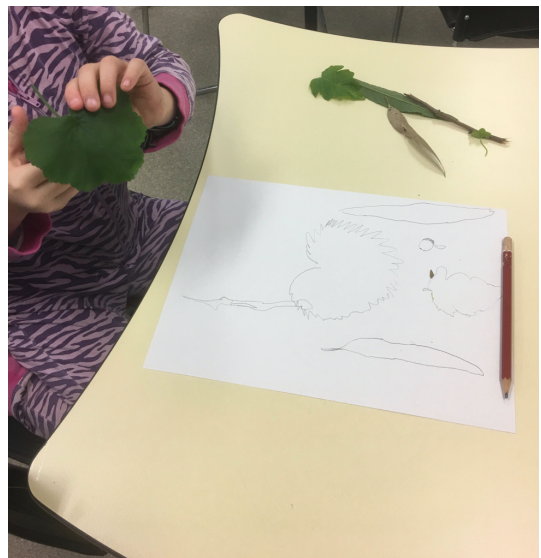


STEM at the Grove

by
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STEM at Glenore Grove State School: How we do it.

"A renewed national focus on stem in school education is critical to ensuring that all young Australians are equipped with the necessary stem skills and knowledge that they will need to succeed." National STEM School Education Strategy, 2016 – 2026

STEM and the Hype.

Why is STEM in Education important?



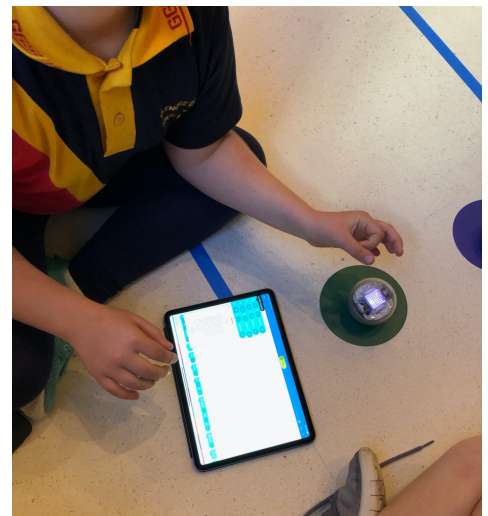
Globalisation has played a major role in the introduction of STEM (Science, Technology, Engineering and Mathematics) into our education system. Our ability to adapt to the changing job environment has been the focus of “future education thinkers” and STEM seems to be the next level of skill attainment. Future job creation is going to rely on the skills that STEM provides learners, which incorporates critical, creative, design and computational thinking, problem solving and collaboration. STEM is not only for logical, left brain thinkers but can generate multipurpose conditions that encourages and assists in cross curricular learning, real-world contexts, differentiated learning, growth mindsets and self-directed learning. So how do we start planning for STEM in education?

The Department of Education, Queensland rolled out a plan in 2016, to introduce STEM to schools across the state. In “*Schools of the Future STEM Strategy*”, it outlines three targeted goals for STEM success:

- Build teacher capacity to transform STEM learning
- Engage more students in STEM learning
- Achieve excellence in STEM learning

Funding was and still is distributed to underpin the goals and strive for successful outcomes. This funding is used at the school level to facilitate the buying of resources, project start-ups, makerspace investments and excursions to name a few. Some of the initiatives that support the DoE’s focus are: Regional STEM champions (whose role as coach can be invaluable); Robotics lending library; Peter Doherty Awards for Excellence in STEM; Virtual STEM academies; STEM Teacher Symposium and The Premier’s coding competition.

Nationally, the importance of female participation in STEM has been a main focus. Traditionally, engineers, scientists or mathematicians had a more masculine embodiment.



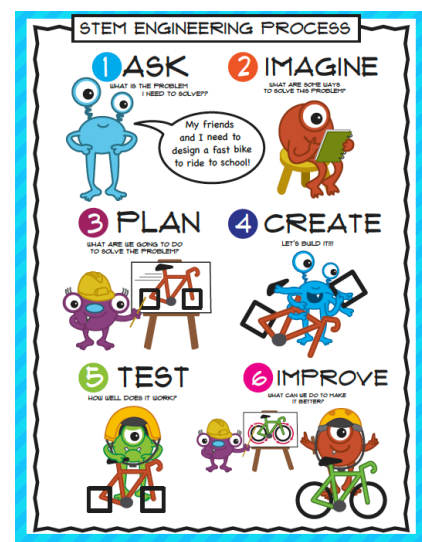


To inspire more female participation in STEM subjects, the DoE planned to support this growth through a program called “The STEM Girl Power Initiative”. This incorporates the following sub-projects: STEM Girl Power Camp, STEM Girl ambassadors in the regions and STEM Girl Power Alumni. The idea is to lessen the gender gap in STEM future job creation. Teachers can play a significant role in influencing or dispelling stereotypes in STEM education and embracing the idea of empowerment when it comes to subjects like Mathematics. The irony is, that girls perform just as well in Mathematics and are equally consistent in their test scores in secondary schooling. Growth mindset is an integral part of “STEM subject empowerment” and is the foundation for design thinking and intentional collaboration.

This all leads us to the concept of “Across the Curriculum”. STEM has its fingers in many pies, which is why it works. One concept or skill area can be elaborated on in many different setting and subject areas. It brings it back to a real-world context and how this influences the student in their own environment. It makes more sense to use something they know and are familiar with to springboard an idea/skill. This problem-based, design thinking, not only allows for skill growth but creates an engaged environment, where collaboration is welcomed. So how does all of this work in a small school?

STEM: the Glenore Grove way.

Since 2016, our students have had the opportunity to sample the new Digital Technologies curriculum. The Digital and Design Technologies C2C units were used as a launching pad to greater and more interactive project-based teaching and learning. In our cluster we were the only school doing a full year of technology units covering both Design and the Digital. This has greatly impacted our student learning, as we have been able to slowly bring in the concept of design thinking into other subject areas that belong in the STEM family. The achievement standards for both technology areas were revisited and improved upon by the DoE, to incorporate the ideas of design thinking and intentional collaboration. Based on the engineering process, units covered, supply a real-world problem taken from their own experiences i.e. “School lunches” and asks for them to research, plan and design a solution. A testing phase needs to occur for process improvement, which also assesses their mindset (fixed or growth) and then requires an improvement.



The collaborative process involved is through clustering students in multi-level groups where each individual has a purpose and responsibility for that day. This responsibility is rotated so that all can have a turn being the researcher, speaker or designer. ‘Reverse Design’ is another concept that has its foundation in STEM. This is a multi-modal exercise to facilitate students to discover the design decisions of a device, object or system through observations and analysis of its structure, function, history and operation.



The purpose is to help students deduce design decisions from end product with little or additional knowledge about the procedure involved or original plan. Students also get to redesign the object, device or system to meet the needs of a particular user. The applications for this way of thinking are endless and can be splayed over many subject areas. Other ways of promoting collaborative process is through station rotations. Glenore Grove teachers have implemented this successfully during class and subject time and particularly on STEM Days. GGSS STEM days were introduced in 2016 to launch the important skill of problem solving, growth mindset, design thinking and the new idea of intentional collaboration. On STEM days, which occur once a term, teachers and students work through challenges based in a physical, hands-on environment. Students have the opportunity to design and build bridges, make volcanoes, test force on objects, fly drones and test heights, create 3-D structures using playdough and toothpicks, code programs and drive robots, make quicksand and slime, to name a few.

All activities cover the STEM subject areas and promote and apply both critical and creative thinking. STEM days have also been themed – “Be a pirate day”; “Sustainable living” and most recently “Fairy-tales”: Growth Mindset.

This has impacted student learning and also building capacity in our teachers. The phrase “learn by doing” is very apparent, as staff members have built their understanding and knowledge base in STEM around the activities they have sourced. Building teacher capacity in STEM has been a focus at Glenore Grove. We have engaged in PD sessions with Regional Assistive Technology advisor Helen Honhke. Her insight into both numeracy and literacy assisted technology has been important to building the teacher capacity in STEM.

Our STEM ambassador, Mrs Hayley Freemantle has attended numerous personal development workshops and conferences improve on the quality of STEM teaching and learning. Our school is involved in the Technologies Professional Learning Community based at Laidley District School.



This PLC not only promotes a consistent approach to teaching technology in our cluster but also is the base of resource lending. Our cluster was given a grant and resources, which includes coding software, Makerspace resources and robots/drone assembly kits. The technology room at Glenore Grove houses some of our own school resources, that are not only used in the teaching of technologies but all other STEM subject areas.

Our list of resources includes: 4 Sphero robots with coding software; 8 iPads with Swift Playground coding software; 52 iPads distributed across all 9 classrooms for assisted technology and interactive mathematics and reading apps; a MacMini server for management and deployment of sourced apps; 4 BeeBots and mats for Prep play and coding; multiple “manipulatives” for mathematics rotation stations; Maker-Space area with Lego building projects and mini-robotics.

Glenore Grove has been fortunate enough to have support staff who have a STEM connection. Our grounds man, Mr Brian Allison frequently brings his drone to our school to do films, support stem day and work with students in and around the school. He has had a vital role in the engineering and improvement of our gardens. Our students have been given a great view of how and what it takes to plan and design a sustainable, producing garden.



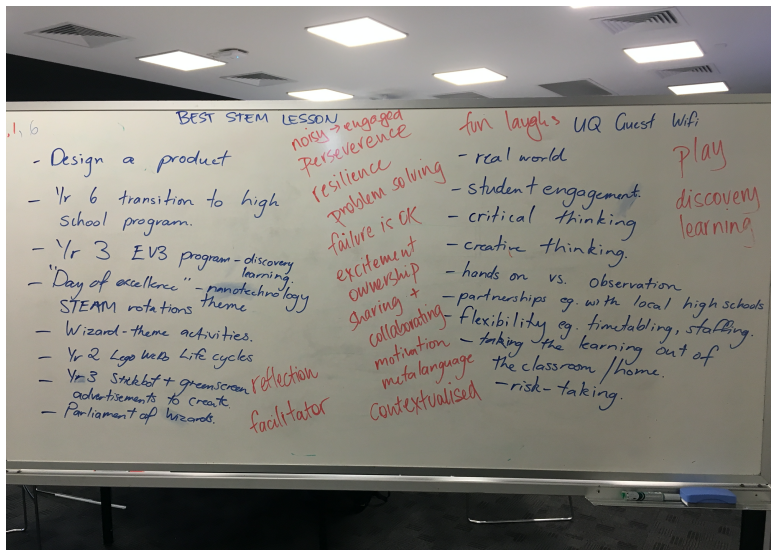
Our gardening club has been involved in the design and creating of grow beds, gumboots for growing, giant Green Rock Frog, a full-size scarecrow and even a hypothetical investigation into alternative watering systems (year 5/6 technology). We are currently entered into the Carnival of Flowers, Hanging Basket Competition initiated by Mrs Anne-Maree Drummond. The entered basket will have a designed “paddock to plate” theme with edible produce. Our Chaplain, Tim Ormiston is currently doing playtime STEM builds, which includes rocket building and testing and force propelled toys.

As part of the initiative to engage and immerse students in STEM, excursions and workshops have been planned and organized each term. Since 2016, 12 – 14 Glenore Grove students have been invited to attend Apple workshops at the Brisbane Apple Store in the historical MacArthur building. The skills and content taught range from making music in GarageBand, Coding with Swift Playgrounds and coding and driving robotic spheros. Students are required to give a verbal presentation on what they have learnt as part of their technology lesson as a follow-up.



Other excursions and inhouse school workshops included a trip to the Queensland Museum, Science Centre, a visit from the Shell Science team and a fantastic, hands on media arts workshop called Roadshow. Even our Under 8's day is STEM based, with activities ranging from food handling, slime creation, playdough play and rocket making. As part of the Inclusive Education initiative, our students with a disability have benefitted from the hands-on small group work that STEM days, excursions and intervention provides.

We provide some students with iPads for differentiated learning and software that supports their individual learning while still being able to contribute within the classroom environment.



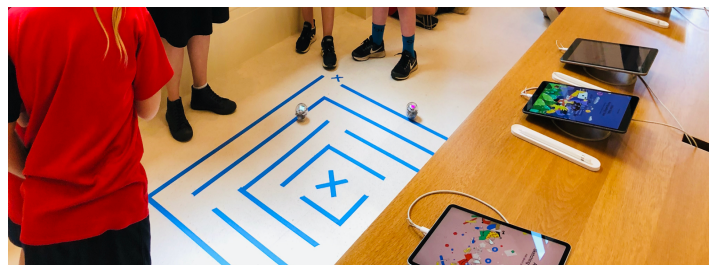
STEM literacy is being trialed with these students, so they become familiar with the terminology in an assisted and fun way. Apps, like Quickmaths, Sorting for Early Science, OSMO, Maths Monster and Lego Worlds, promotes STEM literacy through interactive game platforms.

The year 5/6 band in digital technology requires students to create a video/short movie using iMovie about the maze game they produced for the unit "A-Maze-ing games".

Students are explicitly taught the required software (scratch) and gaming knowledge beforehand and then they are given a "brief" which requires them to make and star in their own movie. This can be in the form of a documentary, advert, movie skit or teaching lesson. STEM literacy in the form of interactive reading books, physical copies and page excerpts are worked upon and completed during each unit of design and digital technology. This promotes reading and familiarizing students with STEM literacy. Books we have accessed include: *George's Marvelous Experiments* by Roald Dahl; *A Really Short History of Nearly Everything* by Bill Bryson; Adam Spencer's *Number Crunches*; *Rosie Revere, Engineer* by Andrea Beaty and *Diary of a Minecraft Zombie*.

Heading into the future with STEM.

Glenore Grove State School will be continuing to place STEM as part of our growth focus for upcoming years. We would like to continue and build upon the relationships with cluster high schools and liaise to ensure that our students are meeting the technology content/learning expectations, making transitions and subject choosing easier and less stressful. We will be proposing to take a STEM extension group each week to start to meet some of these needs.



We are also in the process of migrating our Apps Server to a Content Manager through Apple support. This will aid in app deployment without using the internet and is bandwidth light. The extension STEM group will be a part of migration and will give students who have a digital technology flare, some food for thought about apps and what goes into managing systems. There is also an excursion opportunity to USQ, Toowoomba to have a Makerspace workshop with year 4, 5 and 6 students. Students will have the opportunity to enter contests and competitions that focus on STEM subjects i.e: Qld Science Contest, Young ICT Explorers and the Robotics Regionals held in Brisbane for beginners each July. We are currently making plans to apply for the Australian Government Grants for Maker Space, which supplies up to \$5000 to purchase school resources.



Innovation and STEM go hand-in hand and the amount of new technologies to improve our way of life, life creation and life sustainability are growing exponentially. We need "STEM" thinkers and problem solvers to sustain this massive growth. Doing STEM in the foundation years paves the way for job growth and creation which in turns aids our global economy.



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