



Science Teachers Association of Victoria Inc.

ABN 59 004 145 329

Patron: Associate Professor Misty Jenkins BSc (Hons), PhD, MAICD



VCE Science Teachers Conference Series 2022

PHYSICS

18th February 2022

All sessions will be recorded and available to view until late 2022

Perspectives on Practice: Harnessing Innovation

Welcome to the STAV VCE Physics 2022 Online Conference Presidents' Welcome

We have an exciting, diverse and engaging program with a mix of live and pre-recorded presentations and workshops. Robert Sheehy will open the conference with a timely keynote on "Innovations in electricity: is 100% renewable now possible?"

There will be three live (synchronous) sessions with eighteen choices of workshops and presentations covering curriculum, pedagogy, assessment, technology as well as extension topics. All live sessions will be recorded and available for viewing after February 22nd, providing you with a great ongoing resource. Delegates will also have access to pre-recorded (asynchronous) presentations from 11 February, to watch on demand!

The live program concludes with a review of the 2021 VCE examination led by the Chief Assessor, Andrew Hansen. As was so well received in 2021, the Chief Assessor will pre-record a detailed review of the paper which will be available to view as an asynchronous session from 11 February. You will then be able to post questions and comments prior to the live session. The live session will address the questions and comments and allow opportunity for further interaction.

In addition, Maria James will present the VCAA Update titled 'VCAA Update and Unpacking assessment in the new VCE Physics Study Design'. There will also be the opportunity to network with colleagues.

Finally, thank you for participating in this conference, thus ensuring you stay fully informed of the key issues in the VCE sciences. We trust you will enjoy and find the sessions interesting and rewarding.

Alexandra Abela, President, Science Teachers' Association of Victoria Inc.

Barbara McKinnon, President VicPhysic

Science Teachers Association of Victoria Inc. acknowledges the support of the Department of Education and Training through the Strategic Partnerships Program.



Synchronous Sessions

Live on Friday 18 February 2022

8.45am - 8.55am **Welcome**

Welcome, Acknowledgement of Country & Housekeeping: Alexandra Abela, STAV President

Introduction of Keynote Speaker: Barbara McKinnon, President VicPhysics

8.55am - 9.55am **Keynote Address**

Dr Robert Sheehy, Managing Director, Regenersys Pty Ltd



Innovations in electricity: Is 100% renewable now possible?

Generation of electrical energy has traditionally used coupled thermal engines and very large magnetic rotating generators to convert rotational energy to electricity.

The recent explosive growth of power electronics capabilities and energy harvesting devices such as photovoltaic panels, wind turbines, wave and tidal power generators and fuel cells is increasing the amount of distributed electricity sources being connected to our electricity grids. Many of these sources are direct current (DC) in nature and require some form of power conversion to match the alternating current (AC) and frequency of the grid before power can be delivered. Power electronics and advanced software algorithms make it possible for all these renewable sources to emulate traditional rotating generators. Concerns have been raised over the frequency and voltage stability of the grid as more distributed sources are added, but the flexibility of the new power converters and energy storage solutions have already demonstrated that those concerns can be addressed through innovative use of the new technologies.

This presentation will look at the core differences between traditional large thermal power generation and smaller distributed power generation, the inverters and power converters role in interfacing renewable sources to the grid, and how energy storage coupled with power electronics is providing voltage and frequency stabilisation to the grid – unlocking a pathway toward potentially 100% sustainable electricity.

9.55am - 10.00am **Short Break**

Session A 10.00am - 10.45am

A1 Mr Sandor Kazi, Melbourne Girls' College

Collaborative problem solving: Students taking charge of their learning

How do you get students to challenge themselves by attempting difficult problems? I'll introduce an activity that involves students working initially by themselves, then in groups to solve challenging problems, and demonstrates how they are assessed on their effort and reflection on their learning.

Pedagogy

A2 Mr Milorad Cerovac, Swinburne University of Technology

Developing innovation capabilities through Applied Physics: A case for Systems Engineering

There is much rhetoric that emanates from various governments, economists and other business leaders about the need to innovate and develop innovation capabilities in our students. While there are some opportunities to develop these capabilities within the Physics classroom, the related but seemingly ignored subject of VCE Systems Engineering offers an arguably near-perfect platform to not only foster innovation capabilities in our students, but to also develop other essential 21st century skills. This workshop will take a closer look at the VCE Systems Engineering subject, why schools should offer it, and what's involved in teaching the subject.

Curriculum

A3 Dr Jackie Bondell, Swinburne University / ARC Centre of Excellence for Gravitational Wave Discovery

General Relativity, Black Holes, Gravitational Waves: Contemporary Topics, Innovative Classroom Ideas

In September 1922 the eyes of the scientific community were focused on the remote coast of Western Australia. An international expedition of scientists and astronomers were in Wallal to take photos of the total solar eclipse. The goal was to have images clear enough to analyse the position of stars to provide the first evidence in support of Einstein's Theory of General Relativity. The expedition was a success and, in the hundred years since then, general relativity concepts have laid the foundation for further discoveries related to black holes and gravitational waves. In this session we will review some of the major concepts related to these Einsteinian Physics topics, discuss how they can be linked into the Victorian secondary science and the VCE curricula, and sample innovative (and freely available!) activities that can be used to introduce these topics in the classroom.

Enrichment

A4 Dr Julie Mulholland and Bridget Murphy, ANSTO

Radioactive decay from a real-world perspective

The half-life of a radioisotope is an important factor that needs to be considered in choosing a particular radioisotope for use in nuclear medicine. This workshop will explore an ANSTO Education resource for physics focussing on half-life, covered in Unit 1 Area of Study 3, to bring a real-world perspective linking physics theory with nuclear medicine. Addressing real-world applications of physics theory is essential for students to truly understand the impact of science on their lives and our society. We will explore data processing activities, including mathematical modelling, using authentic science data to determine the half-life of radioisotopes used in medicine, and discuss the relevance of this property to the use of the radioisotope. The activities address ICT skills, problem-solving, as well as critical and creative thinking. We will also discuss alternative ways of explaining the difficult concept of nuclear stability.

Technology

A5 Mr Spiro Liacos, Cheltenham Secondary College

Electricity: The Shocking Truth

How do engineers achieve the extraordinary feat of wiring up a car's electrical circuitry so that the same courtesy light turns on regardless of which door you open? This session will give you ideas (and actual prac sheets and worksheets) that will allow your students to learn to design and construct a variety of electrical circuits that satisfy a range of design briefs. Currently, this series of pracs is without parallel. Ohm my goodness, I couldn't resist including a battery of puns, but I will conductor powerful session with ample opportunities for you to learn watts of stuff that will transform your classes and generator lot of ideas!

Curriculum

A6 Mr Dan O'Keeffe, Vicphysics Teachers' Network

Count Rumford: Spy, Scientist, Inventor, Social Reformer, Diplomat

Count Rumford conducted crucial experiments that lead to the kinetic model of heat and an understanding of the methods of heat transfer. He was also a significant figure in late 18th century Europe. The presentation will describe his experiments and also outline his diverse contributions to European civilisation.

Enrichment

10.45am - 11.15am Morning Tea

Session B 11.15am - 12.00pm

B1 Ms Rachael Gore, Albert Park College

Playful Physics

This session will present ways in which the Pedagogy of Play can be harnessed in the context of the Physics Classroom. Learnings from Project Zero-Harvard Graduate School of Education will be discussed and specific strategies for making thinking visible will be explained. Resources will be shared which scaffold student thinking and playful explorations. These activities will develop students conceptual understanding of core physics concepts and encourage them to take risks in their learning. Participants will leave with a framework they can use in their classrooms to extend students scientific thinking skills and independent investigations.

Pedogogy

B2 Dr Barbara McKinnon, Kew High School

Shining Light on Diffraction, Interference and Image Resolution

This session explores typical conceptual difficulties with applying the wave model to understanding properties of light and introduces strategies for identifying and reconstructing student thinking.

Curriculum

B3 Dr Robert Hollow, CSIRO**Engaging Students Through Real Astronomical Data**

Astronomy is a discipline in which real scientific data is freely and easily accessible. This makes it an ideal area for both first hand and second hand student investigations with the potential to undertake engaging and exciting projects. We explore local and international examples of where to access and how to use data to engage and challenge students. Topics from exoplanets, pulsars and galaxy classification are explored and key databases and citizen science tools identified. The possibilities for open-ended student investigations and citizen science are discussed. Upcoming projects and data challenges are highlighted.

Enrichment**B4 Mr Colin Chapman, Caroline Chisholm Catholic College****Dynamic modelling using Wolfram System Modeler and Mathematica - Using Electronic Records of Evidence to Thicken the description of Student Achievement**

This presentation will explore the development of dynamic simulations that may be coupled with physical devices through an Arduino microcontroller implemented through Wolfram SystemModeler and Mathematica. Innovation in the use of electronic records of evidence that allow for embedded simulations and linked videos of physical experiment will be explored. The presentation will support Unit 2/ Option 2.4: How can AC electricity charge a DC device? Apply the use of heat and light sensors such as thermistors and light-dependent resistors (LDRs) to trigger an output device such as lighting or a motor.

Technology**B5 Mr Chad Ronish, Sanford Underground Research Facility and Peggy Norris, Ph.D. Deputy Director of Education and Outreach, Sanford Underground Research Facility****Making Underground Science in the United States available for students around the world**

The Sanford Underground Research Facility in Lead, South Dakota, USA is conducting particle physics research 1.5 km under the Black Hills. Our Dark Matter, Neutrino and other international collaboration experiments serve as phenomena for our students to access rigorous science content through presentations, tours, and curriculum units that provide access and equity. Our professional development programs help educators of all levels open the world of real life science to students who get to experience, figure-out and do real science. We help create the Wonder that drives student imaginations and questioning attitudes. Join us to see what we do and explore how we can support you and your students.

Enrichment**B6 Mr Colin Hopkins OAM, Retired****Tips and hints for beginning teachers and teachers returning to Physics**

Colin will share tips and hints for engaging students in VCE Physics. Useful resources will be shared. The presentation will conclude with a question and answer session.

Pedagogy

12.00pm - 12.05pm Short Break

Session C 12.05pm - 12.50pm

C1 A/Prof Nicolas Menicucci, RMIT University

Preparing students for successful Physics problem solving in VCE and beyond.

My experience with first-year physics undergraduates at RMIT has provided me with insights that I feel would be helpful to the broader physics teaching community. First-year physics undergraduates at RMIT arrive excited and eager to learn. Soon after, they are hit with the sinking feeling that accompanies seeing a problem they have no idea how to solve at first and mathematics they don't intuitively understand. Supporting these students to learn early on how to navigate their way through this wilderness is vital for their success in later years. For the last five years, I have been designing and implementing innovations in course design and content delivery to help first-year undergraduate students do just that. I will discuss (1) the "magic formula" for getting students to attend and gain value from class; (2) working memory as a limited resource, why fast recall is important, and how to use low-stakes self-assessment to ensure students know the basics by heart; and (3) how "more ink, less think!" is a critical motto for student success in problem solving.

Pedagogy

C2 Mr Theo Hughes, Level 98

Simultaneity - the hidden dot point

In special relativity the concept of "simultaneity" underlies the other concepts of time dilation and length contraction. It was in a previous study design, but missing from the current one, although we may see it return in the next study design. I will explain its importance and how it can be explained and used effectively.

Curriculum

C3 Mr Dino Cevolatti and Stuart Bird, Castlemaine Secondary College

DIRTSCAN - A Scaffolded Problem-Solving Strategy

We will present a scaffolded problem-solving strategy that we call DIRTSCAN that we use to explicitly teach students to use metacognitive strategies using worked examples and multiple exposures. In brief, DIRTSCAN includes stages of Diagramming, Identifying, Relating, Transposing, Substituting, Calculating, Answering, and, Noticing, that encourage students to document their thinking and communicate their understanding to support their active problem-solving of physics questions. We will provide some examples of how we use this strategy across multiple areas and provide opportunities for participants to share their approaches and reflect on how this strategy can be used to address common misapplications of physics.

Pedagogy

C4 Mr Colin Hopkins OAM, Retired

Can the use of past Physics examination papers as revision be enhanced?

Many teachers use past examination papers as their preferred method of revision for the VCE exam. Does research suggest ideas and strategies to improve efficiencies? Can the use of Zone of Proximal Development principles be incorporated into an effective revision process? Colin has looked at current research and will share his insights. Resources will be shared.

Assessment

C5 Dr Penelope Hale, Templestowe Secondary College

Using tracker and data analysis to build student's conceptual understanding in motion

Tracker is an established tool to analyse motion videos. The library of videos offers a range of high quality tasks that can be used for practical investigations and data analysis. Some of these standard videos have also been modelled, enabling theoretical and experimental data to be examined. An example data analysis task for a cart on a slope falling onto a spring will be introduced. The analysis involves aspects of Newton's laws, free body diagrams, motion and the conservation of energy and momentum and energy conservation. Student feedback on this task highlighted the difficulties that were faced in distinguishing between dynamic and static spring systems and which equations to use and allowed a detailed discussion in class of different scenarios. Suitable for unit 2 and 3 physics data analysis and practical investigations.

Technology

C6 Radio Astronomy - The Invisible Universe (VSSEC)

Ms Emma Barnett and Mr Mark Gleeson, Victorian Space Science Education Centre

Turn your students into real astronomers where they utilise a dedicated radio telescope to probe a region of deep-space in search of distant celestial object activity such as stars, supernova and supermassive blackholes. This workshop explores 'The Invisible Universe Program' from the Victorian Space Science Education Centre. In this blended-model program, VSSEC provides your school with digital control access to our Telescope, a range of resources and a recommended curriculum plan. However, how you deliver this in the classroom setting is up to you and your school. As far as we know, this is the world's first radio telescope exclusively devoted to high-school students. This program would be an ideal practical exercise for the VCE Physics Unit 2 study 'What Are Stars?' but is designed to be accessible to all secondary levels. Following this workshop, teachers will be able to implement this program within their schools. Read more here: <https://www.vssec.vic.edu.au/radio-astronomy-the-invisible-universe/>

Curriculum

12.50pm - 1.30pm Lunch Break

Networking Room Open (STAV Alpha)

Session D 1.30pm - 2.30pm

D1 Maria James, VCAA

VCAA Update and Unpacking assessment in the new VCE Physics Study Design

School-based assessment changes were one of the most contentious features of the consultation study design for Physics. This session will unpack the new tasks for school-assessed coursework and refer to the VCE assessment principles in assisting teachers to develop their own assessment tasks that are valid, equitable, balanced and efficient. Adaption of existing tasks to the new tasks will also be explored.

Curriculum and Assessment

2.30pm - 2.35pm Short Break

Session E **2.35pm - 3.35pm**

E1 Andrew Hansen, Ringwood Secondary College

Review of 2021 VCE Physics Examination

Every year the performance of students on the exam offers us the chance to improve our practice. The students sitting the 2021 exam have had a disrupted VCE experience. What do their exam results tell us and what should we do to prepare our students for 2022.

A summary of the report will be available on video prior to the conference. To get the most out of the session please review the material when it becomes available and post your questions in the forum in advance. The session will be spent responding directly to those questions.

Chief Assessor

3:35pm - 3.45pm **Closing remarks**

Alexandra Abela, STAV President & Barbara McKinnon, President VicPhysics

(STAV Alpha Zoom)

3:45pm - 4:30pm **Post conference networking**

(STAV Alpha Zoom)

Asynchronous Sessions

Available to view from 11 February 2022

AS1 Dr Jackie Bondell, Swinburne University / ARC Centre of Excellence for Gravitational Wave Discovery

Dark Matter Schools: An Innovative Partnership Opportunity for Regional Schools

The ARC Centre of Excellence for Dark Matter Particle Physics brings together experts from across Australia and internationally to unlock the secrets of dark matter and foster the science and engineering leaders of the future.

A key component of the centre's education program is a long-term partnership with regional schools inspired by the innovative science taking place right here in Victoria.

This Dark Matter Schools program was piloted in 2021 with Stawell Secondary College. Stawell is the home of the Stawell Underground Physics Lab, the Southern Hemisphere's first underground dark matter detection lab.

In this session, we will share the information about how teachers can incorporate dark matter related topics into their classrooms to meet the VCE Physics curriculum goals. Furthermore, we will present how they can express interest to become Dark Matter Partner Schools to build a long-term relationship with some of the most cutting-edge scientists in Australia.

Asynchronous Curriculum

AS2 Miss Caroline Cotton and Mr Stephen Pinel, BioBrain / Unity College, Queensland

BioBrain - an innovative way to teach Physics and engage students

BioBrain is an interactive platform for VCE Physics teachers and their students. It has both a teacher interface and student interface allowing teachers to assign work to students and quickly see their results and identify any knowledge or learning gaps. An illustrated glossary helps students understand the more difficult terms.

Asynchronous Assessment

AS3 Dr John Cripps Clark, Deakin University

Modelling Motion: Teaching Newtonian Mechanics by modelling the experience of Motion and Force

Unit 3 - Area of Study 3: How fast can things go? Outcome 3 suggests you "Investigate motion ... experimentally, analyse motion using Newton's laws of motion in one and two dimensions, and explain the motion of objects".

This session will present a unit of work developed for Years 5-7 for the reSolve project but eminently useful in your teaching of VCE Physics: <https://www.resolve.edu.au/modelling-motion>. To understand Speed, Acceleration and Force, we need students to relate the experience of the phenomenon and its representation (in graphs, measurements, diagrams, and instruments). With simple classroom experiences and readily available equipment, we will explore how: students' experience of speed builds towards understanding acceleration; students can make a forcemeter and measure and understand Force; and from experiencing, measuring and representing both acceleration and Force understand the relationship between acceleration and force and thus Newton's second law; and then interpret two-dimensional motion.

Asynchronous Curriculum

AS4 Mr Adam Di Blasi, Edrolo

Sharing Year 7 strategies for end of school success.

Edrolo is building an all-in-one comprehensive Year 7 Science resource focused on developing scientific conceptual understanding, building scientific literacy and inquiry skills. In this session, teachers will be guided through how they can set up their Year 7 students for end of school success, and learn about the consistent conceptual approach Edrolo takes to teaching Science. You will receive a free workbook to take from the conference to the classroom to experience the difference first-hand. All attendees will also have the opportunity to apply for a full access trial to Edrolo.

Asynchronous Pedagogy

AS5 Chief Assessors report on 2021 exam

Mr Andrew Hansen, Ringwood Secondary College

Every year the performance of students on the exam offers us the chance to improve our practice. The students sitting the 2021 exam have had a disrupted VCE experience. What do their exam results tell us and what should we do to prepare our students for 2022. A summary of the report will be available on video prior to the conference. To get the most out of the session please review the material when it becomes available and post your questions in the forum in advance. The session will be spent responding directly to those questions.

Asynchronous Assessment

AS6 What's Up? CSIRO's Initiatives in Space

Dr Robert Hollow, CSIRO

CSIRO is a major leader in Australian space initiatives. Specific examples including the Space Roadmap, the CSIRO Centre for Earth Observation, NovaSAR-1, a new radar satellite and the development of CSIROSat-1 due for launch in 2022. CSIRO also provides excellent space tracking and communication through facilities such as the CDSCC operated in conjunction with NASA and the ESA station at New Norcia. The CSIRO Space Future Science Platform funds a diverse range of space projects pushing science and technology in innovative ways. We explore these initiatives in detail, highlighting how they can be incorporated into the curriculum. The role of Earth Observation in addressing the UN's Sustainable Development Goals is discussed. Examples of educational resources and activities are presented.

Asynchronous Enrichment

AS7 Radiation Therapy - Exploring Medical Radiations

Dr Glenn Trainor, Peter MacCallum Cancer Centre

This presentation will explore the application of physics in healthcare, in particular, radiation therapy for cancer treatment. The intent of this session is to highlight the role that physics plays within this specific type of healthcare and how it can relate to students studying physics in VCE. (This presentation is usually an on-site visit but this year will be pre-recorded due to restrictions in visiting the hospital).

Asynchronous Curriculum

Presenters



Alexandra Abela

Alex is the President of the Science Teachers Association of Victoria. She has been a continuous member of STAV since joining as a pre-service teacher in 1993. Since first joining STAV Council in 2001, Alex has held a number of Executive roles, and she is currently STAV's representative on the board of the Australian Science Teachers Association. Alex has held a variety of leadership positions in science education throughout her career. She is passionate about curriculum design, committed to innovation in teacher professional learning, and loves teaching students of Chemistry at Penleigh and Essendon Grammar School.



Emma Barnett

Emma is the Astronomy Enrichment Programs Coordinator at the Victorian Space Science Education Centre, coordinating the Invisible Universe program and rural STEM club program. She studied physics at the University of Melbourne, and throughout her career she has developed a deep enthusiasm for STEM outreach and education. She is passionate about improving the equity of STEM in Australia and giving the future generation of scientists the skills needed to excel.



Stuart Bird

Stuart and Dino Cevolatti have known each other since 1993 during their undergraduate years in on-campus accommodation in Farrer Hall Monash University and later in share-house accommodation in Malvern and Richmond. They undertook their Post-Graduate Diploma of Education in the same year in 2004 at Melbourne University and have been teaching Physics on-and-off ever since. Stuart has been a Leading Teacher at Castlemaine Secondary from 2012 to 2016 and has since taken on VASS and now Integration coordinator roles. Stuart and Dino write and collaborate on commercially available resources for "Quality Assessment Tasks (QATs)".



Jackie Bondell

Jackie is Education and Outreach Coordinator for OzGrav, the ARC Centre of Excellence for Gravitational Wave Discovery. She develops content for public outreach engagement events and curricular materials for schools, focusing on incorporating innovative technology and cutting-edge science activities into curriculum-aligned education opportunities for students and teachers. She focuses on building collaborations with regional schools. Jackie is the Chair of the Education and Outreach Committee for the Astronomical Society of Australia and a National Astronomy Education Coordinator for the Office of Astronomy for Education with the International Astronomy Union.



Milorad Cerovac

Milorad is a sessional tutor and PhD candidate at Swinburne University where he is undertaking research in the domain of Design and Innovation capabilities across K-12 education. He has previously worked in secondary education, as a Physics, Systems Engineering and Applied Computing teacher, which followed an 18 year career in research (telecommunications) and the IT industry.



Dino Cevolati

Dino and Stuart Bird have known each other since 1993 during their undergraduate years in on-campus accommodation in Farrer Hall Monash University and later in share-house accommodation in Malvern and Richmond. They undertook their Post-Graduate Diploma of Education in the same year in 2004 at Melbourne University and have been teaching Physics on-and-off ever since. Dino has been a Leading Teacher at Castlemaine Secondary since 2009 and in 2018 took on the role of Learning Specialist. Dino and Stuart also both write and collaborate on commercially available resources for “Quality Assessment Tasks (QATs)”.



Colin Chapman

Teacher of Systems Engineering, Specialist Mathematics and Physics. Caroline Chisholm Catholic College Head of Learning - Mathematics. VCAA VCE State Reviewer - Systems Engineering



Caroline Cotton

Caroline is a Biology and Chemistry teacher who has developed a new STEM Education platform for Biology, Chemistry, and Physics students and their teachers.



John Cripps Clark

John has taught science in primary, secondary schools and universities in Victoria and NSW and has researched primary science education in rural and urban schools in Victoria, NSW and the ACT, focusing on exemplary teachers of science and their use of practical activities. He teaches Physics, science and technology education to pre-service teachers in school-based education across Melbourne and Geelong and provided professional development for teachers in Victoria in the Switched on Secondary Science Professional Learning program (2010-2011); the Primary Science Specialists (2012-2015) ‘Successful Students STEM (Skilling the Bay) (2015-2017); STEM Catalysts (2018); Graduate Certificate of Secondary Science (2021).



Adam Di Blasi

Adam is a former leading teacher who moved to Edrolo 3 years ago bringing a wealth of knowledge with him after being in the classroom for over 10 years.



Mark Gleeson

Mark is a Primary and Secondary School Leader and Teacher in Victoria, Australia. His primary responsibility is that of Curriculum Manager at the Victorian Space Science Education Centre. In this role, he is tasked with leading the research, implementation, and evaluation of new and existing national and international student and teacher educational programs. Mark is a STEM Learning Specialist, Head of Faculty (Digital Technologies) and Instructional Coach at Strathmore Secondary College. This positions Mark as a change-maker, empowering teachers to personalise and grow their practice to support the changing focus of Industry, Government, and evolving expectations of students in classrooms.

**Rachael Gore**

Rachael is an experienced Physics and Mathematics Teacher with expertise in both VCE and IB curriculums. She is passionate about developing teacher excellence, data informed practice, technology rich classrooms, and researched backed pedagogy. She is a committee member of VicPhysics.

**Penelope Hale**

Penny is a Physics Teacher at Templestowe College and is a passionate advocate for data literacy in science and technology. She promotes the use of data loggers and video analysis in order to develop a core understanding of physics principles using numerical, graphical, and visual representations.

**Andrew Hansen**

Andrew came to teaching after fifteen years working with implantable cardiac devices. He has now been teaching for sixteen years and assessing for the last thirteen. This is his seventh year as Chief Assessor. Andrew believes that a strong conceptual understanding is the key to engagement and success in Physics and is always searching for a better analogy.

**Robert Hollow**

Robert is the Education Manager at CSIRO's Space & Astronomy unit. He leads the PULSE@Parkes program for high school students and coordinates Space & Astronomy's undergraduate and postgraduate students programs. He has extensive experience in high school teaching, curriculum development and astronomy education. He is currently working on projects on space education and career opportunities. Robert is a committee member of the International Astronomical Unions Commission on Astronomy and Development and co-chairs their Astronomy Education Research and Methods Working Group. He is chair of the National Astronomy Education Coordinators for the IAU's Office of Astronomy Education.

**Colin Hopkins**

Retired from HOS at Bialik College. Awarded OAM, 2021 for services to Physics Education. Author of exam question books.

**Theo Hughes**

Theo is the Founder & CEO of Level 98, an independent educational organisation. He previously worked as Education Manager in the School of Physics and Astronomy at Monash University (and is still affiliated with Monash) and prior to that taught at schools, as well as working in IT and publishing.



Maria James

Maria James is the Curriculum Manager for Science for Years Foundation-12 with the Victorian Curriculum and Assessment Authority, overseeing curriculum for Chemistry, Environmental Science and Physics. She holds a Masters degree in Education (Curriculum) and has written a number of textbooks for Junior Science and Senior Chemistry courses. Maria has held a variety of positions in several independent schools, including Head of Science, Dean of Students and Head of Senior College. She is passionate about motivating and engaging students with science, and in encouraging them to take action in local and global contexts.



Sandor Kazi

Sandor has been a teacher at Melbourne Girls' College for over 15 years, who has regularly given VCE lectures and been involved in exam marking. With a background in particle physics, he worked at CERN during the construction of the LHC. In 2014 he was awarded the Hugh Rogers Fellowship which allowed him to visit renowned educator in physics Professor Eric Mazur at Harvard University.



Spiro Liacos

Hi, I'm Spiro Liacos. I have been teaching Physics since 1990, but I feel that I'm still constantly learning new ways of teaching. My wife Georgina and I are the producers of the famous Shedding Light series of videos that are available on ClickView. We also write heaps of worksheets and pracs that can be freely accessed from our website. Just search for Liacos Educational Media.



Barbara McKinnon

Barbara is a VCE Physics and Science teacher and is particularly interested in pedagogies that address conceptual understanding in physics and the use of models in science.



Nicolas Menicucci

A/Prof Menicucci is a theoretical physicist specialising in quantum computing and relativistic quantum physics. He received his PhD from Princeton University in 2008 and is a Chief Investigator in the ARC Centre of Excellence for Quantum Computation and Communication Technology (CQC2T). He has held prestigious research fellowships in Canada and at USyd, as well as at RMIT, where he leads the QuRMIT research group. A/Prof Menicucci has been teaching physics to first-year undergraduates since 2012, and he has developed and implemented innovations to help these students make the transition to university-level physics.



Julie Mulholland

Julie is an Education Officer from Australia's Nuclear Science and Technology Organisation (ANSTO). She is a highly experienced science educator, having over 30 years of experience teaching science, senior chemistry and senior physics in NSW high schools, as well as 14 years as a Head Teacher Science. In 2013, she achieved a NSW Education and Communities Minister's award for excellence in teaching. Julie is instrumental in developing ANSTO's data set resources for high school students.

**Bridget Murphy**

Bridget Murphy has a background in biological science research and science education at secondary and tertiary levels. Bridget is the Education Manager at the ANSTO Discovery Centre and is responsible for developing and delivering new programs for high school students and professional development for secondary teachers.

**Peggy Norris**

Deputy Director of Education and Outreach, Sanford Underground Research Facility

**Dan O'Keeffe**

Dan is the secretary of Vicphysics Teachers' Network. He has been active in Vicphysics and its precursors for a few decades, principally organising professional development activities. Currently he prepares the Vicphysics newsletter and maintains the website.

**Chad Ronish**

Chad is a Science Education Specialist with Sanford Underground Research Facility Education and Outreach Team. He has a MS. Ed in STEM Education and taught in a High School Classroom for 24 years. Chad has a background in nuclear propulsion from the United States Navy and has been a part of Quarknet with Fermi Lab for 12 years.

**Stephen Pinel**

Stephen is a Maths and Physics teacher at Unity College, Caloundra. He was previously Head of Science at Unity College and Proserpine SHS and has been heavily involved in eLearning, leading a team of eLearning Mentors to develop innovative and engaging curricula school wide. Stephen has taught in both the Catholic and State sector in Queensland, as well as abroad in the UK and at the Rotterdam International Secondary School. At the Tertiary level, Stephen has worked at CQUniversity as a course facilitator with external students in both the Education and Engineering schools.

**Glenn Trainor**

Glenn is the Education Coordinator for Radiation Therapy at the Peter MacCallum Cancer Centre in Melbourne. He oversees the largest radiation therapy clinical training program for students within Victoria and is passionate about sharing information about this career option for students with a passion for physics and healthcare.



Robert Sheehy

Received BE and PhD degrees in electrical engineering from the University of New South Wales, Sydney (1992 and 1997). He was at CSIRO Division of Applied Physics from 1991 to 1997 working in the High Voltage test laboratory on various metrology projects and industrial calibration testing up to 1MVDC and 500kVAC while researching insulation condition monitoring in high voltage motors and generators. He was a Power Electronics engineer and Director of Engineering for Rectifier Technologies, Melbourne between 1997 and 2008, where he developed several modular power conversion systems for interfacing batteries with the grid and renewable sources that were licenced for manufacture globally. In the last decade, he has been involved in several teams developing medical products, especially the use of nanotechnology in diagnostic x-ray; development of algorithms for optimised control of micro wind turbines, and development of miniature modular high voltage sources to 160kVDC. Dr Sheehy has completed two years of Antarctic service as an electrical engineer at Davis and Mawson stations to upgrade and operate scientific instruments used to gather data for climate change analysis, and to support improvements to the station isolated power grids. He is a co-inventor on several patents on power conversion, nanotechnology based x-ray tubes and x-ray applications.