Course Title: Masters of Primary Teaching EMPE

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Rachael Marietta Van Dijk 4615190

Rayna Andersson 4621820

Sandeep Kaur Bajwa 4620004

Miwand Zadran 4538777

Shriya Gupta 4619620

Lecturer: Dr. Efrat Eilam

Mosquito Madness

Year 4

Biological Science

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Executive Summary

Overview

The topic of this unit of work is understanding the life cycle of mosquitoes, specifically their morphogenesis and the way the organism changes appearance throughout its lifetime. Other key topics include mosquito habitats, ecology and environmental impacts on the mosquito population.

Learning Outcomes

The learning outcomes for this unit of work are for students to have an understanding of mosquito life cycles, morphogenesis, and the environmental factors impacting mosquitoes such as light, temperature and scents. Students will learn the concept that organisms appearances change throughout their life. Within the unit, students will construct the lifecycle of a mosquito through observation and experimentation, and contribute to class discussion. Students will gain knowledge about how to observe and record observations of living things. Their lifecycle will be handed in at the end of the final lesson and used as a summative assessment. As well as this, a diagnostic assessment will be used in the first lesson to determine student's prior knowledge, and informal formative assessment will be used in each lesson through discussion with students about the lesson content.

Main Activities

Main activities include observing and sketching mosquito larvae using microscopes, testing the effect of light and scent changes on mosquito behaviour, constructing a mosquito life cycle, and participating in reflections on their learning in a poster.

Links to Victorian Curriculum

At the Year 4 level, students learn that different living things have different life cycles and depend on each other and the environment to survive.

The Victorian Curriculum describes how living things can be grouped [VCSSU057]. It outlines that the differences between living and non-living things should be learned, as well as variations between plants and the variation of observable features of animals (ACARA, Science). In this unit of work, students will investigate different physical features of mosquitoes and how environmental factors influence their behaviour. In lesson one, students will discuss their prior knowledge of mosquitoes as a part of the engage phase, discussing the ways in which mosquitoes are living things and their observable characteristics and life stages. In lesson three, students will be provided with cards containing information about mosquito life cycles, and will add information into the relevant place on their lifecycle.

The Victorian Curriculum describes how living things have different life cycles and are dependant on the environment and each other to survive [VCSSU057]. Within this descriptor, students must make and record observations of living things, recognise the environmental factors that can influence life cycles, investigate the role habitat of living things, and predict effects in feeding relationships of living things. [Victorian Curriculum and Assessment Authority]. In this unit, students will explore variations in observable features of mosquitoes using a microscope, and drawing adult mosquitoes and eggs through observation. In lesson two, students will observe and record their observations of mosquito larvae using a microscope- learning about their physical features through close observation. In lesson four, students will conduct three short experiments to test the effect of temperature, light and scent changes on mosquito behaviour. This lesson will involve observation of mosquitoes and recording those observations, as well as learning about how different environmental factors influence mosquito behaviour.

Curriculum Focus [ACARA Year 4, 2015]

Science Understanding

Biological Science	Living things have life cycles [ACSSU072]

	Living things depend on the environment to survive. [ACSSU073]

Science as a Human Endeavour

Nature and Development of Science	'Science involves making predictions and describing patterns and relationships' [ACSHE061].
Use and Influence of Science	'Science knowledge helps people to understand the effects of their actions' [ACSHE062].

Science Inquiry Skills

Questioning and Predicting	'With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge' [ACSIS064].
Planning and Conducting	'With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment' [ACSIS065]. 'Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately' [ACSIS066].
Processing and Analysing Data and Information	'Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends' [ACSIS068].
Evaluating	'Reflect on investigations, discuss, and document what the observations mean by adding and editing within journals and lifecycle sheets' [ACSIS069].

Communicating	'Represent and communicate observations, ideas and findings using formal and informal representations' [ACSIS071].

At a Glance

Phase	Lesson	At a glance
Engage	Lesson 1: Bugs that Bite	To encourage student excitement and curiosity about the unit and elicit prior knowledge. Students will identify mosquitoes and mosquito bites, discuss their prior knowledge about what mosquitoes life cycles look like and draw their ideas and knowledge on a poster.
Explore	Lesson 2: Little Larvae	To observe mosquito larvae in a laboratory setting using microscopes. Students will make, discuss and record observations on observation sheets. Students will identify mosquito larvae using a microscope and sketch an accurate depiction of their observations.
Explain	Lesson 3: Ravenous Researchers	To develop scientific explanations for observations made with microscopes, and represent developing conceptual understanding in the poster. The students will be given mosquito information cards and represent this information on their poster both visually and with labels.
Elaborate	Lesson 4: Factors Affecting our Fliers	To develop a more elaborate understanding of how environmental factors influence mosquito behaviour. Students will complete three short experiments to investigate the effect of temperature, light and scent changes on mosquito behaviour.
Evaluate	Lesson 5: My Mosquito Masterpiece	To evaluate the learning outcomes of the unit through a summative assessment of student's posters. Students will use formal and informal scientific language to communicate their observations, reflections, and findings of the mosquito life cycle to their teacher through both their final poster and by sharing their favourite fact.

ENGAGE
Lesson One: Bugs that Bite

Summary

The focus of the engage stage is to get students excited to learn about mosquitoes and make them curious about the topic. This lesson will elicit the students existing knowledge about mosquitoes and engage them in asking questions, which will be taken into account during the following lessons.

Outcomes

Learning Outcomes

Students will be able to:

- Identify mosquitoes and mosquito bites
- Discuss their knowledge of mosquitoes
- Discuss what they think a mosquito needs to live
- Explain their ideas about a mosquito life cycle
- Contribute to class discussions

Diagnostic Assessment

In this lesson, the teacher will elicit what the students already know

- That mosquitoes have life cycles
- That mosquitoes depend on their environment to survive

Information to teachers

Mosquitoes are small, flying insects that depend on water to survive and reproduce. They are extremely adaptable, and any water source, human-made or natural, is enough to support them. They can live as far down as in mines, or as high up as

mountaintops. They differ from other flying insects by their long proboscis (used to feed). There are more than 3000 species of mosquito worldwide, and only a few of these species are able to carry and transmit diseases that can affect humans' quality of life. The rest of the species are more of a nuisance than harmful, using humans and other animals to feed without spread disease.

Every species of mosquito needs stagnant water to reproduce. Some species need flood water which allows them to breed in a temporary habitat, while others breed in permanent water sources that remain in place for a long period of time such as lakes, ponds or wetlands. Despite their different breeding locations, all mosquitoes experience the same lifecycle. Their life cycle begins with the adult mosquito. They then lay eggs on a body of water, which hatch into the larval stage, followed by the pupal stage and once again the adult stage. For the purpose of this unit of work, the pupal stage will not be studied due to its short length and to keep it simple for students.

For more information about mosquitoes these websites may be useful:

- For detailed mosquito life cycle information: http://www.vdci.net/mosquito-biology-101-life-cycle
- For information about mosquito-borne diseases in Australia: http://medent.usyd.edu.au/arbovirus/mosquit/mosqfact.htm#mosq
- For information about different mosquito species and their habitats in Australia: http://medent.usyd.edu.au/photos/mosquitoesofaustralia.htm

Implementation

Equipment and Materials

For the teacher:

- Make-up or body-paint
- A sound system or speaker for playing mosquito buzzing sound clip during class
- Whiteboard
- Whiteboard markers
- Mosquito buzzing clip: https://www.youtube.com/watch?v=PYnVlOoxZWw

For students:

- A3 Lifecycle sheet (Appendix 1)
- Science journal
- Pen or pencil

The Poster

Individual students will use this for every lesson in the unit to document their existing and developing knowledge of mosquitoes. The poster will be formally introduced in the evaluate stage of the unit. In the engage stage, the poster will have very little information- perhaps a simple drawing and some dot points consisting of prior knowledge students have discussed about mosquitoes and the student's name. As the unit progresses, students will add new information to their poster with pictures, sketches, dot points and sentences. They will have the opportunity to correct and update any information that they want to modify. The poster will document the majority of their learning process and be submitted at the end of the last lesson as a summative assessment for the unit.

Preparation

- Print off one A3 copy of 'Mosquito Life Cycle' sheet (Appendix 1) for each student.
- Purchase or locate face paint or makeup and use it to apply fake mosquito bites.

Lesson Steps

1. Prior to the lesson, the teacher will apply fake mosquito bites on their arms, neck and face using face-paint of makeup.
2. As students enter the classroom, the teacher will play a mosquito buzzing sound clip
3. Discuss with students where the fake bites came from, and let them tell their stories about mosquito bites.
4. Explain to students that they will be learning about mosquitoes, then discuss what they would like to know and collate their ideas on the whiteboard using a brainstorm.
5. Students will begin their mosquito life cycle poster with the discussed existing knowledge.
6. Conclude the lesson with students writing a few notes on the lesson about what they learned and what they would like to know.

Alignment with Victorian Curriculum

'Living things can be grouped on the basis of observable features and can be distinguished from non-living things' [VCSSU057]. It describes variations between plants and the variations between observable features of animals [VCSAS, Year 4]. In this lesson, students discuss their prior knowledge of mosquitoes including the features that make them a living thing.

'Different Living things have different life cycles and depend on each other and the environment to survive' [VCSSU058]. In this lesson, students will discuss their prior knowledge of what mosquitoes need to survive [ACARA, Level 4].

EXPLORE
Lesson Two: Little Larvae

Summary

To observe mosquito larvae in an experimental setting using microscopes. Students are to explore ideas, collect evidence, discuss their observations and record them on their observation sheets. This lesson will provide students with hands-on experience of the science phenomenon and ensure all students have a shared experience that can be discussed and explained in upcoming lessons.

Outcomes

Learning Outcomes

Students will be able to:

- Identify mosquito larvae
- Identify the different body parts of mosquito larvae.
- Discuss and articulate their observations to their group members

- Sketch an accurate depiction of their observations

Assessment

In this lesson, the teacher will move between groups and assess the quality of student observations in order to monitor students developing an understanding of:

- mosquito life cycles, and the changes they go through in the larvae stage
- applying observational skills such as sketching observations accurately

Information to teachers

Teachers will need to implement specific rules that suit their classrooms for observing the tank. The tank will be brought from the lab to the classroom for further observations. We suggest keeping it in a corner that has very little activity by students, having a 'no touching the glass policy,' or even a piece of tape students must stay behind while observing the tank. These rules will need to be discussed either in the lab or prior to entering it at the beginning of class.

The teacher must know the OHS procedure for the lab as it is an environment that could contain hazardous chemicals and other potentially harmful substances (Worksafe Victoria, 2017). The teacher must locate the first aid kit, the fire extinguisher and the fire blanket. The teacher must also identify the closest emergency exits and have a thorough understanding of the school evacuation plan and assembly points. The teacher must ensure that the students understand that they are to strictly follow the teacher's instruction in the lab. Students are not to approach and handle equipment unless directed by their teacher. Students should handle lab equipment carefully and ONLY when they are confident and knowledgeable to do so.

Students' discipline in the laboratory:

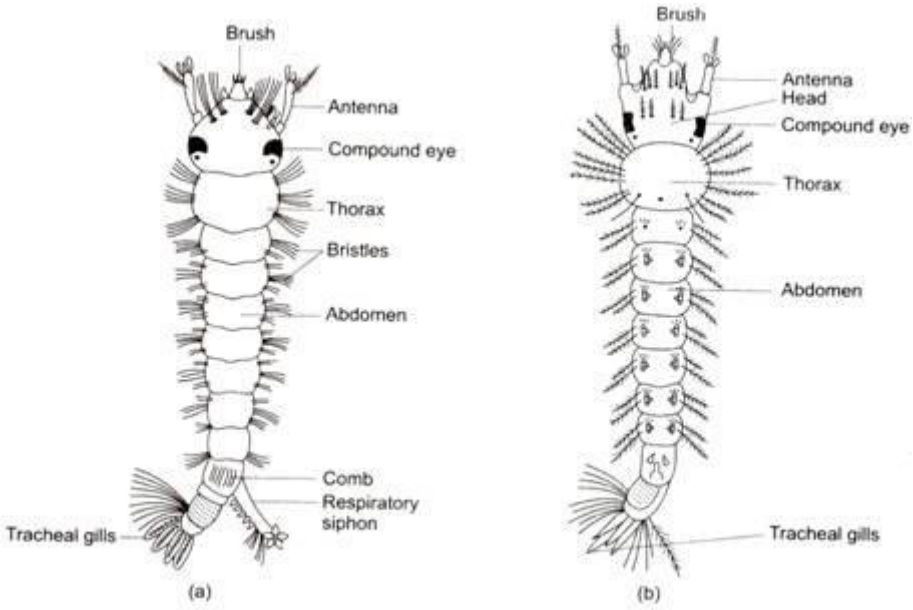
- Students should follow strictly the instructions given by the teacher.
- Students should not enter the laboratory unless a teacher is present.
- Students should not remove anything from the laboratory without permission.
- Students should not rush around or play in the laboratory.
- Experiments underway should not be left unattended.

- Laboratory reagents and chemicals should be returned to the appropriate places immediately after use, with their labels facing the front.
- Students should immediately report all accidents and breakages to their teacher.
- Students should not suck fingers or pencils when in the laboratory since these may be contaminated with chemicals as well as germs. (Education Bureau, 2013)
- The teacher must have knowledge of how to operate and care for a microscope which must then be communicated to the students.

Care of the microscope:

1. Always carry a microscope carefully by holding it firmly by the arm and supporting it at the base. Keep the instrument upright.
2. The microscope should never be placed close to the edge of the bench.
3. Do not tamper with or remove any parts. If the microscope does not seem to be functioning properly, ask for help.
4. Do not handle the lenses. If the lenses are dirty, ask for help.
5. Do not allow liquids, particularly acids and alcohol, to come into contact with any part of the microscope.
6. Always use a coverslip when examining objects or organisms mounted in water or other fluids. (An exception is when a special oil is used with the oil immersion lens.)
7. Always lower the stage before placing or removing a slide.
8. Before putting the microscope away, always put the low power objective in working position and replace the cover. (Lab Protocol, 2019)

The teacher should also be able to identify key parts of the larvae to guide students with their observations



Larvae of (a) *Culex* and (b) *Anopheles*

(Jain D, Biology Discussions)

For more information these websites may be useful:

- Detail descriptions of mosquito larvae body parts: http://mosquito-taxonomic-inventory.info/anatomical-glossary-overview

Implementation

Equipment and Materials

For the teacher:

- Small tank or aquarium (this will need to later fit within a larger aquarium)
- Mosquito net
- Duct Tape
- Adult mosquitoes, larvae, and water
- Jar/Bottle
- Microscope
- Clean slides

- Slide covers
- Droppers
- Slide solution
- Gloves

For students:

- Lab Observation Sheet
- Lab Instruction Handout
- Workbook and pen

Preparation

- Prior to the class, the teacher sets up a glass/plastic tank with water to create a mosquito larvae habitat in the science lab. Both adult mosquitoes and larvae are added and a mosquito mesh net should be fastened over the opening of the tank to minimize the risk of specimens escaping. This can be done by cutting mosquito net to cover the top of the tank and using tape (duct tape recommended) to fasten it all the way around. **Remember to keep a separate jar of larvae out for children to observe in the lab.**
- If possible, the mosquito pupae could be observed as an extension activity for students who finish early or need more of a challenge. Given the additional time this would take, as well as the lower likelihood of mosquitoes in the pupa stage being present in the tank, this was not recommended a whole class activity. Should many pupae be present, the teacher is encouraged to use this opportunity to investigate the pupa stage.
- The teacher should make sure microscopes are operational and ready for use on individual tables.

Lesson Steps

1. Teacher explains the importance of lab safety to the students (preferably before the students are moved to the lab)
2. Students are taken to the lab and split into groups of two, and the teacher explains and models the use of a microscope.
3. The teacher asks students to observe larvae tank, then hands out larvae sample and students begin their experiment. If teachers prefer to allow students to prepare their

own slides, additional instructions will need to be added to Student handouts on how to prepare slides.

4. Student handouts, observations sheets, and Labeled larvae drawing to be given to students.
5. Students will follow their student handouts to make observations, discuss with their lab partner, then proceed to draw what they have seen. Teachers may guide students as much or as little as they see necessary on what notes they should add to their observation sheets.

Alignment with Victorian Curriculum

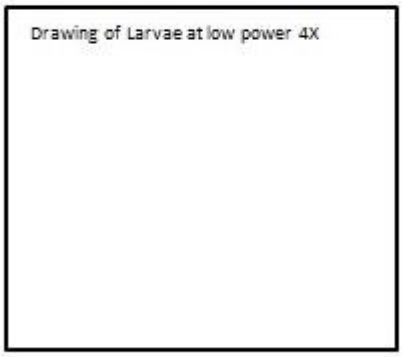
The Victorian Curriculum describe how living things have different life cycles and are dependent on the environment and each other to survive [VCSSU058]. Within this descriptor, students must make and record observations of living things, recognise the environmental factors that can influence life cycles, investigate the role habitat of living things and predict effects in feeding relationships of living things [ACSSU073].

Additional Resources

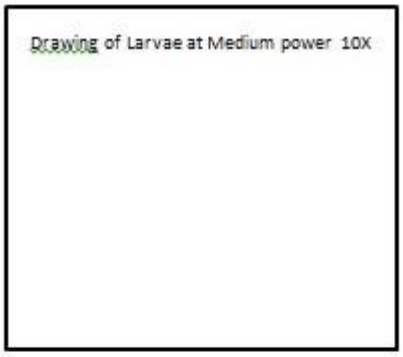
Student Name:

Lab Observation Sheet

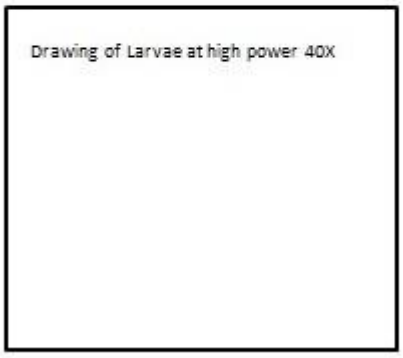
Observation Notes:



Observation Notes:



Observation Notes:



Student Name:

Lab Instruction Handout

Today you will be observing Mosquito Larvae, Stage two of the mosquito life cycle.

BEFORE BEGINNING READ THROUGH ALL INSTRUCTIONS.

1. Write your name at the top right corner of your observation sheet.
2. Listen to teacher instructions.
3. Turn on your microscope.
4. Hold your slide by the edges and carefully place your slide under the microscope being careful to not touch the lense with the slide.
5. Make sure the magnification of your microscope is on low power 4X.
6. Focus your lense and take turns looking at the larvae.
7. In the box on your observation sheet draw what you see with as much detail as possible (Be sure to label any body parts you can identify).
8. On the left side of your observation sheet you can note colour, movement, even questions you may have.
9. Change the magnification of your microscope to medium power 10X.
10. Focus your lense and take turns looking at the larvae.
11. In the box on your observation sheet draw what you see with as much detail as possible (Be sure to label any body parts you can identify).
12. On the left side of your observation sheet you can note colour, movement, even questions you may have.
13. Change the magnification of your microscope to medium power 40X.
14. Focus your lense and take turns looking at the larvae.
15. In the box on your observation sheet draw what you see with as much detail as possible (Be sure to label any body parts you can identify).
16. On the left side of your observation sheet you can note colour, movement, even questions you may have.
17. Remove slide from microscope and return it to the teacher.
18. Turn off microscopes and wait for further instructions.

EXPLAIN

Lesson Three: Ravenous Researchers

Summary

The main focus of this stage is to develop scientific explanations for observations and represent developing conceptual understanding on the poster. The students will be able to construct a diagrammatic representation on the life cycle of a mosquito.

Outcomes

Learning Outcomes

Students will be able to:

- Draw the different stages of the mosquito life cycle.
- Explain and identify stage one, the egg stage of metamorphosis.
- Explain and identify stage two, the larvae stage of metamorphosis.
- Explain and identify the stage three, the pupae stage of metamorphosis (optional for teachers to include).
- Explain and identify state four, the adult stage of metamorphosis.

Assessment

In this lesson, formative assessment will be used to determine that students are able to:

- Explain that mosquitoes have life cycles.
- Identify the correct order of metamorphosis and name each stage.
- Identify different body parts of mosquitoes during different stages.
- Identify the activities of mosquitoes during each stage.

- New information has been accurately added to posters.

Information to teachers

The female mosquito obtains a blood meal, the female mosquito lays the eggs directly on or near water, soil and at the base of some plants in places that may fill with water. The eggs can survive dry conditions for a few months. The eggs hatch in water and a mosquito larva or "wriggler" emerges. It looks like a small worm that is less than a 1cm long. It has a hard round head, a soft body, an abdomen with 10 segments and a siphon tube at the tip of its abdomen. Most eggs hatch into larvae within 48 hrs but it may vary depending on water temperature and type of mosquito (terminix 2017).

The larva lives in the water, feeds and develops into the third stage of the life cycle within 8-10 days, called pupae or "tumbler." The pupa also lives in the water but no longer feeds. Pupae breathe while they are rolled in their cocoon, which is comma-shaped. Finally, the mosquito emerges from the pupal case after two days to a week in the pupal stage. The entire life cycle typically takes up two weeks, but depending on conditions, it can range from 4 days to as long as a month (USEPA 2017).

Please note that if the pupae stage was not observed in the previous lesson, students are not expected to include it on their poster and information about it is not expected to be provided to students. Teachers are encouraged to create and add as many fact cards as they choose for their class to complement their own students learning.

For more information about mosquitoes these websites may be useful:

- Detailed information about each stage of the mosquito life cycle can be found here: https://www.mosquito.org/page/lifecycle
- Information and images directly used for information cards about each stage of the mosquito life cycle can be found here: https://www.cdc.gov/dengue/resources/factSheets/MosquitoLifecycleFINAL.pdf

Implementation

Equipment and Materials

For the teacher:

- Information cards (located in 'Additional Resources' at the end of this lesson)

For students:

- Pens and coloured pencils
- Poster

Preparation

- The teacher will need to make sure that several copies of each information card have been printed off and laid out on tables for students to access throughout the lesson.

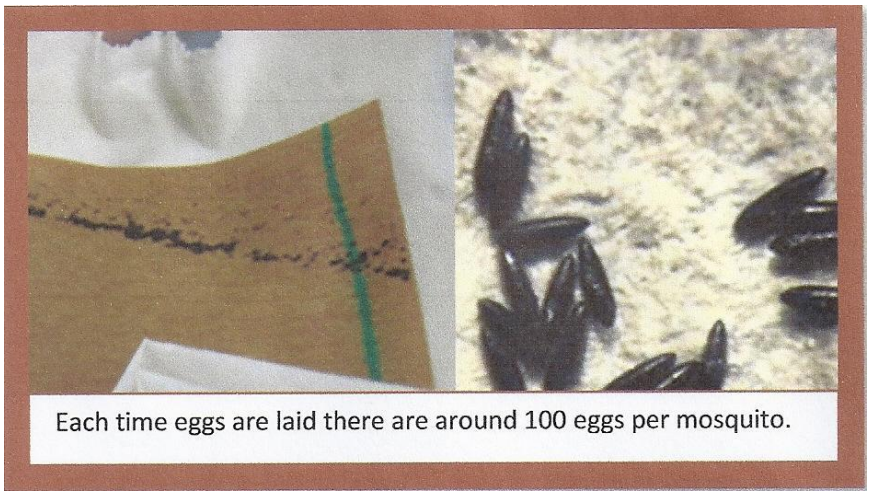
Lesson Steps

1. Students will begin by discussing their experience and observations in the lab from the previous lesson
2. Students will then spend the lesson filling out their poster with observations made in the previous lesson, as well as with information provided to them on the information cards.
3. The teacher should encourage students to use sketches, colour and labels when creating their poster from information provided
4. The teacher should move around the classroom and encourage reflection on the previous lesson, as well as discussion about the new information being learned from the cards

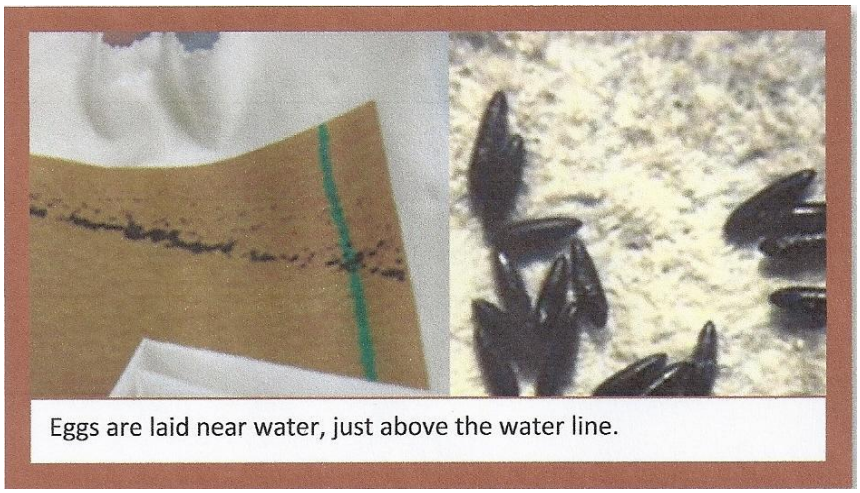
Alignment with Victorian Curriculum

VCSSU058 describes that different living organisms have different life cycles and depend on each other and the environment to survive it also states that students should make and record observations of living things as they develop through their life cycles. In the lesson, students will learn about the different stages of the mosquito life cycle and will be able to

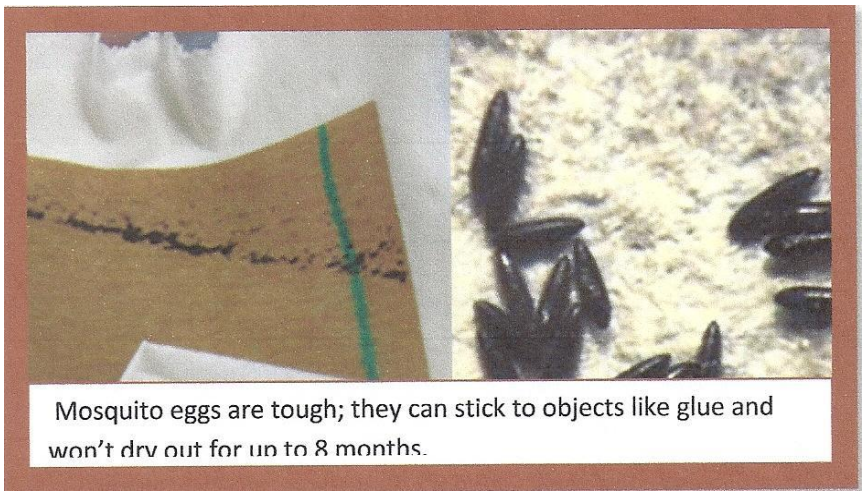
record their observation about each stage. They will know how much time each stage takes to develop into another one. (http://victoriancurriculum.vcaa.vic.edu.au/level4)



Each time eggs are laid there are around 100 eggs per mosquito.

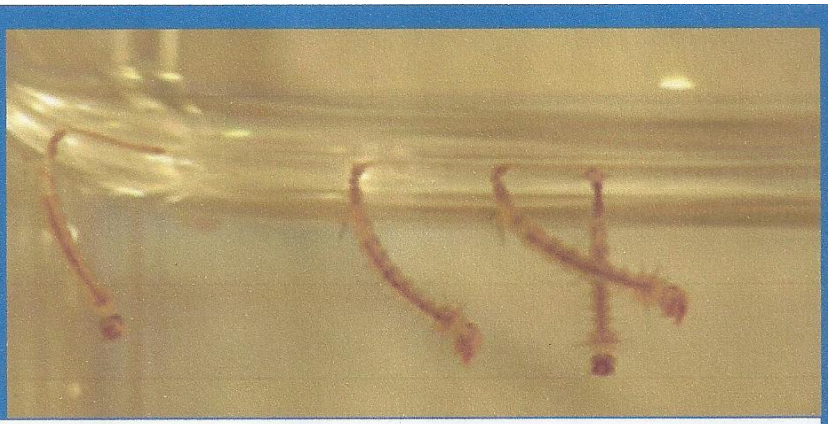


Eggs are laid near water, just above the water line.



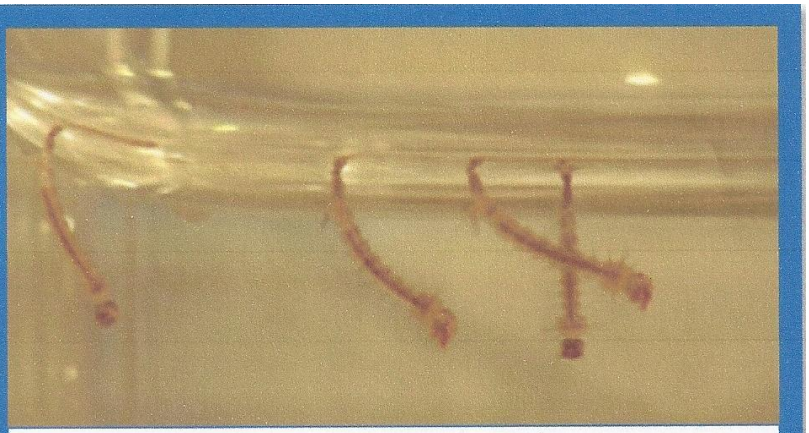
Mosquito eggs are tough; they can stick to objects like glue and won't dry out for up to 8 months.

Only a small amount of water is needed for a mommy mosquito to think it's a great place to lay her eggs. Flower vases, tea cups, beach buckets. vou name it!



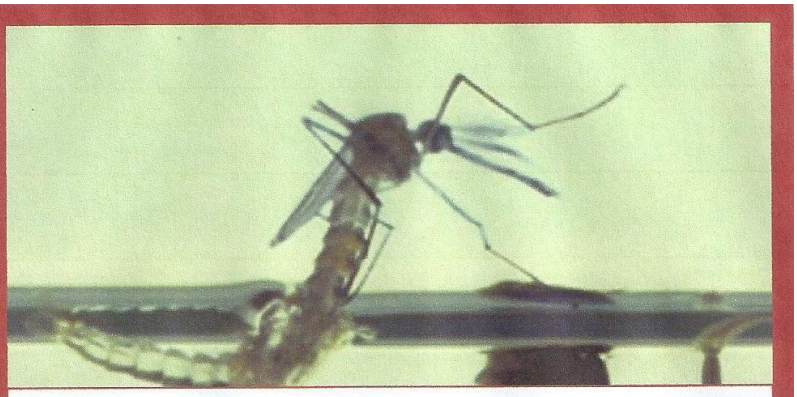
Larvae come out of eggs but only after the eggs are covered with water. Humans pouring more water into where the eggs are laid could make them hatch. This can happen if it rains too!

Larvae moult as they grow closer to becoming an adult mosquito.

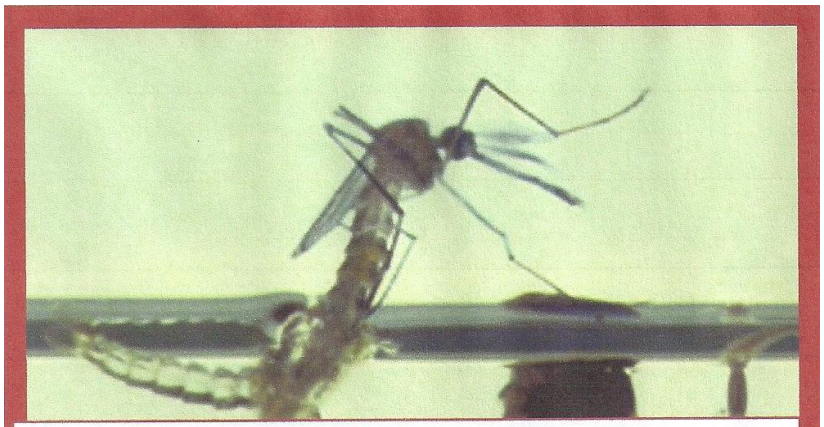


After a Larvae hatches it eats microorganisms (very small bacteria, bugs, and more) it finds in the water.

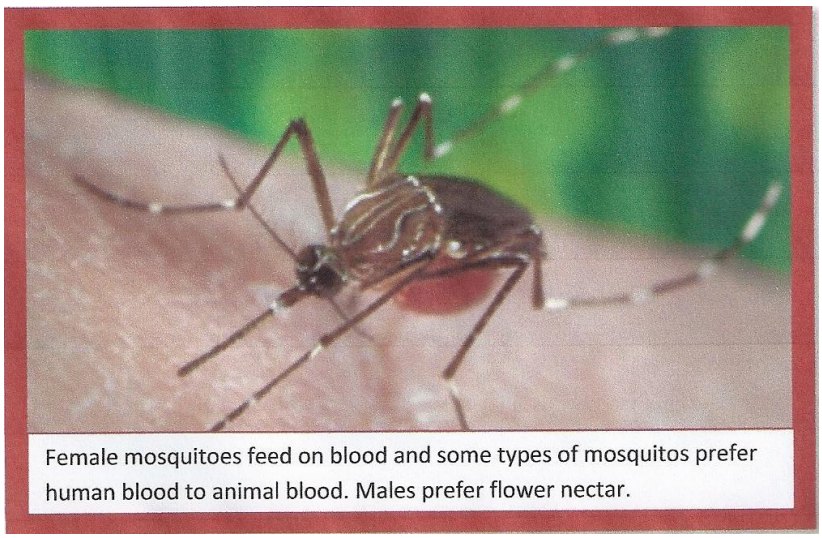
Pupae are the mosquito's bodies as it grows from larva into an adult. It is still under the water at this stage of life.



Adult Mosquitoes do not fly very far from the water supply from where they hatched.



When an adult mosquito finishes growing it will emerge out of the water.



Female mosquitoes feed on blood and some types of mosquitos prefer human blood to animal blood. Males prefer flower nectar.

ELABORATE

Lesson Four: Factors Affecting our Fliers

Summary

The main focus of the elaborate stage is to get the students more involved and curious about the roles of mosquitoes and about the environmental factors affecting them. Students will investigate the environmental factors affecting mosquito behaviour such as water temperature, light and odour.

Outcomes

Learning Outcomes

Students will be able to:

- Discuss which environmental factors may affect adult mosquitoes.
- Form hypotheses on the effects of environmental factors on Adult mosquitoes.
- Plan and implement experiments.
- Take observations during the experiments.
- Draw conclusions based on the results of the experiments.
- Explain the effect of low temperature on reduced mosquito activity.
- Explain the effect of decreased light on a mosquito's increased activity level.
- Explain how a mosquito's behaviour is influenced by odour or sweet scent.

Assessment

In this lesson, formative assessment will be used to assess students understanding of:

- Adult mosquitoes having being influenced by their environment
- How the environment could influence the life cycles of mosquitoes

Information to teachers

In this lesson students will be performing three different observations. Observations will be based on each of the following environmental factors and their effect on mosquito behaviour; water temperature, light and odour. Teachers may choose to keep all three observations as one lesson or to break this 'Elaborate' stage into three separate lessons, one on each environmental factor. This may be more effective in making sure each environmental factor does not affect the other and may create more time for students to reflect. Students will need to develop hypothesis, plan each experiment, conduct the experiment and collect results, analyze the results and draw conclusions. Three separate result sheets should be given to each student stapled together. Each one should be labeled with student's names and which experiment each sheet is for. Student results can then be added to their posters in the evaluate stage.

Time will need to be given in between each experiment for mosquitoes to return to what the teacher believes is their natural state. As mosquitoes are more active at night, the teacher may decide to conduct the temperature and scent experiment while the tank is still covered with the dark sheet. A timer is also optional to time how long each observation lasts. These variables may be discussed later with students on how to better improve each experiment.

Mosquitoes are only active in certain seasons of the year because they are sensitive to water temperatures. They prefer temperatures over 26ºc and will become inactive if temperatures reach below 10ºc. Mosquitoes hibernate in cold weather as they are cold blooded. In colder temperatures, mosquitoes are far more docile and move less, whereas in warm temperatures mosquitoes are far more active and likely to feed (Beck-Johnson et al., 2013)

Mosquitoes are most active during the evening and at night. This is to avoid the bright sun which might dehydrate them. Mosquitoes have an in-built circadian rhythm that is influenced by light levels during the day and night, and this influences their activity level at different times. As the light level changes from light to dark, mosquito activity tends to peak. This time period aligns with dusk when mosquitoes are observed to be most active. (Taylor & Jones, 1969).

Mosquitoes rely on their sense of smell to locate humans, and their sensitive proboscis is used to seek out the smell of carbon dioxide exhaled, sweat, perfume and moisture. When they sense these chemicals in the air, they are drawn towards them because they know a human is nearby to feed on. Female mosquitoes are far more sensitive to human-related smells as they need blood in order to produce eggs (Shen, 2017)

For more information about mosquitoes these websites may be useful:

- For detailed research about the role of scent in mosquito environment: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5338503/
- For detailed information about the activity of mosquitoes at different times of day: https://pdfs.semanticscholar.org/4b0c/56ec14953c885a916b8517d695544de2a940.pdf

Implementation

Equipment and Materials

For the teacher:

- Small Mosquito tank introduced in the 'Explore' lessons
- Larger tank to hold water and ice cubes
- Pitcher of water and bag of ice
- Black cloth to cover the tank
- Torch
- Sweet scented perfume
- Timer or stopwatch (optional)

For students:

- Posters
- Pen and pencils
- Result Sheet

Preparation

- Prior to the light observation, the teacher will need to locate or purchase a piece of dark cloth that will block light. Prior to the lesson, this will be placed over the tank to imitate nighttime for their mosquitoes so students can see how this influences their behaviour.
- Prior to the Temperature observation, the teacher will need to organise filling the large tank with water and a bag of ice cubes to place our smaller mosquito tank within.
- Prior to the scent observation, the teacher will need to organise bringing perfume into the classroom to spray near the mosquitoes and see if they are drawn to it in any way.

Lesson Steps

1. Teacher to inform students that they will be learning about what can influence the behaviour of mosquitoes.
2. Teacher to ask students what environmental factors they think may impact the adult mosquitoes movement in the tank.
3. Students will briefly discuss their ideas and develop their hypothesis. Students must use prior knowledge to justify their hypothesis.
4. The class chooses environmental factors to test. This can be just one or all three of the following: Temperature, Sweet Scent, or Light.
5. The class will break into small groups to plan how to test their hypotheses.
6. Students will be given three separate result sheets to use during their observations.
7. The teacher will then ask students to observe the mosquito behaviour (movement, speed, flight) when the tank is in normal lighting. Students are to make notes on what they see. They will do the same thing when the cloth is placed over the tank by the teacher, making note of any differences. Students should write observations and conclusions on a blank result sheet.
8. The teacher will ask students to observe the mosquitoes behaviour (movement, speed, flight) at the normal temperature and then place the tank within the large ice water tank to drop the temperature. Students will then observe behavioural changes

in the mosquitoes. Students should write observations and conclusions on their result sheets.

9. With the tank still covered, students will then complete their last observation as mosquitoes are more active at night. The teacher will then spray perfume near one side of the tank (not directly into it as this may harm mosquitoes) and ask students to observe whether this changes the mosquito behaviour (they may be drawn to that side of the tank). Students should write observations and conclusions on their result sheets.
10. The teacher will then discuss with the students how temperature, scent, and light may influence the mosquito life cycle- what would happen during cold temperatures to the mosquito life cycle?

Alignment with Victorian Curriculum

This lesson aligns with the Victorian curriculum, which states that students depend on their environment to survive [VCSSU058]. In the lesson, students will make and record observations and recognise the effect of environmental factors such as temperature on mosquito life cycles.

Students will 'with guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge [VCSIS065]. Students will 'suggest ways to plan and conduct investigations to find answers to questions including consideration of the elements of fair tests' [VCSIS066].

Additional Resources

Experiment Result Sheet

Before changing the mosquito's environment

Mosquito's Movement:

_____
_____
_____

Mosquito's speed:

_____
_____
_____

Mosquito's flight:

_____
_____
_____
Extra notes:

After changing the mosquito's environment

Mosquito's Movement:
_____
_____
_____
Mosquito's speed:
_____
_____
_____
Mosquito's flight:
_____
_____
_____
Extra notes:

EVALUATE

Lesson Five: My Mosquito Masterpiece

Summary

The focus of this stage is to evaluate the learning outcomes of the unit through a summative assessment by students. Students will use formal and informal scientific language to communicate their observations, methods, and findings of the mosquito life cycle to fellow peers and their teacher with both their final poster and by sharing their favourite fact.

Outcomes

Learning Outcomes

Students will be able to:

- Finalise their posters as a documentation of their learning process
- Share their understanding, predictions, and investigation of the life cycle and ecology of mosquitoes in a detailed poster
- Finalise labeled sketches of eggs, larvae, and adult mosquitoes in their poster
- Finalise representing how light, temperature, and scent affect mosquitoes
- Form and ask questions that encourage further learning based on their findings

Assessment

In this lesson, students will complete and hand in their summative assessment in which they will:

- Be prompted to reflect on their experience completing the unit
- Finish the final copy of their posters by adding as many additional details and facts that they can remember from the previous lessons
- Share one fact they remember with the class from their learning
- Students will then turn in their final poster with their names on the back and experiment result sheets.

Information to teachers

The Poster Assessment

Teachers, please use the "teacher information" sections from the previous 4 E's to help guide you in searching for vocabulary and scientific facts necessary to gauge how much learning intent was received by students in their writing. This, along with the outcomes at the beginning of each lesson should be visible in students writing on whether they have mastered each section.

Suggestions for Evaluation Criteria

- Students have included some prior knowledge in their poster from the engage stage (Mosquitoes can bite, they leave mosquito bites, they buzz, etc.)
- All stages of the mosquitoes life cycle drawn and labelled in the student's poster
- Students have drawn microscope observations of larvae and accurately labelled body parts
- Students represent how temperature, light, and scent affect mosquitoes
- Students drew conclusions after making observations added to their poster
- Students added questions to their poster to inquire further as an extension
- Students have included details of the mosquito habitat in their drawing (food, water)
- Student experiment result sheets reflect learning outcomes for lesson four.

Implementation

Equipment and Materials

For the teacher:

- It would be suggested that teachers use their own observational notes to assist in both assessing and aiding students with any final language/clarifications they may have.

For students:

- Pencils (May choose coloured for final drafts)
- Rubber
- Draft sketches from previous lessons
- Notes from previous lessons

Preparation

- Teachers can take the opportunity to commend students for their efforts thus far on the unit and give detailed instructions and a time limit for final drafts of their posters. Teachers should have their own notes prepared if needed throughout the session.

Lesson Steps

1. Ask students to gather their journals, pencils, rubbers, and previous draft posters in front of them.
2. Students will be told to work individually on writing about their experience with the unit thus far using the content from previous lessons to add as much detail as they can remember about the mosquito to their poster (This may require further prompting, such as asking them if they forgot anything they may want to add about mosquito larvae, etc.)
3. Students will be asked to go through their work and either create a new draft or correct their old poster draft with any facts they need to update.
4. Students will then be asked to gather together at the front of the classroom with just their posters in hand.
5. Together with the teacher, they will sit down and one at a time and share one thing they have learned in the unit.
6. After this has finished students can choose to write down one question they still have or would like to still know about mosquitoes on the back of their poster with their name.
7. Students can then turn their posters into the teacher so they can look for continued knowledge of the learning outcomes of the unit alongside their experiment result sheets.

Alignment with Victorian Curriculum

This lesson:

> 'Incorporate new vocabulary from a range of sources, including vocabulary encountered in research, into own texts' [VCELA293]
>
> 'Different living things have different life cycles and depend on each other and the environment to survive' [VCSSU058]
>
> 'Compare results with predictions, suggesting possible reasons for findings' [VCSIS070]

'Represent and communicate observations, ideas and findings to show patterns and relationships using formal and informal scientific language [VCSIS072]

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