

Leaving Certificate Computer Science

Bulletin 3, June 2021

EVERYTHING YOU ALWAYS WANTED TO KNOW ABOUT COMPUTER SCIENCE—BUT WERE AFRAID TO ASK

by Monica Ward

You might have heard the words ‘computer science’, but maybe you are not sure what they really mean. Don’t worry – you are not alone. In this section of the bulletin we look at what ‘computer science’ means and some other questions around the subject.

What is Computer Science (CS)?
Computer science is a broad term that covers many different aspects of computing. It includes both hardware (e.g. things you can touch like a laptop or the internal parts of a computer) and software (e.g. the apps and programs you use on different devices). It covers programming and all aspects of software development. It can range from the very theoretical to the very practical. Even those who work in computer have different opinions about what ‘computer science’ actually means – so it is OK for those outside the field to be a bit unsure as well.

Is Computer Science hard?
Computer science is a broad field and covers many different areas. It does require a bit of effort to learn, but then so do most subjects. It helps if you like working things out. Part of the reason that it has a reputation of being hard is that it is more unknown than other subjects. Most people have a general idea what history, geography or French, but they are all learnable, but they don’t know what computer science is. Some aspects of computer science are more difficult than others, but they are all learnable. The key is to remember that computer systems are made up of many different components and people will like certain parts and find they easier and more enjoyable than others.

What does a Computer Scientist actually do?
Many people have a mental image of a computer scientist as someone who spends all day sitting at a computer, looking at the screen, working alone, not talking to anyone and rarely taking breaks. While there are some computer scientists that sometimes spend all day working on a program, most of the time computer scientists work on other tasks. A lot of the time, computer scientists or more generally, people who work in computing, work on solving problems. They try to understand what the problem is and break it down into smaller and smaller problems until they get to the point where they can eventually solve the small problems one by one. They then combine all their solutions together to solve the bigger problem.

In order to do this they usually work in teams where people have different skills and can bounce ideas off one another. Different team members might work on different tasks. For example, if a team is working on developing a website for an organisation, the roles include:

- working with the users to find out what they want they website to do
- designing how the website will look
- sending and receiving information from the website to other systems
- connecting the website to the internet
- making sure the right security systems are in place
- making sure all the different components link up together
- testing the website and the components
- to make sure it does what it’s meant to do, that it’s secure, looks good and is easy to use.

In some big companies, each of these roles will be done by several people but in smaller companies, the same person might cover several different roles. Even within these roles, there is a lot of variety. What a person does at the start of a project will be different to what they do at the end of a project.

So you can see that there are loads of different roles and jobs that computer scientists actually do – they do not all do the same job and there can be a lot of variety in what they do and this keeps things interesting.

What skills do you need to become a computer scientist?
As you can see, being a computer scientist involves having a mix of skills. It helps if you like puzzles and figuring things out – problem solving in other words. There is also a need to be a good programmer. It helps if you like puzzles and figuring things out – problem solving in other words. There is also a need to be a good programmer. It helps if you like puzzles and figuring things out – problem solving in other words. There is also a need to be a good programmer. It helps if you like puzzles and figuring things out – problem solving in other words.

Do you have to be really good at maths to be a computer scientist?
Well, it depends on what area of computer science you want to work in. If you are interested in cryptography, then it helps if you like maths, but if you are interested in other areas of computer science, then it’s helpful but not absolutely essential that you are really good at maths.

Should I do Leaving Cert Computer Science?
There are three reasons why you might consider studying computer science for the leaving cert.

It is a new subject and the approach is more modern than some other subjects. There is a big emphasis on the practice side of things – so you won’t spend all your time in the classroom. There are many active learning components where you learn by doing – this is usually more effective and enjoyable.

The course is quite open and you can choose to bring in elements of other subjects in which you are interested (e.g. science, business, music, a language or the environment) when doing some of the project work. You will be working in a team and you’ll be able to build bigger and better projects than you could on your own.

You’ll get a chance to learn what computers science is all about. You might like it and decide that you’d like to continue to learn about it after the leaving cert. You might realise that it’s not for you, but you will have a detailed knowledge of computing that will be helpful for you in almost any career. There is also a need to be a good programmer. It helps if you like puzzles and figuring things out – problem solving in other words.

Monica Ward is the Assistant Head for Teaching Excellence in the School of Computing at Dublin City University and was the Irish Universities Association’s domain expert for the Leaving Cert Computer Science curriculum.



MY FIRST YEAR WITH ESA’S ASTRO-PI AND MISSION SPACE LAB

by Danny Murray

It’s a rite of passage for every programming student to write their first program which simply says “Hello world”. Most students write this on their laptop or in a computer lab but some lucky students quite literally get to look down at planet earth and say “Hello world”.

Our school, St. Joseph’s Rush, entered ten teams in this year’s Mission Space Lab competition to perform experiments on the International Space Station. Nine teams successfully made it through to flight status and just this week we received our opening shots of our planet from 400km above us. To give you all an idea of the competition and what it looks like in the classroom, here are four things I wish someone would have told me about ESA’s Mission Space Lab.

The bit that I thought was the competition, was not the competition. Getting your students to flight status and into space is far more straightforward than I’d thought.

While I’d heard about the Astro-Pi competition and students being able to write code to run on the space station, I’d thought that such an astronomical prize must be reserved to the 0.01%, the coding Olympians, that survive elimination. I thought that a lot of competitions come with an “anyone can technically enter” banner on their webpage but then so did the webpage for the Olympics. It wasn’t until Stephanie O’Neil from Science Foundation Ireland kindly organised a chat between the teachers and someone from the European Space Agency (ESA), that I understood that the word “competition” refers only to the last part, the project report.

Getting your experiment to the ISS is more of a checklist than a competition. It’s completely achievable and remarkably straightforward thanks to the well written guides online (available here). Reaching “flight status” is a lot like taking a flight on a budget airline and having to be clear of the routes to avoid baggage fees. You do need to read the ESA’s rules carefully to avoid trying to do something silly such as directing the ESA to turn the space station around to try to photograph something specific like your house. The ISS is moving at 7km/s. That’s not going to happen and your idea won’t fly. Spying on astronauts and accessing the station’s systems will do also your idea knocked out of orbit.

If your experiment’s code runs for the allotted three hours and has a good chance of gathering the data that it aims to gather, your project will probably make it to space. I’d thought that getting to space was the prize you get if you win the competition. This isn’t how it works at all. The competition is for the report that your students write up after you get their photos back from space. The actual prize is the chance to meet and talk to one of the astronauts.

Students don’t have to do output experimental results in space. Often a student’s program in space just takes photos that are then sent to the teacher in a zip file later on. Then they can sip tea safely on earth while analysing their data. Simple!

You’re advised not to try and run image processing code on the Raspberry Pi computers onboard the ISS as they’re not built for that kind of intensive use. In April/May you will receive a zip file back from the ISS containing all of the photographs and sensor data from your student’s program. At that point, your team has another full month to analyse the data and test their hypothesis. Regardless of the topic, if you are taking photos there’s a good chance you’ll want to use some image processing on a more powerful desktop PC to uncover details in the photos that the human eye wouldn’t pick up. Students these days are well used to Instagram filters and it is these same filters that we use, except that we can program them (in python) to output helpful percentages (like the amount of brown in a forest to track changes over the years).

The “Astro-Pi” is not some fancy purpose-built space hardware. It’s a collection of four or five Raspberry Pi accessories that you might find in a shop such as a camera and a Sense Hat. You can get a nice 3D printable box for joining them all together though!

If your team designs and submits a worthwhile idea that will work, they will be sent out an Astro-Pi kit containing a regular Raspberry Pi with a visible and an infrared camera, a Sense Hat and everything you need apart from a keyboard, mouse and screen. They even include a helpful VGA/HDMI jack for those older school screens. You’ll also get the bolts and screws and wires for that lovely Astro-Pi case that matches exactly the case onboard the ISS (which you can 3D print if you so wish). The 3D printed case isn’t needed to proceed through the next stages but it is pretty cool nevertheless.

As a teacher, you can do Mission Space Lab with your whole class even if only one or two teams will make it through to the later stages.

As long as you have regular Raspberry Pis, cheap sensors, and some webcams you can do many of the same kind of experiments as you can with a full Astro-Pi kit. If you’re teaching sensors, rocket science is about as exciting a theme as you can get. I had initially shied away from the competition thinking I didn’t want to end up with some students with the galaxy and nebulae and screen. They even include a reflection I’d overestimated the importance of an official kit over the theme itself and all of the resources that you can still use regardless of your students’ progression in the competition.

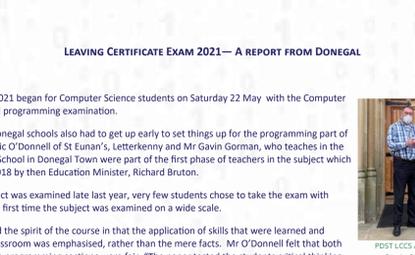
The overlap between Mission Space Lab and Leaving Cert Computer Science is substantial. The subject already has two six-week projects built in on Sensors and Data Collection and Analysis. Astro-Pi ticks both boxes heavily with a real-world application and data that is literally gathered in space. Had I ended up with some non-participating groups, I would have used our own Raspberry Pi computers for other space-themed projects. It’s definitely something I’m looking forward to doing again next year.

Danny Murray teaches computer science in St. Joseph’s Secondary School, Rush, Co. Dublin

CODEPLUS

The SFI funded CodePlus project focuses on addressing the gender imbalance by engaging female students in Computer Science activities, in order to help them make more informed choices about studying CS and pursuing careers in the field.

The project held a webinar on Wednesday April 28th attended by over 150 young female secondary school students from schools based in Dublin, Limerick and Galway. There were terrific and engaging talks from software engineers Vijayashree Ranganath from Fidelity Investments and Orla Walsh from Dell presenting on their careers and experiences in Computer Science!



CodePlus involves a partnership between TCD, NUI Galway and Lero – the SFI Research Centre for Software at ULIO to further develop the existing project, which has been running in TCD since 2015. The project has developed since its inception and most attended in the past 3 years has engaged over 1,000 secondary school girls in 20 hours of coding workshops. In addition over 2,000 girls have attended career talks, given by female role models. These have taken place either in the field, by on-site in the offices of technology companies.

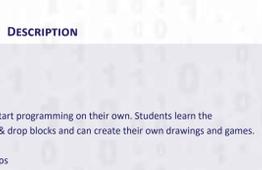
CodePlus seeks to address the gender imbalance in the field, by encouraging, facilitating and providing opportunities to teenage female students to engage with Computer Science. For further information on CodePlus or if your school would like to become involved, please contact us at <http://codeplus.scss.tcd.ie/> or via twitter, [@codeplusfcd](https://twitter.com/codeplusfcd).



CESI

(The Computers in Education Society of Ireland)

Some of you may not be familiar with CESI so let me introduce the organisation to you. Founded in 1973, CESI brings together individuals from all levels in education, who are passionate about the possibilities of technology for teaching and learning, and the tool of exchanging information, posing and answering questions, pushing the boundaries, exploring the potential of the latest development and being excited, all characterise the interactions of the CESI tribe.



Computers in Education Society of Ireland
Cumann Ríomh-Oideachais na hÉireann

How and where does this occur you may well think. The mailing list is a real anchor to the activities with social media also playing its part. CESI is the website and acts as a portal to other related and interesting sites. Annual conferences are very important in cementing old relationships and starting new ones. Held virtually this year 2021, it proved a major success with the laughter and enjoyment so evident in the face to face context transferring very well to the online version. A development which found its time in the pandemic is the CESI Staffroom – an attempt to capture the informal learning that takes place over a cuppa.

The organisation has been part of the TPN (Teachers Professional Network) for many years. With the introduction of Computer Science (CS) as a Leaving Certificate subject, CESI added the role of subject association for CS to its activities. This means it provides a hub for teachers engaged in the teaching of CS, to discuss, support and share the classroom experience for the betterment of all involved. CESI continues to be part of a very productive working team with PDST in the support of LCCS and CS going forward. It is also a member of the LCCS Support Framework Group.

CESI is free to join and all that is required is that you sign up to the main mailing list which includes a dedicated CS mailing list. It is open to those involved in education at any level and to those who simply have an interest in education and technology. I’m delighted to extend to you an invitation to join.

Adrienne Webb
Chair, CESI

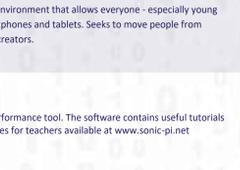
CESI/LCCS Table Quiz

The inaugural CESI/LC CS Table Quiz was launched at this year’s CESI Conference on Saturday 27th February by CESI National Executive members Sarah Jayne Carey and Helen O’Kelly, who also designed it and publicised it through the LCCS Slack. Conference attendees got a taste of Round 1 - Computer Science & Entertainment questions!

As with most events this year the table quiz was designed as a virtual experience to be run asynchronously in Phase 1 and Phase 2 Computer Science classrooms over a number of weeks from early March.

How did it work? There were 5 rounds of 10 multiple-choice questions published using Google Forms on a daily basis from 1st - 5th March 2021. Each class had to work together to agree on their answers and then the teacher submitted the answers for each round to the Google Forms on their behalf. Classes initially had 2 weeks to submit their answers, but we extended the deadline by a week after requests from participating schools, with the final deadline being Friday, 16th April at 4pm.

In total, 13 schools submitted answers - many thanks to every class and teacher who participated at what is a very busy time for all. Thanks too to SDeeducation who sponsored the prizes - vouchers for €100, €60 and €40 for 1st, 2nd and 3rd prizes, respectively.



5th year LCCS students in Claregalway College, winners of the inaugural CESI/LCCS Table Quiz.

It was an incredibly close contest between the top-placed teams but after all 5 rounds the 5th years in Claregalway College and the 6th years in St Mary’s CBS, Enniscorthy were tied for first place with a score of 46/50, closely followed by the 6th years in Bush Post Primary School in 3rd place on 45/50! With Friday the 6th years we headed into a tie-break in which St. Mary’s CBS exam were 4/5 but Claregalway came out on top with 5/5. The final results for the top-placed teams were as follows:

- 1st place—5th year, Claregalway College (46+5). Teacher: Iarla Connaughton.
- 2nd place—6th year, St Mary’s CBS, Enniscorthy (46+4). Teacher: Mark Murtagh.
- 3rd place—6th year, Bush Post Primary School (45). Teacher: Gemma Duffy.

We look forward to next year’s CESI/LC CS Table Quiz - in whichever format it can be run!

Sarah Jayne Carey and Helen O’Kelly

LCCS BUDDY SYSTEM

Keep an eye out for the launch of a new Buddy System later this year to support LCCS. This initiative is one of the actions outlined in the LCCS Support Framework document published in November 2020 (available here) and is being progressed by the LCCS Framework group.

Leaving Certificate Computer Science is a subject for all regardless of ability, background or gender. The primary aim is to offer support to help to support the growth and development of computer science education in Ireland. Another aim of the buddy system is to offer all schools - particularly those that aren’t already offering LCCS as a subject - additional support that would enable them to do so.

The idea of the buddy system is to provide a means of connecting teachers/schools with ‘buddies’ from industry, from schools and from higher/further education. These buddies will be able to use the system to register the terms of support they can offer, and teachers/schools who are interested in availing of additional support will be able to choose from a menu of supports to meet their own needs.

Since the introduction of LCCS in September 2018, teachers throughout the country have been doing a fantastic job to ensure that students are given the opportunity to explore their own passions and interests through the lens of computer science. These teachers have built up a great deal of expertise into what it takes to get this fantastic subject off the ground and potentially could make ideal buddies.

This initiative will also complement and supplement what is already happening in many schools and pivot organisations that are already involved to target schools that are not availing of potential support. Many organisations already have offerings/programmes in place and it is envisaged that these could dovetail readily into the new buddy system.

Over time the buddy system has the potential to become a focal point for high quality information and events that are relevant to computer science educators and students at post-primary level in Ireland.

Watch this space for more news on the buddy system in our next edition!

Minister Harris announces €5.2 to support Science Foundation Ireland Discover Programme

Funding will support 49 projects across the state, including funding to Girls Coding – Code Plus.

The 49 projects will take place local and nationally across Ireland covering topics including biodiversity, STEM sign language, climate action and sustainability, coding, epilepsy, understanding pandemics, digital wellbeing, and the link between music, maths, and physics. The initiatives also target a wide range of ages including young children, teens, and adults as well as some initiatives designed for young people from disadvantaged backgrounds and attending DEIS schools and those living with sight loss – encouraging inclusivity and diversity.

Girls Coding – CodePlus – seeks to address imbalance by encouraging, facilitating, and providing opportunities to teenage female students to engage with Computer Science. This project includes an expansion to the Galway and Limerick areas, in addition to the Dublin based activities funded under the SFI Discover Programme in every year.

The full press release can be accessed here.

FROM THE PDST

SPRING WEBINAR – PUZZLE GURU ROB EASTAWAY

In April, PDST were delighted to welcome author, maths speaker, and puzzle advisor to the new Puzzles in Computational Thinking classes.



Rob has written numerous popular maths books with such titles as “Maths on the Back of an Envelope”, “How to Take a Penalty – The Hidden Maths Behind Sports” and “Maths for Mums and Dads” and is well known from his appearances on BBC television and through his website, robwestaway.com.

His focus for the webinar was on puzzles and especially analysing what makes a puzzle ‘good’ or ‘bad’. He took a question, for example, from an old English Maths exam where the often-used characters A, B and C feature. We have information on the combined weights of A and B; B and C etc, and the question is to work out their individual weights.

Students found this puzzle unrealistic and boring, a situation barely helped by renaming the characters to Alf, Bert and Charlie! For our students to engage with the puzzle, the puzzle itself needs to be engaging in some way. Rob reframed the problem to one of weighing babies in a hospital, which was difficult due to the babies’ refusal to stay still on the weighing scales. So, instead of the combined weights of A and B, we have the nurse holding the baby and standing on the scales. Instead of B and C, the doctor holds the baby and the nurse checks the scales. Finally, the baby takes the reading while the doctor stands on the scales holding the nurse. An otherwise failing puzzle brought to life through the setting of a novel and surprising scene.

LEAVING CERTIFICATE EXAM 2021— A REPORT FROM DONEGAL

The Leaving Cert 2021 began for Computer Science students on Saturday 22 May with the Computer Science theory and programming examination.

Teachers in two Donegal schools also had to get up early to set things up for the programming part of the exam: Mr Paucic O’Donnell of St Eunan’s, Letterkenny and Mr Gavin Gorman, who teaches in the Abbey Vocational School in Donegal Town were part of the first phase of teachers in the subject which was launched in 2018 by then Education Minister, Richard Bruton.

Although the subject was examined late last year, very few students chose to take the exam with Saturday being the first time the subject was examined on a wide scale.

The exam reflected the spirit of the course in that the application of skills that were learned and practised in the classroom was emphasised, rather than the mere facts. Mr O’Donnell felt that both the written and the programming sections were fair. “The paper tested the students critical thinking and problem solving, which was welcome,” he said. “One question involving analysing a match/ticket game was asking, what from students, as they had to understand the rules of the game on the spot.”

PDST LCCS Advisor Tony McGennis and Paucic O’Donnell, LCCS teacher and Deputy Principal in St Eunan’s College, Letterkenny.

Some of the 2021 LCCS class from Abbey Vocational School, Donegal
Town, their teacher Gavin Gorman and school Principal Geraldine Diver

LCCS Students from St Eunan’s College, Letterkenny with their Principal Damien McCleary

Mr O’Donnell found the programming section fair, with just one challenging part at the end. Mr Gorman also mentioned the last part of the programming question, but was happy with the exam overall, saying it was “doable”.

Both Mr O’Donnell and Mr Gorman were part of the pioneering group of teachers who embarked on a program of professional development which developed into a professional community, helping each other in different aspects of the subject.

The experience of these teachers encouraged a second phase of schools in 2020 to offer Computer Science as a subject for the Leaving Cert. The uptake in Donegal schools has been particularly impressive.

This is an amended version of an article written by PDST LCCS advisor Tony McGennis which appeared on Donegal Live here on 23 May.

Useful websites for TY students to get started with coding

TITLE	DESCRIPTION
	https://studio.code.org/s/express-2019 A great option for students who wish to start programming on their own. Students learn the fundamentals of programming with drag & drop blocks and can create their own drawings and games.
	https://arcade.makemakecode.com/ MakeCode Arcade is a block-based code editor to build retro arcade games for the browser and handheld consoles.
	https://projects.raspberrypi.org/en/projects?software=python Some great projects that will help students start writing code and get going with digital making.
	https://www.khanacademy.org/computing/computer-programming An interactive website where students can learn how to use the JavaScript language and the ProcessingJS library to create fun drawings and animations.
	https://www.codecademy.com/catalog/subject/all A range of online web development and programming courses including the Code Foundations course and the Computer Science course.
	https://www.apple.com/ie/swift/playgrounds/ An app that makes it fun to learn and experiment with code. Students solve interactive puzzles in the guided “Learn to Code” lessons to master the basics of coding, or experiment with a wide range of challenges that let them explore many unique coding experiences.
	http://appinventor.mit.edu/ An intuitive, block-based visual programming environment that allows everyone - especially young people - to build fully functional apps for smartphones and tablets. Seeks to move people from technology consumers to become technology creators.
	Sonic Pi is a code-based music creation and performance tool. The software contains useful tutorials and references for getting started with resources for teachers available at www.sonic-pi.net
	p5.js is a web-based JavaScript library for creative coding, with a focus on making code accessible to artists, designers, architects, designers, programmers, and interactive designers. The p5.js website contains a detailed reference tool, guided learning resources and ready-made examples to hack and remix.
	Turtlitch is a block-based programming language based on Snag! that allows users to both use and learn programming techniques to create patterns and designs that can then be stitched onto fabric using programmable embroidery machines.
	Open P-TECH is a free digital education platform from IBM with digital learning courses such as professional skills, sustainability, design thinking, AI and Cybersecurity—all designed for and mapped to Junior and Senior Cycle Key Skills. Teacher resources are included and students can earn credentials approved by IBM and its partner organisations.

UPCOMING EVENTS AND COMPETITIONS

EVENT/COMPETITION	ENTRY DATE	URL	ABOUT
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ACM SIGSCSE Various dates <https://sigscse.org/sigscse/events/>
The SIGSCSE organisation provides a forum for educators to discuss issues related to the development, implementation, and/or evaluation of computing programs, curricula, and courses, as well as syllabi, laboratories, and other elements of teaching and pedagogy.

BT Young Scientist Autumn 2021 <https://btyoungscientist.com/>
BT Young Scientist is an Irish annual school students’ science competition to encourage interest in science in secondary schools.

EU Code Week 9-24 October 2021 <https://codeweek.eu/>
EU Code Week is a grassroots initiative which aims to bring coding and digital literacy to everybody in a fun and engaging way.

Computer Science Apprenticeships Ongoing <https://apprenticeship.ie/career-seekers/get-started/learn-more/ict/Software-Developer-Associate-L6>
Apprenticeships and college courses in the area of ICT, Computer Programming, and Data Science.

Formula Females All year round <https://www.formulafemales.org/>
The Go Girls Karting initiative is designed to give young females an insight into the world of Motorsport, whether it’s competing as a driver or undertaking a career through STEM.
Using Motorsports as a platform to teach STEM education provides a new way of thinking for students who need something different in order to learn.

Teen Turn Programs available various dates throughout the year <https://teen-turn.com/>
Teen-Turn aims to provide teen girls the opportunity to gain hands-on STEM experience so that they can visualize themselves in those kinds of careers and therefore make third level course choices accordingly.

Science on Stage Applications close 17th September 2021 <http://www.scienceonstage.ie/>
Science on Stage (SoS) Europe is a European initiative to encourage science teachers to share best practice in science teaching. A key focus of SoS is the hosting of biennial teacher festivals to showcase innovative teaching ideas. Follow up activities focus on sharing, developing and sustaining the inspiration gained at the festival.

UPCOMING CONFERENCES

CONFERENCE	DATE	URL	ABOUT
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ICER - ACM International Computing Education Research Conference August 2021 Charleston, South Carolina <https://sigscse.org/events/icer.html>
The International Computing Research (ICER) conference aims at gathering high-quality contributions to the computing education research discipline. It attracts over 100 computing education researchers.

ISLS 7-11 June 2021 Bochum, Germany <https://2021.isls.org/>
The International Society of the Learning Sciences (ISLS) is leading the professional society for academics, professionals and students seeking to advance the sciences and practices of learning. ISLS brings together those interested in learning experiences across schools, homes, workplaces and communities, and who seek to understand how collaboration and learning is enabled by knowledge, tools, networks, and social structures.

SnapCon 29 July–1 August <https://www.snapcon.org/conferences/2021>
Gathering of educators, researchers, makers and enthusiasts of the Snap! programming language. Participants will share ideas, experiences, and artefacts around the joy and beauty of computing.