Journal & Pitch
Final Grade: C+

Performance Standards for Stage 2 Scientific Studies

	Investigation, Analysis, and Evaluation	Knowledge and Application
A	Critically deconstructs a problem and designs a logical, coherent, and detailed scientific investigation using a scientific method and/or engineering design process. Obtains, records, and represents data, using appropriate procedures, conventions and formats accurately and highly effectively. Systematically analyses and interprets data and evidence to formulate logical conclusions with detailed justification. Critically and logically evaluates procedures and their effect on data. Critically and perceptively evaluates the effectiveness of collaboration and its impact on results/outcomes.	Demonstrates deep and broad knowledge and understanding of a range of science inquiry skills and scientific concepts. Applies science inquiry skills and scientific concepts highly effectively in new and familiar contexts. Critically explores and understands in depth the interaction between science and society. Communicates knowledge and understanding of science concepts coherently, with highly effective use of appropriate terms, conventions, and representations.
B	Logically deconstructs a problem and designs a well-considered and clear scientific investigation using a scientific method and/or engineering design process. Obtains, records, and represents data, using appropriate procedures, conventions and formats mostly accurately and effectively. Logically analyses and interprets data and evidence to formulate suitable conclusions with reasonable justification. Logically evaluates procedures and their effect on data. Critically evaluates the effectiveness of collaboration and its impact on results/outcomes.	Demonstrates some depth and breadth of knowledge and understanding of a range of science inquiry skills and scientific concepts. Applies science inquiry skills and scientific concepts mostly effectively in new and familiar contexts. Logically explores and understands in some depth the interaction between science and society. Communicates knowledge and understanding of science concepts with mostly coherent and effective use of appropriate terms, conventions, and representations.
C	Deconstructs a problem and designs a considered and generally clear scientific investigation using a scientific method and/or engineering design process. Obtains, records, and represents data, using generally appropriate procedures, conventions and formats with some errors but generally accurately and effectively. Undertakes some analysis and interpretation of data and evidence to formulate generally appropriate conclusions with some justification. Evaluates procedures and some of their effect on data. Evaluates the effectiveness of collaboration and its impact on results/outcomes.	Demonstrates knowledge and understanding of a general range of science inquiry skills and scientific concepts. Applies science inquiry skills and scientific concepts generally effectively in new or familiar contexts. Explores and understands aspects of the interaction between science and society. Communicates knowledge and understanding of science concepts with generally effective use of appropriate terms, conventions, and representations.
D	Prepares a basic deconstruction of a problem and an outline of a scientific investigation using a scientific method and/or engineering design process. Obtains, records, and represents data, using procedures, conventions, and formats inconsistently, with occasional accuracy and effectiveness. Describes data and undertakes some basic interpretation to formulate a basic conclusion. Attempts to evaluate procedures or suggest an effect on data. Attempts to evaluate the effectiveness of collaboration and its impact on results/outcomes.	Demonstrates some basic knowledge and partial understanding of science inquiry skills and scientific concepts. Applies some science inquiry skills and scientific concepts in familiar contexts. Partially explores and recognises aspects of the interaction between science and society. Communicates basic scientific information, using some appropriate terms, conventions, and/or representations.
E	Attempts a simple deconstruction of a problem and a procedure for a scientific investigation using a scientific method and/or engineering design process. Attempts to use some procedures and record and represent some data, with limited accuracy or effectiveness. Attempts to describe results and/or interpret data to formulate a basic conclusion. Acknowledges that procedures affect data. Acknowledges the effectiveness of collaboration and its impact on results/outcomes.	Demonstrates limited recognition and awareness of science inquiry skills and/or scientific concepts. Attempts to apply science inquiry skills and/or scientific concepts in familiar contexts. Attempts to explore and identify an aspect of the interaction between science and society. Attempts to communicate information about science.

Notes in coloured text boxes are added to provide information and support for teachers and corresponds to text ifound on that page.

IAE1 - Student demonstrated detailed thought processes and idea generation, however, lacked a detailed method, hypothesis and variables. There was no process in place to confirm the safety or purity of the water obtained. C grade band.

IAE2 - Data presented was generally effective. Data was also presented as a list of answers to questions which was challenging to follow and analyse. C grade band.

IAE3 - Student provided a detailed journal that discussed process and steps. Analysis was limited in that scientific links and trends were generally appropriate. B grade band.

IAE4 - Inadvertent errors throughout with no real links to scientific concepts and application. Limitations were discussed in general terms and not in enough detail to support B grade band. C grade band.

IAE5 – Student reflects on collaboration within the group and provides a basic evaluation of the impact it had on the group's outcomes. C grade band.

KA4 - Terms, convention and language skills mostly coherent and effective. Student alternated between formal and informal conversation as well as consistent use of personal statements appropriate for a journal. Bibliography uses appropriate conventions. B grade band.

	STAGE 2 SCIENTIFIC STUDIES – HUMAN BIOLOGY **Collaborative inquiry folio (20 %)** **Student Name:**

Purpose
1- Obtaining, recording, and representation of data, using appropriate procedures, conventions, and formats. 2- Analysis and interpretation of results to formulate and justify conclusions. 3. evaluate procedures and results, represent and analyse evidence, and formulate and justify conclusions. 6. communicate knowledge and understanding of scientific concepts, using appropriate terms, conventions, and representations.

Task Description
Collaborative Inquiry – group design: Context: ***A group of students have broken down in the outback and have no remaining potable water. They find a muddy puddle of salt water and have to design a device to produce safe, drinkable water using only the equipment found in the boot of the car.*** Students need to work together to make a water treatment device, test the device, recording the results and then modify their design appropriately. They will record their individual contribution and progress in a journal to reflect their learning and development of the method. They also record the data collected and analyse it for meaning. After conducting the investigation, students individually prepare a presentation in the form of a pitch, defence, or justification that evaluates the procedures used and the effectiveness of the collaboration.
Task Instructions
1. Work with partners in order to suggest a possible procedure for purifying water. 2. Discuss and identify safety considerations in the investigation. 3. Obtain, records, and represent data, using appropriate procedures, conventions, and formats. 4. Analyse and interpret data and evidence to formulate logical conclusions. **5.** Evaluate procedures and their effect on data.

Assessment Conditions

Part A: Collaborative Inquiry Design

Personal journal – maximum 12 A4 pages.

Students record individually, in a personal journal:

- initial thinking, ideas, and their individual deconstruction of the problem
- evidence of their own contribution to the project and supporting documentation on the application of their collaborative skills
- representation(s) of the data collected by the group
- preliminary analysis and interpretation of results/outcomes
- connections between results and scientific concepts.
- an evaluation of the procedures and results/outcomes
- a conclusion with justification and the consideration of possible limitations.

The journal should include the student's deconstruction and may also include, but is not limited to:

- planning strategies
- methods trialled
- suggestions for improvements
- ideas or questions investigated or posed
- reflection on progress
- pictorial record of experiments
- analysis of data
- future planning
- peer review.

Part B: Collaborative Inquiry Evaluation

A recorded presentation – maximum 5 minutes, if oral.

This evaluation should include:

- an outline of the problem/need/opportunity
- an evaluation of the effectiveness of collaboration and its impact on results/outcomes

You will be assessed on:

IAE 1	KA 4
IAE 2	
IAE 3	
IAE 4	
IAE 5	

File name STUNDENTSACENUMBER–2STU20–AT2– Collaborative inquiry folio

Due Date: _____

Stage 2 Scientific Studies
Collaborative Inquiry Journal

Task:

IAE1: Identification of the problem and criterion for success.

You and a small group of people have broken down in the middle of the outback. With no service, it is unknown how long you will be there until another car passes through. Using the supplies in your car as well as in the environment around you, find a way to successfully create clean drinking water from a muddy puddle you found on the side of the road.

Research/Background Information:

KA4: Some scientific background justifying the direction of the investigation.

Humans can survive weeks without food but water is a different story. It's a probable guess that humans can survive 3 – 5 days without water, assuming they are not physically tiring themselves out (Wonderopolis, 2019). As the body is made up of around 60% water, health professionals recommend an approximate amount of 2 litres of water per day, for the average adult (Gunnars, K. 2019). This recommendation can differ depending on a few factors. Some factors include; climate being too hot or too cold, being physically active and age (Better Health Channel, 2014). If the climate is too hot the body begins to sweat more increasing water loss. Likewise, in cold climates the air lacks humidity causing the lungs to work more which results in increased respiratory water loss (Guest Blogger, 2019). Ultimately, your body loses water through breathing, sweating, urine and bowel movements (RelayHealth, 2014). If any of these activities increase, then the liquid intake must also increase to replace the loss.

Water plays an important part in the human body. It keeps tissue, spinal cord and joints hydrated which benefit the muscles functions. It also aids with digestion and excretion (Laskey, 2015). Although water may look, smell and taste normal but there can be hidden contaminants. Some of common hidden contaminants include; Aluminium, copper, lead, fluoride, mercury and many more. Even if you cannot see the bacteria, doesn't mean it isn't there.

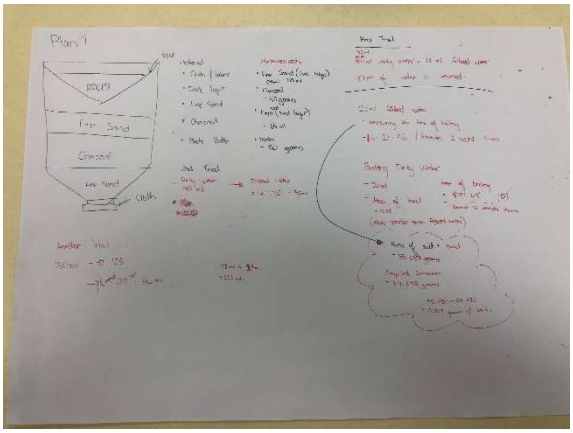
Group Plan:

Part One:

IAE1: Evidence of planning with some justification of steps planned.

The first thing that must be done to the dirty water is filter it. We will use the materials given to us which would be found in a car and make a funnel. Cutting a milk carton in half creating a funnel and a cup. In the filter we will layer it with fabric, crushed charcoal, rocks and sand. This will eliminate the physical chunks of bacteria present in the water as well as some of the chemicals present. Fabric will also be placed over the filter and secured with tape to prevent any further contamination to the water and well as act as an extra step of filtering. This step may be repeated two or three times for the best possible result for part two.

Figure 1. Planning Sheet



Part Two:

With the filtered water, it is now time to work on reducing the contaminants. The filtered water will be placed into a container with 4 wicks stemming out into 4 separate empty cups, made from materials in the car. These wicks will be made from twisted fabric inside plastic covers to prevent water loss to due evaporation from the heat. This set up will clean the physical appearance of the water, as well as remove the chemicals and bacteria slightly. Now that the filtered water is physically clear, it is time to remove all hidden contaminants; chemicals such as dissolved salts and biological such as bacteria.

Some misunderstanding about the science behind filtration.

Part Three:

KA4: Communication of ideas behind boiling slightly confused.

The simplest way to remove the hidden contaminants is to heat up the water and boil them out more precisely. Using a solar still to collect the evaporated water will ensure that the chemicals are burned and eliminated from the filtered water. This way, the end result will be fresh, clean drinkable water.

Journal

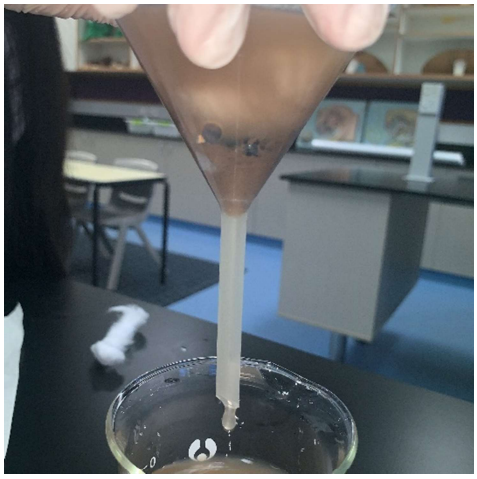
First day planning:

Beginning the development of our plan started with testing and experimenting. Having a play with scientific technology/equipment and slowly reducing the apparatus to what we would have if we were stranded in the middle of nowhere with just the car and ourselves. Investigating what method worked best for filtering the physical and chemical impurities and bacteria out of the water.

First day of experimenting:

We used the basic method of funnel and filter paper to pull out the physical bacteria such as; dirt, leaves and grass in the muddy water. This also reduced the darkness of the brown in the water. After this was done once, we repeated it tinkering at out filtering layer. In the second funnel we placed; filter paper, cotton balls, charcoal chunks and rocks to clean the water (Refer to figure 2). This reduced the colour of the water again creating a light brown shade but it was still not clear.

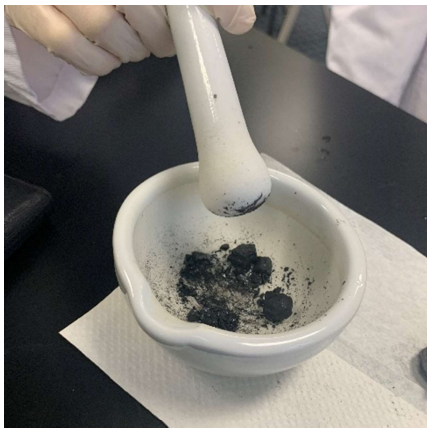
Figure 2. First strong filter



IAE1: Evidence of trialling a technique.

We decided to filter the water a few more times adding grass and sand to block the dirt. Conducting different variations of our filter, it was found that crushed charcoal works better to remove the tint than whole charcoal. We used a pestle and mortar to grind the charcoal chunks into a powder (Refer to figure 3).

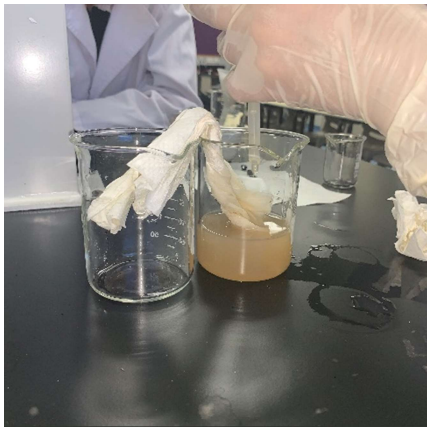
Figure 3. Crushing charcoal chunks



We took this new information and used it to our advantage by always crushing the charcoal before placing it in the filter. After a few filters later the colour improved but was not where we wanted it to be. That's when one of our member in the group conducted some research and found another method to filer the water. This method involved the use of fabric/paper to transfer the water from one beaker into another by capillary action. We decided to put it to the test and see if it could clean our water.

The water began to rise through the tissue paper but at an extremely slow rate. While we waited we drew out our plans for the filter and set up of our task. After approximately 20 minutes, we had a tiny pool of water in the bottom of our second beaker, and to our surprise it was mostly clear. The method had worked, although it was significantly slow (Refer to figure 4).

Figure 4. New filtering method



Second day of experimenting:

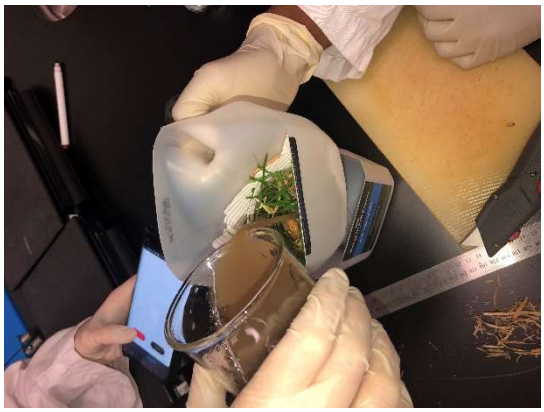
IAE1: Justification for changes made.

Now with a working method, we had more knowledge than in our previous time testing. We created a filter using the top of a milk carton and the bottom became our beaker. The filter consisted of multiple layers to eliminate the chunks in the water as well as partly remove the dark tint. These layers consisted of fabric, fine sand, charcoal and rocks. All placed in a specific order:

- Layer 1 - Small square of fabric
- Layer 2 - 45ml of fine sand
- Layer 3 - 40 grams of charcoal
- Layer 4 - 65ml of fine sand
- Layer 5 - 80 grams of rocks

(Refer to figure 5).

Figure 5. Milk carton filter



While the water was filtering, our second method was being made. Another milk carton was cut at the bottom with the same height as the other milk carton to be used as the second beaker. Fabric was then cut and twisted to the desired length, placing one end into the water filled beaker and the other end into the empty beaker.

Weather could be an issue here. If it was to become very humid due to heat, then the water would evaporate from the fabric rather than flow into the other side. This left us with a challenge to solve. After researching and discussing we decided that we will use recycling such as straws to cover the fabric which will trap the water inside and away from the heat. Another challenge we solved during our exploration was the pace. If the rate of filtering was going to be so slow then adding multiple streams would hopefully help this issue. So we used the top of the second milk carton as out third beaker and cover the opening with duct tape and added another fabric strip. The idea of having four outlets from the dirty water with the fabric strip to purify the water was presented. This way each outlet was designated to each person, therefore everyone would get their own share of water.

First individual researching:

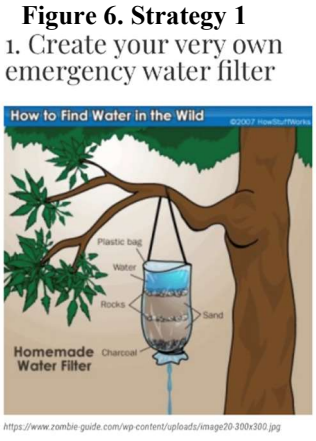
IAE5: Evidence of own contribution to the project.

In the break from our testing, this time was used to conduct some research. Researching lots of contributing factors such as:

- Strategies to purify water (Refer to figure 6 & 7)
- Recommended intake of water for the average adult
- The importance and role of water
- What contaminants can be present in unclean water

All of these factors are necessary to research in order to obtain a better understanding of the task at hand. By gaining a greater understanding of the task will hopefully led to the results being more successful.

Figure 6. Strategy 1



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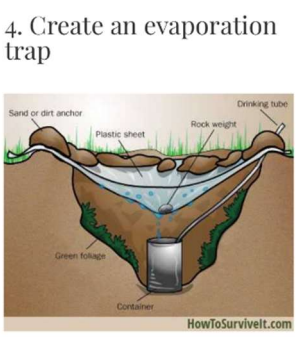

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Figure 7. Strategy 2

Third day of experimenting:

Now that we had a slow but successful method of filtering the dirty water to clear water, there was still one thing to consider. That thing is the unseen bacteria. Although the water looks clear, there may be invisible bacteria particles or disease that would make us sick if consumed. With this knowledge, our third experiment was based on purifying the water with heat. In this investigation we used tap water to reduce the preparation time and to prove the concept by filtering the dirty water as our method is relatively slow. To purify our water we created our own solar still (Refer to figure 8 & 9). Using two foil trays we moulded into a deep open box and sealed them together with strong waterproof duct tape. We then placed 500ml into the solar still and placed a beaker in the centre. We then covered the solar still with a black plastic bag taped in place. Placing a few small rocks to create a dent which will let the evaporated water fall into the beaker. We chose the black plastic back over the clear plastic as our prior knowledge tells us that darker things heat up faster that light coloured things.

IAE5: Supporting documentation on the application of collaborative skills

Figure 8. Construction of solar still

Figure 9. Finished solar still

Now with our solar still created it was time to begin the experiment. Heading outside we evaluated the landscape and agreed on the best place to put our solar still. We found a flat piece of concrete within a grassy area where the sun was almost directly over, this was the perfect place for our solar still (Refer to figure 10). We chose this as the ground was level and in almost direct sunlight. This would ensure nothing unpredictable happened while we waited for our solar still to do its work. Our experiment started at approximately 3:02 and ended at 3:24. This means our solar still was in the sun for an approximate of 22 minutes. When carefully removing the black plastic bag we were shocked with what we saw. Our solar still had collected no water, none in the beaker and none of the plastic bag. The concerns that out solar still didn't work were put to rest as we had a further look. A few small water droplets was found on the tape used to connect the top and bottom tray together (Refer to figure 11). This suggest that it was working but further tests will need to be done to enhance the effectiveness.

IAE4: Evaluation of the solution.

Figure 10. Solar still placement

Figure 11. Collected water

Second individual researching:

In this break, further research was conducted to obtain greater knowledge about water itself. Researching what the role of water is in the human body as well as exploring what contaminates the water. This information is useful as it will allow us to be aware of the contaminants and challenge us to provide solutions to eliminate them. This will ensure that by the end of the task, the drinking water we purify will be fresh and clean physically and chemically.

Fourth day of experimenting:

Today the group got together began to put numbers to our experiments. These numbers included:

- The average time taken for the water to be filtered
- How much water was obtained after the filtering and how much was lost?
- How long does it take to boil out the harmful chemicals in already filtered water?
- How long does it take to boil out the harmful chemicals in dirty water?
- How much mass was harmful chemicals?
- What was the percentage of mass filtered?

By completing these task and being able to put numbers to them, it will provide us with the ability to estimate how much water we need to collect before the purification occurs and how long the purification process will take. The numbers and testing provide a more reliable prediction that just simply guessing. The following numbers were found:

- It took approximately 16 minutes and 83 seconds for 150ml of water to be filtered.
- From the filtration, 125ml was obtained and 25ml was absorbed. This can be seen in figure 12.(Loss rate – 25 ÷ 150 x 100 = 16.66%)
- It took approximately 6 minutes and 22 seconds to boil out the harmful chemicals in already filtered water (20ml)
- It took approximately 8 minutes and 52 seconds to boil out the harmful chemicals in the dirty water (20ml)
- We found that approximately 0.970 grams of salt and other chemicals were in the 20ml of filtered water. This can be seen in figure 13.
- We found that approximately 8.755 grams of salt and other chemicals were in the 20ml of dirty water. This can be seen in figure 14 and 15.
- Percentage of mass filtered: (0.970 ÷ 8.755) x 100 = 11.07%

IAE2: Data recorded. Some conventions not followed.

Figure 12. Strong filter

Figure 13. Boiled filtered water by-products

Figure 14. Boiled unfiltered water by-products

Figure 15. Boiled unfiltered water by-products

Final Results:

Table 1: Showing results of boil time in regards to filtering and unfaltering dirty water.

IAE2: Inconsistent use of significant figures.

Type of Water	Amount of Water	Empty Weight (grams)	Weight after boiling (grams)	Leftover Chemicals (grams)
Filtered water	20ml	54.667	55.637	0.970
Unfiltered water	20ml	54.667	63.422	8.755
			Percentage of Mass unfiltered	11.07%

Which method is better: filtering or not filtering before boiling?

With the given results table 1 above and figures 13, 14 and 15, it can be concluded that filtering the dirty water before boiling is definitely the better method. The results show that with the unfiltered water, 13.8% of the 20ml of original dirty water we left after boiling, whereas 1.74% of the 20ml filtered water was left undissolved. These results combined with the evidence also support the effectiveness of our filter. Our filter reduce the solids by approximately 89%. Therefore filtering the water before boiling will reduce the time as well as the hidden bacteria in the water.

How long to filter 1 litre:

IAE3: Some inaccuracies in data calculations.

I takes approximately 16 minutes and 83 seconds to filter 150ml with a 16.66% loss rate. 1 litre is 1000ml.

1000 ÷ 125 = 8 8 x 16.83 = 134.64 minutes

134.64 ÷ 60 = 2.244 hours (0.244 x 60 = 14.64)

To obtain 1 litre of filtered water, it will take an approximation of 2 hours 14 minutes 64 seconds ~ 2.5 hours

With the above calculations, the time for the appropriate amount needed can be found.

134.64 minutes x 4 Litres = 538.56 minutes

538.56 ÷ 60 = 8.976 hours (0.976 x 60 = 58.56)

Therefore, to obtain 4 litres of filtered water, it would take approximately 8 hours 58 minutes 56 seconds~ 9 hours.

Final Discussion

Collaborative Reflection:

IAE5: Review of collaboration within the group.

Throughout the many days of experimenting, the collaboration side was not always so helpful. There were days where everyone was working together and communicating efficiently. However, on other days there was either unsuccessful or no communication, as well as some group members not participating. On these 'weak' days, the collaborative aspect to this task as well as the group results was in jeopardy. Lack of collaboration in a collaborative task can create a few challenges. One of those challenges being the distribution of the group's evidence photos. This was an issue as without the photo evidence, the findings have no meaning without evidence to support it. This challenge was resolved by including the teacher. Informing the teacher of the problem and then they provided the solution and got the other members to send out the photos. Another challenged face was when the group wasn't fully working together. This lead to data being contained with those who were collaborating, leaving the other(s) in the dark. This was resolved by overcompensating on the said 'good days' when everyone was collaborating. This way everyone would be on the same page and further experimenting could be done successfully.

IAE3: An overall conclusion without reference to the specific model engineered to solve the problem.

Conclusion:

Through all of the researching, experimenting and discussing the task was able to be completed. If the problem of breaking down in the middle of nowhere along with 3 others and no service it is possible to create clean drinking water from a muddy puddle. Using two methods such as filtration and boiling. The given results suggest that you could survive as long as all the material needed to apply both methods were obtainable. This includes the source of dirty water.

Note:
IAE3: The student has not made connections between results and scientific concepts. See subject outline.

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STU_AT2 Journal water assessment notes

In terms of the subject outline specifications this personal journal has included:

- some evidence of initial thinking, ideas, and their individual deconstruction of the
- problem
- some evidence of their own contribution to the project and some supporting
- documentation on the application of their collaborative skills
- some representation(s) of the data collected by the group
- preliminary analysis and interpretation of results/outcomes
- no discussion of connections between results and scientific concepts.

There is evidence of some early thinking and plans including photo of planning sheet although it is not clear if/how roles were allocated. Some possible steps to solving the problem with some justification for these steps given, initially including some specific detail. Later in the journal, there is a jump to the results with no prior indication what steps were followed or why. Adjustments were made to the design of the investigation as various methods trialled but there is little evidence of repeating tests to confirm outcomes. (IAE1)

Some qualitative data is recorded in the journal and some quantitative data is recorded in an informal way. One data table which mostly following conventions is included. (IAE2)

An analysis of results is undertaken progressively, leading to suggestions of changing plans. Conclusions were more of a practical nature rather than being linked to scientific concepts. Limitations in techniques have not been related to the reliability of the conclusion (IAE3)

The evaluation of the procedures and results has been more of a commentary than a critical review (IAE4).

STU_AT2_Evaluation water recorded presentation

In the recorded presentation, students are required to:

- outline the problem faced
- evaluate the effectiveness of collaboration and its impact on results/outcomes

This student has:

- outlined the problem faced
- shown a visual representation of the steps followed in the first part of the attempt to solve the problem
- repeated the text from their journal reflecting on the collaboration of the group and this is also read by the student

IAE5: Refers to some of the challenges faced as a result of collaboration and what was done to overcome this. Minimal additional evidence of collaboration appears in the journal. Overall, the effectiveness collaboration has been considered and is at a C grade level.

It would be good to see a greater depth of evaluation about how well group members:

- led and allocated tasks,
- worked to deadlines,
- ensured accountability
- impacted/influenced decisions and progress.
- ensured reliable, accurate and precise results/outcomes when collaborating on data collection