

Research workbook

Class:

Names:

THE STAGES OF INQUIRY-BASED LEARNING



The stages of inquiry-based learning:

1. Introduction



2. Exploration



3. Designing your experiment



4. Conducting an experiment



5. Concluding



6. Presenting












7. Elaborating/broadening



Name 1:

Name 2:

Part	Hand in / Control	Maximum points	Score
Formulate the research question; Research cycle part 1 and 2  1. Introductie  2. Verkennen	Week 4	20	
Plan of approach and test stage; Research cycle part 3  3. Opzetten onderzoek	Week 4 or Week 5	20	
Results of your research (preferably in your log) Research cycle part 4  4. Uitvoeren onderzoek	Week 6 of Week 7	20	
Presentation of the poster Research cycle part 5-6  5. Concluderen  6. Presenteren	Week 8	20	
Handing in your report Research cycle part 5-6-7  5. Concluderen  6. Presenteren  7. Verdiepen/verbreden	Week 8	20	
Total score		100	

Mark for your inquiry = Total score / 10

1. Introduction



The first step is to determine the subject of your inquiry or design. Over the last three weeks we have been introducing the theme of this module and we have tried to give you a broad view on the theme. Now it is time for you to choose a smaller subject from the theme in order to perform your own investigation or make your own design. The next questions will help you determine this subject.

1. What part of the three weeks did you like the most?

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2. Are there any areas covered over the first three weeks which you still have questions about? If so, what areas and/or questions?

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3. Have you discovered any measuring instruments or apps that you would like to work

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with? (write down which)

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4. Do you have a hobby that you can apply to the theme? If so, what hobby?

The four questions you have answered on the previous page are important since these help you choose the subject for the next four weeks. It should help you choose a subject that interests you.

Discuss the subject with your partner. It is important you both want to do research about the same subject.

What is the subject?

.....
.....

Who is going to perform the research with you? Write down your and your partner's name.

1 (my name)

2 (my partner)

What was your motivation for choosing this subject?

This must be extremely clear and you should try to write as much as you can about your motivation!

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Remember, your motivation for choosing the subject is very important, so make sure you have written it down in detail.

Go to your teacher or the technical assistant and ask for approval of your motivation. If approved, then you receive a signature in the box below.

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When your subject has been approved by your teacher or the TA, you can go on to the next step of the research cycle.

2. Exploring phase



What do we already know about this subject?

Make a mindmap or a wordweb about your subject. Write down everything you already know.

From mindmap to research question.

The next step is to formulate a research question, however not all questions are correct research questions. Check out what questions are not good:

The “look it up” question

Many questions that students ask can be looked up in a book or on the internet. Of course there is nothing wrong with those questions, but they aren't proper research questions. A good research question is investigated in practice. You don't know the answer yet and it is not possible to find the answer in a book or on the internet. The only way to answer your question is through experiment.

The “why” question

An example of a “why” question is “why do mealworms become beetles?”. It is easy to see that this question does not clearly lead to a plan of approach. When you want to know more about the subject you can try to break the question up into small pieces. A question like “When do mealworms look like beetles?” or “Do all mealworms become beetles?” are more approachable to investigate. In other words, give your research more focus by focussing your question; a “why” question is too broad and needs more focus.

The “multiple” question

A proper research question should give rise to one experiment. Multiple questions like “On what shoes and on what floor can I run the fastest?” are in fact made up of two questions. It is not possible to design a reliable experiment that answers both questions at once. Multiple questions should be divided up into single questions. After that you can choose what question you like to answer.

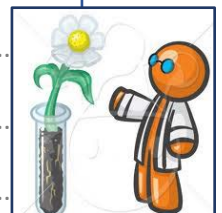
With this in mind, try to formulate a research question for the subject you would like to investigate. To test your question you can use the ‘Question machine’ on the next page. To test if your question is a suitable research question it will have to pass through all important criteria. If your question doesn't go through the machine entirely, then something is wrong with your question. In that case you must try to change the question in such a way that it will be able to go through the machine.

Research questions to be tested with the ‘Question machine’:

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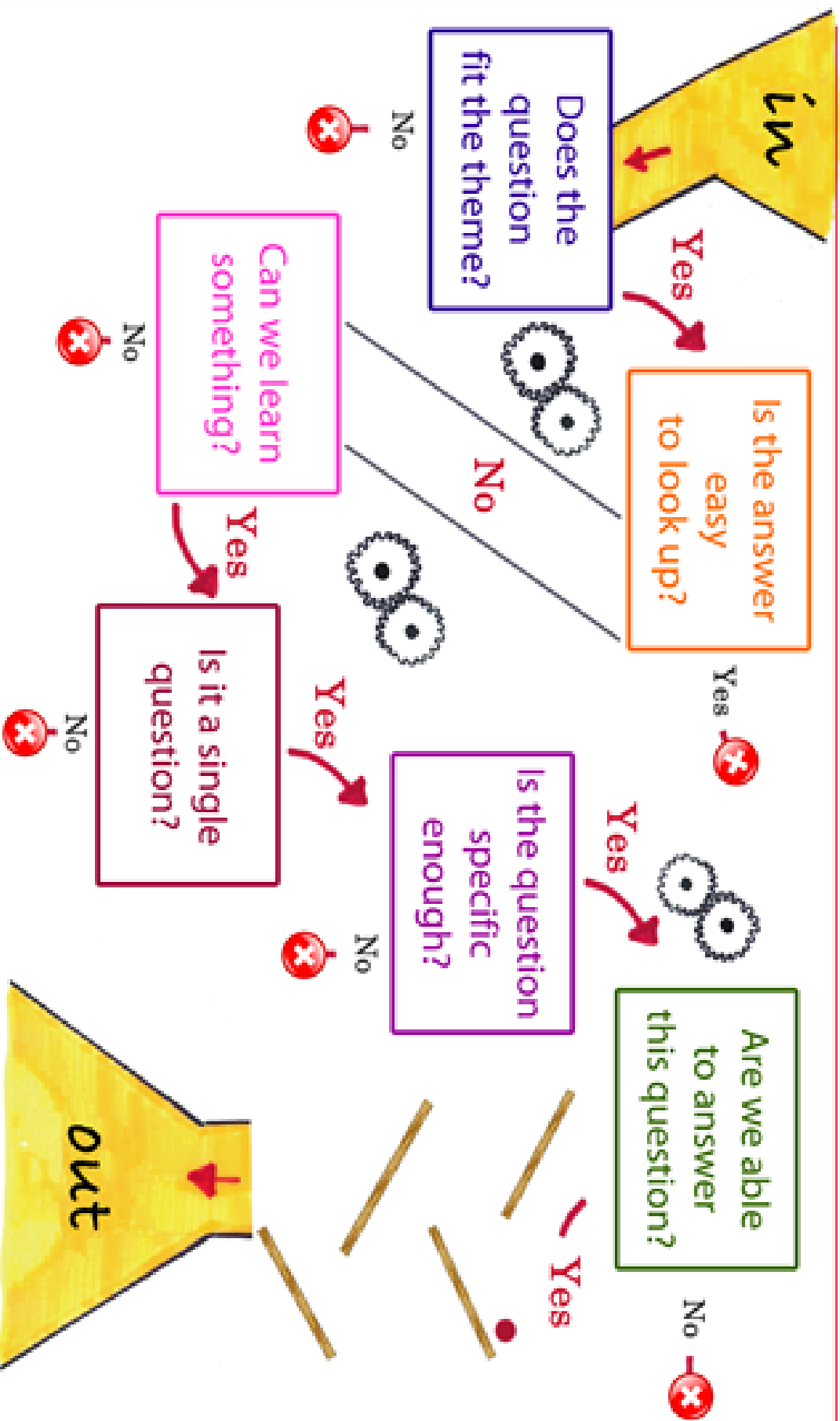
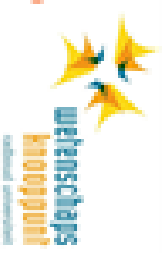
Write down the research question that has passed the ‘Question machine’:

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The Question Machine

Do we have a suitable research question?



What results do we expect to find? (hypothesis)

[Write down what you think is going to happen or what the answer to the research question will be.]

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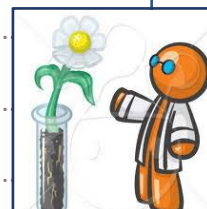
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Go to your teacher or technical assistant and ask for approval of your final research question. If approved, then you receive a signature in the box below.

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Score part 1 and 2 (teacher or TA) (max 20 punten):

1. **Introductie**   2. **Verkennen**

Be sure to copy your score on to the assessment form at the beginning of this workbook. (max. 20 points)

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3. Designing your experiment



How are we going to conduct our experiment?

[By answering the following questions, you will write down your plan of approach.]

- What are we going to measure and how are we going to do that?

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- What is the variable in our research and what remains the same?

Variable:
.....

All of this remains the same:
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- What materials or extra help do we need?



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- How much time do we need?

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- Where and when are we going to conduct our inquiry?

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- Who's going to do what during the inquiry?



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- What measuring instruments do you need during your research? Fill the circle if you need it. (You may add options)

<input type="radio"/> Ruler	<input type="radio"/>
<input type="radio"/> Measuring tape	<input type="radio"/>
<input type="radio"/> Stopwatch	<input type="radio"/>
<input type="radio"/> Thermometer	<input type="radio"/>
<input type="radio"/> dB meter	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>

- How are you going to record your results? (You may add options.)

<input type="radio"/> Table	<input type="radio"/>
<input type="radio"/> Graph	<input type="radio"/>
<input type="radio"/> Photos	<input type="radio"/>
<input type="radio"/> Film	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>

- How often should we repeat our inquiry before we are able to draw any conclusions?

<input type="radio"/> One time is enough	<input type="radio"/> Four times
<input type="radio"/> Two times	<input type="radio"/> More times, because:
<input type="radio"/> Three times	

Now describe step by step how you are going to conduct your inquiry.

Make sure you write it down so that another classmate can do your research by just reading your instructions in this page.

Think of writing down:

- What you **exactly** do (most important)
- What materials you need (measuring instruments, etc.)
- How long the steps take (seconds, minutes, hours, etc.)
- Where you do the steps (in the classroom, outside, etc.)
- etc.

(Try to write the steps as precise as possible, but also in as few words as possible.)

Step1

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Step2

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Step3

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Step4

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Step5

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Step6

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Step7

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Step8

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Step9


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Step10.....

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For your plan of approach check the testphase from your teacher or TA

<p>.....</p> <p>Copy your score on to the assessment form at the beginning of this workbook. (max 20 points):</p>	 3. Opzetten onderzoek
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4. **Conducting your experiment**



The preparation

Make a list of materials you are going to organize for your research. Keep in mind that you will have to organize as much as you can yourself; only ask for help from the teacher if you really need to. He/she is very busy helping everyone, so it is always better to organize something yourself instead of letting the teacher do it for you.

A large rectangular box with a blue border, containing 15 horizontal dotted lines for writing. The lines are evenly spaced and extend across the width of the box.

Let's start

At this stage we won't give you any worksheets because every experiment will be different.

Keeping a log

Write down your results in your log. A log can be a notebook, but it can also be a word document or notes which are neatly presented in a binder.

For a researcher it is standard routine to keep notes in a log during an experiment. A log consists of the date, the time, the setup of the experiment, the circumstances during the experiment, the results and anything that the researcher notices during the experiment.

Why does a researcher keep a log? By carefully writing down what you have done and safely keeping it stored you are able to communicate with other scientists about what you have exactly done. You are able to share your experiences with others and learn from each other.

Important questions

The answers to the questions below are what would fit in a logbook. Try to answer the questions about your research and add the answers to the next pages.

Write it in such a way that someone else is able understand what you have done.

1. What is the date, time and place?
2. What have I done?
3. What are the results (measurements)?
4. Did something unexpected happen? If so, what exactly?
5. What is going very well and what isn't? Why?
6. Have I got anything else important to mention?
7. What am I going to do next lesson?

Example of a log:

17 December 2015, 11:30 AM, classroom 20. I have measured the temperature of the lukewarm water with a thermometer. The temperature was at 20 degrees Celsius. This temperature was expected. I have not been able to do measurements of the temperature of other liquids yet since these are not available at school now. My partner is going to organize milk and I am going to get orange juice. The next lesson we are going to measure the temperature of lukewarm milk and lukewarm orange juice and record the results in a table.

The log above is very precise. Anyone else would easily be able to understand what you have done and what you are going to do! 😊

Logbook

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Logbook

A large rectangular area with a blue border, containing 25 horizontal dotted lines for writing.

Logbook

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Check your results with your teacher or TA (preferably your log):

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Copy your score on to the assessment form at the beginning of this workbook. (max. 20 points)

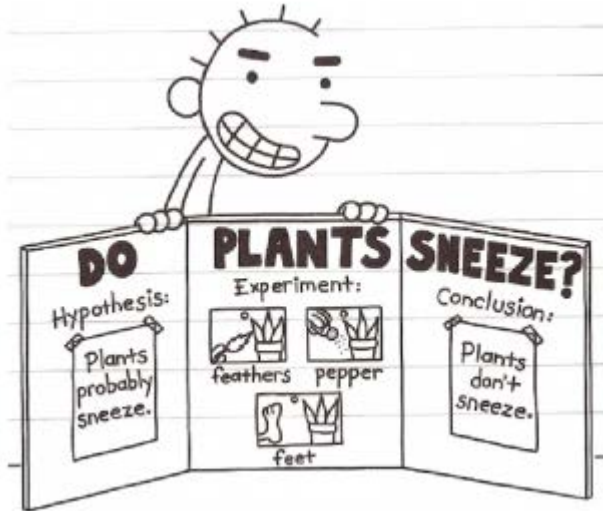


4. Uitvoeren onderzoek

5. To conclude



After you have collated your results you can start drawing your conclusion. Your conclusion must be an answer to your research question. So you have to check your research question to make sure you answer it correctly.



Our research question was:

[This is the same question that came through the question machine.]

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Our hypothesis (what you expected to find before doing the experiment) was:

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Our experiments showed that:

[This is what you really found after doing your experiments.]

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By filling in the answers below you will produce a good conclusion:

The answer to the research question is (the conclusion drawn from your results):

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Our expectation was:

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So our hypothesis was **CORRECT / INCORRECT**

Discuss with your teacher how fair your research was and write down below what the answers are of this discussion:

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Our results ARE / ARE NOT fair, because:

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Every research ends with a couple of tips for further research. These tips are about the way you have done research.

The most important improvement of our research would be:

[Write down one tip of how you would improve your research if you would redo it.]

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A better research question (not required):

[is there a better way of asking your research question? If so, what is the improved version?]

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6. Presenting

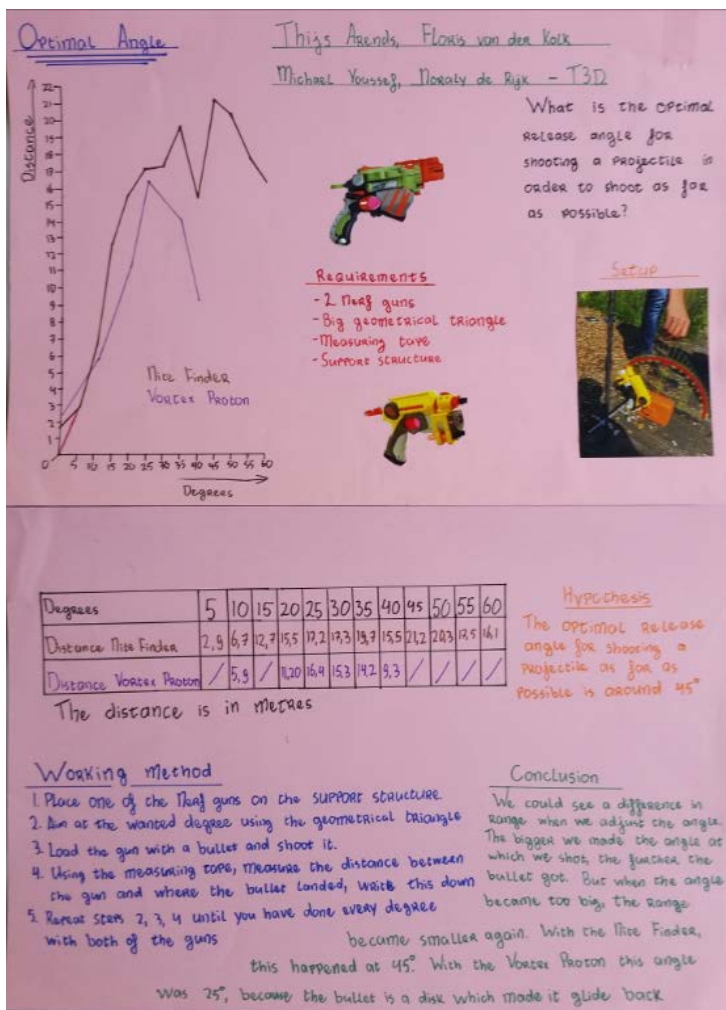
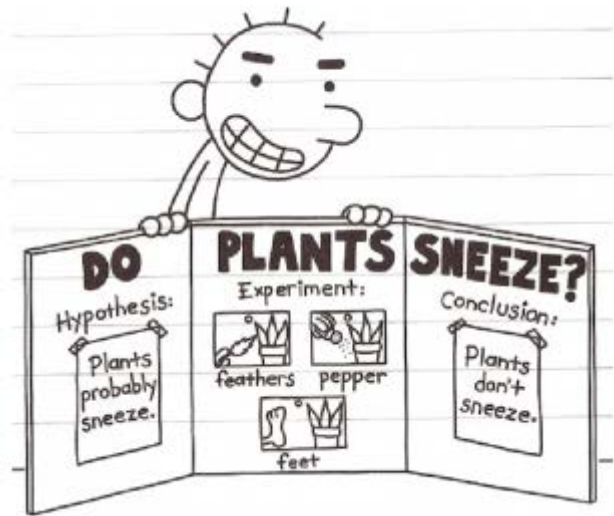
You will present your research to the rest of the class through a poster. To make your poster you have to use the things you wrote down in this booklet and your notes from your log.

On your poster you need to have the following items:

- Subject (Title?)
- Research question
- Hypothesis
- Method (picture/drawing?)
- Results (Tables / graphs)
- Conclusion (Answer to your research question and whether or not your hypothesis was correct)
- One tip for improvement or further inquiry.



6. Presenteren



Example of a poster