Classroom Activity Pack:
Building Communities in the Classroom Using Science and Drama

Introduction

BEES! is a new musical from **WillFredd Theatre** in association with **The Ark,** created especially for children. The musical tells the story of a honeybee named Mel who loses her colony and tries to find her way in the world without it. Through fun songs, catchy rhymes, and a story about an amazing adventure, the audience learns about a diversity of bee species along with Mel and even discovers how important bees are to human beings.

In the classroom activity pack, three sessions have been created for exploring science and drama in the classroom as a resource for teachers using the Science curriculum.

We aim for this pack to be used to further explore the themes from our theatre show *BEES!* with your pupils either before or after attending a performance. The activities are designed to correspond with the Science and Drama curricula and to support pupils' development in science skill-building, fostering curiosity, and appreciation for our environment. These ideas aim to remind us that, just as the bees, "*we're all here for a short time*" and have the potential to make a great impact on our environment. Teachers are encouraged to adapt activities to best suit the needs of their class and the curriculum.

Background Buzz

Did you know that there are over 20,000 different types of bees? They all have different life histories, and three are the focus of the *BEES!* show:

- A honeybee (*Apis mellifera* – "Mel")
- A bumblebee (*Bombus lucorum* – "Luke")
- A solitary bee (*Nomada marshamella* – "Marsha").

As unique as each species is, all play an active role in the growth of flowers and plants. Bees affect our food supply and the food chain, and are a significant part of our everyday lives without realising it. They are intelligent and referred to as 'engineers of nature' (*Tales from the Hive*, 2007).
In 2015, Ireland released the All-Ireland Pollinator Plan, one of only a few countries in Europe to publish a strategy to address pollinator decline and protect pollination. We will be releasing a Junior version of this plan so that children can become involved in this unique movement to become pollinator-friendly.

The ideas in this activity pack will lead to a discovery of how "*the bees need the flowers and the flowers need the bees*". The activities explore the roles and responsibilities humans and bees take in the environment.

Curricular Links and Skills

Curricular Links Within the Show

Attending and reflecting on theatre performances with your class will explore many of the key strands of the **Drama**, **English**, and **SPHE** curricula, particularly in relation to:

- examining the relationship between story, theme and life experience
- using insights arising out of dramatic action to draw conclusions about life and people
- receptiveness to language
- competence and confidence in using language
- emotional and imaginative development through language
- reflection on drama and listening and responding
- myself and the wider world
- environmental care

BEES! also explores elements of the **Science** and **Geography** curricula including:

- *Environment Awareness & Care* - Develop an awareness of the interdependence of the living and non-living elements of environments. Encourage a positive environmental action and a commitment to sustainable life-styles and instil in them a sense of personal and community responsibility as custodians of the earth.
- *Living Things* - The wide variety of living organisms both plant and animal in the local and global environments. The life process including nutrition, movement, growth and reproduction, common to animals including humans. The life process, including growth, nutrition and reproduction common to plants.
- *Human and Natural environments* - involvement with child in active exploration/ investigation of environments

Within this Activity Pack

The following skills can be built through engagement with the suggested activities in this pack:

- Working Scientifically
- Questioning
- Observing
- Predicting
- Investigating and Experimenting
- Estimating and measuring
- Analysing
- Recording and communicating

The final session concludes with an activity based in:

- Designing and Making
- Exploring
- Planning
- Making
- Evaluating

Session 1: Exploring Bees

Activity 1: A–Bee–C Relay

Preparation
Write a list from A to Z down the left side of a large piece of paper. Repeat this for the number of groups you will have in your class. Spread these out along the classroom walls or tables where the students can reach them.

Activity
- Divide the class into groups of about 5- 6 students per group, each stationed at a piece of paper.
- One at a time, each student in the group writes down a word beginning with each letter of the alphabet about bees. The groups work together until they have completed the entire list from A-Z. To add a competitive element to it, time the teams.
- Afterward, invite each team to present their answers. Answers can range from different species of bees, types of plants they pollinate, descriptive words that have to do with bees, etc.
- Invite older students to question one another and justify their answers.

Adaptation
This can be done together as a class on one sheet of paper.

Discussion
- What do students already know about bees?
- What would they like to find out?

Information to Share
- There are over 20,000 different species of bees, and these can be either social or solitary bees.
- Bees are pollinators which means they help encourage the reproduction of plants naturally. Some plants cannot produce seeds to create the next generation without bees.
- Honeybees and Bumblebees are social bees and live in colonies.
- Solitary bees lay their eggs and then leave the young to emerge and grow on their own.
- Bees sting when faced by danger. Honeybees are some of the only bees which die after they sting a predator.

Activity 2: Pollination Stations

This exercise presumes a basic knowledge of the pollination process which your class will have if they have already attended a performance of BEES! If you are working in advance of attending the production you will need to outline the basics of the pollination process for this exercise.

Materials

Small post-it notes or pieces of paper in 2 different colours (about 20 of each colour for pollen), printed photographs or drawings of two different crops (2 copies each), tape, lollipop sticks (about 40 for nectar), and beads (about 20 for seeds)

Preparation

Print out images of any two of the crops on the below list. Place the photos in each corner of your classroom. For example, two corners with broccoli and two corners with apples. Next, place stacks of post-it notes or small coloured pieces of paper near each photo, along with lollipop sticks for nectar. Put approximately 10 green post-its at each broccoli plant representing pollen, 10 red post-its at each apple plant representing apple pollen, and 10 lollipop sticks at each corner representing nectar. In total at least 20 green post-its, 20 red post-its, and 40 lollipop sticks.

Activity

Begin by asking the class to raise their hand if they have ever eaten any of the following:

Apples	**Cucumbers**	**Onions**	**Avocados**	**Almond**
Broccoli	**Cherries**	**Orange**	**Grapefruit**	**Blueberries**

Explain that to produce food crops, we need the bees. The bees are essential for fruit flowers to be fertilized and for fruits to form. The bees also produce more vegetable crop seed for the following year.

In this activity the class will be acting as “pollen-eaters”, searching for food (nectar and pollen) and consequently carrying pollen to the other plants of the same crop, causing fruit and seeds to grow.

- Divide the class into four groups.
- Choose four students to represent the plants in the corners of the room.
- Each group will take the role of a bee colony. Their mission is to gather nectar from each of the plants and bring it back to the colony. As they collect nectar they inadvertantly collect and carry the sticky pollen. The coloured sticky notes represent the pollen.
- At each crop, the ‘bees’ are to take one nectar lollipop stick from the ‘plant’ in exchange for the ‘plant’ sticking one pollen note to the ‘bee’.
- As they move around the room, the ‘bees’ can transfer that sticky note to the next ‘plant’ which receives it. Each plant must receive the same colour sticky note in order to make a seed. If the bees reach a different plant, they can collect the pollen from that one and then move on.
- Students as ‘bees’ circulate the room and pollinate as many of the different plants as they can by sticking the coloured post-it notes to the students representing plants, collecting and holding onto nectar as they go until a seed has grown at each plant.
- Once a plant has ten pieces of pollen around it, a new seed can grow. This can be represented by beads. The teacher can distribute a bead to the ‘plant’ once it has ten pieces of pollen on it.

Activity 2: Pollination Stations (continued)

For an added challenge

Choose one person in each group to represent things which endanger the bee. For example a parasite, wind, pesticide, or predator (a bee-eater bird). These students will go about pollinating the crops with their groups and secretly wink at the other worker bees as they do. If a bee is winked at, he/she must fall to the ground (this can be done dramatically or the student can quietly take a seat). The worker bees' mission is to try to collect as many pieces of nectar as possible before dying.

Discuss

- How many trips did you or your group have to take to each crop?
- How long do you think it would take a bee to make this journey from a crop to its nest?
- How many pieces of nectar did you collect? What will that be used for?
- What kinds of dangers would the bees face day to day?

Information to share

- Bees drink nectar for energy, or store it in their "honey stomach" to regurgitate back at the nest, and store pollen in special structures on their bodies: in honeybees and bumblebees they pack it onto flat surfaces on their hind legs.
- The pollen brushes onto their bodies/hair as they forage and is transported.
- The honey bee usually makes 10 journeys a day (each one about an hour), visiting hundreds of different blossoms.
- The wing beats approximately 230 times per second which is where the buzz sound comes from.
- It takes nectar from 5 million flowers to make one pint of honey.
- Video clip: 5:38-8:32 - https://www.youtube.com/watch?v=FtKqic69xVo

Activity 3: A Honey Bee Machine

The next step after the bees gather nectar and pollen is to bring it back to the hive. This activity aims to explore how a honey bee colony functions to create space and honey in the hive.

- Begin with a discussion of the various jobs in the hive. Tasks include : collecting food (to feed all the bees in the colony), to make space, and to start a new colony.
- Explain that there are three types of honey bees: the worker bees (infertile females), the queen bee (fertile females), and the drones (males).
- There are about 40-50,000 bees per colony and only 100 or so are males. The rest are females, and most are workers.
- Once the bees bring in the nectar from the flowers, they regurgitate it 70-80 times to reduce water and make honey. They then seal it into the comb with wax and prepare the space for the queen to lay eggs.
- For each kilo of honey, the bees make approximately 56 grams of wax.

  Show a video clip about the way the bees work in the hive:
  https://www.youtube.com/watch?v=FtKqic69xVo (2:00-5:35)

- Afterwards, explain that together as a class you will all work together to take the role of a worker bee in a hive.
- Invite each student to choose one sound and one gesture or repeatable movement that represents their worker bee. Give them time to decide and practice this.
- Invite one volunteer to stand in the front of the class and share their sound and gesture.
- One by one, invite each student to join the machine and add to this sound and gesture so that they build upon what the other person is doing.
- Continue until the entire class has a role repeating their own sound and gesture to create one honey bee machine.
- You can play with the group to encourage the bees to speed up and slow down.

Discuss

- How do the bees work together?
- What did you notice another person doing?
- How did you add to this?
- In the video clip, what do the bees do when they feel they have run out of space?

This can be repeated to create varying other types of machines or functioning groups such as a flower machine, a bumblebee machine, a pollination machine, a jarring machine for producing honey, a machine that includes humans, etc.

Session 2: Diversity and Danger for Bees

Activity 1: The Anatomy of a Bee

Explain to students that there are many different species of bees, but all bees have most of the same body parts such as 6 legs, 4 wings, 2 antennae and females have 1 stinger. They differ in shape, size and colour.

Invite students to build a bumblebee using simple 3D or 2D materials provided for each body part listed below. They can do this individually or as groups.

3D Bee Material Suggestions

Head	Pompom
2 Large Eyes	Large sequins
3 Small Eyes	Smaller sequins
2 Fore Wings	Bent pipe cleaners
2 Hind Wings	Bent pipe cleaners of a different colour
6 Legs	Pipe cleaners
2 Antennae	Pipe cleaners
Abdomen	Toilet paper roll
Thorax	Toilet paper roll

2D Bee

Head	Large cut-out circle of paper
2 Large Eyes	Cut out black paper in hexagonal shapes
3 Small Eyes	Draw these as tiny dots on the top of the head
2 ForeWings	Triangular shaped colour paper
2 Hind Wings	Smaller triangular shaped colour paper
6 Legs	Thin strips of paper cut into upside down 'L' shapes
2 Antennae	Thin strips of paper
Abdomen	Large oval shaped paper
Thorax	Smaller oval shaped paper

See Appendix 1 for a simplified template of the anatomy of a bee

Once the bee is assembled, invite the students to colour it in, add hair. Some common bumblebees are black with white/yellow stripes. Invite students to choose different types of bumblebees and colour them in with the right colour patterns.
See http://bumblebeeconservation.org/about-bees/identification/common-bumblebees/

Discuss

- Where is the stinger located?
- Is there a part of the bee you did not know existed? Which part?
- Where do the honey bees store the nectar?
- Where do they usually carry pollen?

Adaptation

Students can also either draw a picture of a bee with all of the parts they learned about or colour in a diagram of the bee. See appendix 1 for bee diagram and body parts.

Activity 2: Bee Aware of Danger

This activity aims to encourage students to explore the decline of bees.

- Divide the class into five groups.
- Provide each group with an image (see Appendix 2) and a blurb.
- Explain that each group was given one reason why many different kinds of bees are in danger.
- The groups should look at their image and read the information that goes along with it (provided below).
- Once they have discussed what they have, they must prepare a newscast sharing this information with the class.
- Provide the group with a few minutes to prepare the news report. Students are invited to take roles as reporters, farmers, meteorologists, beekeepers or scientists.
- Each group prepares a 1 minute report telling the cause of danger and at least one suggestion for the viewer to try at home.

Dangers for Bees

- **Homelessness**
  Bees nests are disappearing because there are fewer "natural" areas of farms where wild bees can live such as hedge bottoms and wild areas with long grass. Many areas are being disturbed by livestock such as cows. Try leaving some undisturbed areas (eg piles of grass clippings, areas of longer grass which are not mown) for bees to nest in.
- **Hunger**
  There aren't enough flowers on some farms or in cities and bees need the food to last from early spring to late autumn and sometimes run out of nectar. Try planting more wildflowers to help the bees get more food!
- **Sickness**
  A very dangerous bug called the *Varroa* mite is causing the honeybees to become very sick because of the diseases the parasite carries. They attach onto the bee and are difficult to see. Try capturing them with a 'drone comb' or with powdered sugar!
- **Poisoning**
  More and more farmers are using chemicals on plants to fight unwanted bugs, but this is harming the bees. Try supporting organic farms in your area!
- **Changing Environment**
  Extreme weather is causing plants to grow early and leaving the bees with less nectar when they are ready to collect it. Try planting flowers, herbs, and crops that will grow well in Irish weather!

Each group should share these presentations for the rest of the class. Encourage students to ask questions as audience members after each group presents.

Conclude with an overview of the five main reasons for the decline of bees in Ireland.

Information taken from National Biodiversity Data Centre, 2015
http://www.biodiversityireland.ie/projects/irish-pollinator-initiative/bees/declines-in-irish-bees/

Session 3: A Farm without Bees

The following session guides students through a drama that incorporates the 7 steps for working scientifically, as written in the Science Curriculum.

Activity 1: Meet Farmer John/Jane

Using drama in education techniques, invite the class to imagine a person called Farmer John (or Jane) who manages the farm so that there is habitat for wild bees to maintain healthy land that is full of crops. Ask the students to describe the layout of this farm and what kinds of plants they would find.

Materials

Large sheets of paper, markers, paper, pencils, rulers, magnifying glass, evidence notes.

1. Questioning

Where would the bees make their hives or nests? What other creatures would you find on this farm? What kinds of crops are grown? How would the farm be affected without bees for one day? 2 weeks? 2 months? 2 years?

2. Observing

In groups or as a whole class, ask students to draw an image of what they imagine the layout of the farm would look like with a healthy bee population. Then invite them to draw a picture of the farm after the bees went missing for several months. What would be different? How would the farm be affected? For example, are there fewer flowers? Would there be as many animals? Would the food the animals eat come from a different source? Share drawings and discuss what students came up with as the main effects.

3. Predicting

Explain that Farmer John will be in to talk to the class because he has noticed that the bees on his farm have disappeared. In groups, the students should predict the main cause of the disappearance of the bees. Together they will brainstorm questions they would like to ask Farmer John regarding the plants they imagine he grows at the farm. List any other questions about the dangers facing the bees in this particular instance.

4. Investigating

The teacher is invited to step into role as Farmer John to begin the 'Investigating' stage of the scientific process. Prepare the students by saying that you will take the role of the farmer and invite the class to take the role of researchers/botanists specialising in plant and bee life.

Once in role, introduce yourself to the class as Farmer John and tell them that you are searching for their help as researchers. Let them know that you have noticed your colony has left the farm. You are not sure where they have gone, but you have noticed a few strange things around the farm (such as less buzzing, dying crops, sounds of unfamiliar birds, dead or deformed bees). You are very busy with the rest of the animals and unfortunately do not have the time to dedicate to searching for the cause, but you know how badly it can affect the crops and, in time, yourself and the animals.

Next, use the drama technique 'Hotseating' to invite the class to ask questions about what Farmer John has noticed happening over the past few days/weeks. Invite one or two representatives to

Activity 1: Meet Farmer John/Jane (continued)

interview the Farmer while the others write down important information that he/she shares.

Farmer John can mention any of the following:

- He has begun to use pesticides to control some of the insects that are eating his fruit plants.
- He noticed the bees were dying in late Autumn.
- Many bees were emerging from the hive with misshapen wings and a smaller abdomen.

5. Estimating and Measuring

Invite the class to rearrange the furniture in the classroom so that it represents the farm. Locate and signify the main areas where the bees would form their colonies. Decide on at least four areas of interest and dedicate one or two small groups to each area.

Each group will find a piece of evidence (notes written by the teacher) at each area of the farm. These pieces of evidence will come from the group depending on the areas they have laid out for the farm.

Some suggestions according to the Bee Danger activity in session 2 are:

1. Area: Barn or shed.

- **Evidence**: A few sick bees with misshapen wings and small abdomens are found outside of a honeybee hive.
- **Task:** Estimate how many bees are found and what has made them sick?

2. Area: A field.

- **Evidence:** The field is found to be bare, with very few wildflowers around.
- **Task:** Estimate how many bee-friendly plants are already there and how many you could add to it?

3. Area: A lime fruit tree in the garden.

- **Evidence:** There are dead bumblebees below the tree because the bees ran out of nectar and became exhausted.
- **Task:** Estimate how many bumblebees the farm has lost and decide what kinds of trees or nests to add to the farm to get them back.

4. Area: An abandoned hive outside of the barn.

- **Evidence:** A box built by Farmer John is found with no more bees left.
- **Task:** Estimate how many cells were left open and abandoned and decide on a cooler, weather-protected place to move the hive.

6. Analysing

Once the individual groups have collected and discussed the information from the bits of evidence, call the class into one big group to enter a discussion in role. Lead this by going into role as a Research Assistant who called in to gather the information from the group. What patterns did the class notice emerge? Invite each group to share one or two things they noticed happening at the farm. The Research Assistant can prompt them with questions about what they think caused the few crops, sparse nests, dead bees, etc. Conclude by telling the group the results will be passed to Farmer John and thank them for their help.

Activity 1: Meet Farmer John/Jane (continued)

7. Recording and Communicating

Students are left with the question, How can we get the bees to come back?

In order to communicate their needs for food to Farmer John, the activity will close by the students stepping into the role of the honey bees.

Honey bees communicate to one another by doing what is called a '*waggle dance*' according to the location of the sun and where nectar can be found. See video: https://www.youtube.com/watch?v=2S-ozxplrdI

In groups, ask students to plan an interpretive dance communicating what they need help with to the farmer. For example, one group can create a dance asking to plant more wildflowers, another can ask to build a new nest, another can ask to get rid of the mites, and another can ask to stop using insecticides. The teacher steps into role as Farmer John and must guess what each group is trying to communicate through their movements.

Activity 2: Prepare to Pollinate

Announce that the research the class went through to help Farmer John was recently announced to the public. Thank them for their work.

Discuss

- What can we do as a class? Individually?

Activity

Design and make a pledge for increasing the amount of pollinators in your area by planting bee-friendly flowers and plants. Explore the types of plants available, plan where to grow them, and invite each student to sign this pledge showing reasons and ways to help save bees.

Some options for additional bee-friendly activities to do with your class are:

- Plant flowers that are able to grow in the Spring in the school garden so that the students can observe and evaluate it. Suggestions for this include crocus, primrose, lily-of-the-valley, blackcurrant, or flowering currant. After some time of growth, evaluate the progress of the plant. **When choosing your plant, remember: Bees notice bright colours such as blue and yellow best!**
- You can see a list if reccomended plants at: https://www.rhs.org.uk/science/conservation-biodiversity

Maybe you could make a bumblebee nest...

Take a look at this link from the Bumblebee Conservation Trust for ideas:
http://bumblebeeconservation.org/about-bees/habitats/bumblebee-nests

References and Further Information

- About bee species in Ireland and the Pollinator Plan:
  http://www.biodiversityireland.ie/projects/irish-pollinator-initiative/ipi-aims-and-updates/

- Bumblebee Conservation Trust:
  http://bumblebeeconservation.org/

- Buglife (UK-based):
  https://www.buglife.org.uk/

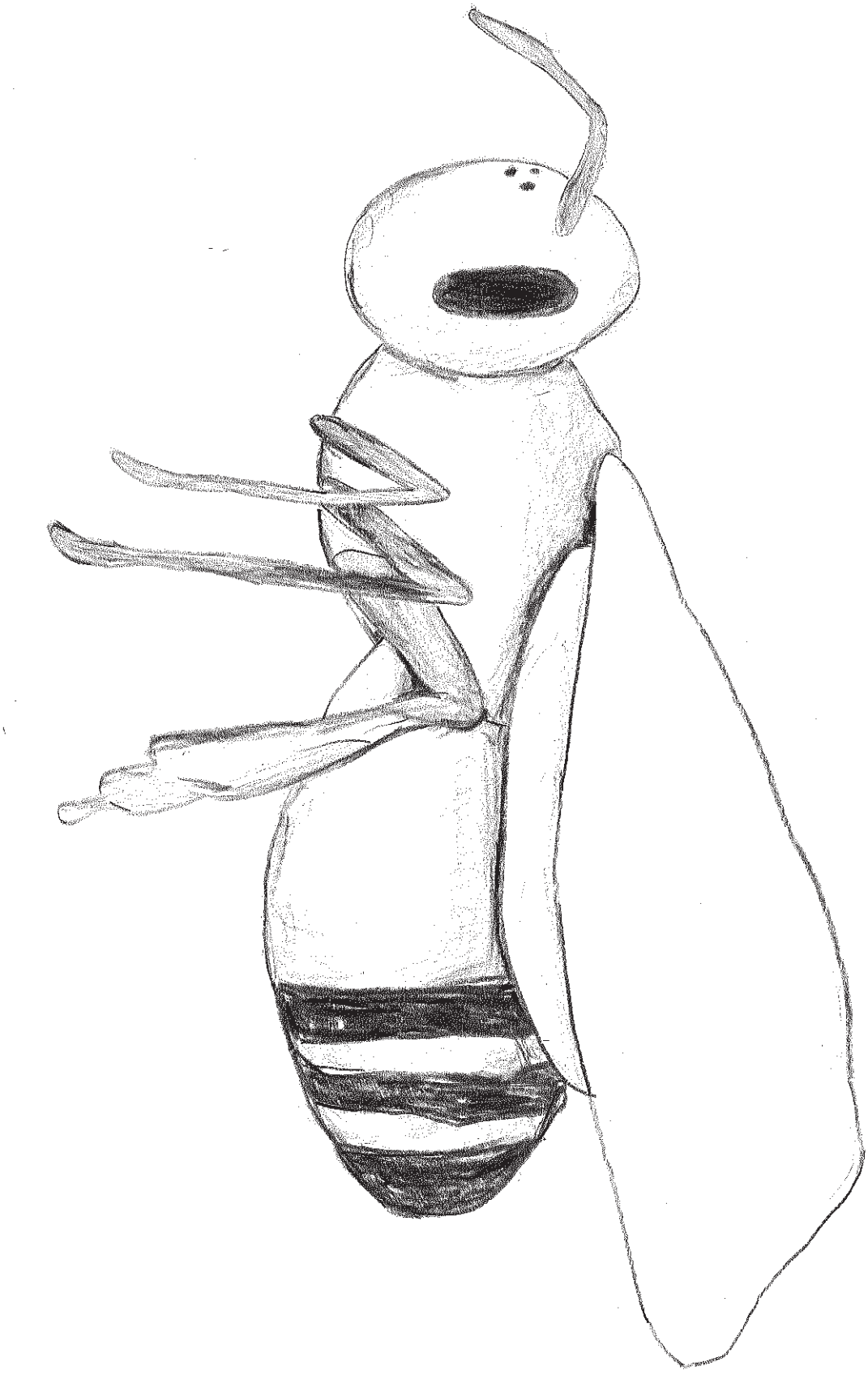
- Documentary about Honeybees, Tales from the Hive:
  https://www.youtube.com/watch?v=FtKqic69xVo

- Information taken from National Biodiversity Data Centre, 2015
  http://www.biodiversityireland.ie/

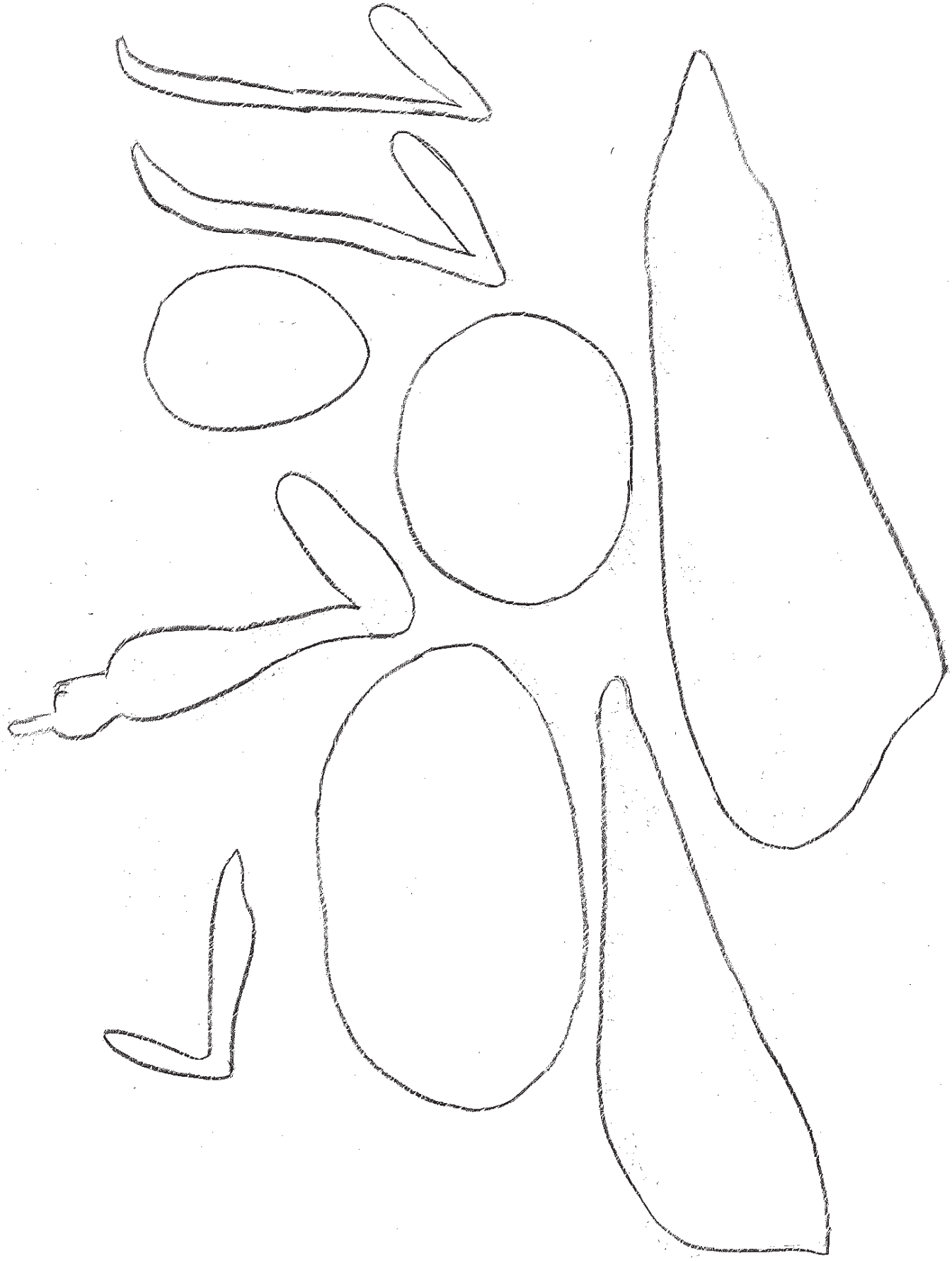
- Bee Decline:
  http://www.biodiversityireland.ie/projects/irish-pollinator-initiative/bees/declines-in-irish-bees/

- Bee-Friendly Plant List:
  https://www.rhs.org.uk/science/conservation-biodiversity

Appendix 1 | Session 2 : Anatomy of a Bee



Appendix 1 | Session 2 : Anatomy of a Bee



HUNGER

There aren't enough flowers on some farms or in cities and bees need the food to last from early spring to late autumn and sometimes run out of nectar. Try planting more wildflowers to help the bees get more food.

HOMELESSNESS

Bees nests are disappearing because of where farms are located. Some farms are even being used for factories and bees are being pushed out of natural homes like trees. Try building your own nest for bees near a farm or field.

SICKNESS

A very dangerous bug called the Varroa Mite is causing the bees to become very sick. They attach onto the bee and are difficult to see. Try capturing them with a comb or with powdered sugar!

POISONING

More and more farmers are using chemicals on plants to fight unwanted bugs, but this is harming the bees. Try supporting organic farms in your area!

CHANGING ENVIRONMENT

Extreme weather is causing plants to grow early and leaving the bees with less nectar when they are ready to collect it. Try planting flowers, herbs, and crops that will do well in Irish weather!

About The Ark

The Ark is a unique, purpose-built cultural centre in the heart of Dublin's Temple Bar, where children aged 2 -12 can explore theatre, music, literature, art, film, dance and more. The programme of world class performances, exhibitions and creative workshops changes every few weeks, so audiences both young and not so young can expect a different experience every visit.

The Ark gratefully acknowledges the support of its principal funder the Arts Council and also its other annual supporters: the Department of Education and Skills, Temple Bar Cultural Trust and Dublin City Council.

Find out more about The Ark at **ark.ie**

About WillFredd Theatre

WillFredd Theatre was founded in 2011 in Dublin, Ireland. They are Co-Artistic Directors Sophie Motley and Sarah Jane Shiels and Producer Kate Ferris.

WillFredd's work engages with contemporary culture, actively inviting new audiences into the theatre. Through ethical encounters between artists and communities of place, space and interest, the company develop theatre which responds to and represents elements of these communities. WillFredd believe in constant evaluation and interrogation of their work through extensive Research and Development phases where work is shown back to the communities we develop it with.

The company's previous full productions include: FOLLOW (2011) , FARM (2012), CARE (2014) and JOCKEY (2015). WillFredd would like to acknowledge the support of Rough Magic and Irish Theatre Institute.

Find out more about WillFredd Theatre at **willfredd.com**

Activity Pack created by Heidi Schoenenberger

Cover image: Ros Kavanagh/Studio Aad
Show photos: Ros Kavanagh

We would be very happy to receive any feedback, images or recordings made by the children in your class.

Our address is:
The Ark,
11A Eustace Street
Temple Bar
Dublin 2
or email them to
TheArkDublin@gmail.com

The Ark is supported by:

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IRISH THEATRE INSTITUTE
creating opportunities abroad strengthening resources at home

ROUGH MAGIC
PRODUCTION SUPPORT