 Classroom redesign STEM project

Term 2/3 2016

Big ideas – why does this learning matter?

* designing built environments to cater for a specific need
* redesigning the furniture and technology available in our classroom to enhance learning
* sense of belonging/ownership of their learning space
* students being able to design and work in a flexible learning space that is appropriately furnished/resourced to accommodate 21st century learning ideals and pedagogy

Driving questions

How can we make our classroom an effective and flexible 21st century learning space?

Central syllabus ideas/concept

Outcomes and other syllabus material referenced in this document are from:

* [Science (incorporating Science and Technology K-6) K-10 Syllabus](http://syllabus.nesa.nsw.edu.au/science/science-k10/) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2012
* [Mathematics K-10 Syllabus](http://syllabus.nesa.nsw.edu.au/mathematics/mathematics-k10/) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2012
* [English K-10 Syllabus](http://syllabus.nesa.nsw.edu.au/english/english-k10/) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2012
* [Creative Arts K-6 Syllabus](http://educationstandards.nsw.edu.au/wps/portal/nesa/k-10/learning-areas/creative-arts/creative-arts-k-6-syllabus) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2006
* [History K-10 Syllabus](http://syllabus.nesa.nsw.edu.au/hsie/history-k10/) © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2012

Science – built environments/working scientifically and technologically

Technology/Engineering – Computer assisted design

Information and communication technology (ICT) – can be used effectively and appropriately to access, create and communicate information and ideas, solve problems and work collaboratively.

Students are provided with opportunities to develop ICT capability when they develop design ideas and solutions, research science concepts and applications, investigate science phenomena, and communicate their scientific and technological understandings. In particular they learn to access information, collect, analyse and represent data, model and interpret concepts and relationships, and communicate scientific and technological ideas, processes and information. Digital technologies and aids, such as animations and simulations, provide opportunities to view phenomena and test predictions that cannot be investigated through practical experiences in the classroom.

Mathematics – measurement, space and geometry, number and algebra

Information and communication technology (ICT) – includes digital technologies such as calculators, spreadsheets, dynamic geometry software, and computer algebra and graphing software. Students use ICT effectively and appropriately when investigating, creating and communicating ideas and information, including in representing mathematics in a variety of ways to aid understanding. ICT can be used by students to solve problems and to perform previously onerous tasks more readily.

In the Number and Algebra strand in the NSW K–10 Mathematics curriculum, students can use ICT in such topic areas as creating patterns, creating and interpreting graphs and solving equations using spreadsheets and representing information graphically. In the Measurement and Geometry strand of the curriculum, students can utilise ICT in such areas as exploring properties of angles and shapes, including symmetry; creating designs that involve shapes and transformations; representing, visualising and manipulating three-dimensional objects; investigating congruency and similarity; representing position and paths; making informal measures of length and area; and developing formulas for perimeter and area. In the Statistics and Probability strand, students can use ICT in such areas as recording and displaying data in various forms, comparing data sets, calculating measures of location and spread, modelling probability experiments, and using the internet to gather and analyse data presented by the media.

English – reading, writing

The study of English enables students to develop and apply knowledge, understanding and skills of ICT – in their composing, responding and presenting, and as part of the imaginative and critical thinking they undertake in English.

Students have the opportunity to become competent, discriminating and creative users of ICT as they learn to use ICT effectively and appropriately when investigating, creating and communicating ideas and information. Students will learn about the ethics of information communication through technology.

CA – design and artwork; scale models, mock-ups and drawings, and design ideas

Students make artworks for a variety of audiences using different forms and techniques to convey meaning and represent the likeness of things in the world. Familiar and unfamiliar built, natural, rural and urban environments as well as environments that are increasingly available as virtual spaces (eg computer game programs), are of great interest and curiosity. They provide a rich source of ideas in the making of artworks and the appreciation of art. Investigations can focus on close observation of the qualities of the built environment, such as heritage sites and urban and suburban places (eg schools, streets, parks, playgrounds, shopping centres, service stations, factories, churches, wharves and building sites). Considering how environments should remain as cultural landmarks and reflections of the past or how they could be transformed could extend opportunities. Rural and natural environments, including bushlands, gullies, creeks, beaches, rock and coastal formations, desert and rainforest areas and landscapes or seascapes in different seasons and changing weather conditions provide other sources for ideas for artworks.

Hook/entry event

* New furniture arrives at school for the students to trial. (on load form a community partner). How do we arrange it in the classroom? Which furniture works well for us and fits in with our curriculum?
* Visit to Futures Learning Unit to assess and evaluate alternate furniture types and Robotics.
* Find and visit a school that has agile learning spaces and project based learning in action.

Possible experts

* DET – staff – Futures Learning Unit
* Civic Australia – manufacturer of agile learning spaces/resident interior designer.
* Modern Teaching Aids – robotics

Audience

Director, Principal, staff, students and community of Emu Heights Public School/media and possible wider audience if we create a school video of our showcase day through DET resources.

Culminating event

Presenting our findings to our community sponsors, the Principal and Director of Public Schools – Blue Mountains to effect change.

The 4 classes involved will present a collaborative STEM exhibition and invite the local community and media. 5/6R will showcase our process and designs to the wider school community and display to view, plans models and our final proposal.

Putting designs for changing our classroom into action by fundraising, and setting up the new learning space.

Possible outcomes that could be covered

| Science | Mathematics – Number | Mathematics – Measurement | Mathematics – Geometry/Statistics | Creative Arts and History | English |
| --- | --- | --- | --- | --- | --- |
| STE 14BE – Built Environments  describes systems in built environments and how social and environmental factors influence their design | MA3-2WM – Whole Number  selects and applies appropriate problem-solving strategies, including the use of digital technologies, in undertaking investigations | MA3-9MG – Length  selects and uses the appropriate unit and device to measure lengths and distances, calculates perimeters, and converts between units of length | MA3-14MG – 3D Space  identifies three-dimensional objects, including prisms and pyramids, on the basis of their properties, and visualises, sketches and constructs them given drawings of different views | VAS3.1 – Places and Spaces  Investigates subject matter in an attempt to represent likenesses of things in the world – Including photography, digital arts, drawing, painting sculpture and 3D | EN3-1A – Speaking and Listening  communicates effectively for a variety of audiences and purposes using increasingly challenging topics, ideas, issues and language forms and features |
| ST35WT – Working Technologically  plans and implements a design process, selecting a range of tools, equipment, materials and techniques to produce solutions that address the design criteria and identified constraints | MA3-4NA – Whole Number  orders, reads and represents integers of any size and describes properties of whole numbers | MA3-10MG – Area  selects and uses the appropriate unit to calculate areas, including areas of squares, rectangles and triangles | MA3-15MG – 2D Space  manipulates, classifies and draws two-dimensional shapes, including equilateral, isosceles and scalene triangles, and describes their properties | VAS3.2 – Places and Spaces  makes artworks for different audiences, assembling materials in a variety of ways | EN3-2A – Writing and Representing  composes, edits and presents well-structured and coherent texts |
| ST34WS – Working Scientifically  investigates by posing questions, including testable questions, making predictions and gathering data to draw evidence-based conclusions and develop explanations | MA3-5NA – Addition and Subtraction  selects and applies appropriate strategies for addition and subtraction with counting numbers of any size | MA3-11MG – **Volume and Capacity**  selects and uses the appropriate unit to estimate, measure and calculate volumes and capacities, and converts between units of capacity | MA3-18SP – Graphs  uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables | n/a | EN3-3A – Reading and Viewing  uses an integrated range of skills, strategies and knowledge to read, view and comprehend a wide range of texts in different media and technologies |
| ST3-15I – Information  describes how social influences impact on the design and use of information and communication systems | MA3-6NA – Multiplication and Division  selects and applies appropriate strategies for multiplication and division, and applies the order of operations to calculations involving more than one operation | MA3-12MG – Mass  selects and uses the appropriate unit and device to measure the masses of objects, and converts between units of mass | MA3-17MG – Statistics and Probability  position locates and describes position on maps using a grid-reference system | History – HT3-3  Identifies change and continuity and describes the causes and effects of change on Australian society | EN3-4A – Spelling  draws on appropriate strategies to accurately spell familiar and unfamiliar words when composing texts |
| ST3-16P – Products  describes systems used to produce or manufacture products, and the social and environmental influences on product design | MA3-7NA – Fractions and Decimals  compares, orders and calculates with fractions, decimals and percentages | n/a | n/a | n/a | EN3-5B – Responding and Composing  discusses how language is used to achieve a widening range of purposes for a widening range of audiences and contexts |
| n/a | MA3-2WM – Working Mathematically  selects and applies appropriate problem-solving strategies, including the use of digital technologies, in undertaking investigations | n/a | n/a | n/a | EN3-6B – Grammar and Punctuation  uses knowledge of sentence structure, grammar, punctuation and vocabulary to respond to and compose clear and cohesive texts in different media and technologies |
| n/a | MA3-1WM – Working Mathematically  describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions | n/a | n/a | n/a | EN3-7C – Thinking imaginatively, creatively, interpretively and critically  thinks imaginatively, creatively, interpretively and critically about information and ideas and identifies connections between texts when responding to and composing texts |
| n/a | n/a | n/a | n/a | n/a | EN3-8D – Expressing Themselves  identifies and considers how different viewpoints of their world, including aspects of culture, are represented in texts |
| n/a | n/a | n/a | n/a | n/a | EN3-9E – Reflecting on Learning  recognises, reflects on and assesses their strengths as a learner |

English

Throughout this unit students will –

Speaking and Listening

* plan, rehearse and deliver presentations, selecting and sequencing appropriate content and multimodal elements for defined audiences and purposes, making appropriate choices for modality and emphasis
* use interaction skills, varying conventions of spoken interactions such as voice volume, tone, pitch and pace, according to group size formality of interaction and needs and expertise of the audience
* participate in and contribute to discussions, clarifying and interrogating ideas, developing and supporting arguments
* identify and summarise key ideas and information from guest speakers, eg note-taking or using digital technologies

Writing and Representing

* recognise and discuss issues related to the responsible use of digital communication
* explore and analyse the effectiveness of informative and persuasive devices in texts
* understand and use the key elements of planning, composing, reviewing and publishing in order to meet the increasing demands of topic, audience and language
* plan, draft and publish informative and persuasive texts, choosing and experimenting with text structures, language features, images and digital resources appropriate to purpose and audience
* compose informative texts that show evidence of developed ideas
* compose texts that include sustained and effective use of persuasive devices, eg texts dealing with environmental issues
* experiment with text structures and language features and their effects in creating literary texts, for example, using imagery, sentence variation, metaphor and word choice
* compose increasingly complex print, visual, multimodal and digital texts, experimenting with language, design, layout and graphics
* use increasingly complex research data from print and digital sources to compose short and sustained texts
* assess the reliability of resources, including digital resources, when researching topics
* reread and edit students' own and others' work using agreed criteria and explaining editing choices
* use a range of software, including word processing programs, learning new functions as required to create texts

Reading and Viewing

* recognise evaluative language, including emotive language and modality
* identify and explain how analytical images like figures, tables, diagrams, maps and graphs
* contribute to our understanding of verbal information in factual and persuasive texts
* recognise the effect of multimedia elements, eg film techniques, animation, voice-overs, sound effects, framing, close-ups
* explain sequences of images in print texts and compare these to the ways hyperlinked digital texts are organised, explaining their effect on viewers' interpretations
* select, navigate and read texts for a range of purposes, applying appropriate text processing strategies and interpreting structural features, eg table of contents, glossary, chapters, headings and subheadings
* navigate and read texts for specific purposes applying appropriate text processing strategies, eg predicting and confirming, monitoring meaning, skimming and scanning
* interpret digital images which do not contain written text
* use comprehension strategies to interpret and analyse information and ideas, comparing content from a variety of textual sources including media and digital texts
* recognise how aspects of personal perspective influence responses to text
* summarise a text and evaluate the intended message or theme
* analyse and evaluate the way that inference is used in a text to build understanding in imaginative, informative and persuasive texts

Respond to and Compose Texts

* compose more complex texts using a variety of forms appropriate to purpose and audience
* recognise the techniques used by writers to position a reader and influence their point of view
* identify and use a variety of strategies to present information and opinions across a range of texts
* consider and develop sustained arguments and discussions supported by evidence

Grammar and Vocabulary

* select some more challenging language features, literary devices (eg irony, humour) and
* grammatical features (eg modality) to engage and influence an audience experiment with different types of sentences, eg short sentences to build tension and complex sentences to add detail use topic sentences and appropriately organise main (independent) and subordinate (dependent) ideas to enhance coherence in written texts
* select appropriate language for a purpose, eg descriptive, persuasive, technical, evaluative, emotive and colloquial, when composing texts
* use grammatical features, eg pronouns, conjunctions and connectives, to accurately link ideas and information to ensure meaning when composing texts

Mathematics

Number

* use numbers of any size in real-life situations, including in money problems
* interpret information from the internet, the media, the environment and other sources that use large numbers (Communicating, Reasoning)
* recognise different abbreviations of numbers used in everyday contexts, eg $350 K represents $350 000
* use efficient mental and written strategies and apply appropriate digital technologies to solve problems
* use estimation and rounding to check the reasonableness of answers to calculations
* create simple financial plans

Measurement

* choose appropriate units of measurement for length
* calculate the perimeters of rectangles using familiar metric units
* choose appropriate units of measurement for area
* calculate the areas of rectangles using familiar metric units
* choose appropriate units of measurement for volume and capacity
* record volumes using the abbreviation for cubic metres (m3)

Geometry

* describe translations, reflections and rotations of two-dimensional shapes
* identify line and rotational symmetries
* describe translations, reflections and rotations of two-dimensional shapes

Science

Working Scientifically

Students question and predict by:

* with guidance, posing questions to clarify practical problems or inform a scientific investigation (ACSIS231, ACSIS232)
* predicting what the findings of an investigation might be (ACSIS231, ACSIS232)
* applying experience from similar situations in the past to predict what might happen in a new situation

Students plan investigations by:

* with guidance, planning appropriate investigation methods to test predictions, answer questions or solve problems including surveys, fieldwork, research and fair
* deciding which variable should be changed and measured in fair tests while keeping everything else the same
* collaboratively and individually selecting suitable methods for gathering data and information first-hand and from reliable secondary sources

Students conduct investigations by:

* working individually and collaboratively in conducting a range of appropriate investigation methods, including fair tests, to answer questions or solve problems
* using suitable equipment and materials, checking observations and measurements by repeating them where appropriate
* using equipment and materials safely, identifying potential risks
* accurately observing, measuring and recording data, using digital technologies as appropriate
* using formal units and abbreviations for measuring and recording data
* suggesting improvements to the methods used to investigate a question or solve a problem

Students process and analyse data and information by:

* constructing and using a range of representations, including tables, graphs (column, picture, line and divided bar graphs) and labelled diagrams
* using numerical techniques to analyse data and information, including calculating the means and percentages of small sets of data
* drawing conclusions and providing explanations based on data and information gathered first-hand or from secondary sources
* comparing gathered data with predictions, and using as evidence in developing explanations of events and phenomena
* reflecting on their gathered evidence in relation to the process used to gather, process and analyse their data and information
* their own prior knowledge as well as accepted scientific explanations
* their own and others' conclusions

Students communicate by:

* constructing and using a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data including using digital technologies as appropriate
* using a variety of ways to honestly and accurately communicate ideas, explanations and processes, including multi-modal texts, labelled diagrams, as well as written and oral factual texts as appropriate

Working technologically

Students explore and define a task by:

* exploring needs for, or opportunities to undertake, the task
* identifying the users' needs and wants using techniques, eg observations, surveys, interviews and market research
* developing a design brief individually and in collaboration with others
* developing design criteria that considers, where relevant, function, aesthetics, social and environmental considerations
* planning the process considering constraints where relevant, eg time, finance, resources and expertise

Students generate and develop ideas by:

* selecting and using creative thinking techniques, including mind-mapping, brainstorming, sketching and modelling
* selecting and using research techniques appropriate to the task
* selecting and using techniques for documenting and communicating design ideas to others, eg drawings, plans, flow charts, storyboarding, modelling and presentations, using digital technologies
* identifying a range of appropriate materials for the task
* selecting and using techniques to investigate the suitability of materials
* applying established criteria to evaluate and modify ideas

Students produce solutions by:

* testing the suitability of materials, considering whether the test was fair or not
* developing a plan and specifications to guide production
* using their plans and production sequence for a design project, selecting and safely using a range of tools, equipment and related techniques to cut, edit, join, manipulate and shape materials and/or information

Students evaluate by:

* identifying the strengths and limitations of the process used
* self or peer assessing the final product by using the established design criteria

Built Environment

Systems in built environments are designed to meet the needs of people.

Students:

* identify elements that work together as a system to serve and support built environments and how they are designed to meet the needs of people, eg transport systems that provide access for people to get to work or systems that provide electricity to sites
* draw a plan of, or model, a built environment that includes a range of systems to meet the
* needs and wants of a specific group of users, eg shade for a playground

Social and environmental factors influence the design of built environments.

* consider ways that the design or use of places and spaces have changed over time and the social and/or environmental factors that have influenced these changes, eg changes in the design and use of a library due to technological developments or the design of buildings after an earthquake
* generate and develop ideas about how built environments might be designed and constructed in the future to incorporate sustainable environmental practices, eg the use of recycled materials, natural lighting and solar energy
* develop designs and solutions to meet specific social or environmental needs of users, eg an energy-efficient building or high-traffic airport terminal/train station

Information

Systems can be used to transfer information and support communication. Students:

* explore how information and communication systems can be used to exchange ideas, collaborate with others, organise and present data, eg a database, spreadsheet and multimedia designs
* communicate with others in different social and/or cultural contexts when designing an information solution, eg being a member of a collaborative online learning community

Social influences can impact on the design of information sources and technologies.

Students:

* demonstrate appropriate and responsible use of information sources and technologies considering, where relevant, different points of view and/or stereotyping
* explore a range of emerging information technologies and the ways that communicating with others has changed, eg the use of video-conferencing, blogs and wikis
* discuss issues of safety and privacy of personal information when communicating, selecting and using information sources and technologies

History

* How did Australian society change throughout the twentieth century? – link to schools

Creative Arts

* closely observes details of things in the world and seeks to make artworks about these using various techniques such as proportion, perspective, composition, foreshortening
* uses different artistic concepts (eg colour, tone, light, scale, abstract), and explores how symbols may be used in their interpretation of selected subject matter
* explores subject matter of personal and social interest from different viewpoints including issues, activities and events in the community and global environment, places and spaces, people, objects and fantasies.

Open-ended assessment opportunities

To capture conceptual understanding around the Big Ideas and key/driving syllabus content which is embedded in the learning.

| Week | Task | Evidence to collect |
| --- | --- | --- |
| Pre | * teach students to effectively use email. Google Drive and google docs to aid communication and collaboration * teach students how to use Debono’s-Six Thinking Hats to strengthen critical thinking * teach students how to use excel effectively to record, calculate and graph information * contact community partners and experts for support * purchase cushions/beanbags/folders/and storage tubs * purchase Robotics for evaluation * negotiate with Futures learning unit or expert school re visits. * prepare action and project plan * inform community * ensure permission to publish has been received for each student * discuss project with students – Do we need to change our learning space/How can we form our groups – what expertise do we need? * devise and communicate success criteria | related assessment tasks  STEM Learning Journal and project folder used across All KLAs  photos of journey and related entries  individual recording of personal contributions  integration of ICT |
| Midpoint | English   * learning Journal – using digital media * reading – summaries of findings print and multimodal texts * research – collate, evaluate and present – print and multimodal texts * speaking and listening – radio commercials/presentations/minutes/recordings of group meetings * individual group presentation (including digital media) of findings/progress to class group * writing – exposition – Principal – proposal and related advertising – multimodal texts * writing Information reports – furniture and technology – print and multimodal texts * writing letters/email to community sponsors   (students test and prepare a written evaluation of the furniture and technology that they have researched and prepare recommendations for purchase of those preferred)   * students use feedback to reflect on and amend their ideas/processes/products as necessary | learning journals/project folder  writing/research work samples  completed classroom plans  related work samples assessed against relevant outcomes  integration of ICT  commercials/radio jingles etc  feedback recorded in learning journal |
| Midpoint | **Mathematics**   * provide students with A3 sheets of paper/grid paper to plan and draw classroom and furniture to scale * students calculate area and perimeter of learning space and design classroom layout taking into account the space that each piece of furniture will take up allowing for movement in the room etc. * students estimate and calculate related costs * students create an Excel spreadsheet to create a database of suppliers and cost furniture and technology | scale drawings/models  computations (numeration) and in area/perimeter/measurements  completed classroom plans/scale drawings  completed Spreadsheets/costing  related work samples assessed against relevant outcomes  integration of ICT |
| Midpoint | Creative Arts   * students use design journals and visual art diaries to sketch their ideas * students create a 3D scale model and plan for classroom including placement of furniture, technology and storage * student select colours from provided swatches – consider aesthetic appearance of whole room | visual art diaries/design journals  related work samples assessed against relevant outcomes  integration of ICT |
| Midpoint | ICT   * students create movies, radio commercials PowerPoints, [website on creating and using augmented reality] <https://www.aurasma.com/> to advertise and promote their designs * students photograph furniture, design ideas create related QR codes * film making to present ideas, team proposal * use iPads to track learning and provide evidence for learning journal * word processing, spreadsheet, google sketch up, email, Google drive, iPad applications * evaluate – What technology can we use to support our learning? * computer Assisted Design Software * use of google drive and email to collaborate * students accurately observe, measure and record data, using a range of digital technologies as appropriate | iMovie  https://www.aurasma.com  commercials  radio jingles etc  PowerPoints  photographs  technology evaluations  digital cad plans  related work samples assessed against relevant outcomes  classrooms designs, models  integration of ICT |
| Midpoint | History   * students investigate – How did Australian society change throughout the twentieth century? – link to schools – How have classrooms and teachers changed? | group research presentation to form part of group proposal |
| Midpoint | Science  Students;   * consider ways that the design or use of places and spaces have changed over time and the social and/or environmental factors that have influenced these changes, eg changes in the design and use of a classroom due to changes in curriculum/pedagogy technological developments * generate and develop ideas about how built environments might be designed and constructed in the future to incorporate sustainable environmental practices, eg the use of recycled materials, natural lighting and solar energy * research and evaluate what furniture would work best in our classroom * identify elements that work together as a system to serve and support our classroom environment and how each component is designed to meet the needs of students * develop designs and solutions (considering practicality) to meet specific social or environmental needs of users, eg an energy-efficient building/21st century classroom * draw a plan and build a model of a classroom that includes a range of resources meet the needs of stage 3 students using suitable equipment and materials for their models * research and evaluate a range of technology to support their learning. | related research, summaries, conclusions and recommendations  reports of finding arising from investigation, testing.  New South Wales Department of Education Learning Tools Selector application –  https://app.education.nsw.gov.au/learning-tools-selector/Search |
| Post | Students;   * present final design proposals to principal, director of public schools, and school community on open day to effect change * individually reflect on their designs * reflect, collaborate and evaluate their proposals * give feedback from community partners * share our learning with Stage 2 and ES1 and staff from Glenmore Park Learning Alliance. | learning Journals  final design proposal, written work costings and related team presentations |
| Unit self-assessment | Project Based Learning  A systematic teaching that engages students in learning essentials; knowledge and life-enhancing skills through an extended, student-influenced inquiry process structured around complex, authentic questions and carefully designed products and tasks.   * It starts with the questions or challenge * It is a student-centred activity * It requires critical thinking, collaboration and communication * It involves meaningful tasks * It is assessed on individual basis | Ask the question does this project/activity address the points listed? |