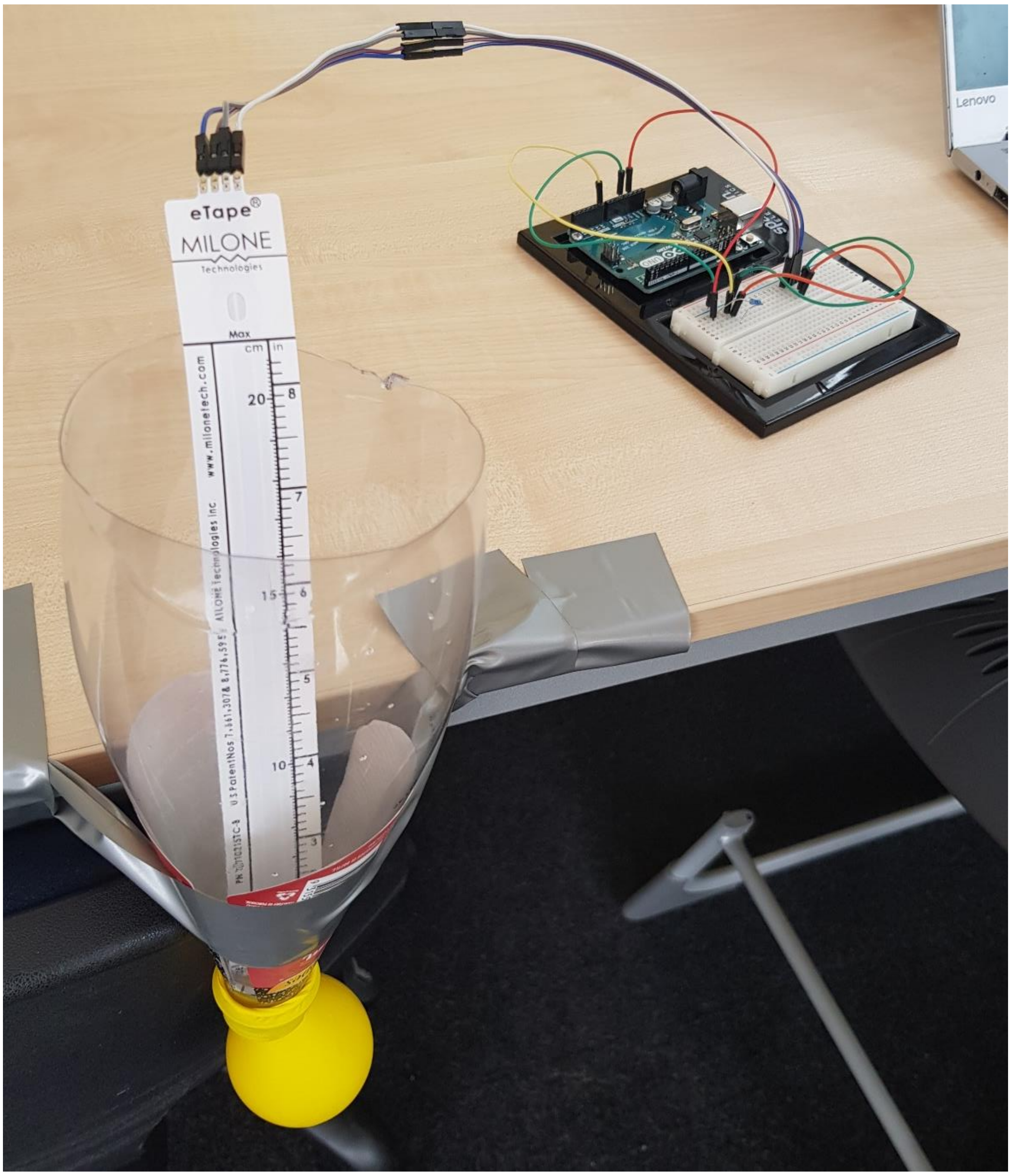
SEPTEMBER 18, 2020



CHAIRING IS CARING

YEAR 10 SCIENCE

Teacher: Heather Omant
Word count: 3,020
By Adele Harman and Eliza Gurney

Contents:

Aim:

The aim of this investigation is to create a device that alerts a user of their current sitting posture and allows them to adjust their posture to a more ideal sitting position.

Introduction:

Online learning has bought many issues such as bad posture and prolonged sedentary behaviour to light, leading to an increased interest in studying and solving these issues.

The Science Behind Posture

Posture is the stance a person holds their body, being different for each person. Posture can be both good and bad, with good posture involving the position that creates the least amount of stress on muscle and bad posture causing unnecessary tension on muscles due to bad positioning.

Many Australians suffer from back pains most likely caused by poor posture, with approximately 16% of Australia's population in 2017-18 having back problems.

These back pains have many causes. The main issue is the move to a sedentary lifestyle in modern years, causing prolonged sitting behaviour which is bad for humans as your body put into a position that increases the pressure put onto the spine. This sedentary behaviour is prolonged in schooling, work and home environments which takes up the vast majority of an average person's life.

When posture is changed, the body will subconsciously change our thoughts, further showing why posture does in fact have an impact on people's lives and why the youth of today should be educated about its influences.

Sedentary behaviour and sitting time

According to The World Health Organisation it is estimated that 95% of the adult population in the world is inactive with the average Australian worker sitting for 10 hours at work and at home.

Sitting down for more than 4 hours each day has led researchers to find sitting: slows down enzymes, decreases metabolic rate, disrupts blood sugar levels, increases insulin, risks of heart disease, diabetes, obesity, depression, cancer, muscle joint problems, blood pressure levels, and causes a lack of muscle exercise in the legs

It is recommended by the Australian Government's department of Health that people minimise the amount of time they sit for and that sitting is broken up into breaks as often as possible, doing around 2.5 to 5 hours of moderate physical activity between the ages of 18-64. Different age groups receive a different recommendation of how much exercise they should do with is shown in the Australia's Physical Activity and Sedentary Behaviour Guidelines (2014). Sitting for more than 7-10 hours a single day is bad for your health and recommends a maximum of 2 hours a day looking at a screen.

Best Chairs for Posture

A good chair allows a person to maintain a neutral position, also giving room for adjustments for correct bodily positioning.

One of the best office chairs, the Steelcase Gesture Chair, was created specifically to address ergonomic issues. The gimmick for this chair is the advanced posture corrector, which causes the seat to move in a 2.8:1 ratio. This makes it so it will adjust to keep feet on the ground.

The movement of the chair is directly based on human movements, specifically spine and neck movements.

The Steelcase Gesture Chair costs $1000 USD which is a massive price for a single chair and when looking at the prices of school chairs, being $37 AUD each, it is clear to see why schools have not used ergonomic.

Studies have also shown that the correct reclining angle in a chair is 135 degrees(Figure 1) which is nearly impossible to work with, meaning that overall using a standing desk is best.

This shows there is still a hole in the market for an easily accessible solution to bad posture at schools.

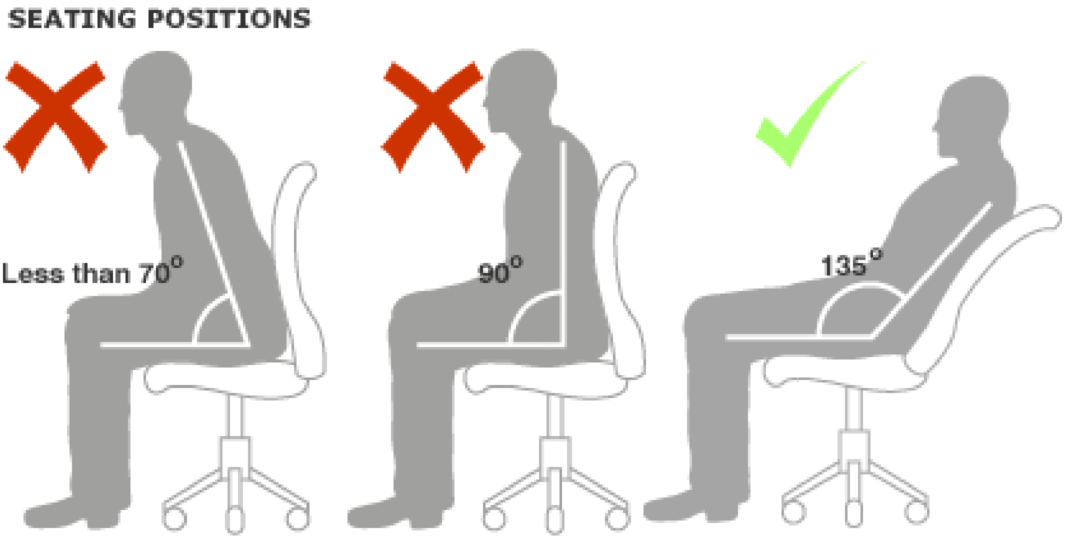


Figure 1- the best angle for a person to sit at, causing the least stress on the spine.

Effects of Bad Posture

Shorter term effects include having back pains, jaw pains, poor circulation, bad digestion, numb arms, repeated headaches, overall discomfort, stiffness, and pains of differing harshness.

When poor posture is continuous it can degrade the spinal and cause. This can lead to chronic pain in the neck and back as well as development of osteoarthritis, disc herniation and degenerative disc disease.

Long term effects of bad posture can also affect your breathing and without the lungs working properly, important organs will lack the oxygen they need to function.

Impacts of poor posture can lead to change in the spine's and a misaligned spine can also distort the natural curves in the lower back, neck, and upper-to-mid-back.

Posture in schools

In schools, students are sitting down and working for long periods during class and lunch hours. During these times, students may be sitting in chairs that are poorly designed which can cause poor posture. According to Mr Brennan 90% of back pains and poor posture is caused by poor seating at school. Chairs that are provided by school's (Figure 2) slope backwards which does not allow students to have their feet flat on the floor and creates bad posture. If a desk is not the correct size or height, then this can also lead to severe posture problems.

Figure 2- the type of chair used in Australian schools.

Strategies already in place for bad posture

There are many different strategies already in place to combat bad posture whilst sitting, being physical, digital, or medicinal exercise and treatments.

Physical posture correctors

Physical posture corrector's have been made for the specific purpose to passively correct posture without much human input.

The Evoke Pro A300 Posture Corrector, which is worn in a backpack like fashion (Figure 3 and 4) acts as an upper back posture corrector. A reviewer, Stephanie Vermillion, notes that the corrector is unnoticeable yet comfortable. The main downsides of this product is its lack of XXL options, it being tough to put on for people who have larger builds and its uncomfortableness if worn on bare skin.

Figure 3- back view of the Evoke Pro A300 Posture

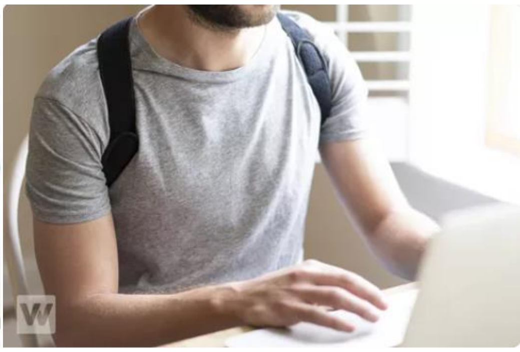


Figure 4- front view of the Evoke Pro A300 Posture

These types of posture correctors are often uncomfortable for women, with products such as the Perfect Everyday Posture Corrector Cami Bra (Figure 5) aiming to address this with many of the same features whilst being a bra. The main issue with this however is the lack of sizes due to the massive variety in bra dimensions as well as a more expensive price tag, with this example being $50 USD for a single bra.

Another physical posture corrector is the BetterBack, which is more focused on the lower back while sitting. The corrector uses bands that wrap around the user's knees (Figure 6) to relieve pain and improve posture. The corrector allows up to a 55" waist and below. The main downsides of this device include that non-discrete design and the fact that the device can only be used whilst sitting down, which does not actively improve standing posture.

Figure 5- back view of the Perfect Everyday Posture

Figure 6- example of how the Better Back is used

Digital posture correctors

There has been an increase on devices and apps that aim to correct posture in recent years, being a mixture of user and electronic input for posture to improve.

One such device is the Upright Go (Figure 7) which is a small device that sticks to a customer's back and when accompanied by the Upright app acts as a posture coach. The main downside to this device is the 10-hour battery life however an upright go 2 (Figure 8) was made by giving the device a 30-hour battery life.

Figure 7- picture of the upright go

Figure 8- picture of the upright go 2

Posture.io (Figure 9 and 10) is another device that connects to an app to measure posture however it is at a much lower cost, being approximately $21-$32 USD, which is much cheaper than most digital posture correctors. The product measures posture by measuring the change in magnetometer positions and translating that to a user's posture. The main issue with this product is the fact that it is not available for purchase and is thus only a proof of concept and cannot be properly tested.

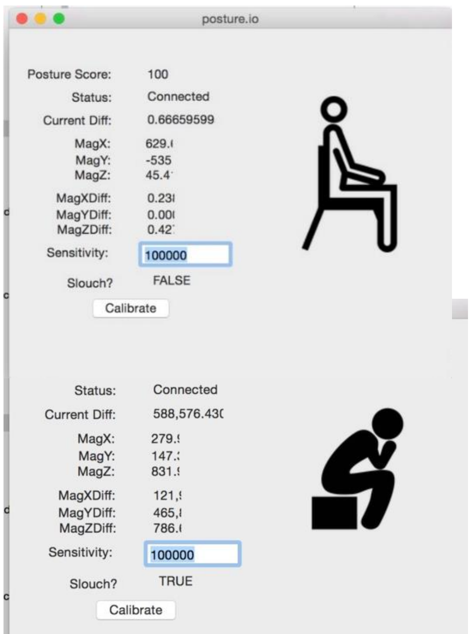


Figure 9 & 10- posture.io software in action

Specialist help

One may also seek a specialist help either through a chiropractor or physiotherapist, with each providing treatment and feedback on how to correct bad posture.

A chiropractor acts as a rehabilitation coach so that you are using the best methods to correct posture. However, a lot of the activities can be done by yourself for a lot cheaper.

A physiotherapist would likely also try to increase muscle strength and eliminate postural problems albeit through different treatments. This would likely begin with an examination of posture and then choosing the best treatment from what muscles need to be strengthened.

Pilates has also been recognised to reduce the chance of kyphosis (Figure 11) and is a common recommendation among physiotherapists if people want to correct posture.

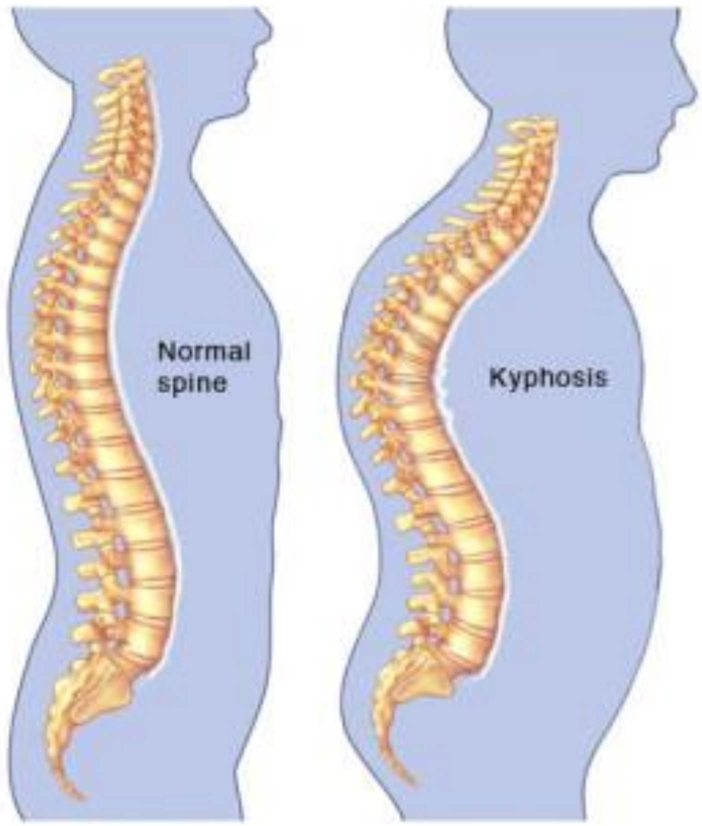
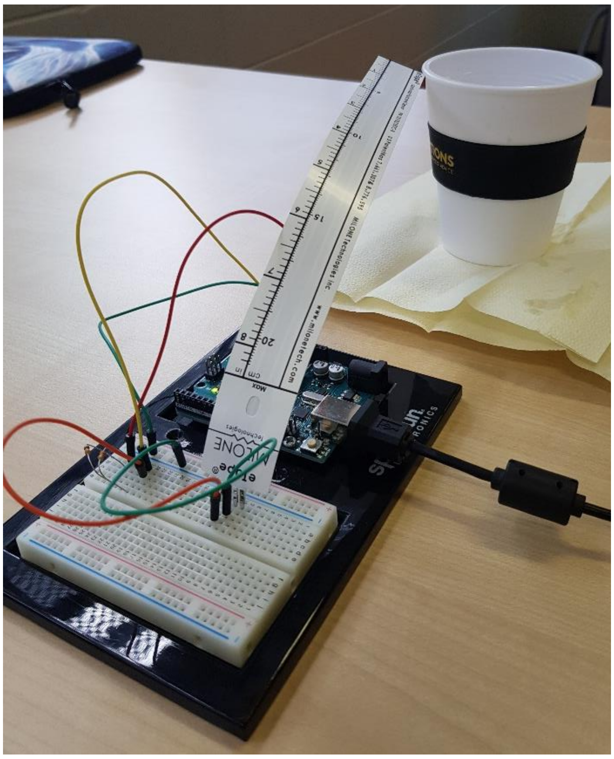


Figure 11- normal spine vs spine with kyphosis

Design Brief:

Designing a prototype

The goal for the prototype was to be able to measure posture in a fairly cheap way that can be accessed by a wide range of people. The way the prototype was decided to measure posture was by a buoyancy system with water. This was done by having a bladder at the bottom of a bottle that would be filled with water, and when the individual presses their back on the bladder, the water would go up the bladder into the bottle and a device programmed by the Arduino would read the water levels. When the user slightly leans forward the water would drop, and the device would alert the person that they are sitting with incorrect posture. Another way of measuring posture that was not chosen for the experiment but was discussed was a pulling system. Having a pully system was harder to get a hold of as a stretch sensor was needed and most stretch sensors were either too small or were not available.



Code

Challenges

Challenges faced with the coding process included finding a way to connect both Arduinos together so that the LCD screen would output data from the other Arduino. It was found that three types of cables were needed to be connected between each Arduino and two USB cables also needed to be attached the same computer for both of the Arduinos to communicate with each other.

Another challenge that was encountered was getting the lcd screen to work. The screen would output random symbols due to the two Arduinos not connecting properly, and the code was incorrect.

The last challenge that was encountered with the coding was getting correct measurements for calibration. The water sensor would output different numbers each time it was in a different position, meaning no stationary values would be shown each time the sensor was used.

End product (raw code)

Code A, for Arduino 1 (water sensor)

```
// the value of the 'other' resistor
#define SERIESRESISTOR 560
#include <LiquidCrystal.h>
// What pin to connect the sensor to
#define SENSORPIN A0

void setup(void) {
  Serial.begin(115200);
  pinMode(13, OUTPUT);
}
void loop(void) {
  float reading;
  reading = analogRead(SENSORPIN);
```

```
  //Serial.print("Reading ");
  //Serial.println(reading);
 // convert the value to resistance
  //reading = (1023 / reading)  - 1;
  //reading = SERIESRESISTOR / reading;
  //Serial.print("Sensor resistance ");
  //Serial.println(reading);
 //reading between bad and good posture
  if (reading>=570){
    Serial.print("Posture Bad ");
    //Serial.print("Reading ");
    Serial.println(reading);
  }
  else if (reading<=569){
    Serial.print("Posture Good ");
    //Serial.print("Reading ");
    Serial.println(reading);
  }
  delay(300);
}
```

Code B, for Arduino 2 (LCD screen)

```
/*
 LiquidCrystal Library - Serial Input
*/
/*
This example code is in the public domain.
http://arduino.cc/en/Tutorial/LiquidCrystalSerial
*/
// include the library code:
#include <LiquidCrystal.h>
// initialize the library with the numbers of the interface pins
```

```
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
void setup() {
  // set up the LCD's number of columns and rows:
  lcd.begin(16, 2);
  // initialize the serial communications:
  Serial.begin(115200);
}
void loop() {
  // when characters arrive over the serial port...
  if (Serial.available()) {
    // wait a bit for the entire message to arrive
    delay(100);
    // clear the screen
    lcd.clear();
    // read all the available characters
    while (Serial.available() > 0) {
      // display each character to the LCD
      lcd.write(Serial.read());
    }
  }
}
```

How the code works

Code A works by first defining the series resistor and the sensor pin. The void setup then initiates the serial and pin 13 output and the void loop uses all of this information to calculate readings. Since only the reading was needed for this experiment, the resistance has been removed however it is still in the code as reference. An if and else if statement are then used to calculate bad posture, with a reading above or equal to 570 in this case printing bad posture and anything below that printing good posture (refer to figure 12).

Code B reads the code from Code A and translates it for the LCD screen. First the library code is included and then initialised. Void setup then sets up the columns and rows as well as initialising serial. The void loop then uses an if statement to first delay any received data, clear the LCD screen, read characters given from data and then display said data on the LCD.

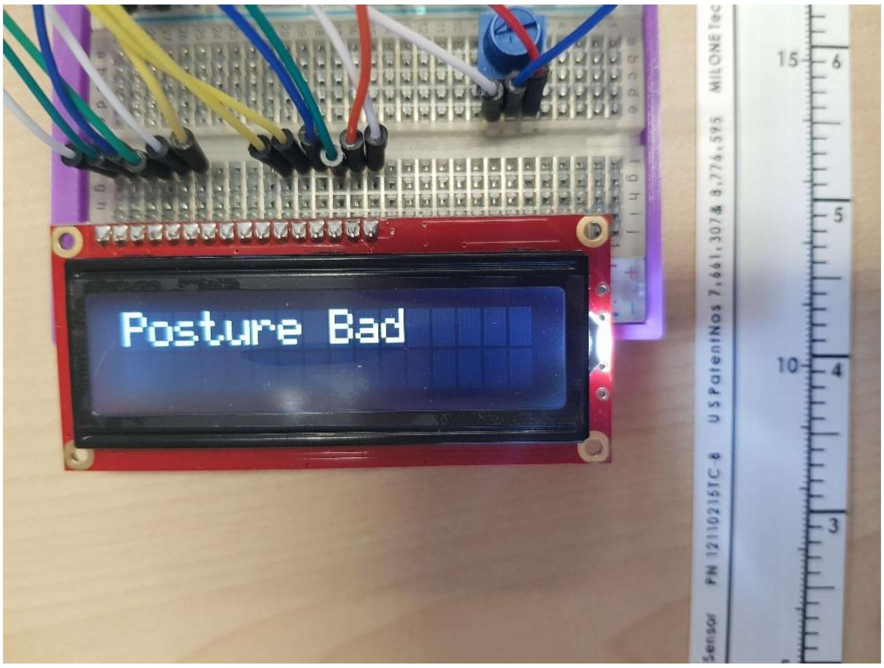


Figure 12 - LCD screen outputting Posture Bad

Experiment results

First prototype:

The first prototype tested was a failure due to a few reasons. The idea behind the first prototype was to find a tube that was at least 1 inch wide to fit a water sensor inside and attach a balloon to one end to simulate water level rising and falling, acting as a switch to alert for bad posture. This idea was first hindered by the issue of being unable to find a wide and long enough tube, meaning that a large syringe was used as compromise. This created issues as the rate that water travelled from the tube to the balloon was too slow. There was limited access to duct tape for the experiment meaning that the prototype was less secure. This failure led to create a few design changes such as using a cylinder that has a wider hole for the balloon to attach to as well as using duct tape to better secure the balloon to the bottle and prevent leaks.

2nd prototype:

The second prototype (figure 13 and 14), was a success from the previous prototype as a soda bottle was used with a balloon. The bottom of the soda bottle was cut off allowing electronics to fit. Water was able to flow freely up from the bottle. The balloon had no leakages however was not big enough to hold the amount of water needed. The sensor fit in the bottle very well however was not stable. The bottle was duct taped to a table with the Arduino device. Things that could be improved are: The bladder attached to the end of the bottle should be larger and the sensor to be in a stationary position in the bottle so a stable output can be given.

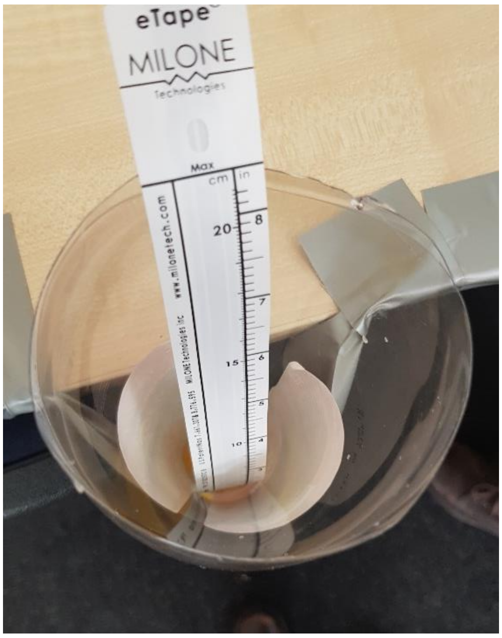


Figure 13 and 14- Second prototype with water sensor inside

Making 3rd Prototype:

The third prototype (figure 15 and 16) was successful in adjusting water levels when pressure was applied. A soda bottle was attached to a tube and bladder. The bladder and tube were glued together to create a seal between the two objects and then the tube was sealed into the lid of a bottle creating a secure water flow. The prototype was tested on a chair and was successful in raising the water level in the bottle but had to be supported by a plastic bag to be in the right position. The Arduino has not yet been used with the third prototype but the flow of water from the bladder, tube and then bottle was successful with one minor leak that has since been fixed.

Figure 15 and 16 – Third prototype

How the final prototype works

The final prototype (figure 17 and 18) was a great success. Unlike the third prototype, the bottle was held up by a clamp and the measuring sensor from the device was held up by tape to stop it from moving around inside the bottle. A chair provided by the school was used and the electronics were put on a platform to make the sensor more accurately read. The third prototype was used with minor adjustments alongside two Arduino to measure posture.

Figure 17- Functional and final prototype

Figure 18- Final prototype side view

Limitations

Whilst the final prototype of the project was a success, it still faced many limitations. The largest limitation is the design of the prototype, only consisting of one bladder and sensor, meaning that it will only give a reading if a user leans forwards, not if a user has incorrect feet positioning, neck positioning or shoulder positioning. The device also has a delay when telling the user of bad posture, needing time to process the data given. Another issue encountered that would be a problem if put into schools is the inability to use the device if the chair does not have a back to allow the bladder to rest. The piece of equipment is also uncomfortable if the water put into the bag is cold, meaning that the bladder will either need to be thickened or have the water heated up. The code requires calibration for each different user, for the different weights and pressures that people have, meaning that manual calibration is currently required. The last issue that this device has is the materials used to create it, being mostly plastic and non-recyclable, meaning that in the long term these materials will need to be switched out for more eco-friendly versions. Ideas of future revisions will be made in the discussion to improve on the limitations reviewed.

Discussion :

From looking at the data collected from experiments, the prototype designed can be seen as a success. The final prototype made addresses the aim to create a device that alerts a user of their current sitting posture through the use of a bladder and LCD screen.

The final prototype design made still leaves much room for improvement, with many limitations. One of the issues surrounding the prototype, being the use of only one bladder, could be addressed with a solution that involves using a bladder that has a similar appearance to air packaging (refer to figure 19 -21 for design inspiration) in the needed areas such as back, neck and lower back. Each individual section would include a water sensor inside which would allow for more areas of posture detection and even tilt detection.

Figure 19 – Bladder with similar appearance to air packaging

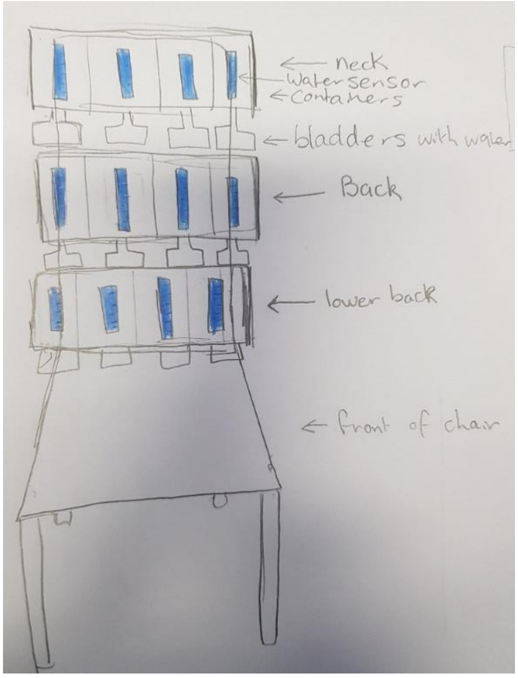


Figure 20- multiple bladders being implemented on the front of a chair

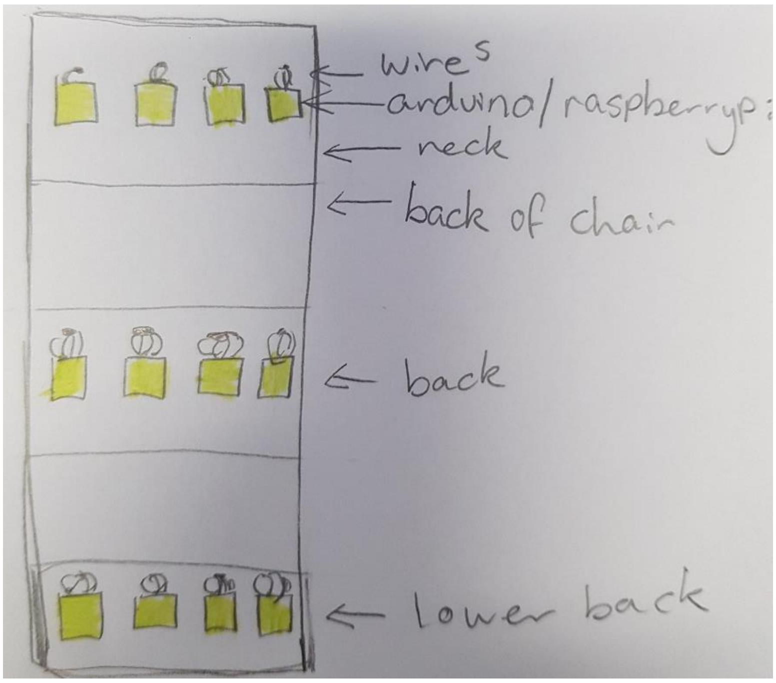


Figure 21- Back of chair with Arduinos attached

The prototype also achieved a design that could be potentially implemented into schools through its simple and relatively cheap design however the issue of chairs that do not have backs is still a problem. For implementation into schools, the device may need to be housed in a seat back design that can be slipped onto a chair or clamped to the bottom of a stool (for design inspiration refer to figure 22 -24). This would also help with the temperature of the water if a cover were put over it to thicken the layer between the body and bladder.

Figure 22 - back rest

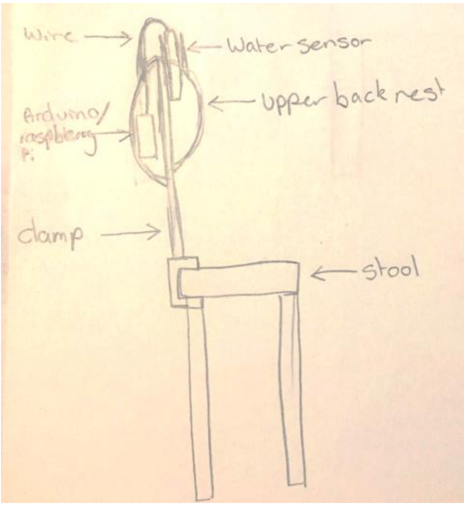


Figure 23 - Design being implemented on a stool

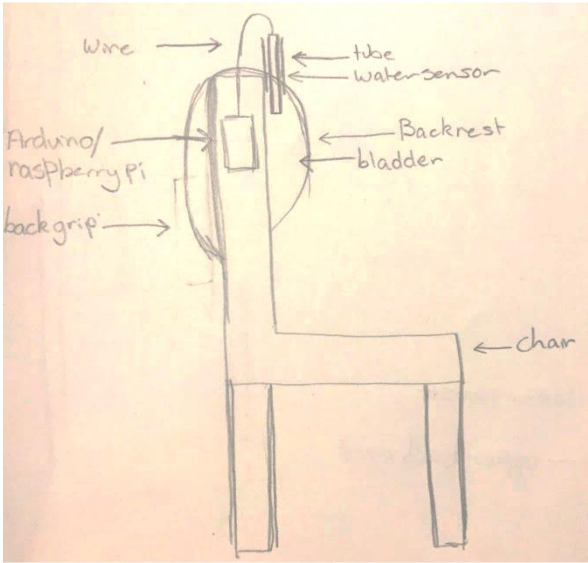


Figure 24 – Design being implemented in a school chair

With the implementation into schools, an Arduino would no longer be ideal due to its reliance on having a computer, meaning that the best new candidate would be the

Raspberry Pi, which would allow the program to run without the use of a computer and create a less bulky design.

With improvements to the physical design, the code can also be refined. The next step in the coding process would likely be to make a connection between the computer or other device wireless, with a website that can possibly more easily alert the user of bad posture over the simple display that is currently in place. While the main experiment used simple reedings to calculate bad posture, using an equation to calibrate water levels and convert to % of bad posture would allow for closer and more accurate readings.

It was also found that the prototype was made out of materials that were non ecofriendly. It used plastics, tape and other materials that can break down into microplastics and harm the environment. The bottle could be replaced with something that is not plastic and can be reused, like glass or stainless steel. However, a glass container has a higher risk of breaking. The bladder could be made out of silicon instead of foil as it is more durable and more friendly to the environment as well as being malleable. Silastic was used to combine the items together and is a better substitute than most binding liquids such as glue. The prototype works well but materials that make up the device are mostly not ecofriendly. However, it is a great way to reuse old materials.

Overall this experiment has shown the importance of posture and the desperate need for posture correction in the current school environment.

References:

The effect of online learning

- Joshua Stern, Ph.D. (ND). *Introduction to online teaching and learning .* Available at: http://www.wlac.edu/online/documents/otl.pdf. [Last Accessed 18/08/20].
- University of Illinois Springfield (2020). *Strengths and Weaknesses of Online Learning.* Available at: https://www.uis.edu/ion/resources/tutorials/online-education-overview/strengths-and-weaknesses/. [Last Accessed 21/08/20].

- Jana Angeles (2019). *Education statistics around the globe.* Available at: https://www.upskilled.edu.au/skillstalk/education-statistics-around-the-globe. [Last Accessed 21/08/20].
- australia.edu (2017). *Online Education in Australia.* Available at: https://australia.edu/admissions/Online-Education/. [Last Accessed 18/08/20].
- IBISworld (2015). *Online Education in Australia - Market Research Report.* Available at: https://www.ibisworld.com/au/industry/online-education/1907/. [Last Accessed 18/08/20].
- IGI Global (2020). *What is Online Learning Environment.* Available at: https://www.igi-global.com/dictionary/interacting-at-a-distance/21004. [Last Accessed 21/08/20].
- Jeremy Stuparich (2001). *E-learning in Australia: universities and the new distance education.* Available at: http://www.oecd.org/education/skills-beyond-school/1854142.pdf. [Last Accessed 23/8/20].
- Australian Government (2018). *Occasional Forum Series: Quality Assurance of Online Learning.* Available at: https://www.teqsa.gov.au/sites/default/files/online-learning-report-march-2019.pdf?v=1553589787. [Last Accessed 23/08/20].

Sedentary and sitting time

- SBRN (N.D). What is Sedentary Behaviour?.Available at: https://www.sedentarybehaviour.org/what-is-sedentary-behaviour/#:~:text=Sedentary%20behavior%20is%20any%20waking,are%20engaging%20in%20sedentary%20behaviour. [Last Accessed 21/8/20].
- getaustraliastanding.org (N.D). *Australians sit almost 10 hours each day (on average).* [ONLINE] Available at: http://getaustraliastanding.org/. [Last Accessed 21/8/20].
- Brigid Schulte (2015). *Health experts have figured out how much time you should sit each day.* Available at: https://www.washingtonpost.com/news/wonk/wp/2015/06/02/medical-researchers-have-figured-out-how-much-time-is-okay-to-spend-sitting-each-day/. [Last Accessed 21/08/20].

- physiopedia (2014). Australia\'s Physical Activity and Sedentary Behaviour Guidelines. [ONLINE] Available at: . [Last Accessed 25/8/20].

- Water Sensor
- gaslab.com (2020). gaslab.com. Available at: https://gaslab.com/blogs/articles/what-is-a-liquid-level-sensor#:~:text=Liquid%20level%20sensors%2C%20also%20called,particular%20level%20in%20a%20container. [Last Accessed 25/8/20].
- Core electronics (ND). 12 eTape Liquid Level Sensor + extras. Available at: https://core-electronics.com.au/12-etape-liquid-level-sensor-extras.html. [Last Accessed 1/09/20].
- T.K. Hareendran (2020). Optical Liquid Level Sensor. Available at: https://www.electroschematics.com/optical-liquid-level-sensor/. [Last Accessed 1/09/20].
- Adafruit (ND). *12\" eTape Liquid Level Sensor + extras.* Available at: https://www.adafruit.com/product/464. [Last Accessed 25/08/20].
- navya14 (2016). *eTape liquid level sensor.* Available at: https://forum.arduino.cc/index.php?topic=436029.0. [Last Accessed 25/08/20].

- Correct sitting posture
- Concept seating (2020). *HOW TO PROPERLY SIT AT A COMPUTER.* Available at: https://www.conceptseating.com/how-to-properly-sit-at-a-computer. [Last Accessed 28/08/20].
- CUErgo (ND). *Sitting and Chair Design .* Available at: http://ergo.human.cornell.edu/DEA3250Flipbook/DEA3250notes/sitting.html#:~:text=Definition%20%2D%20Sitting%20is%20a%20body,with%20the%20work%20can%20relax.. [Last Accessed 28/08/20].
- Dohrmann Consulting (2014). *How to sit at a computer.* Available at: https://www.ergonomics.com.au/how-to-sit-at-a-computer/. [Last Accessed 28/08/20].

- BackCentre (2020). *How to Adjust your Office Chair to get the Correct Sitting Posture.* Available at: https://backcentre.com.au/how-to-adjust-your-office-chair-to-get-the-correct-sitting-posture/. [Last Accessed 1/09/20].

Arduino

- MEGAN HEMMINGS (2018). What is a Jumper Wire?. Available at: http://blog.sparkfuneducation.com/what-is-jumper-wire. [Last Accessed 21/8/20].
- Arduino (N.D). Language Reference. Available at: https://www.arduino.cc/reference/en/. [Last Accessed 21/8/20].
- Patrick Di Justo (2015). Raspberry Pi or Arduino Uno? One Simple Rule to Choose the Right Board . Available at: https://makezine.com/2015/12/04/admittedly-simplistic-guide-raspberry-pi-vs-arduino/. [Last Accessed 21/8/20].
- Arduino (N.D). What is Arduino?. Available at: https://www.arduino.cc/en/guide/introduction. [Last Accessed 21/8/20].
- circuito.io (N.D). EVERYTHING YOU NEED TO KNOW ABOUT ARDUINO CODE. Available at: https://www.circuito.io/blog/arduino-code/#:~:text=Arduino%20code%20is%20written%20in,a%20human%2Dreadable%20programming%20language. [Last Accessed 25/8/20].
- AllAboutEE (2012). *Arduino Liquid Sensor Example Code and Schematic.* Available at: https://www.youtube.com/watch?v=Lu_9eiPu_pA. [Last Accessed 28/08/20]
- MadMadHoosier (2019). eTape Liquid Level Sensor. Available at: https://forum.arduino.cc/index.php?topic=607410.0. [Last Accessed 28/08/20].
- OldSteve (2016). *eTape wiring and code .* Available at: https://forum.arduino.cc/index.php?topic=393640.0. [Last Accessed 28/08/20].
- Arduino (N.D). *If Statement (Conditional Statement).* Available at: https://www.arduino.cc/en/Tutorial/ifStatementConditional. [Last Accessed 28/08/20].

- Short term effects
- BetterHealthChannel (2015). *Posture.* [ONLINE] Available at: https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/posture. [Last Accessed 1/09/20].
- Extra
- BBC (2006). Sitting straight \'bad for backs\'. Available at: http://news.bbc.co.uk/2/hi/6187080.stm. [Last Accessed 5/9/20].
- Linda Searing (2019). e.g. Training and certification. Available at: The Big Number: The average U.S. adult sits 6.5 hours a day. For teens, it's even more. [Last Accessed 9/5/20].
- William Morrison (2019). What is Sedentary Behaviour?Why Does My Lower Back Hurt When I Sit and How Can I Relieve the Pain?. Available at:. https://www.healthline.com/health/lower-back-pain-when-sitting#:~:text=A%20common%20reason%20your%20back,by%20an%20underlying%20medical%20condition [Last Accessed 5/9/20].
- AIHW (2020). Back Problems. Available at: https://www.aihw.gov.au/reports/chronic-musculoskeletal-conditions/back-problems/contents/what-are-back-problems. [Last Accessed 5/9/20].
- Belle Beth Cooper (2013). The Science Behind Posture And How It Affects Your Brain. Available at: .https://www.lifehacker.com.au/2013/11/the-science-behind-posture-and-how-it-affects-your-brain/#:~:text=A%20study%20by%20researchers%20from,our%20decision%2Dmaking%2C%20subconsciously.&text=And%20in%20fact%2C%20it%20seems,our%20thinking%20and%20decision%2Dmaking [Last Accessed 5/9/20].
- Barbara Brody (2018). The Surprisingly Easy Move That Can Make You Happier and Boost Your Energy Instantly. Available at: https://www.health.com/mind-body/how-posture-affects-mood#:~:text=No%20evidence%20proves%20that%20poor,the%20symptoms%20of%20these%20disorders. [Last Accessed 5/9/20].

- e.g. Microsoft Corporation (N.D). Symptoms Causes And Treatment Of Bad Posture. Available at: https://www.thephysiocompany.com/blog/stop-slouching-postural-dysfunction-symptoms-causes-and-treatment-of-bad-posture. [Last Accessed 5/9/20].
- SBS (2018). A third of Aussies don\'t exercise enough, global study finds. Available at: https://www.sbs.com.au/news/a-third-of-aussies-don-t-exercise-enough-global-study-finds. [Last Accessed 5/9/20].
- Regina Guthold (2019). Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1·6 million participants. Available at: https://www.thelancet.com/journals/lanchi/article/PIIS2352-4642(19)30323-2/fulltext. [Last Accessed 1/09/20].
- Tegan Taylor (2019). Teens don\'t get enough exercise, so how can we support them to be more physically active?. Available at: https://www.abc.net.au/news/health/2019-11-23/teens-young-people-physical-activity-exercise-get-moving/11725890. [Last Accessed 1/09/20].
- Michelle Joyce (2018). *Good posture used to be taught in every school. Why we need to bring it back.* Available at: https://medium.com/@powerofposture/posture-used-to-be-taught-in-every-school-why-we-need-to-bring-it-back-a08a7fe08b69. [Last Accessed 5/09/20].

- Strategies already in place for bad posture whilst sitting
- Evoke Pro Store (N.D). Back Posture Corrector for Women and Men - Shoulder Brace Back Posture Corrector - Upper Back Support - Back Straightener Posture Corrector - Resistance Band Included (Regular). Available at: https://www.amazon.com/Back-Posture-Corrector-Women-Resistance/dp/B075KDK21S/ref=cm_cr_arp_d_product_top?ie=UTF8. [Last Accessed 5/9/20].
- verywellhealth.com (N.D). Evoke Pro A300 Posture Corrector Review. Available at: https://www.verywellhealth.com/evoke-pro-a300-posture-corrector-review-4797594. [Last Accessed 5/9/20].

- BetterCo (N.D). BetterBack. Available at: https://getbetterback.com/products/betterback. [Last Accessed 5/9/20].
- Ashley Hall (2020). The 8 Best Posture Correctors of 2020. Available at: https://www.verywellhealth.com/best-posture-correctors-4171981#:~:text=Best%20for%20Back%20Pain%3A%20Back%20Brace%20Posture%20Corrector,-Buy%20on%20Amazon&text=The%20Flexguard%20Support%20Back%20Brace,pain%20along%20with%20poor%20posture.&text=Combined%20with%20the%20adjustable%20straps,and%20beneficial%20for%20your%20posture . [Last Accessed 5/9/20].
- uprightpose.com (N.D). UPRIGHT GO 2™ YOUR PERSONAL POSTURE TRAINER. Available at: https://store.uprightpose.com/products/upright-go2. [Last Accessed 5/9/20].
- PostureCo (N.D). Amazing App Features Supported By Research!. Available at: https://www.postureanalysis.com/posturescreen-posture-movement-body-composition-analysis-assessment/. [Last Accessed 5/9/20].
- Natasha Lomas (2015). Posture.io Is A Low-Cost Hack To Stop Slouching At The Desk. Available at: https://techcrunch.com/2015/05/03/posture-io-is-a-low-cost-hack-to-stop-slouching-at-the-desk/. [Last Accessed 5/9/20].
- braceability.com (2018). Don\'t Be a Slouch: 8 Easy Stretches for Improving Posture. Available at: https://www.braceability.com/blogs/articles/8-easy-stretches-for-improving-posture. [Last Accessed 5/9/20].
- Omega Rehab (N.D). 5 WAYS A CHIROPRACTOR CAN HELP WITH FIXING POSTURE. Available at: https://www.omega-rehab.com/5-ways-chiropractors-help-fix-bad-posture/ . [Last Accessed 5/9/20].
- Brad Beer (2015). The truth about how pilates improves posture. Available at: https://www.pogophysio.com.au/blog/pilates-posture/#:~:text=Pilates%20based%20exercise%20has%20been,3%2C%204%2C%205 . [Last Accessed 5/9/20].

Posture in Schools

- irishtimes.com (2006). School furniture major cause of adult back pain says expert. Available at: https://www.irishtimes.com/news/health/school-furniture-major-cause-of-adult-back-pain-says-expert-1.999892#:~:text=%22Most%20children%20leave%20school%20with,bags%2C%22%20said%20Mr%20Brennan.&text=%22School%20chairs%20slope%20backwards%20which,their%20feet%20on%20the%20floor . [Last Accessed 5/9/20].
- Michelle Joyce (2018). *Good posture used to be taught in every school. Why we need to bring it back.* Available at: https://medium.com/@powerofposture/posture-used-to-be-taught-in-every-school-why-we-need-to-bring-it-back-a08a7fe08b69. [Last Accessed 5/09/20].

- Posture
- republiclab.com (N.D). Top 15 Best Ergonomic Office Chairs 2020 - Buyer\'s Guide. Available at: https://www.republiclab.com/ergonomic-office-chairs-guide/. [Last Accessed 5/9/20].
- Dohrmann Consulting (2014). How to sit at a computer . Available at: https://www.ergonomics.com.au/how-to-sit-at-a-computer/. [Last Accessed 5/9/20].

- Images
- The Standard (2020). Ergonomic Tips for Working from Home. Available at: https://www.thestandard.com.hk/breaking-news/section/4/146172/Ergonomic-Tips-for-Working-from-Home. [Last Accessed 5/9/20].
- verywellhealth.com (N.D). Evoke Pro A300 Posture Corrector Review. Available at: https://www.verywellhealth.com/evoke-pro-a300-posture-corrector-review-4797594. [Last Accessed 5/9/20].
- Leonisa (N.D). Perfect Everyday Posture Corrector Cami Bra. Available at: https://www.leonisa.com/en/products/perfect-everyday-posture-corrector-bra/. [Last Accessed 5/9/20].
- Michelle Joyce (2018). Good posture used to be taught in every school. Why we need to bring it back.. Available at: https://medium.com/@powerofposture/posture-

used-to-be-taught-in-every-school-why-we-need-to-bring-it-back-a08a7fe08b69. [Last Accessed 5/9/20].

- BetterCo (N.D). BetterBack. Available at: https://getbetterback.com/products/betterback. [Last Accessed 5/9/20].
- SparkFun (N.D). Liquid Level Sensor - 8\". Available at: https://www.sparkfun.com/products/10221. [Last Accessed 5/9/20].
- T.K. HAREENDRAN (N.D). Optical Liquid Level Sensor. Available at: https://www.electroschematics.com/optical-liquid-level-sensor/. [Last Accessed 5/9/20].

Acknowledgments:

Mrs Omant, Mr Kidd, Ms Stuebing, Mrs Jones, Angela Gurney, Shawn Gurney, Jennifer Harman, Students who participated in Survey, Isabel Roth

Appendix

Log

Date/Time	Work done	Contribution
29/05/20 8:45- 10:25	Looking at ideas to start the project. Have decided to do something related to dig tech. 'seat that notifies you when you have been sitting for too long' (possible idea)	Adele and Eliza
1:30- 3:15 1/06	Watched a movie to help with ideas on the science investigation	Adele and Eliza
8:45 – 10:25 5/06/20	Researched more on dig tech topic for investigation and narrowed idea to creating a good learning environment online. Decided on making a Vr classroom.	Adele and Eliza
12:40-1:30 9/6/20	Talked to Mrs Stuebing about developing/ creating the idea	Adele and Eliza
12:40-1:30 11/6/20	Tested out some pre-existing Vr experiences and noted what was more engaging.	Adele and Eliza

8:45- 10:25	We have begun to narrow down our idea. (pressure pad on chair) (VR) We realised the amount of people needing to be surveyed for the vr would be quite a lot.	Adele and Eliza
11:35- 11:45 14/6/20 - 70	Decided that we will focus on a chair that gives recommendations for long, comfortable sitting sessions in regard to online learning	Adele and Eliza
12:40- 1:30 15/6/20	Talked to Lucy Eade about our project and she gave us ideas and shared her report that she had made	Adele and Eliza
1:30 – 3:15 15/6/20	Researched ideas, expanding and extending them to match our idea. Also looked at types of code that will best suit our project.	Adele and Eliza
8:45- 10:25 - 19/06	Made a to-do list which helped narrow down our ideas to posture, notifications through computer (sedentary behaviour), eye level in relation to screen. Gathered multiple references. Adapting a chair to become more comfortable for the user and a pressure sensor that notifies you when you have been sitting for long periods of time.	Adele and Eliza
8:50 – 9:40 26/6/20	Looked at resources in more detail.	Adele and Eliza
1:30- 3:15 29/6/20	Theory	Adele and Eliza
12:40-12:50 30/6/20	Talked with mrs Stuebing about current idea and have sent an email to Mr Kidd and Mrs Stuebing on how we could measure someone's posture	Adele and Eliza
9:00-9:30- 30	Meeting with Ms Stuebing and Mr Kidd , discussed	Eliza

	methods of measuring posture and technologies that can be used.	
9:30-10:40 -70	Theory	Eliza
12:00-12:50 15/7/20	Sketching design ideas	Eliza
8:45-10:25 24/7/20	Finalised design ideas	Adele and Eliza
1:30-2:00 27/7/20	Meeting with Mrs Stuebing and Mr Kidd	Adele and Eliza
2:00-2:15 27/7/20	Theory	Adele and Eliza
8:45-10:25 31/7/20	Designing prototype	Adele and Eliza
8:45-9:45 7/08/20	Researching about how to use a water level sensor	Adele and Eliza
9:45- 10:15 7/08/20	Looked at code and downloaded Arduino	Adele and Eliza
1:30-3:15 7/8/20	Put together a prototype to see what outputs were given.	Adele and Eliza
1:30-3:15 10/08/20	Adjusted code so values that were outputted would turn on and off a light switch. On the Arduino Uno.	Adele and Eliza
10:50-12:40 11/08/20	Theory/ report layout	Adele and Eliza
1:30-3:15	Risk assessment/ survey work	Adele and Eliza
10:50-12:40	Theory	Adele and Eliza
21/08 8:45-10:25	Theory	Adele and Eliza
21/08 1:30-3:15	Theory	Adele and Eliza
24/08/20 1:30-3:15	Figuring out 1st prototype	Adele and Eliza
10:50- 12:40 25/08/20	Theory/ results	Adele and Eliza
10:50 -12:40 27/08/20	Theory	Eliza
8:45- 10:25 28/08/20	Tested and recorded 2nd prototype	Adele and Eliza
1:30-3:15 28/08	Theory/ results	Adele and Eliza
1:20 - 3:25 29/08/20	Theory	Adele
10:50-12:40 1/9/20	Theory	Adele and Eliza
7:00- 8:00 1/9/20	Theory	Adele
9:20- 10:30 1/9/20	Results and Theory	Adele
1:30-3:15 1/9/20	Theory	Eliza
5:30-9:00 2/9/20	Theory	Eliza
10:00-10:25 3/09/20	Theory/ graphing results	Adele and Eliza
6:00-8:35 3/09/20	Results / survey	Adele
8:00-9:00 4/9/20	Buying materials for prototype #3	Adele and Eliza
9:30-10:00 4/9/20	Assembling all materials for prototype #3	Adele and Eliza

10:20-11:30 4/9/20	Testing possible prototype ideas with varied sizes of materials.	Adele and Eliza
11:50-12:20 4/9/20	Testing possible prototype ideas with varied sizes of materials.	Adele and Eliza
1:30-2:40 4/9/20	Finalised idea for prototype	Adele and Eliza
9:30 – 10:50 5/09	Results	Adele
12:40 – 2: 20 5/09	Results and theory	Adele
12:00-2:00 5/9/20	Theory	Eliza
2:30- 6:00 5/9	Theory	Eliza
4:20 – 6:10 5/9	Theory/ results/ references	Adele
6:05-7:20 5/9	Theory	Eliza
7:40-8:00 5/9	Theory	Eliza
10:30-12:10 6/09/20	Proofreading/editing	Eliza
12:10-12:50 6/09/20	Editing theory	Adele
1:40 -3:20 6/09/20	Materials, referencing images, tidying up theory	Adele and Eliza
10:30-10:40 7/09/20	Updating to do list	Eliza
1:30-3:15 7/09/20	Reformatting report/ design brief	Adele and Eliza
10:50- 12:40 8/09/20	References/ test prototype	Adele and Eliza
5:00 – 6:008/09/20	References	Adele
5:30 – 6:00 8/9/20	References	Eliza
6:20 – 6:40 8/9/20	References	Eliza
7:30-7:45 10/9/20	Annotating images	Eliza
8:45- 10:25 11/09	Cut down word limit	Adele and Eliza
12:40 – 3:15 11/09	Coding, Discussion, design brief	Adele and Eliza
6:30 – 7:30 11/09/20	Adding images to specific areas on report, tidying up word limit	Adele
8:30-9:40 13/9/20	Limitations and looking at code	Eliza
7:20-7:30 14/9/20	Sending email/ looking for diagrams to help with code	Eliza
12:00-12:40 15/9/20	Discussion	Eliza
2:00-3:15 15/9/20	Discussion	Eliza
2:30 – 3:15 15/09	Appendix and discussion.	Adele
6:15-6:45 15/09	discussion	Adele
12:50-1:25 16/09	Meeting with mr kidd and mrs Stuebing about LCD screen	Adele and Eliza
2:30-3:15 16/09/20	Started future design methods (sketches)	Adele and Eliza

6:00 - 8:00 16/09/20	Finishing sketches	Adele and Eliza
7:30-8:00 17/9/20	Finishing code	Eliza
8:45 – 10:25 18/09	Setting up LCD screen and connecting two arduinos together	Adele and Eliza
12:40 – 1:30 18/09	Connecting arduinos together	Adele and Eliza
1:30 – 3:15 18/09/20	Coding and connecting Arduino	Adele and Eliza
1:30 -3:15 21/09/20	Coding and putting photos into doc	Adele and Eliza
10:25-12:40 22/09/20	Filming and testing final prototype	Adele and Eliza
5:20 - 8:05 22/09	Tidying up and finishing report. Making video	Adele and Eliza
8:05-9:10 22/09/20	Cutting down word count/ finishing explanation of code/ contents page	Eliza

Link to demonstration-

https://www.youtube.com/watch?v=f3O_EmV1SOM&feature=youtu.be

Risk Assessment

RISK ASSESSMENT **St Mary's College, Hobart Students**

Chairing is caring

Written by: Adele Harman, Eliza Gurney **Commenced on:** 14 Aug 2020 **Expires:** 14 Nov 2021

Classes for which experiment is required

Teacher: Mrs Omant **Year Group:** 10

Items to be prepared by laboratory technician

1 x Arduino uno circuit board
1 x 560k resistor
1 x Breadboard
1 x Etape liquid level sensor 8'
2 x Laptop
2 x Arduino app
1 x USB cable
6 x Jumper wires
1 x Rubber Tube
1 x Syringe
Water

Procedure or reference, including variations

https://techcrunch.com/2015/05/03/posture-io-is-a-low-cost-hack-to-stop-slouching-at-the-desk/

Equipment to be used

breadboard, electronic

circuit board

Potential hazards	*Standard handling procedures*
Lead solder on circuit board may release particles of lead oxide when touched.	Wash hands after touching a circuit board in order to remove any particles of lead oxide on skin.

laptop computer

Potential hazards	*Standard handling procedures*
Power cord may be a trip hazard.	If on trolley, ensure trolley does not block exit.

resistor

Potential hazards	*Standard handling procedures*
Low resistance resistors become hot when large currents pass through them. Possibility of heat burns.	Do not exceed power rating of resistor.

plastic syringe

Potential hazards	*Standard handling procedures*
HIGHLY DANGEROUS WHEN NEEDLE IS ATTACHED. MAY CAUSE INJECTION OF TOXIC CHEMICAL. Can be filled with liquid and used as water pistol.	Store syringes where they will not be stolen or used inappropriately. Might be stolen for intravenous drug use. Blunt-end needles should be used with syringes since they are safer and less likely to be stolen.

rubber tubing

Potential hazards	*Standard handling procedures*
ALLERGY ALERT. May be used as a whip. May cause an allergic reaction if latex is present in the tubing.	Replace tubing as soon as any cracking is visible. Do not use with organic solvents. Check for damage before use.

water flow rate sensor

water, 43.5°C or less (cold-warm)

Potential hazards	*Standard handling procedures*
Water below 43.5°C is generally considered safe for adults and children. Cold water causes numbness and hypothermia if exposure is prolonged.	Water spilled on the floor may be a slip hazard. Do not drink in the classroom, due to the possibility of contamination.

Others

USB cable

Knowledge

I/we have read and understood the potential hazards and standard handling procedures of all the equipment, chemicals and biological items, including living organisms.
I/we have read and understood the Safety Data Sheets for all hazardous chemicals used in the experiment.
I/we have copies of the Safety Data Sheets of all the hazardous chemicals available in or near the laboratory.

Agreement by student(s)

I/we, Adele Harman, Eliza Gurney, agree to conduct this experiment safely in accordance with school rules and teacher instructions.

Risk assessment

I/we have considered the risks of:

fire or explosion	breakage of equipment	exposure to pathogens	waste disposal
chemicals in eyes	injuries from equipment	injuries from animals	improper labelling/storage
inhalation of gas/dust	rotating equipment	intense light/lasers	inappropriate behaviour
chemicals on skin	electrical shock	UV, IR, nuclear radiation	communication issues
ingestion of chemicals	vibration or noise	pressure inside equipment	allergies
runaway reaction	sharp objects	heavy lifting	special needs
heat or cold	falling or flying objects	slipping, tripping, falling	other risks

Assessment by Student(s)

I/we have assessed the risks associated with performing this experiment in the classroom on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2018.

I/we consider the inherent level of risk (risk level without control measures) to be:

Low risk Medium risk High risk Extreme risk

Risks will therefore be managed by routine procedures in the classroom.

Certification by Teacher

I have assessed the risks associated with performing this experiment in the classroom on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2018. I confirm that the risk level and control measures entered by student(s) above are correct and appropriate.

Electronic Signature: Heather Omant **Date:** 14 Aug 2020

You have provided an electronic signature which is the equivalent of signing your name with a pen and as such will constitute a legally binding agreement between the relevant parties. We can give no warranty in respect to fraud or security breach resulting from the use of an electronic signature.

Certification by Laboratory Technician

I have assessed the risks associated with preparing the equipment, chemicals and and biological items, including living organisms, for this experiment and subsequently cleaning up after the experiment and disposing of wastes, on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2018.

I consider the inherent level of risk (risk level without control measures) to be:

Low risk Medium risk High risk Extreme risk

Risks will therefore be managed by routine procedures in the laboratory.

Electronic Signature: Adele Harman and Eliza Gurney **Date:** 14 Aug 2020

You have provided an electronic signature which is the equivalent of signing your name with a pen and as such will constitute a legally binding agreement between the relevant parties. We can give no warranty in respect to fraud or security breach resulting from the use of an electronic signature.

Monitoring and review

This risk assessment will be monitored using comments below and will be reviewed within 15 months from the date of certification.

Attach further pages as required

RISK ASSESSMENT | **St Mary's College, Hobart Students**

Chairing is caring

Written by: Adele Harman, Eliza Gurney **Commenced on:** 11 Sep 2020 **Expires:** 11 Dec 2021

Classes for which experiment is required

Teacher: Mrs Omant **Year Group:** 10

Items to be prepared by laboratory technician

1 x Soda Bottle
1 x Arduino Uno circuit board
1 x 560k resistor
1 x breadboard
1 x Etape Liquid Level Sensor
1 x Computer
1 x Arduino app
1 x USB cable
6 x Jumper wires
2 x balloon
1 x Duct Tape
1 x Scissors

Procedure or reference, including variations

Natasha Lomas (2015). Posture.io Is A Low-Cost Hack To Stop Slouching At The Desk. Available at: https://techcrunch.com/2015/05/03/posture-io-is-a-low-cost-hack-to-stop-slouching-at-the-desk/. [Last Accessed 5/9/20].

Equipment to be used

balloon

Potential hazards	*Standard handling procedures*
CHOKING HAZARD. ALLERGY ALERT. May lead to death due to choking or suffocation. Latex balloons may cause an allergic reaction in some individuals. Check for latex allergies before use. Do not fill with flammable or toxic gas.	Do not allow students 8 years old and under to blow up balloons. Store out of reach of students.

plastic bottle

Potential hazards	*Standard handling procedures*
Organic solvents may affect the plastic of the bottle, causing it to leak. May contain harmful residues, after use for experiments. Do not drink contents in science laboratory, due to the possibility of cross-contamination.	Do not use plastic bottles (except teflon) for organic solvents. Ensure that bottle is properly labelled. Do not put toxic liquids in old drink bottles, due to possibility of confusion and accidental drinking of contents. Ensure that any bottle containing a hazardous chemical is correctly labelled according to GHS and the Code of Practice.

breadboard, electronic

circuit board

Potential hazards	*Standard handling procedures*
Lead solder on circuit board may release particles of lead oxide when touched.	Wash hands after touching a circuit board in order to remove any particles of lead oxide on skin.

laptop computer

Potential hazards	*Standard handling procedures*
Power cord may be a trip hazard.	If on trolley, ensure trolley does not block exit.

resistor

Potential hazards	*Standard handling procedures*
Low resistance resistors become hot when large currents pass through them. Possibility of heat burns.	Do not exceed power rating of resistor.

metal scissors

Potential hazards	*Standard handling procedures*
Sharp points may cause puncture wounds or cuts. Blade	Avoid use of scissors with sharp points unless necessary.

edges are sharp and may cause cuts. May be used as a weapon.	Store securely.

duct tape

Potential hazards
Do not tape over mouth or nose, or use as a restraint.

water flow rate sensor

wire

Potential hazards
Can be flicked and the end may cause eye injuries.

water, 43.5°C or less (cold-warm)

Potential hazards	*Standard handling procedures*
Water below 43.5°C is generally considered safe for adults and children. Cold water causes numbness and hypothermia if exposure is prolonged.	Water spilled on the floor may be a slip hazard. Do not drink in the classroom, due to the possibility of contamination.

Knowledge

I/we have read and understood the potential hazards and standard handling procedures of all the equipment, chemicals and biological items, including living organisms.
I/we have read and understood the Safety Data Sheets for all hazardous chemicals used in the experiment.
I/we have copies of the Safety Data Sheets of all the hazardous chemicals available in or near the laboratory.

Agreement by student(s)

I/we, Adele Harman, Eliza Gurney, agree to conduct this experiment safely in accordance with school rules and teacher instructions.

Risk assessment

I/we have considered the risks of:

fire or explosion	breakage of equipment	exposure to pathogens	waste disposal
chemicals in eyes	injuries from equipment	injuries from animals	improper labelling/storage
inhalation of gas/dust	rotating equipment	intense light/lasers	inappropriate behaviour
chemicals on skin	electrical shock	UV, IR, nuclear radiation	communication issues
ingestion of chemicals	vibration or noise	pressure inside equipment	allergies
runaway reaction	sharp objects	heavy lifting	special needs
heat or cold	falling or flying objects	slipping, tripping, falling	other risks

Assessment by Student(s)

I/we have assessed the risks associated with performing this experiment in the classroom on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2018.

I/we consider the inherent level of risk (risk level without control measures) to be:

Low risk Medium risk High risk Extreme risk

Risks will therefore be managed by routine procedures in the classroom.

Certification by Teacher

I have assessed the risks associated with performing this experiment in the classroom on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2018. I confirm that the risk level and control measures entered by student(s) above are correct and appropriate.

Electronic Signature: Mrs Omant **Date:** 11 Sep 2020

You have provided an electronic signature which is the equivalent of signing your name with a pen and as such will constitute a legally binding agreement between the relevant parties. We can give no warranty in respect to fraud or security breach resulting from the use of an electronic signature.

Certification by Laboratory Technician

I have assessed the risks associated with preparing the equipment, chemicals and and biological items, including living organisms, for this experiment and subsequently cleaning up after the experiment and disposing of wastes, on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2018.

Low risk Medium risk High risk Extreme risk

Risks will therefore be managed by routine procedures in the laboratory.

Electronic Signature: Mrs Jones **Date:** 11 Sep 2020

You have provided an electronic signature which is the equivalent of signing your name with a pen and as such will constitute a legally binding agreement between the relevant parties. We can give no warranty in respect to fraud or security breach resulting from the use of an electronic signature.

Monitoring and review

This risk assessment will be monitored using comments below and will be reviewed within 15 months from the date of certification.

Attach further pages as required

RISK ASSESSMENT **St Mary's College, Hobart Students**

Chairing is caring

Written by: Adele Harman, Eliza Gurney **Commenced on:** 11 Sep 2020 **Expires:** 11 Dec 2021

Classes for which experiment is required
Teacher: Mrs Omant **Year Group:** 10

Items to be prepared by laboratory technician

1 x 1.1L Soda Bottle
1 x water bottle
1 x solar power shower
1 x Blu Tack
1 x Arduino Uno circuit board
1 x 560k resistor
1 x breadboard
1 x Etape Liquid Level Sensor 8'
1 x Computer
1 x Arduino app
1 x USB cable
6 x Jumper wires
1 x Glue
1 x Duct Tape
1 x Scissors
2 x Foil Wine Bladder
2 x Plastic Bag
1 x Wheel office chair
1 x string
1 x Clear tube

Procedure or reference, including variations

Natasha Lomas (2015). Posture.io Is A Low-Cost Hack To Stop Slouching At The Desk. Available at: https://techcrunch.com/2015/05/03/posture-io-is-a-low-cost-hack-to-stop-slouching-at-the-desk/. [Last Accessed 5/9/20].

Equipment to be used

plastic bag

Potential hazards
May cause suffocation if large and without holes.

blu-tack

Potential hazards
Can be rolled into balls and used as a projectile.

plastic bottle

Potential hazards
Organic solvents may affect the plastic of the bottle, causing it to leak. May contain harmful residues, after use for experiments. Do not drink contents in science laboratory, due to the possibility of cross-contamination.

Standard handling procedures
Do not use plastic bottles (except teflon) for organic solvents. Ensure that bottle is properly labelled. Do not put toxic liquids in old drink bottles, due to possibility of confusion and accidental drinking of contents. Ensure that any bottle containing a hazardous chemical is correctly labelled according to GHS and the Code of Practice.

breadboard, electronic

building glue, cartridge

Potential hazards
May causes skin and eye irritation. May cause an allergic skin reaction. Risks vary with product composition.

Standard handling procedures
Consult the Safety Data Sheet from the manufacturer before use.

circuit board

Potential hazards
Lead solder on circuit board may release particles of lead oxide when touched.

Standard handling procedures
Wash hands after touching a circuit board in order to remove any particles of lead oxide on skin.

laptop computer

Potential hazards
Power cord may be a trip hazard.

Standard handling procedures
If on trolley, ensure trolley does not block exit.

resistance wire

Potential hazards
May cause electric shock if touched, depending on the voltage of the power supply. If the wire contains nickel, e.g. nichrome, repeated skin contact may cause an allergic reaction for people with a nickel allergy.

Standard handling procedures
People with nickel allergy should wear gloves when handling resistance wire that is an alloy containing nickel.

metal scissors

Potential hazards
Sharp points may cause puncture wounds or cuts. Blade edges are sharp and may cause cuts. May be used as a weapon.

Standard handling procedures
Avoid use of scissors with sharp points unless necessary. Store securely.

string

Potential hazards
May be used as a garotte or restraint.

swivel chair (typist chair)

Potential hazards
Do not use a chair with only four rollers, since it may topple over. Do not use on a glide mat, since the chair may slip from beneath while attempting to sit or slide out of control on mat.

Standard handling procedures
Check for damage before use. Dispose of any chair with only four rollers. Do not use near the top of a staircase or other sudden drop; deaths have been reported as a result of chair with person falling backwards down a staircase.

duct tape

Potential hazards
Do not tape over mouth or nose, or use as a restraint.

water bottle

Potential hazards
Organic solvents may affect the plastic of the bottle, causing it to leak. May contain harmful residues, if previously used for experiments. Do not drink contents in science laboratory, due to the possibility of cross-contamination.

Standard handling procedures
Do not use plastic water bottles (except Teflon) for organic solvents. Ensure that bottle is properly labelled according to GHS and the Code of Practice. Do not put toxic liquids in old drink bottles, due to possibility of confusion and accidental drinking of contents.

water flow rate sensor

wire

Potential hazards
Can be flicked and the end may cause eye injuries.

Others

Foil Wine bladder
Clear Tubing
Solar power Shower

Knowledge

I/we have read and understood the potential hazards and standard handling procedures of all the equipment, chemicals and biological items, including living organisms.
I/we have read and understood the Safety Data Sheets for all hazardous chemicals used in the experiment.
I/we have copies of the Safety Data Sheets of all the hazardous chemicals available in or near the laboratory.

Agreement by student(s)

I/we, Adele Harman, Eliza Gurney, agree to conduct this experiment safely in accordance with school rules and teacher instructions.

Risk assessment

I/we have considered the risks of:

fire or explosion	breakage of equipment	exposure to pathogens	waste disposal
chemicals in eyes	injuries from equipment	injuries from animals	improper labelling/storage
inhalation of gas/dust	rotating equipment	intense light/lasers	inappropriate behaviour
chemicals on skin	electrical shock	UV, IR, nuclear radiation	communication issues
ingestion of chemicals	vibration or noise	pressure inside equipment	allergies
runaway reaction	sharp objects	heavy lifting	special needs
heat or cold	falling or flying objects	slipping, tripping, falling	other risks

Assessment by Student(s)

I/we have assessed the risks associated with performing this experiment in the classroom on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2018.

I/we consider the inherent level of risk (risk level without control measures) to be:

Low risk Medium risk High risk Extreme risk

Risks will therefore be managed by routine procedures in the classroom.

Certification by Teacher

I have assessed the risks associated with performing this experiment in the classroom on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2018. I confirm that the risk level and control measures entered by student(s) above are correct and appropriate.

Electronic Signature: Mrs Omant **Date:** 11 Sep 2020

You have provided an electronic signature which is the equivalent of signing your name with a pen and as such will constitute a legally binding agreement between the relevant parties. We can give no warranty in respect to fraud or security breach resulting from the use of an electronic signature.

Certification by Laboratory Technician

I have assessed the risks associated with preparing the equipment, chemicals and and biological items, including living organisms, for this experiment and subsequently cleaning up after the experiment and disposing of wastes, on the basis of likelihood and consequences using the School's risk matrix, according to International Organization for Standardization Standard ISO 31000:2018.

I consider the inherent level of risk (risk level without control measures) to be:

Low risk Medium risk High risk Extreme risk

Risks will therefore be managed by routine procedures in the laboratory.

Electronic Signature: Mrs Jones **Date:** 11 Sep 2020

You have provided an electronic signature which is the equivalent of signing your name with a pen and as such will constitute a legally binding agreement between the relevant parties. We can give no warranty in respect to fraud or security breach resulting from the use of an electronic signature.

Monitoring and review

This risk assessment will be monitored using comments below and will be reviewed within 15 months from the date of certification.

Attach further pages as required