

# SciFEST 2022

## NATIONAL FINAL

*Project Abstracts*



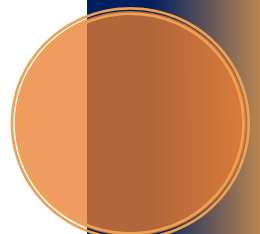
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November 2022



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## SciFest@TU Dublin Blanchardstown

### [Stand 1]

**Title of Project:** A Comparison of Fitness and Flexibility of Irish Dancers vs non-Irish Dancers

**Students:** Lily O' Reilly, Yasmin Callaghan, Ella Rose Meade

**School:** Enfield Community College, Enfield, Co. Meath

**Teacher Mentoring Project:** Rebecca Kenneally

### ABSTRACT

Our hypothesis was that Irish dancers are fitter and more flexible than non-Irish dancers. We tested students in our school with mixed genders and these students played other sports such as football or hurling. We got these students, along with the Irish dancing students, to carry out a sit and reach test where they had their legs straight and tried to reach as far as they could on a metre stick. We also did a vertical jump with a metre stick against a wall and got students to jump without bending their knees to record the height of the jump. We got students to do a leg raise test using a large protractor to measure the angle between their two legs. For fitness, we measured the time taken to return heart rate to rest after jogging and jumping jacks. We found that the steeper the slope between immediately after exercise and until the heart rate returns to rest meant that the student was fitter.

We discovered that the people tested who did not Irish dance had a higher heart rate after exercise than Irish dancers. We conclude that Irish dancers are more flexible due to having a higher leg raise, higher vertical jump and further sit and reach than non-Irish dancers. A real-life application of this experiment is to promote Irish dancing especially in secondary school and realise that it is a competitive sport which is as challenging as any other sport and will physically improve flexibility and fitness.



# SciFest@ATU Galway

[Stand 2]

**Title of Project: A Novel Alternative to Synthetic Fertilisers**

**Students:** Sean Allen

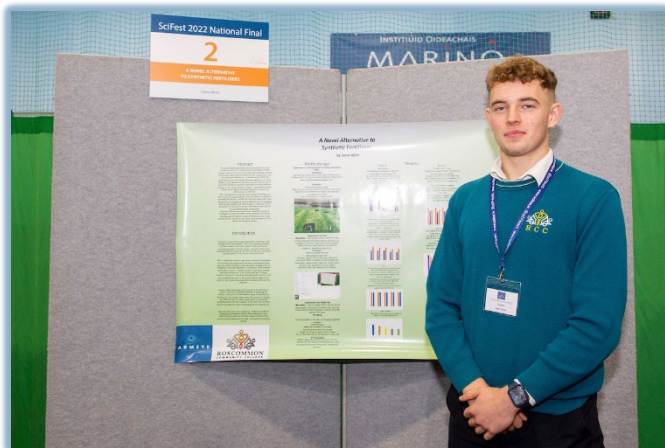
**School:** Roscommon Community College, Lisnamult, Roscommon Town, Co. Roscommon

**Teacher Mentoring Project:** Elizabeth Glancy

## ABSTRACT

The EU are regulating synthetic fertilisers heavily in the next number of years as it is significantly contributing to climate change. I want to find a more sustainable way of getting nutrients into the soil, rather than as a synthetic granule. I tested waste milk as an alternative fertiliser as it is heavily wasted within the agricultural sector. I also tested anaerobic digestate as it is a by-product of the methane fermentation process. I want to see if it would be a possible sustainable, alternative way of making fertilisers, because it uses waste products to make it. I also tested a mixture of both waste milk and anaerobic digestate to compare their effectiveness as a fertiliser.

I also investigated the method used to spread the fertiliser, as this is currently a topical debate. I used two different methods of spreading the fertiliser – dribble bar cover and splash plate cover. My reasons for investigating the two different types of spreading were to take variability out of the question in the main part of the project. At the end of my trial I will compare the results of the two different types of spreading.



After the initial tests are carried out, I waited six months to investigate the long-term effects of the treatments on the soil, and how well the nutrients stayed in the ground over a long period of time. I carried out dry matter tests on week three and week six on the grass and soil.

[Stand 3]

**Title of Project: Can Clonakilty Bay Clean Itself and also Reduce Methane Emissions from Cattle?**

**Students:** Sinéad O’Mahony, Éabha Egan, Grace Murphy

**School:** Sacred Heart Secondary School Clonakilty, Convent Road, Clonakilty, Co. Cork

**Teacher Mentoring Project:** Claire Holland

## ABSTRACT



The water in Clonakilty Bay is high in phosphates and nitrates due to the leaching of fertilisers from local farms. As a result, there is a high amount of sea lettuce in the bay area.

If a cow is fed a seaweed called *Asparagopsis armata*, it reduces their methane emissions. This seaweed needs phosphates and nitrates to grow.

We wanted to see if the water from Clonakilty Bay can be used to grow *Asparagopsis armata*. In doing so the levels of phosphate and nitrates should reduce and the seaweed could be used to

reduce methane emissions from cattle. We used a laboratory model to study the growth of *Asparagopsis armata* in seawater samples from Clonakilty Bay. This entailed periodic parameter monitoring, testing of nutrient levels and measurement of the seaweed growth, to allow for the analysis of the data.

At the beginning of the experiment all seaweeds experienced a high growth rate, before slowing down until they reached their peak and then diminishing. The bay water with added nutrients had the best overall percentage growth with its peak being at week 28, with an increase of 808% from its initial weight. The seaweed growing in bay water that was not changed out throughout the experiment experienced the worst overall growth with its peak being at week 20, with an increase of 333% from its initial weight.

We observed that while it is possible to grow *Asparagopsis armata* in water from Clonakilty Bay, doing so on a large scale may be difficult.

## SciFest@SETU Carlow

[Stand 4]

**Title of Project: A Biological Solution to Local Pollution**

**Student:** Mary Kelly

**School:** St Mary's College Arklow, St Mary's Rd, Abbeylands, Arklow Co. Wicklow

**Teacher Mentoring Project:** Joanne English

### ABSTRACT

The aim of my project was to investigate if urbanisation and agriculture are two of the leading causes of pollution for the Ballyduff River and to propose solutions to prevent this pollution.

The local Water Officer, Dónal O'Keeffe, assisted me in carrying out two experiments: a physio-chemical monitoring with both field and lab analysis and biological kick sampling. Then I measured the hardness of the water (calcium and magnesium) through redox titration. I also interviewed Dónal O'Keeffe, my grandad Peter Kelly as he is a farmer in the Ballyduff area, and Edward Burgess who works in the Agricultural Catchments Programme in Teagasc. Edward also took me to one of the agricultural catchments for a day. I sent out surveys to over 200 citizens in my area consisting of questions aiming to gather information on the public's opinion on river pollution in general and on the Ballyduff River in particular.

In conclusion, these experiments demonstrated that the river was polluted, particularly by nitrogen and phosphorus. The experiments also gave me an indication of the leading causes of the pollution, which are agriculture and urbanisation, as the area and activity surrounding the different streams indicated the main causes. Additionally, I can confirm the Ballyduff River water is soft and after doing some research I gathered that elements such as copper, lead and zinc are much more toxic in soft water. Therefore, since the Ballyduff River water is soft it is a possibility according to studies done that there are more toxins and metals in the river. Finally, from the experimental, survey and interview results, I proposed eight solutions to aid the river: riparian buffer zones, the rape plant, proper manure management, proper construction of septic tanks, net traps on the riparian zones, education of locals.



## SciFest@TUS Thurles

[Stand 5]

**Title of Project: How Can We Adapt to a World Where Facial Expressions may be Invisible**

**Students:** Hannah O'Mahoney, Rachel Regan, Kate Carr

**School:** Ursuline Secondary School, Templemore Road, Thurles, Co. Tipperary

**Teacher Mentoring Project:** David O'Heney

### ABSTRACT



While there is no doubting the tremendous health benefits associated with mask wearing, it must also be questioned. Our project's aim was to investigate our hypothesis, which acknowledges that while masks are essential to stopping the spread of the virus, they do in fact hinder communication. Therefore, we intended to prove that individuals cannot accurately identify facial expressions when hidden beneath COVID-19 facemasks.

Through surveys of masked and unmasked images, we tested our theory. Which found that negative emotions proved most difficult to recognise. This raised concern as only 33% of students and 23% of teachers accurately identified awkwardness.

We expressed concern for the deaf community by reaching out to them in terms of their mental health during the pandemic and we also researched transparent facemasks as a possible solution to this issue.

The main objective of our research is to share our findings with the public. We've begun this by creating a social media account, published an article in local newspapers and contacted government officials. If people become aware of this problem then perhaps they will help us to solve it.

## SciFest@SETU Waterford

[Stand 6]

**Title of Project: Sensory Stimulation on Infants and Toddlers to Reduce the Effects of Autism**

**Students:** Sheryl Merin Scaria, Bianca Gouws

**School:** Presentation Secondary School Clonmel, Dungarvan Road, Clonmel, Co. Tipperary

**Teacher Mentoring Project:** Jacqueline Ryan

### ABSTRACT

Sensory stimulation is the implementation of certain activities to help improve a person's sensory processing abilities. Research has proven that children with autism show underdeveloped sensory pathways. They experience what is known as sensory overload. Our hypothesis states that when infants and toddlers are exposed to sensory stimulation it might reduce the severity of the symptoms of autism if diagnosed with it at a later stage.



In our background research we found that although people have done research on sensory stimulation to combat autism, no data has been found as an action being taken to help prevent/reduce it. We sent out surveys to parents and professionals in the field and received replies from a total of eight countries. We used the results in a comparative study to help us better understand the relationship between people's views on sensory stimulation and the corresponding autism figures in those countries.

The aim of our research is to test our hypothesis and to help parents create the best possible future for their children. Therefore we decided to compile all the information we gained into one practical solution, a sensory board. A sensory board has various activities which stimulate more than one sense at a time. This is very beneficial for developing sensory pathways in the brain. We didn't find any contradicting research, and most of the answers from our survey seemed to align with our views. If we progress, we would like to take our research further in order to help as many people as possible.

## [Stand 7]

### **Title of Project: The Impact of Covid-19 on the Mental Wellbeing of Teenage Girls**

**Students:** Laetitia Nouaha, Melissa Asare, Sidra Shahzad

**School:** Loreto Secondary School, Balbriggan, Co. Dublin

**Teacher Mentoring Project:** Brian Higgins

### **ABSTRACT**

Initially, the inspiration for this project stemmed from the opinions of our peers: that the Covid-19 pandemic has had a major impact on their lives.

We acknowledged that if our hypothesis – that the Covid-19 pandemic had a negative impact on teenage girls' mental wellbeing in our school - could be proven true, we could contribute to maintenance and improvement of female adolescents' positive mental wellbeing within our school. We conducted longitudinal surveys in October 2021, April 2022 and in October 2022 structured with the questions from the World Health Organisation Well-Being Index, the Growing Up in Ireland Survey and numerous questions pertaining to mental wellbeing.

We conducted focus group interviews where we asked questions to investigate what we should include in our website and to gain further insight into what teenage girls' experiences were like during the Covid-19 pandemic. Based on our findings we developed a website to support teenage girls' mental health and we held a Mental Wellbeing Day in our school consisting of different activities for each year group in our school to promote positive mental wellbeing.

Our research showed improvement in mental wellbeing from a score of 5.6/10 during post lockdown to 5.52/10 post restrictions. The average score for the WHO-5 survey for post lockdown was 45%, post restrictions it was 55%. In conclusion, our study proved that the Covid-19 pandemic has had an overall negative impact on the mental wellbeing of the teenage girls in our school, as we had originally hypothesised.



## SciFest@TU Dublin Blanchardstown

[Stand 8]

**Title of Project: An Investigation into the Use of Seaweed as a Feed Additive in Ruminants**

**Students:** Eoin O’Sullivan, Diarmuid O’ Connor

**School:** Dunshaughlin Community College, Dunshaughlin, Co. Meath

**Teacher Mentoring Project:** Claire Tuttlebee

### ABSTRACT



We based our project around the introduction of seaweed into the diet of ruminants to explore the potential health benefits and boosts in performance.

Our idea first originated from research carried out by Teagasc in their Seasolutions project where brown seaweeds were used due to their concentration of bioactive compounds such as phlorotannins. This research demonstrated the seaweeds’ potential to inhibit methane production in ruminants.

We wanted to see on a farm level what benefits the use of seaweed could pose for our young Friesian calves as they were starting to develop rumen and digestive functioning, as well as building their immune system. We conducted our trials on two groups of 16 Friesian heifer calves, all born within the first 10 days of the calving season. The first weights we took were the birth weights. These were measured with a weigh band which wrapped around the midsection of the calf. The next set of weights we took were the calves’ 3-week weights. At this point they were gaining an average of 0.6 kg per day. Both the trial and control groups of calves were on identical diets which consisted of 6 litres of whole milk per day and roughly 750 grams of Lakeland calf grower meal per head per day as well as whatever straw they consumed from their bedding. After 3-week weights were taken, our 35-day feeding period of the trial began. We dissolved seaweed into the milk at 5 grams per head per day.

After analysing the results we found that our trial group put on 0.9 kg per day while our control group continued to steadily put on 0.6 kg per day on average. This means the trial calves were putting on approximately 300 grams more in weight per day than our control group. As well as this the seaweed raised the milk’s pH, leading to the elimination of nutritional scours and increased chelated mineral intake. This was followed up by observing their adaptation to grass, which was also phenomenally successful.

## SciFest@TU Dublin Blanchardstown

[Stand 9]

**Title of Project:** A Comparison of Fitness and Flexibility of Irish Dancers vs non-Irish Dancers

**Students:** Lily O' Reilly, Yasmin Callaghan, Ella Rose Meade

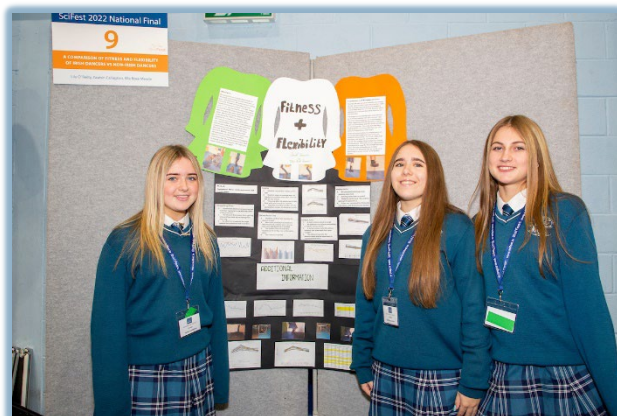
**School:** Enfield Community College, Enfield, Co. Meath

**Teacher Mentoring Project:** Rebecca Kenneally

### ABSTRACT

Our hypothesis was that Irish dancers are fitter and more flexible than non-Irish dancers. We tested students in our school with mixed genders and these students played other sports such as football or hurling. We got these students, along with the Irish dancing students, to carry out a sit and reach test where they had their legs straight and tried to reach as far as they could on a metre stick. We also did a vertical jump with a metre stick against a wall and got students to jump without bending their knees to record the height of the jump. We got students to do a leg raise test using a large protractor to measure the angle between their two legs. For fitness, we measured the time taken to return heart rate to rest after jogging and jumping jacks. We found that the steeper the slope between immediately after exercise and until the heart rate returns to rest meant that the student was fitter.

We discovered that the people tested who did not Irish dance had a higher heart rate after exercise than Irish dancers. We conclude that Irish dancers are more flexible due to having a higher leg raise, higher vertical jump and further sit and reach than non-Irish dancers. A real-life application of this experiment is to promote Irish dancing especially in secondary school and realise that it is a competitive sport which is as challenging as any other sport and will physically improve flexibility and fitness.



## SciFest@TUS Athlone

[Stand 10]

**Title of Project: Developing Modified Buffer Strips to Increase Biodiversity and Water Quality in Grassland**

**Students:** Dara Shortall, Dean Burns

**School:** Moate Community School, Church St, Moate, Co. Westmeath

**Teacher Mentoring Project:** Mairead Cusack

### ABSTRACT



Our project aimed to develop a modified plant buffer strip to efficiently absorb nutrient run-off while contributing positively to biodiversity.

In 2021 we planted five buffer strips containing perennial ryegrass, phacelia, black oats, mustard and fodder radish. Following five weeks of growth a fixed concentration of fertiliser was applied and the run-off chemical composition (pH, dissolved oxygen content, nitrate concentration) was studied over a two-week period. These preliminary results

indicated that a buffer strip containing both phacelia and black oats would increase nutrient absorption. Phacelia initially reduced run-off nutrient levels due to its short, dense root system, while the deep roots of black oats absorbed nutrients at lower depths. However, poor environmental conditions during the test period limited our ability to determine the potential of phacelia as a green manure in Ireland.

This summer, further investigations were carried out to maximise the efficiency of buffer strips by incorporating mycorrhizae fungi into the rhizosphere, potentially increasing root surface area by hyphae development. A combined buffer strip containing phacelia and black oats was investigated to determine their suitability as companion species. Additionally, the impact of each species on biodiversity was studied using the Schmidt (2001) method and a Flower Insect Timed Count (FIT) test. Finally, following nine weeks of growth, the effect of each strip on long term nutrient absorption was studied once again following fertiliser application.

Using our results, we believe we have developed a buffer strip that is a viable option for farmers as it supports crop yields and biodiversity.

## SciFest@ATU Galway

[Stand 11]

**Title of Project: An Investigation into the Recovery of Adolescents Moving from the Sympathetic to the Parasympathetic Nervous System**

**Students:** Mairéad Lohan, Tommy Morris

**School:** Roscommon Community College, Lisnamult, Roscommon Town, Co. Roscommon

**Teacher Mentoring Project:** Elizabeth Glancy

### ABSTRACT

We proved our hypothesis that:

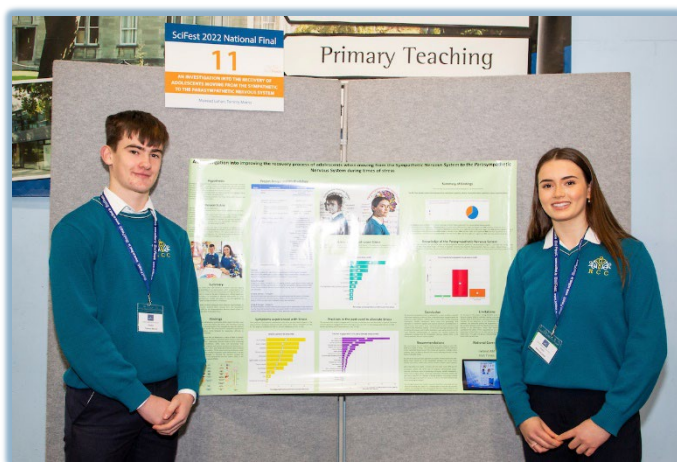
- Knowing the science of what happens when the body is in a state of stress, how the sympathetic nervous system is activated, and how one can move between the Sympathetic Nervous System (SNS) to the Parasympathetic Nervous System (PSNS) can improve the recovery process
- Reinforcing learned resilience skills will help counteract the negative effects of mental and emotional stress on adolescents
- Developing stress-alleviating activities will help adolescents navigate the current Covid-19 pandemic crisis

After conducting our questionnaire titled *Understanding Mental Health*, from the 487 responses received, we discovered:

- 74% of participants have never heard of the (PSNS), 22% heard of the (PSNS) but do not understand it, while only 4% understand what it is
- School (77%), daily life (34%) and physical appearance (34%) are the most common areas where participants feel stressed
- The most common symptoms experienced with stress were lack of motivation (52%), headaches (44%) and anger/irritability (44%)
- Listening to music (63%), exercising (41%) and talking with friends or family (30%) are the most common practices to alleviate stress

Our social experiment consists of six groups with two whole experimental groups, two partial groups and two control groups. From this, we found that:

- You are **twice** as likely to benefit from stress-reducing activities if you understand the science behind mental health
- 52% of participants would use **breathing exercises** to alleviate stress, 25% said they might use them again, and 23% said they would not use them



## SciFest@MTU Cork

[Stand 12]

**Title of Project: Low-Cost Air Conditioning Kit**

**Student:** Lyle Hatchett

**School:** Clonakilty Community College, Clonakilty, Co. Cork

**Teacher Mentoring Project:** Patrick O’Keeffe

### ABSTRACT



I have invented a low-cost air conditioning unit that uses evaporative cooling and does not require electricity. This project aims to tackle the global crisis of extreme heat. 2022 was one of the hottest summers yet and many suffered, especially in developing countries with no access to air conditioning. My system does not require the infrastructure of electricity, rather just a bit of dirt/tissue and water. It uses the process of evaporative cooling; the water being evaporated out of the absorptive material cools the air travelling through the internal pipes. It was quick, easy and cheap for me to

make, using steel pipes and PVC, and cost a mere €35. I truly believe this could be a viable option for small homes in hot climates.

I have built two prototypes, the second of which came back with amazing results. For the tests I heated up a room to 26 °C and calculated the drop in temperature over a three-hour period, first with the unit in the room and then without. The test with the unit dropped by 7 °C, whereas the test without only dropped by 4.9 °C. Over each hour period the unit cooled the room at 2.33 °C/hour compared to the 1.63 °C/hour without the unit. Meaning the air conditioning unit cools the room by 0.70 °C faster per hour. This proves my air conditioning unit works and the cheap simplistic design should make it an option for many houses around the world.

## SciFest@TUS Limerick

[Stand 13]

**Title of Project: Mela No More**

**Student:** Laura Brennan

**School:** Desmond College, Gortboy, Newcastle West, Co. Limerick

**Teacher Mentoring Project:** Donal Enright

### ABSTRACT

#### Purpose of the Project

Skin cancer is the most common cancer in Ireland with an estimated 13,311 average annual diagnoses:

- Melanoma skin cancer 1,197
- Non-melanoma skin cancer 12,114

UV cannot be seen or felt (infrared radiation causes heat, not UV) so you need to defend yourself against overexposure. My device provides a visual indication for parents and children as to the presence of UV rays.

#### Description of the project

A wearable early warning system for children using photochromic paint to alert them and their parents to the increased UV rays that cause skin cancer.

#### Data

Using a UV photochromic paint on PVC, I had two of my colleagues test its effectiveness by recording colour changes 12 times a day each day during June, July and August (1116 readings in total). I have compared these to the UV Index published by Met Eireann and graphed against hourly temperature readings over the same period.

#### Conclusions

The lowest UV index recording I observed was 0.1. This was obtained on several mornings at 8am and again at 8pm in the evening time. The highest recorded index (7.5) was achieved at 2pm on 28 June.

Using the watch, I observed the colour change each hour from 8am to 8pm. With assistance from my classmates I took readings in three separate locations. In September, I compared my readings and made a spreadsheet which indicated one of the four potential colours at the centre of the watches.



## SciFest@MTU Kerry

[Stand 14]

**Title of Project: A Group-Theoretic Approach to Pythagoras' Theorem**

**Students:** Liam Waldron, Rachel Griffin, Luke O'Sullivan

**School:** Killarney Community College, New Road, Killarney, Co. Kerry

**Teacher Mentoring Project:** Maire Spillane

### ABSTRACT

Pythagoras' Theorem is a foundational theorem in geometry, with many far-reaching implications in other fields. There are many proofs of Pythagoras' theorem, from geometry, trigonometry and even using the exponentiation properties of complex numbers.

Right-angled triangles naturally associate points to both the Cartesian coordinate system and the polar coordinate system in two dimensions. In our project, we approached the Pythagorean Theorem through the framework of group theory. We explored the algebraic structures which can be defined within these coordinate systems. Mappings between coordinate systems have several interesting properties which lend themselves nicely to being considered in this manner. For example, the domain of such maps is also their codomain.

In our initial project, investigating pseudo-rotational groups defined over specific  $p$ -norms, we found the only distributive case to naturally generate Pythagoras' Theorem, while at the same time producing a field isomorphic to the complex numbers. In our extended project, we generalise this notion to less restricted coordinate mappings, providing an insight into necessary relations between coordinate transformations



meeting certain criteria. In our project we explored objects whose properties produce similar behaviour to the properties of the right-angled triangle that produces Pythagoras' theorem. From this we demonstrated that certain such structures must lack certain fundamental properties, showing the uniqueness of the right-angled triangle. Through this, our project also provides a proof of Pythagoras theorem. Right-angled triangles naturally provide a link between two coordinate systems and our project shows how this special case can naturally recreate the Pythagorean Theorem.

## SciFest@ATU Donegal

[Stand 15]

**Title of Project: An App to Improve Writing in Children with Dysgraphia**

**Student:** Hughie McShane

**School:** Abbey Vocational School, The Glebe, Donegal Town, Co. Donegal

**Teacher Mentoring Project:** Donna Furey

### ABSTRACT

For this project I set out to create a game to help the motor skills of people with dysgraphia, an under-researched condition that impairs writing skills and the ability to store a pattern in memory. I used the Unity game engine to create a game that is controlled with a stylus and a tablet, in which the player must navigate around patterns to help improve motor skills. The patterns were curved and mimicked the shape of the most common letters and so were deliberately designed to develop letter formation and fluency in letter formation. I also added projectiles to dodge and collectables to collect to add fun to the game. The game was then tested on several students in the school with dysgraphia. They all responded positively to the game, and most said they believed it helps their motor skills. However, the game lasts for less than an hour, and for any improvements to occur in a player's handwriting, they would have to repeat the content of the game over several weeks. Here is the link to the Android version of the game, and here is the link to the Windows version.



[Stand 16]

**Title of Project:** *GaelTalk* - a Virtual Reality Immersive Irish Language Learning Experience

**Student:** Aaron Dignam, Ciarán Leddy, Senan Bryne

**School:** St Joseph's Secondary School, Convent Lane, Rush, Co. Dublin

**Teacher Mentoring Project:** Daryl Dunne

## ABSTRACT

According to CSO data in 2016, only 39% of the Irish population could in fact speak Irish. Moreover, 31% of this Irish-speaking cohort only use it in an educational setting. Only 4% of the Irish population use the Irish language as their main means of communication on a daily basis.

We have created a virtual reality immersive Irish language learning experience that can promote the practice of the Irish language. Our experience, created on Steam VR, is comprised of many different Irish language scenarios that the participants use to improve their language skills.

Our experiment consists of a pre-intervention and post-intervention test. A large sample of participants completed a basic Irish language test which gave us a baseline score which we used to calculate the level of improvement. A targeted group of participants was then selected to log a number of hours in our VR experience before repeating a similar test to the original in order to see if their understanding of the language had improved.



Our data showed that the average score of the participants who experienced the VR program scored 11.4% higher than the average for their non-VR counterparts. Additionally, 68% of people said they had learned better from the experience, and 85% said they would be happy to use VR language learning software in the future. Based on the information collected through our testing of Gaeltalk, we believe that our virtual reality project could be beneficial to people trying to learn the Irish language more efficiently.

## SciFest@TU Dublin Tallaght

[Stand 17]

**Title of Project: VIPMOD: Visually Impaired Person's Moving Object Detector**

**Student:** Maura Moore-McCune

**School:** The King's Hospital, Palmerstown, Dublin 15

**Teacher Mentoring Project:** Ciaran O'Connor

### ABSTRACT

Approximately a quarter of a million people in Ireland are visually impaired. As a visually impaired person, I have difficulty seeing and hearing oncoming vehicles, such as electric cars or e-scooters. My aim is to develop an app for visually impaired or disabled users to detect these fast-moving objects. I named this device **VIPMOD: Visually Impaired Person's Moving Object Detector**. The app has many other potential users, such as cyclists, users of e-scooters, and horse riders.

This project evolved through four different prototypes, culminating in the app that is currently being developed. The first three prototypes used micro:bits - affordable pocket-sized computers.

**Prototype 1** determines a magnetic object's distance from the user by the variation in its magnetic field.

**Prototype 2** uses a radio signal between two micro:bits: one in the car, and one worn by the person - the varying radio signal strength determines distance.

**Prototype 3** uses an ultrasonic detector to measure an object's distance, alerting both pedestrian and driver of each other's presence.

**Prototype 4** is an app which calculates the distance between two users, incorporating several accessibility functions - Text to Speech, Voice recognition and Dark Mode. The app sends visual and audio alerts to users detected in the vicinity, calculating the distance between them.

I have tested and compiled data on the app and have also contacted several organisations with a view to continued testing in real-life situations. I have designed VIPMOD to help disabled people to live safer and more independent lives.



[Stand 18]

**Title of Project: A Four Seasons Photovoltaic Self-Charging Rover – the Mars PSR**

**Students:** Seán Clerkin, Dara Courtney, Joshua Brandon

**School:** Largy College, Analore Road, Clones, Co. Monaghan

**Teacher Mentoring Project:** Colette Smith

### ABSTRACT

We started working on the Mars PSR by designing and making a prototype using equipment found at home! This then led to the 2<sup>nd</sup> prototype design which we completed on Solidworks. We decided to use solar cells on this design because solar energy is often used to power space missions because it is the only source of energy that does not need to be launched with the spacecraft and can power the spacecraft for several years. Solar cells, also called photovoltaic cells, convert sunlight directly into electricity. The angles we placed our solar cells at are important; the Sun emits light uniformly in all directions, and so the intensity of radiation will follow the inverse square law with distance from the Sun.

While relying on solar panels may seem risky in such a dusty environment on Mars, it was decided that we needed to make some type of a vacuum system that would remove the dust that clogs around the moving parts of the Rover. NASA have had limited success themselves with this idea, but we wanted to try it anyway, and made various prototypes of vacuum systems that could attach to a Mars Rover.



The third PSR prototype was designed using Onshape, so that we could build on more CAD skills. We decided to make many changes from the regional SciFest fair in DkIT. The purpose of this project was to further refine our Rover to include a functioning camera, a temperature sensor, a new vacuum system, better solar cells and vehicle lights on it with a possible airbag landing system so that the PSR arrives safely on Mars!

## SciFest@TUS Limerick

[Stand 19]

**Title of Project: Eataware**

**Students: Maha Shahzadi**

**School: Coláiste Nano Nagle, Presentation Campus, Sexton St, Limerick, V94YW24**

**Teacher Mentoring Project: Samantha Prior**

### ABSTRACT

Through the manipulation of assistive technology, the aim of my project was to create an accessibility app for visually impaired people that allows them to shop for their groceries independently while tracking any dietary requirements they may have due to any secondary illnesses. To do so, I carried out extensive research into visual impairment and assistive technologies/apps used by visually impaired people for their day-to-day tasks. I also analysed the three most popular, free ingredient tracking application to brainstorm the features and screen layouts for my app.



Furthermore, I conducted a semi-qualitative interview with a visually impaired individual to get a first-hand account of their grocery shopping experience as a visually impaired person. After getting user input and fully understanding the needs of my users I then developed my app features accordingly.

The features of my app include: a Product Scanner (allows the user to identify products and get health alerts); Money Identification (allows the user to identify money through image recognition); and Search Web/Store (directs the user to official sites of grocery retailers in their area). As visual impairment is a spectrum, the user interface design of my app includes a wide range of design features addressing most common levels of visual impairment. The current prototype of the app was coded on Thinkable. Firebase was used for authentication and the data collection hub for the app. The prototype developed has the outlined features fully functioning, demonstrating the idea proposed.

## SciFest@TU Dublin Grangegorman

[Stand 20]

**Title of Project:** Can the Introduction of an Archimedes' Screw Mechanism Improve the Efficiency of an Overtopping Hydro-Electric Turbine?

**Students:** Abigail O'Brien Murray, Olivia O'Shea

**School:** Loreto Secondary School Balbriggan, Brick Lane, Balbriggan, Co. Dublin

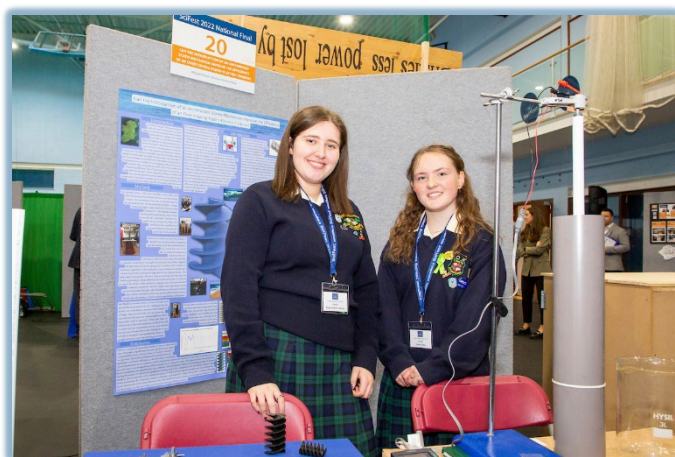
**Teacher Mentoring Project:** Daniel Toomey

### ABSTRACT

We've seen a rise in the prevalent issue of climate change. After reading many scientific papers we discovered that wave energy isn't being used to its full potential. After researching this we found that 90% of the potential hydro-electric sources from around Ireland's vast coastline are not being used to the fullest. In this day and age where there have been monumental improvements in renewable energy technology, the world's most vast resource of potential hydro-electric energy is being neglected.

The main goal of our project is to investigate the effect that the introduction of an Archimedes' screw mechanism has on the energy output of an overtopping hydro-electric turbine. Previously we investigated whether or not different time intervals had an effect on the energy output of Archimedes' screw and Kaplan turbines and which of the two turbines performed better at these different time intervals. In doing this we found that at lower time intervals of 10 seconds the Kaplan turbine performed better but at 20,

and 30 second intervals there was no significant difference in energy output. But, taking variance into account, the Archimedes' screw is the more reliable mechanism, meaning that in areas with higher time intervals, estuaries, coastlines, etc., the Archimedes' screw mechanism is the more reliable choice with the same efficiency as a Kaplan turbine.



Now we wish to investigate the effects on an enlarged system to see if the results are consistent with an increase in size. We also wish to investigate the effects of different flow rates on this enlarged system.

## SciFest@ATU Donegal

[Stand 21]

**Title of Project: A Dyslexia Lamp with a Difference**

**Students:** Micheál Deely, C J Burke

**School:** Abbey Vocational School, The Glebe, Donegal Town, Co. Donegal

**Teacher Mentoring Project:** Donna Furey

### ABSTRACT

I have dyslexia and have undergone colorimetry testing. This process determined the colour of the lenses for my glasses. I found that the coloured lenses did improve my reading and writing skills. When I changed my prescription, I began to use a simple lamp with a coloured bulb at home. I also found that on different reading backgrounds different coloured bulbs suited me better.

When I went to research the availability of multi-colour function lamps for dyslexia the only one on the market was not within my price range. This gave us the initial idea for our project. We then decided to make a more portable and lightweight laptop style lamp that had a multi-colour function. We thought that this would be better for students to use discreetly in the classroom and the multicolour function is important because different students read better with different colours of light.

We tested our prototype with eight students who had dyslexia in our school. Of the eight colours on our lamp most students preferred the light blue (25%) and the light green colour (37.5%). 62.5% of the eight students tested had a higher reading score with the coloured light than without the coloured light. All students said that the coloured lamp helped them to read better. Most (87.5%) said that they preferred the laptop design to the traditional desk lamp design and 62.5% of the eight students tested said that they would use the device in class.



## SciFest@ATU Sligo

[Stand 22]

**Title of Project: CoolAid: A Wearable Hypothermia Prevention Device**

**Students:** Alex Scott, Anna Woodward

**School:** Ursuline College, Finisklin Rd, Sligo

**Teacher Mentoring Project:** Anthony Carolan

### ABSTRACT

Our project aims to create a wearable device that can detect the initial stages of hypothermia and so reduce the rising numbers of cases. Hypothermia is a condition caused by prolonged exposures to very low temperatures. It's very dangerous because it affects how the victim thinks and moves. This device has the ability to read and process some key factors that are affected by or cause hypothermia, for example water temperature and pulse rate of the user. If the wearer is showing early signs of hypothermia that they would not recognise themselves an alarm goes off, alerting them to get out of the



water, as well as informing the wearer of how long it will take them to swim back to shore using GPS. If the user's condition worsens to a dangerous level the device will also alert their emergency contacts. Using sensors to monitor environmental factors such as the temperature of the air and water, and wind speed, we can calculate the amount of time it is safe for the user to stay in the water. We believe that this device has the potential to protect people who are at risk of hypothermia and change the lives of those who are affected by it for the better.

# SciFEST 2022

## BOSTON SCIENTIFIC MEDICAL DEVICES

Award Finalists



## SciFest@ATU Sligo

[Stand 22]

**Title of Project: CoolAid: A Wearable Hypothermia Prevention Device**

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## SciFest@ATU Donegal

[Stand 23]

**Title of Project:** Reducing Stress Through a Smartwatch Style Device

**Student:** Adithi Vijayakumar

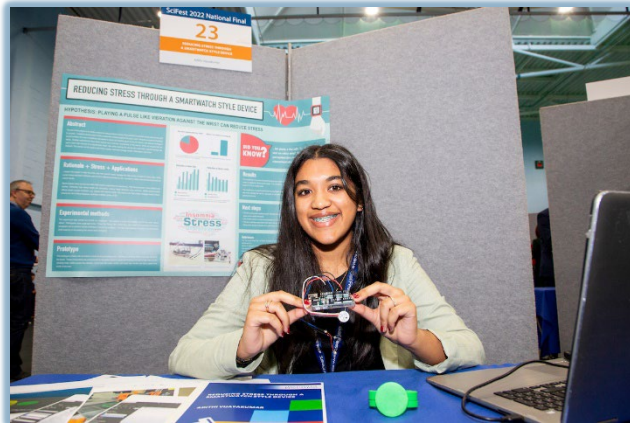
**School:** Institute of Education, 85 Leeson Street Lower, Dublin 2

**Teacher Mentoring Project:** Catriona Hendry

### ABSTRACT

In this project I created a smartwatch-style device that reduces stress. The device emits a slow pulse-like vibration against the user's wrist which reduces heart rate and stress levels.

During my research I completed a survey, investigating stress levels, and the effects of stress on adults. Results gathered showed extremely high levels of stress and that stress had caused medical conditions such as headaches, anxiety, heart palpitations, menstruation issues, high blood pressure, fatigue and sleep issues amongst others. I created the device, using an arduino board, a vibrating motor (coded to emit a pulse-like vibration) and a pulse monitor (records user's heart rate).



Three experiments were conducted. The first experiment was carried out to find the optimum strength and frequency of the vibrations. In the second experiment, the functionality of the device was tested. Participants were subjected to exercise while wearing/not wearing the device, and heart rate was monitored at different intervals. Results showed that participants' heart rates reduced at a significantly faster rate while wearing the device as opposed to not wearing it.

The third experiment was carried out in order to test the hypothesis: Playing a pulse-like vibration against the wrist will reduce heart rate and stress. Participants were subjected to a three-tier stress test, while wearing/not wearing the device. Participants self-assessed their stress levels at various intervals. Participants reported lower stress levels while wearing the device. Their heart rate results showed heart rates decreased significantly faster while wearing the device.

These results supported my hypothesis. This device can be used by students, adults, people with special needs, anxiety disorders, insomnia, sleeping issues. It can also be customised for special groups, e.g. children.

## SciFest@ATU Galway

[Stand 24]

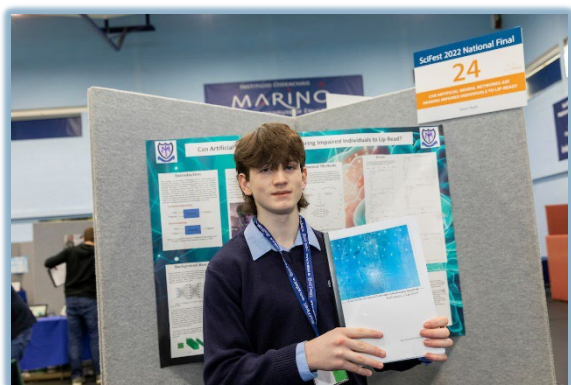
**Title of Project: Can Artificial Neural Networks Aid Hearing Impaired Individuals to Lip-Read?**

**Student:** Fionn Rush

**School:** Mary Immaculate Secondary School, Lisdoonvarna, Co. Clare

**Teacher Mentoring Project:** Máire Morrissey

### ABSTRACT



a). We all involuntarily lip-read certain words; however, the accuracy of lip-reading is minimal. Professional lip-readers can read lips at only 47% accuracy, and anywhere after that is inference. According to the World Health Organisation, by 2050 nearly 2.5 billion people will have some degree of hearing loss and at least 700 million will require hearing rehabilitation. Accurate, functional lip-reading equipment and resources could greatly contribute to this rehabilitation.

b). For my investigation I created an artificial neural network using the coding language python, to learn to read lips with the help of algorithms, statistical models, and machine learning to accurately predict a desired result. This means training a neural network to recognise speech using only visual information.

c). Neural networks are inspired by the natural pathways of the brain, with their neurons, or perceptrons, that signal to each other, and adapt them to aid in problem solving. This project will discuss how a 3D convolutional neural network has been built and how it will be used to aid hearing-impaired individuals to lip-read with accuracy.

d). A neural network is preferable to writing regular code in order to increase accuracy in lip-reading. The applications of this proposed project are significant for education, healthcare and wider society. With my project I reached an accuracy of 60% recognition rate, as opposed to the 47% accuracy of a professional.

[Stand 25]

**Title of Project: A Surgical Forceps Incorporating Frustrated Total Internal Reflection**

**Student:** Rachel Feeley

**School:** Mercy Mounthawk Secondary School, Mounthawk, Tralee, Co. Kerry

**Teacher Mentoring Project:** Eimear Nolan

## ABSTRACT

In many surgical procedures, body vessels, e.g. blood vessels, ducts, adhesions, fallopian tubes, or the like are sealed to functionalise or close the vessels. Traditionally, staples, clips or sutures have been used to close a body vessel. However, these traditional procedures often leave foreign body material inside a patient, which can lead to tissue inflammation, infection and death. It has been estimated that more than 1,500 cases of complications due to retained foreign body material in a patient occur annually in the USA. Mortality rates due to complications related to retained foreign body material in a patient are as high as 11%-35%. My project aims to avert this by incorporating optics to create conditions of frustrated total internal reflection to facilitate energy-efficient sealing and cutting of tissue using light energy. It involves using energy techniques that seal or cut by heating tissue rather than using staples or sutures. My surgical forceps comprises of two jaw members and involves the directing of a light beam onto the tissue-contacting surface of the first jaw member, reflecting the light beam from an interface between the tissue-contacting surface and a medium having a low index of refraction (e.g. air), grasping tissue between the first and second jaw members, and transmitting a portion of the light beam through the tissue-contacting surface and the tissue when tissue is grasped between the first and second jaw members. My forceps offers an alternative method, one that is less painful, non-invasive and highly effective.



## SciFest@TUS Limerick

[Stand 26]

**Title of Project: E.A.T. “Eat Assistive Technology”**

**Student:** Aoibhilinn Heath

**School:** Desmond College, Gortboy, Newcastle West, Co. Limerick

**Teacher Mentoring Project:** Donal Enright

### ABSTRACT

#### Purpose of the project

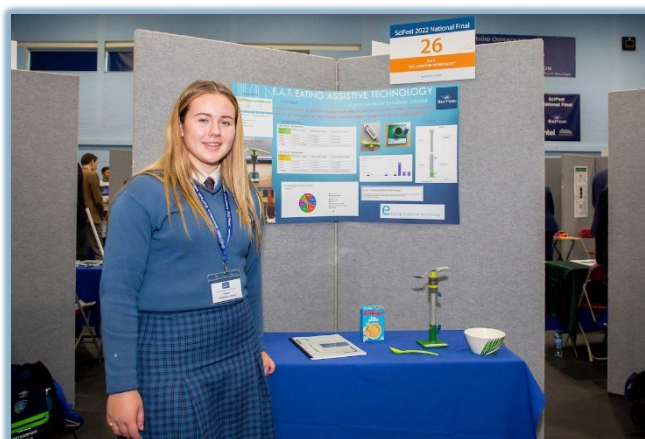
Independence is an invaluable commodity for the disabled community. This device will enable individuals with limited upper arm movement to feed themselves with minimal assistance using my ergonomic, height adjustable device. My device is capable of being affixed to any flat surface, and using my specially designed mechanism, allows food to be moved from table to tongue.

#### Description of the project

My Independent eating aid allows someone with a disability such as arthrogyriposis, ALS, amputee, or any other disability that limits hand and arm movement to feed themselves independently. This low-tech assistive technology is affordable and simple to use.

#### Features include:

- Ergonomically designed
- Increases independence
- Light weight
- Height adjustable
- Free standing
- Capable of supporting spoons / forks
- Portable
- Easy to use



#### Data

I used the device these past few months for my breakfast and I can verify that it works better for non-viscous foods, but it does work. I’ve demonstrated my device to people in my ‘bubble’ at home and in school and feedback has been extremely positive thus far. I created a video of how it works and circulated this to schools and establishments where people with limited upper arm movements frequent. Using their feedback has allowed me to enhance my device.

#### Conclusions

**“It actually works”** these are the words I remember having demonstrated my device to caregivers and users of St. Gabriel’s Special School, Rathfredagh Cheshire Home, and St Vincent’s Centre, Lisnagry. However, it has been I who learnt the most during this project.

## SciFest@TUS Thurles

[Stand 27]

**Title of Project: A Wheelchair Attachment Making it Easier for Users To Climb Steps**

**Student:** John David O'Donnell

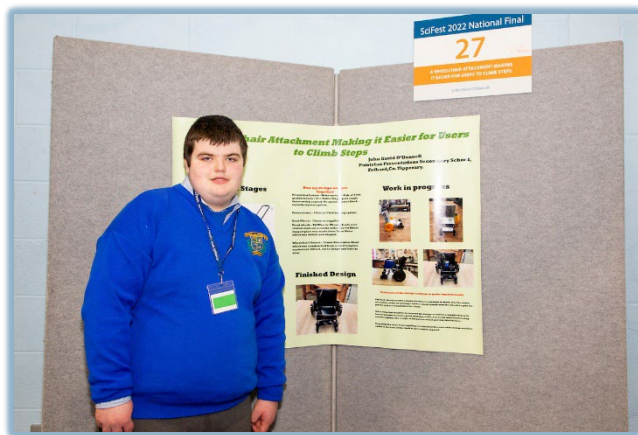
**School:** Patrician Presentation Secondary School, Rocklow Road, Fethard, Co. Tipperary

**Teacher Mentoring Project:** Margaret O'Neill

### ABSTRACT

The purpose of my project was to develop an attachment for a wheelchair which allows a user to climb a step or a kerb safely and independently giving them greater freedom of mobility. I was inspired to develop my idea of making life in a wheelchair easier and more accessible after having observed the challenges my grandmother experiences daily. When she visits our local town she has many difficulties trying to make her way safely onto the pavements from the roadway. This has negatively impacted her mobility and independence.

To find a solution to this problem I developed a wheelchair attachment based on a tri-wheel design. The tri-wheel is already used in some hand carts to allow the user to move items up steps. I thought that if this design was suitable for this purpose then it should also work in helping a wheelchair negotiate steps or obstacles. This attachment replaced the two front wheels of the wheelchair. The prototype I developed was successful in overcoming small obstacles.



Having achieved my goal in a prototype, I think it should be possible for a full-sized wheelchair to climb up on a step safely if it were fitted with my attachment. I hope it can be retrofitted to existing wheelchairs at a relatively low cost to make it easier for users to climb steps. It will give users greater independence to continue with everyday tasks without the need to ask others for assistance and in turn give them a better quality of life.

## SciFest@MTU Kerry

[Stand 28]

**Title of Project: CPR Chest Pedal Chest Compression Device**

**Students:** Jim Culhane, Paula-Eve Culhane

**School:** Comprehensive School Tarbert, Listowel, Co Kerry

**Teacher Mentoring Project:** Thomas Culhane

### ABSTRACT

Our project came about by realising that manual CPR is difficult to do and rescuer fatigue sets in early and is a known phenomenon in medical scientific literature.

Our research indicated that present-day CPR devices on the market are hospital and ambulance orientated and vastly expensive and need power sources.

Our aim was to design a cheap effective intuitive device without requiring an external power source and using recyclable parts. We wanted to postpone rescuer fatigue for as long as possible. We researched various mechanisms and the final device involves bicycle pedals linked to a car piston mechanism type design. We had to try four different versions to get to the final product to date.

Our CPR chest compression pedal device can postpone rescuer fatigue using it by itself or in a combination scenario with manual CPR for 30 minutes or more. Rescuer fatigue usually occurs within the first two minutes! Compression depths are consistent using this device because of its design and it is easy to use.

Compression depths are often not done properly in manual CPR, even as soon as the two minutes mark according to the medical literature.

Our conclusions to date from using our device are that CPR compression depth is accurate consistently, rescuer fatigue is postponed and there is no need for swapping in/out rescuers every two minutes. Also, as most heart attacks happen in the home this is very significant.





# Previous Winners

## SciFest STEM Champion 2021

### SciFest@TUS Athlone

[Stand 31]

**Title of Project: Cosmic Radiation Protection Simulation**

**Student:** Clare Reidy

**School:** Our Lady's Bower, Retreat Rd, Athlone, Co. Westmeath

**Teacher Mentoring Project:** Julie-Anne Greaney



## Berlin Long Night of Science Award 2021

### SciFest@ATU Sligo

[Stand 30]

**Title of Project: Keep a Clear Head – An Investigation into the Observed Physiological Brainwave Effects, when present within Interfering Domestic Electromagnetic Fields**

**Students:** Niamh Carolan, LÍle Hensey

**School:** Ursuline College Sligo, Finisklin, Sligo

**Teacher Mentoring Project:** Anthony Carolan



## Broadcom MASTERS International Award 2021

### SciFest@MTU Kerry

[Stand 29]

**Title of Project: Nature Takes on Nature: Investigating the Effect of Juglone on Japanese Knotweed**

**Student:** Grace Ni Iffearnáin

**School:** Gaelcholáiste Chiarraí, Tobar Mhaigh Dor, Trá Lí, Co Chiarraí

**Teacher Mentoring Project:** Tríona Uí Mhaolchatha



# SciFest 2022 Award Winners

## SciFest STEM Champion 2022

**Students** Rachel Griffin, Luke O'Sullivan, Liam Waldron

**School** Killarney Community College, New Road, Killarney, Co. Kerry

**Project** A Group-Theoretic Approach to Pythagoras' Theorem

**Teacher** Maire Spillane

## Teacher of Excellence 2022 Award

**School** A Group-Theoretic Approach to Pythagoras' Theorem

**Teacher** Maire Spillane

## SciFest STEM Champion 2022 Runner-Up Award

**Student** Maha Shahzadi

**School** Coláiste Nano Nagle, Sexton Street, Limerick

**Project** Eataware

**Teacher** Samantha Prior

## Berlin Long Night of Science Award 2022

<b>Students</b>	Anna Woodward, Alex Scott
<b>School</b>	Ursuline College Sligo, Finisklin, Sligo
<b>Project</b>	CoolAid: A Wearable Hypothermia Prevention Device
<b>Teacher</b>	Anthony Carolan

## Boston Scientific Medical Devices Grand Award 2022

<b>Student</b>	Fionn Rush
<b>School</b>	Mary Immaculate Secondary School, Lisdoonvarna, Co. Clare
<b>Project</b>	Can Artificial Neural Networks Aid Hearing Impaired Individuals to Lip-Read?
<b>Teacher</b>	Máire Morrissey

## Boston Scientific Medical Devices Runner-up Award 2022

<b>Students</b>	Jim Culhane, Paula-Eve Culhane
<b>School</b>	Tarbert Comprehensive School, Tarbert, Listowel, Co. Kerry
<b>Project</b>	CPR Chest Pedal Chest Compression Device
<b>Teacher</b>	Thomas Culhane

## Intel Technology Award 2022

<b>Student</b>	Maura Moore-McCune
<b>School</b>	The Kings Hospital, Palmerstown, Dublin 20
<b>Project</b>	VIPMOD: Visually Impaired Person's Moving Object Detector
<b>Teacher</b>	Ciaran O'Connor

## SciFest STEM Outreach Award 2022

<b>Student</b>	Maura Moore-McCune
<b>School</b>	The Kings Hospital, Palmerstown, Dublin 20
<b>Project</b>	VIPMOD: Visually Impaired Person's Moving Object Detector
<b>Teacher</b>	Ciaran O'Connor

## SciFest Social Sciences Award 2022

<b>Students</b>	Tommy Morris, Mairead Lohan
<b>School</b>	Roscommon Community College, Lisnamult, Roscommon, Co. Roscommon
<b>Project</b>	An Investigation into the Recovery of Adolescents Moving from the Sympathetic to the Parasympathetic Nervous System
<b>Teacher</b>	Elizabeth Glancy

## SciFest Life Sciences Award 2022

<b>Students</b>	Honor Lynch, Aoife Lynn, Juliette Kelleher
<b>School</b>	Loreto College, 53 St Stephens Green, Dublin 2
<b>Project</b>	The Einstein of Enzymes: A Battle Against Plastic Pollution
<b>Teacher</b>	Katie Kinkaid

## THEA Award 2022

<b>Student</b>	Laura Brennan
<b>School</b>	Desmond College, Station Road, Newcastle West, Co. Limerick
<b>Project</b>	Mela No More
<b>Teacher</b>	Donal Enright

## ISTA Award 2022

<b>Student</b>	Sean Allen
<b>School</b>	Roscommon Community College, Lisnamult, Roscommon, Co. Roscommon
<b>Project</b>	A Novel Alternative to Synthetic Fertilizers
<b>Teacher</b>	Elizabeth Glancy

## SciFest Scientist of the Future Award 2022

**Students** Micheál Deely, C J Burke

**School** Abbey Vocational School, The Glebe, Donegal Town, Co. Donegal

**Project** A Dyslexia Lamp with a Difference

**Teacher** Donna Furey