type/amount of materials	4	3	2	1
—-reasons for materials used for general strategy	4	3	2	1
• safety procedures followed	4	3	2	1
DATA COLLECTION				
• expresses data in labeled charts	4	3	2	1
• takes accurate measurements and observations	4	3	2	1
• correctly labels with proper SI units	4	3	2	1
• completes data table	4	3	2	1
CONCLUSION				
• forms a conclusion from test run which indicates whether data supports or refutes the seed design	4	3	2	1
• suggests ways to refine or redesign seed for further investigation	4	3	2	1
PROCEDURE FOR REDESIGN OF SEED				
• submits labeled graphic of seed redesign	4	3	2	1
• submits lab notes which include:				
—-detailed list of type/amount of materials	4	3	2	1
—-reasons for materials used for general strategy	4	3	2	1
• safety procedures followed	4	3	2	1
DATA COLLECTION				
• expresses data in labeled charts	4	3	2	1
• takes accurate measurements and observations	4	3	2	1
• correctly labels with proper SI units	4	3	2	1
• completes data table	4	3	2	1
CONCLUSION				
• discusses and accounts for differences between performance of initial seed and redesigned seed	4	3	2	1
• suggests ways to improve overall seed	4	3	2	1
APPEARANCE				
• written material is neat and legible	4	3	2	1
• uses correct grammar and spelling	4	3	2	1
REFLECTION				
• demonstrates a self-perspective	4	3	2	1
• relates how learning may be used in the future	4	3	2	1

CLASS PARTICIPATION CRITERIA CHECKLIST 

LEVEL 4

CONDUCT:

___ respects the learning process
___ shows initiative by encouraging others in the group
___ speaks to all participants
___ adheres to class rules and encourages others

SPEAKING REASONING:

___ understands questions before answering
___ cites appropriate evidence from background information
___ expresses in complete thoughts
___ displays logic and insight
___ synthesizes ideas

LISTENING:

___ pays close attention and records details
___ responses include comments of others
___ identifies logical errors
___ overcomes distractions

PREPARATION:

___ understands concepts fully
___ comes prepared to take part in discussion
___ crucial points have been identified

LEVEL 3

CONDUCT:

___ supports the learning process
___ may be impatient with confusing ideas
___ comments often without encouraging others
___ may address only the teacher
___ adheres to class rules

SPEAKING REASONING:

___ responds to questions voluntarily
___ comments indicate thought and reflection
___ ideas draw interest from others

LISTENING:

___ generally pays attention
___ responds thoughtfully to others
___ questions logical structures
___ self-absorption may distract the ideas of others

PREPARATION:

___ has reflected upon ideas and come with relevant questions
___ understands most concepts

LEVEL 2

CONDUCT:

___ may interfere with the learning process
___ shows insight but may insist too forcefully
___ may not contribute to conversation
___ tends to debate rather than discuss
___ doesn't adhere to class rules

SPEAKING REASONING:

___ responds when called upon
___ comments indicate little effort in preparation
___ comments may be illogical and may ignore important details
___ ideas may not relate to previous comments

LISTENING:

___ attention wavers
___ classifies ideas inappropriately
___ requires inordinate repetition of questions
___ shows interest in own ideas

PREPARATION:

___ has briefly considered important ideas
___ misunderstands key concepts

LEVEL 1

CONDUCT:

___ has little respect for learning process
___ may be argumentative
___ takes advantage of minor distractions
___ may use inappropriate and speak about irrelevant topics
___ intentionally does not adhere to class rules

SPEAKING REASONING:

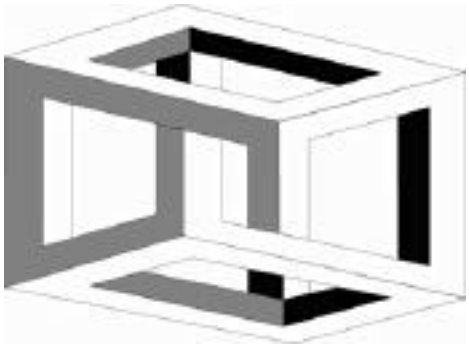
___ extremely reluctant to participate
___ comments are illogical and meaningless
___ has incomplete thoughts
___ makes little relationships between comments and text

LISTENING:

___ acts uninvolved in discussion
___ misinterprets previous comments and ideas
___ shows ambivalence towards any ideas presented

PREPARATION:

___ has not prepared for discussion
___ important ideas are unfamiliar
___ no attempt has been made to deal with difficult ideas



BAR GRAPHING RUBRICS

Type: computer/ink/pencil	1 pt
Includes:	
Title of Graph	1 pt
X-axis labeled with variables and units	2 pt
X-axis units evenly spaced	1 pt
y-axis labeled with variables and units	1 pt
y-axis units evenly spaced	1 pt
bars accurately plotted	2 pt
overall neat and legible	1 pt
TOTAL POINT VALUE OF GRAPH	**10 pt**

LINE GRAPHING RUBRICS

Type: computer/ink/pencil	1 pt
Includes:	
Title of Graph	1 pt
X-axis labeled with variables and units	1 pt
X-axis units evenly spaced	1 pt
y-axis labeled with variables and units	1 pt
y-axis units evenly spaced	1 pt
points plotted accurately	2 pt
points connected accurately	1 pt
overall neat and legible	1 pt
TOTAL POINT VALUE OF GRAPH	**10 pt**

COOPERATIVE WORKER RUBRIC

LEVEL 3

___ accepts role assigned with enthusiasm
___ discusses tasks and ideas with group
___ completes all tasks defined by role and contributes to the group effort
___ follows class rules and encourages others to do so
___ respects individual differences
___ positively responds to others
___ encourages positive behavior in others
___ helps to overcome setbacks to insure success

LEVEL 2

___ accepts role assigned
___ discusses tasks and ideas with group
___ completes a fair amount of work agreed upon by the group
___ follows class rules
___ accepts individual difference
___ responds to others
___ is not disruptive to others
___ does not work against group

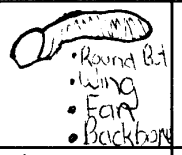
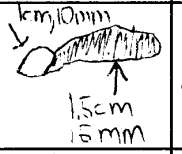
LEVEL 1

___ agrees to complete very little or no work
___ discourages equal distribution of work
___ does not follow class rules
___ negatively responds to others' differences
___ actions or conversations disrupt others
___ leaves several assigned tasks unfinished
___ usually does not take part in group discussion
___ may work against the group

Laura Constantinides

OBSERVATIONS OF NATURALLY-OCCURRING WIND-DISPERSED SEEDS

Maple Ragweed PineSeed Milkweed Goldenrod

	SEED 1	SEED 2	SEED 3	SEED 4	SEED 5
general shape		 Funnel Shaped	oval w/ pointy end		 Round
length (mm)	4cm 40mm	.5cm 5mm	.75cm 7.5mm	3.5cm 35mm	1cm 10mm
width (mm)		.25cm 2.5mm	.25cm 2.5mm	5.25cm 52.5mm	1cm 10mm
depth (mm)	.75cm 7.50mm	.25cm 25 mm	.25cm 2.5mm	3.5cm 35mm	.5cm 5mm
mass (g)	1/10 Gram	.1 gram	1/10 Gram	Less than 2 gram	1/5 Gram
surface area characteristics	Round Small Helicopter	•little strands coming out of base	•Brown with light spots •Fat	Fuzzy	Fuzzy White Small
descriptions of attachments	Wing •thin •rough •light •flexible air	Brown base	None Really	Fuzzy Strands of hair	Fuzz Balls Attached
other characteristics	•Mostly Brown •Small	very small	Light at one end dark at other	Light White Gray	Dark Middle, Light Fuz