Normanhurst Boys High School

Integrated STEM Unit — The Sounds of Music

Stage 4: Year 8

Rationale

There is a natural and historical connection between music, performing arts and learning within the STEM model. The artes liberales are those subjects or skills that in antiquity were considered essential for a person to know in order to take part in life. These included core learning in Grammar, logic, and rhetoric, and 'Scientific' studies or Quadrivium- arithmetic, geometry, the theory of music, and astronomy to further develop the individual.

This project uses scientific theory to assist in designing and constructing a musical instrument while investigating the question:

What makes sound into music?

Explorations of follow up questions include:

Are musical preferences culturally constructed or biologically innate?

Professor Joe Wolfe (UNSW Physics and Acoustics) view is that:

"Music is made from Physics, Physiology and Fashion"

Introduction to the Learning Unit:

This learning unit will be delivered over two terms as an enrichment learning experience in topics that are already being studied and have been timetabled in Science and Mathematics. In TAS, this unit will be delivered as a standalone design project based upon the experiments and findings in Science and data collection, representation and analysis in Maths.

Science: The students investigate variables and sound waves and are introduced to the physics and acoustics of music. They will have knowledge from Year 7 Science in the following areas:

- Literacy; Writing scientific reports. Appropriate use and structure of writing an aim, method, results, discussion and conclusion
- Scientific method: An understanding of how to follow scientific procedures and how to safely set up lab equipment following teacher instructions. Work collaboratively to solve problems as they design and test their instruments. Collect and record first-hand data appropriately in tables and graphs.
- Safety in the lab: Ability to work safely with peers and minimise danger following basic risk assessments learnt in Year 7.

They will test how to change a variable to produce different notes. They will learn about the relationship between pitch and frequency and amplitude and volume. Students will submit a written research project detailing how they went through the scientific method and then present their group findings to their peers orally.

Mathematics: The students would have well developed number skills and would have prior knowledge about concepts of algebra, simple equations and formulae, the methods of solving equations, number plane and interpretation of simple information from graph from the concepts learnt in year 7. The work in this unit will draw upon their knowledge, skills and competencies in above mentioned topics along with effective research skills.

The students will research various music styles from different cultures in order to understand their philosophy, the reasons behind the variations. They will also try to identify the similarities amongst those music forms and the factors that lead to these similarities.

**Normanhurst Boys High is a culturally diverse school and students research the mathematics and science behind the scales of other cultures. A survey of preferred musical styles is conducted and sounds to compose music of a distinctly Normanhurst "style" are identified.*

In the concept of ratios and rates, speed of the sound waves and wave equation relating to different features of sound waves are studied.

TAS: The work in this unit will draw upon the students' prior knowledge about design process, safe use of machinery and products constructed using mixed materials.

The student will research the historical use of materials in the construction of musical instruments, investigate the concept of resonance and use their findings from Maths and Science research and experiments, along with survey results to engineer, design and construct musical instruments that will recreate the identified sounds. Each team maintains a **journal** which will be worked upon collaboratively in Office 365.

These instruments and their accompanying variables are tested and re-tested against the goal of desired sounds. TAS students involved in a GATs extension will reverse engineer their instrument to produce a modular instrument educational kit to teach concepts of acoustics.

Students work **collaboratively across 3 KLAs to solve problems** and identify areas of improvement on their instruments through using trial and error.
*This is the fundamental manner in which scientists and **engineers** work in the real world within a team to reach goals.*
They are utilising each other's' strengths and learning to cooperate more effectively; a fundamental "21st century skill".

Students will be required to compose a musical item with other students using their musical instruments. The Arts component of the project transforms the STEM into a STEAM project.

Organisation over a semester

Faculty

TASKS

Mathematics	Research: characteristics of music from different cultures	music survey and graph results	frequency, range of hearing, wavelength		ratios, including Pythagorean scales	rate applied to scale and speed of sound	graphs to calculate speed of sound			
Science	Use of scientific methods to design experiments	Different forms of energy Waves as energy carriers Nodes and antinodes, compression waves	variables & instrument experiments, air, drums & strings	research on the human ear and responses to music						
	Use of scientific methods to design experiments to explain wave equation, measure frequency and record			use of CRO						
TAS	compare & contrast design process with science SRP.Design Brief: Maths survey Sounds of Normanhurst	factors effecting design :refer science waves, research musical instruments, materials & cultures	Materials experimentation Resonance	Sound Grab from Maths survey in Audacity. Design, sketch instruments refer to science variables	Cyclic Construction ,Testing and Modification of instrument to replicate chosen sound grab			Musical Kit design (GATS)		
	ONGOING: maintain electronic STEM journal including documentation of design process.									
ALL							Rehearsal and Performance			
Weeks	2	4	6	8	10	12	14	16	18	20

Integrated STEM Project: Stage 4: Year 8: Outcome Mapping for Sounds of Music		
Science	**TAS**	**Mathematics**
PW3 Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes change within systems. (ACSSU155)	4.1.1 applies design processes that respond to needs and opportunities in each design project	**Values and attitudes**: Appreciates mathematics as an essential and relevant part of life: recognizing its cross- cultural development. **General capabilities**: critical and creative thinking, inter- cultural understanding, ICT capability, literacy
SC4-WS5 Collaboratively and individually produces a plan to investigate questions and problems	4.1.2 describes factors influencing design in the areas of study of Built Environments, Products, and Information and Communications	MA4-19SP collects, represents and interprets single sets of data, using appropriate statistical displays
SC4 - WS6 Follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually	4.2.2 selects, analyses, presents and applies research and experimentation from a variety of sources	MA4-1WM communicates & connects mathematical ideas using appropriate terminology, diagrams & symbols
		MA4-2WM applies mathematical techniques to solve problems
SC4-7WS processes and analyses data from secondary sources to identify trends, patterns and relationships, and draw conclusions	4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects	MA4-3WM recognises and explains mathematical relationships using reasoning
SC4 – 9WS Presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations	4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project	MA4-20SP analyses single sets of data using measures of location, and range
SC4 - 8WS Selects and uses appropriate strategies, understanding and skills to produce creative and plausible solutions to identified problems.	4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project	MA4-7NA operates with ratios and rates, and explores their graphical representation
	4.6.1 applies appropriate evaluation techniques throughout each design project	

General Capabilities: *(See Teaching and Learning Program to identify links to General Capabilities)*

Learning Across the curriculum used in this document are from the Board of Studies Teaching and Educational Standards (BOSTES) NSW
http://syllabus.bostes.nsw.edu.au/mathematics/mathematics-k10/learning-across-the-curriculum/

The cross-curriculum priorities:

- *Aboriginal and Torres Strait Islander histories and cultures*
- *Asia and Australia's engagement with Asia*
- *Sustainability*

The general capabilities:

- *Critical and creative thinking*
- *Ethical understanding*
- *Information and communication technology capability*
- *Intercultural understanding*
- *Literacy*
- *Numeracy*
- *Personal and social capability*

Other learning across the curriculum areas:

- *Work and enterprise*

The outcomes used in this document are from the Board of Studies Teaching and Educational Standards (BOSTES) NSW.
http://www.boardofstudies.nsw.edu.au/syllabus_sc/

General Capabilities

LITERACY	NUMERACY	ICT CAPABILITY	CRITICAL AND CREATIVE THINKING	ETHICAL BEHAVIOUR	PERSONAL AND SOCIAL CAPABILITY	ASIA AND AUSTRALIA'S ENGAGEMENT WITH ASIA	SUSTAINABILITY	INTERCULTURAL UNDERSTANDING
• Write scientific reports • Write explanatory texts • Communicate using scientific terminology • Communicate using metalanguage • Write procedural texts • Write evaluation. • Read and follow instructions. • Report writing	• Make measurements • Analyse data to identify trends • Construct graphs to represent data • Derive equations from graphical data • Interpret information • Perform calculations	• Research to collect information • Ethical use of internet • Use Audacity to extract audio files. • Use spread sheets as a tool to perform calculations and create graphs • Use Moodle Google docs and Microsoft 365 to collaborate • Use CAD program. • Create using 3D printer	• Use thinking skills to complete group activities and open-ended tasks • Solve problems in order to complete a design brief	• Consider how the actions of people impact on the sustainability of systems • Discuss perceptions of cultural& gender bias in performance and preference of music and instruments	• Work together to conduct research • Work together to participate in science investigations • Work together to participate in designing • Work together to participate in learning experiences	• Investigate the cultural significance, history of materials and use of technologies in constructing musical instruments in Asia and Indigenous communities • Investigate development of musical scales in these cultures	• Discuss the use of recycled materials in construction of musical instruments. "bash-the-trash"	• Research to identify factors that lead to differences and similarities in music styles from various cultures, the scales it is based on and the philosophy of music for t hose cultures.

TAS – "Musical Instrument Maker"

Area of Study: Products

Design Specialisation: Industrial

Technologies: Mixed Materials

This unit of work involves students collaborating in designing, producing and evaluating musical instruments. Their team brief is to create a musical instrument (string, wind or percussion) using findings and experiments from Science & Maths to be used to perform "the sounds of Normanhurst"(STEM)

Extension: Teams then reverse engineer their designs, developing these into a modularised music kit (educational aid) This kit includes plans and mixed media components to reconstruct these instruments for use by schools teaching concepts of waves, sound and acoustics.

*This extension could either be the construction of the actual music kit or conceptual, and based on a trading card variation.

Term/ Week	Outcomes	Students learn about:	Students learn to:	Teaching and Learning Strategies
3/1&2	4.1.1 applies design processes that respond to needs and opportunities in each design project	• design processes including – analysing needs, problems and opportunities – establishing criteria for success – researching – generating creative ideas – communicating ideas – experimenting and testing ideas – risk management – managing resources – producing design solutions – evaluating ideas and solutions • needs and opportunities in the areas of study	• establish a design process that responds to an identified need and opportunity • apply a design process when developing quality solutions for each design project • establish criteria for successful achievement of needs and opportunities • record design processes and decision making in a design folio for each design project. • consider short-term and long-term consequences of design in the design process • evaluate design processes • identify needs and opportunities that require solutions in the areas of study	Introduce (or revise) the design process. Identify main steps. Discuss cyclical nature of design process, no definitive entry/exit points, documentation, design modification and development in response to research and testing, ongoing evaluation. (refer to the revised design process) ***Make connections with the Science Research Project (compare and contrast Design process with SRP)*** Identify the need/problem: Design brief: **Design and construct a musical instrument that produces "the sounds of Normanhurst"** i.e. ***Used to produce music identified as culturally popular from Maths survey*** Discusses musical instruments as **products**. **Discuss in class and produce criteria for success.** View ***Linsey Pollack performance*** and discuss the concept of a musical instrument - reflect and record their concept of a musical instrument
3/3	4.1.2 describes factors influencing design in the areas of study of Built Environments, Products, and Information and Communications	• definitions of design • factors affecting design – function – aesthetics – human form – scale – ergonomics – ethical – environmental	• recall a definition of design • examine factors affecting design in the areas of study of Built Environments, Products, and Information and Communications • describe the factors affecting design in the	Class Presentation on "Factors affecting design" followed by individual activity ***Make connections with Science (variables) and sound waves*** Watch UNSW physiclips http://www.animations.physics.unsw.edu.au/waves-sound/sound/index.html ***Make Connections with Maths Survey On most popular cultural music*** Examine the 3 groups of music instruments – Stringed, Wind and Percussion. For these instruments analyse the factors affecting design

Term/ Week	Outcomes	Students learn about:	Students learn to:	Teaching and Learning Strategies
		– legislation including WHS – cost – socio-cultural – resource availability – physical and material properties – safety	development of each design project • evaluate the appropriateness of specific design solutions for different cultural groups including Aboriginal and Torres Strait Islanders and other Indigenous peoples	
3/4	4.2.2 selects, analyses, presents and applies research and experimentation from a variety of sources	• experimentation and testing of design ideas • relationship of experimentation to success criteria • research methods – needs analysis – surveys and interviews – searching techniques including use of the Internet	• apply the results of experimentation to designing and making when developing each design project • identify, interpret and evaluate data from a variety of sources • use effective research methods to identify needs and opportunities and locate information relevant to the development of each design project • identify solutions to other similar needs and opportunities • use the internet when researching	**History and Cultural Significance Research:** brainstorms musical instruments from 10 different cultures including Aboriginal and Torres Strait Islanders and other Indigenous people • Form groups and select a musical instrument from a different cultural group • Research the musical instrument, their construction , materials used and the significance of play in the selected cultural group • Evaluate the appropriateness of the musical instrument for the cultural group • Present an oral presentation of findings to the class. ***Cultural Music Survey – Make connections with Maths*** Re-analyse the results from Maths Survey to help students decide on the choice of instrument design **developing intercultural understanding**
On-going	4.5.1 applies management	• resource availability including	• identify resource availability and apply	Manages the electronic design portfolio & journal through Google docs including a GANTT chart.

Term/ Week	Outcomes	Students learn about:	Students learn to:	Teaching and Learning Strategies
	processes to successfully	– time – money – materials, tools and techniques – human resources including skills and expertise – other resources • management techniques including action, time and budget planning	realistic limitations to each design project • develop and apply action, time and budget plans in design projects	Manages time and resources to complete the various stages of the design process in the construction of the musical instrument • Design Situation and Brief • Research Ideas • Development of Solutions • Planning and Production • Tools and Materials used • Testing and Evaluation
On-going	4.5.2 produces quality solutions that respond to identified needs and opportunities in each design project	• suitable materials, tools and techniques for design projects • skill development and refinement • construction steps that contribute to a quality solution • relationship of quality solutions to needs and opportunities and the criteria for success for each design project	• identify suitable materials, tools and techniques for each design project • practice and refine skills needed for design projects • apply a design process that responds to needs and opportunities for each design project • produce solutions reflecting quality standards appropriate to each design project	After conducting a thorough research of musical instruments and testing and evaluating the three groups of musical instruments students produce quality solutions that responds to the brief, situation and constraints of the musical instrument "the Physics of Music and Musical Instruments' Tufts university ***Makes connections to science - SRP***

Term/ Week	Outcomes	Students learn about:	Students learn to:	Teaching and Learning Strategies
3/5 -10	4.3.1 applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of Musical Instruments	**Materials** • characteristics and properties of a wide range of materials such as – metals – polymers – textiles – timber • the use of materials in traditional and non-traditional ways **Tools** • specific tools related to materials appropriate to a design project • the function and safe use of a range of contemporary tools used for – measuring – marking out – cutting – construction **Techniques** • traditional and non-traditional techniques used for – cutting – shaping a variety of materials – joining different materials – finishing	• experiment with combinations of a wide range of materials considering their characteristics and properties • identify how materials have been used in innovative and non-traditional ways • select and use a wide range of materials for the identified needs and opportunities of a design project • explore ways that tools can be safely used to achieve new results • select and safely use tools and equipment for a design project • experiment with traditional and non-traditional techniques • select and use traditional and non-traditional techniques for the identified needs and opportunities of a design project	**Part 1: Design and create** a prototype string, wind or percussion instrument. Students sketch proposals of instrument and 1. Timber (various sizes) 2. Strings (various lengths)investigate **Pythagorean Scale:** https://www.youtube.com/watch?v=0NSZ7KkCP5Q 3. List of Mixed materials (plastic recyclables) Material Resonance notes "Physics of Musical Instruments " Tufts university 4. List of Tools (needed to construct the musical instrument) In groups of 5 organise 4 areas in your woodwork room so students can access these resources: 1. Timber Corner 2. Strings box 3. Mixed Materials Corner In groups of 4 choose from strings, wind and percussion to design and make the musical instruments. Teacher provides demonstrations on the tools and machines needed to make the musical instrument (Identify the correct tools to cut, shape and finish the musical instrument) Students test changes (variables) to instrument design and attempt to replicate the chosen sound. Reference is made to Pythagorean Scale and experimentation. **Part 2: Design and Construct** a musical instrument that can produce the sound of the "sound grab" ***informed from Maths*** *and* ***tested in Science.*** **Designs must include one 3-D printed component** 1. Students choose one musical instrument from the 3 categories – string, wind and percussion 2. For the chosen instrument students are to research and collect the necessary materials 3. Using Audacity Students are to conduct a thorough analysis of the different sounds produced in the sound grab. 4. Students are to draw from their predetermined and informed knowledge on materials and the impact of sound on various materials ***(make connections with Maths and Science)*** 5. Students are to mark, measure and cut the materials required for the construction of the musical instrument 6. Using various joining techniques students are to make the instrument 7. Students test and evaluate the instrument to produce the "sound grab" This process is documented with mobile phones (photos and recording for portfolio).

Term/ Week	Outcomes	Students learn about:	Students learn to:	Teaching and Learning Strategies
4/1	4.3.2 demonstrates responsible and safe use of a range of tools, materials and techniques in each design project	• risk management strategies • responsible behaviour in working environments • Work Health and Safety practices • the safe and responsible use of materials, tools and techniques in each design project • maintenance of tools and equipment	• manage risk when developing design projects • use tools, materials and techniques in a responsible and safe manner in each design project. • maintain tools and equipment including computer equipment	Students complete safety tests as specified in Equipment Safety in Schools (ESIS). Teacher demonstrates the safe use of tools and equipment needed for the design of the musical instrument

Term/ Week	Outcomes	Students learn about:	Students learn to:	Teaching and Learning Strategies
4/7	4.6.1 applies appropriate evaluation techniques throughout each design project	• developing criteria for success as a tool for assessing design development and production • ongoing evaluation of design ideas and decisions • final evaluation considering – design process used – design solutions – reflection on learning	• apply criteria for success in decision making during the development of each design project • use criteria for success to reflect on the design process used and the solutions • evaluate prior to, during and at completion of each design solution • self-assess and peer-assess design solutions	Testing and Evaluation of Prototype Instrument: 1. What is the name of the musical instrument? 2. What sound or music does the musical instrument produce? ***(Make links to science – using the Cathode Ray Oscilloscope)*** 3. What materials have been used to make the instrument? 4. Will Substituting parts or materials of the instrument changes the sound produced by the instrument? Judge the proposed musical instrument ideas in terms of the criteria for success, e.g. aesthetics, usefulness, suitability, ease of production using results from experiments. Evaluate the musical instrument against the criteria for success determined earlier in the project *This process is documented with mobile phones (photos & recording for portfolio).* *Linsey Pollak –Moodle Quiz Match the music to the instrument/ what material produces that sound or tone or music* Testing and Evaluation of student designed musical instruments: Making music that reflects the culture of Normanhurst ***Make connections with Maths to use survey results to inform students of the most preferred sound track/instrumental music (sound grab)*** ***Make connections with Science so they can test the instrument to match the sound produced in Science.***

Term/ Week	Outcomes	Students learn about:	Students learn to:	Teaching and Learning Strategies
On-going	4.6.2 identifies and explains ethical, social, environmental and sustainability considerations related to design projects	• ethical and responsible design • environmental and sustainability considerations	• identify ethical, social, and environmental and sustainability considerations relevant to each design project • be responsible and ethical in the decisions made in the development and production of each design project • explain the responsibilities of designers • demonstrate appropriate ethics and etiquette in relation to computer use such as general computer care, passwords, file security, network use, printing and shared resources	History and cultural Significance of musical instruments – Research How does music affect a person's mood? How does music affect the brain? Choice of music and human nature – A Case Study write an individual response assessing the ethical, sustainability and environmental aspects of the timber musical instrument, e.g. the use of plantation timber versus

Term/ Week	Outcomes	Students learn about:	Students learn to:	Teaching and Learning Strategies
On-going sketch up and final presentation	4.2.1 generates and communicates creative design ideas and solutions	• methods used to generate creative design ideas including – mind mapping – brain storming – sketching and drawing – modelling – experimenting and testing • use of design folio to record and reflect on design ideas and decisions • communication methods including – drawings, sketches and models – written reports – oral presentations – digital presentations • communication methods suitable for specific audiences including – users and clients – technical experts – peers • using ICTs to plan, develop and document design projects	• use a variety of methods to generate creative design ideas for each design project • use a design folio to record and reflect on design ideas and decisions • sketch, draw and model to aid design development • manipulate images with tools such as editing, resizing, grouping, aligning and positioning • communicate information appropriate to specified audiences • compose a design folio for a specific audience in electronic format including features such as tabs, indents, headers and footers, margins and line and paragraph spacing and using appropriate layout and graphic design	Design Portfolio production (Digital Portfolio or hardcopy folders) Free hand drawing of musical instruments. Introduction to CAD/ Google Sketch up – basic understanding and interpretation of isometric and orthographic sketches. Develop a design folio in electronic format to communicate the research and the creative ideas generated. Practice and refine sketching and drawing of design ideas. Complete a selection of three-dimensional annotated sketches to communicate design ideas. Select and justify the final design idea. Present final design idea to class members for discussion.

Term/ Week	Outcomes	Students learn about:	Students learn to:	Teaching and Learning Strategies
		•	• use ICTs to communicate information including saving a document in various file types and storage locations from within the application • use word processing features including page numbering and page breaks, find and replace, word count, spell check and thesaurus, columns and sections, inserting text/objects/images	

Extension

Students are introduced to educational kits through investigation of to Sparkfun and Adafruit Kits

Brief:

Design an Education Kit for a school to construct a musical instrument and then make the musical instrument with the mystery kit given to your group.

Stage 4 Science

Topics: Sustainability & renewable resources, electricity - circuits

"Science heats Up": Energy and scientific method: Students design instrument to produce 3 distinct notes and test it using scientific variables

Term/Week	Outcomes	Content	Teaching and Learning Strategies
T1 W4	PW3 Energy appears in different forms including movement (kinetic energy), heat and potential energy, and causes change within systems. (ACSSU155)	PW3 a. identify objects that possess energy because of their motion (kinetic) or because of other properties (potential)	Students identify waves as energy transfer. Students set up a ticker timer with fishing line attached to a mass carrier suspended over the edge of the bench. Students recognize nodes and antinodes and use a ruler to measure wavelength (distance between two nodes, or twice the distance between a node and an antinode)
T1 W4			Identify sound as a compression wave that travels through air. Observation of cardboard tube compression chamber. Relate observations to compression of air and relate to the propagation of sound through air
T1 W5		PW3 e. investigate some everyday energy transformations that cause change within systems, including motion, electricity, heat, sound and light	View a range of videos to observe the three types of instruments, Guitar, air horn and drums. Watch unswphysiclipshttp://www.animations.physics.unsw.edu.au/waves-sound/sound/index.html ***Relates to TAS on-guard safety tests (T4 W1)***
T1 W5	WS6 Follows a sequence of instructions to safely undertake a range of investigation types, collaboratively and individually	WS6 f. performing specific roles safely and responsibly when working collaboratively to complete a task within the timeline	View the three instruments to be tested and complete a risk assessment-identify risks, control them and evaluate them (judge how dangerous they are) ICE. Risk assessment for musical instruments - Guitar, air horn, percussion Analysing the issues involved with playing the instruments, e.g. securing the instrument, loud sounds, sharpness of string, sharp edges of guitar, cleaning mouthpiece, etc.

Term/Week	Outcomes	Content	Teaching and Learning Strategies
T1 W6	WS5 Collaboratively and individually produces a plan to investigate questions and problems SC4-5WS WS7 processes and analyses data from secondary sources to identify trends, patterns and relationships, and draw conclusions SC4-7WS	WS5.2a-d.Students plan first-hand investigations. SC4-7WS.Processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions	**(Air horn)** Students choose 1 variable and plan and conduct an experiment to test their hypothesis Changing the tension of the rubber diaphragm and using the cathode ray oscilloscope to measure frequency Students develop a scale on the air horn and relate this scale to tension. Become familiar with the wave equation and its representation using the Cathode Ray Oscilloscope (CRO). ***Relates to TAS Testing and evaluation of instrument (T4 W7)***
T1 W6		WS5.2a-d.Students plan first-hand investigations. SC4-7WS.Processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions	**(Drum)** Students choose 1 variable and plan and conduct an experiment to test their hypothesis. Measure length of tube and record the note using the CRO Students must determine how to keep compression consistent (amplitude). ***Relates to Mathematics by determining the frequency of the note by measuring the length of the tube, knowing the speed of sound is constant. (T1 W10)***
T1 W7		WS5.2a-d.Students plan first-hand investigations. SC4-7WS.Processes and analyses data from a first-hand investigation and secondary sources to identify trends, patterns and relationships, and draw conclusions	**(Stringed Instrument)** Students choose 1 variable and plan and conduct an experiment to test their hypothesis. Determine volume (amplitude) of a note according to different resonating surfaces using the CRO Students must determine how to keep intensity of the pluck consistent. ***Relates to TAS Testing and evaluation of instrument (T4 W7)***

Term/Week	Outcomes	Content	Teaching and Learning Strategies
T1 W7	WS7 Processes and analyses data from secondary sources to identify trends, patterns and relationships, and draw conclusions SC4-7WS WS9 Presents science ideas, findings and information to a given audience using appropriate scientific language, text types and representations SC4 – 9WS	WS7.1d. Accessing information from a range of sources, including digital information. WS9a. Presenting ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate.	Research the human ear and how it detects and processes sound. Include the parts of the brain that respond to the sound stimulus and highlight research into the emotional response to music. This will be presented as a group power point with embedded sounds and videos.  ***Relates to Mathematics cultural music survey. (T1 W4)***

Stage 4 Mathematics

Topics: Research, ICT, Literacy, Rates & Ratios, Statistics

Term/Week	Outcomes	Content	Teaching and Learning Strategies
T1W2	**Values and attitudes**: Appreciates mathematics as an essential and relevant part of life: recognizing its cross-cultural development. **General capabilities**: critical and creative thinking, inter-cultural understanding, ICT capability, literacy **(as identified in Stage 4 Syllabus)**	Inter-cultural understanding: Comparison of different forms of music Philosophy behind different music styles from various cultures	Research: Task 1: Identifying and describing three characteristics that are different and three features that are similar in various music forms. Task 2: Collecting and presenting information about main concepts/philosophy/significance of music including scale of music in various cultures. Task 3: Identifying traditional pieces of musical instruments that are unique to different cultures. ***TAS would refer to this research of music from different cultures and their instruments to discuss various aspects in those designs***
W2-3	MA4-19SP collects, represents and interprets single sets of data, using appropriate statistical displays MA4-1WM communicates & connects mathematical ideas using appropriate terminology, diagrams & symbols MA4-2WM applies mathematical techniques to solve problems MA4-3WM recognises and explains mathematical relationships using reasoning	Learn about types of data and ways to collect data • Collect primary/secondary data using random process • Construct appropriate survey questions and a related recording sheet in order to collect numerical and categorical data about a matter of interest	Conducting survey, collecting data regarding choice of music. • Construct appropriate survey questions and recording sheet • Conduct survey using a collection of music pieces from different cultures to create a "Music Grab" • Collect data using a rating scale: e.g. 1: dislike, 2: neutral, 3: like ***TAS: Discussions: common types of instruments in 'Music Grab' and their designs(or in the most popular piece of music as identified by the survey)*** ***Science: Discussions: Source of vibration/disturbance that generates the sound in the common instruments in 'Music Grab', features of those sound waves- frequency, wavelength***
T1 W3		• Collect and interpret information from primary or secondary sources presented as tables and /or graphs, about an area of interest.	Organisation and representation of data using tables and graphs. • Organise data using tally and frequency distribution tables • Represent data using column graphs, bar graph and sector graphs

Term/Week	Outcomes	Content	Teaching and Learning Strategies
T1 W4	MA4-20SP analyses single sets of data using measures of location, and range	• Describe and interpret data using mean, mode, medium and range	• Use concept of MODE identify the piece/s of music liked by most of the people (Music Grab) • Use concept of Range to identify : The range of number of instruments used in various pieces of the Grab; ***the frequency range that human ear is able to hear learnt in science*** ***Science: discussions about range of frequency in relation to sense of hearing and physiology*** • Research features of most popular piece of music from the survey: frequency, pitch, wavelength and amplitude - ***directly relates to the concept of frequency and wavelength of sound waves learnt in science***
T1 W10-11	MA4-7NA operates with ratios and rates, and explores their graphical representation MA4-1WM communicates & connects mathematical ideas using appropriate terminology, diagrams & symbols MA4-2WM applies mathematical techniques to solve problems MA4-3WM recognises and explains mathematical relationships using reasoning	Recognise and solve problems involving simple ratios • Solve a variety of real-life problems involving ratios • Use rates to compare quantities measured in different units • a variety of real life problems involving rates	• Understand concept of ratios as comparison between quantities measured in same units and use examples from daily life • Use prior data from music survey to find the ratio amongst people who like a particular piece of music, dislike it or are neutral. • Applying concept of ratios to scale factor: enlargement/reduction factor for any design. ***ICT application of Google Sketch-Up learnt in TAS*** • Understand rate as a comparison of two quantities measured in different units. Identify speed as a • Analyse information and calculate speed of various objects, travel, light and sound. Draw upon the concepts learnt in ***Science and calculate Speed, frequency or wavelength of sound using wave equation: speed = frequency x wavelength.***

Term/Week	Outcomes	Content	Teaching and Learning Strategies
T2 W1-2	MA4-7NA operates with ratios and rates, and explores their graphical representation MA4-1WM communicates & connects mathematical ideas using appropriate terminology, diagrams & symbols MA4-2WM applies mathematical techniques to solve problems MA4-3WM recognises and explains mathematical relationships using reasoning	Interpret and analyse graphs from authentic data • Write or tell a story that matches a given distance time/graph • Calculate speeds for distance/time graphs • Calculations using wave-equation	• Analyse distance-time graphs and describe motion of an object over a given time period (including use of widgets on HOTMATHS). • ***Use distance-time graphs of sound waves and the speed of sound to calculate wavelength/frequency of sound waves*** • Understand that a given piece of music has many sound waves combined together. ***Use ICT to understand and then sketch graphs to represent constructive interference of sound waves in music.***