Year Two Report: Build and Test

Penryn Creativity Collaborative
Action Research Report

Research Question:
How does working on real-world projects lead to learners being powerful in their understanding?

Lead Action Research Teacher:
Alexander Childs, Head of STEAM, Penryn College

Key Industry Partner:
Allen and Heath

Penryn College
"Achieving through Challenge"

ALLEN&HEATH

IET The Institution of Engineering and Technology

Penryn College "Achieving through Challenge"
University of Exeter
Supported using public funding by ARTS COUNCIL ENGLAND
Freelands Foundation

Penryn Creativity Collaborative Action Research Report

This Action Research project is part of the Penryn Creativity Collaboratives.

To cite the report please use:

Childs, A. (2023). *How does working on real-world projects lead to learners being powerful in their understanding?* Penryn Creativity Collaboratives. https://penryn-college.cornwall.sch.uk/creativity-collaboratives

CONTEXT

Creativity Collaboratives is a national pilot programme of eight clusters of schools across England who are working together to test innovative practices in teaching for creativity, sharing learning to facilitate system -wide change. The programme, launched in October 2021, is funded by Arts Council England with generous support from the Freelands Foundation. Creativity Collaboratives: Penryn Partnership is the Southwest pilot for the programme and over the course of three years is focused on exploring one central question:

Does teaching creativity across the curriculum lead to young people who are better prepared for their future in a changing workforce?

The Penryn Creativity Collaborative is led by Penryn College with eight local primary schools and research partner, the School of Education at the University of Exeter. This report presents findings from one of thirteen action research projects which took place during Year 2 of the Penryn Creativity Collaboratives programme. Each action research project was led by a teacher with students from their own school, included a link with a partner from a local industry and the lead teacher was supported by researchers from the University of Exeter through a programme of training and mentoring.

Full findings from Year 2 can be found in the research report. To cite this report please use:

Crickmay, U. Childs, S. Chappell, K. (2023). *Preparing for a Creative Future: Year Two Report Build and Test* https://penryn-college.cornwall.sch.uk/creativity-collaboratives

This action research project took place in Penryn College, an 11-16 school on the south Cornish coast, England. A lively, thriving and oversubscribed school, Penryn College prides itself on offering the very best for their students.

In 2019 Penryn College created a STEAM (Science, Technology, Engineering, Arts and Maths) faculty with a commitment to developing students' ability to solve problems. Staff focus on the application of technologies and the use of innovation to give students the skills and confidence to succeed in life after Penryn College. Since its formation the STEAM faculty has worked alongside industry partners in developing each scheme of work. The aim of this is to provide students with an experience of the world of work including apprenticeships, visits and STEAM events led by businesses and colleges

This action research project involved Year 10 pupils (aged 14-15) of Penryn College and was led by Alex Childs, Head of STEAM. The students follow the AQA (Assessments and Qualifications Alliance) GCSE (General Certificate of Secondary Education) Engineering course and 15 chose to take part in the study. The group included 3 female students and 12 male students. The project explored the design and manufacture of a mixing desk and fitted within the electronics unit of the course. In collaboration with Allen and Heath, a world leader in this area of design, the project had a real-world focus. Allen and Heath designed the electronics and aimed to provide an industry expert to support the development of a working prototype. Allen and Heath have been working behind the scenes with teachers at this stage but will involve student visits and collaborative working with students in the next iteration.

As a second part of the research project, a group of 18 year 8 students (aged 12-13) were selected to take part in an immersive engineering challenge run by the Institue of Engineering and Technology (IET). The Faraday Challenge was a one-day event with students designing to a brief and pitching their ideas as a prototype model.

Penryn Creativity Collaborative Action Research Report

THE PROJECT

This project came in 2 parts. The first provided a real-world challenge for students as the vehicle for their learning of electronics. The project began with a request from Allen and Heath for students to contribute to the design of their smallest mixer to date. The mixer is aimed at a small backyard band who may wish to play small venues where they would need to provide the sound system. The mixer would allow the band to combine sound from 2 microphones, 1 guitar and 1 keyboard. The internal electronics were designed by Allen and Heath to ensure function and safety but would be made by students along with their own design for layout and styling. Students would need to learn and use technical skills and apply their understanding to solve design problems to produce a working prototype.

The second part of the project was the Faraday challenge, delivered by the IET (The Institution of Engineering and Technology). This is a one-day event where groups of 6 students are given a brief and asked to design, model and pitch their solutions. This year the brief was around 'future airspace'. The students have a standard set of parts to work with and a limited budget to spend. They are then free to design a solution to whatever issues they feel may occur in our 'future airspace'.

DEFINITIONS OF KEY TERMS

Creative Skills

The research drew on the Penryn Partnership Creative Skills Framework developed during Year 1 of the Penryn Creativity Collaboratives programme (Crickmay, Childs & Chappell, 2023). The framework defined creative skills in a five-part model and this action research focused on three sections of this model as follows:

- **Honing and developing ideas:** This combines the skills needed to develop creative ideas, incorporating aspects of self-reflection together with development of techniques and understanding of the rules and the persistence needed to progress creative ideas and actions
- **Empowered action:** Foregrounding pupils' own agency in creative action, as a skill this includes the ability to take risks and question accepted ideas, the capacity to be immersed and the ability to act on creative ideas
- **Generating new ideas that matter:** The ability to combine innovation with critical attention to the consequences of ideas, considering the ethical impact of creative actions and understanding diverse values

Real World Learning

'Learning that prepares you for anything you want to do throughout your life at school, home, in the community or at work' (Lucas, 2020, p. 63)

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AIMS OF THE RESEARCH

The main research question this study addressed was:

How does working on 'real-world' projects lead to students feeling powerful in their understanding?

I was interested in exploring what may be the drivers of that feeling of empowerment and what leads to students demonstrating greater empowered action. I wanted to know how a student gets to the point where they feel they can take on a new challenge and be successful. Research during Year 1 of the Penryn Creativity Collaboratives project showed that in order for students to have the creative skills they need to be better prepared for a changing workforce, they need to be adaptable and determined problem solvers. Therefore, can we teach this and if so, what methods are most effective and why?

The specific issues the study tackled:

- Are real-world problems inherently too difficult and complicated for students to solve at this age group?
- Is excitement for a big project sometimes at the cost of the individual success of doing something smaller independently?
- How can we get students to access and use previous knowledge and understanding to solve new problems?
- When does cross-curricular application of knowledge become independent?
- Can we offer enough time for all students to be successful in solving problems when we teach in mixed ability groups?
- How do we differentiate so students still feel powerful in their understanding when other students are clearly working on harder problems?

METHODS AND PARTICIPANTS

The Mixing Desk project took place in a class of 22 Year 10 (aged 14-15) mixed gender students of mixed prior attainment, 15 members of this class took part in the action research. The project to design a mixing desk was planned as a 10-week unit of work, consisting of a series of sessions analysing previous designs, designing a product and its styling, manufacture of the electronics and development and modification.

Additional evidence was included from a second project, the Faraday Challenge, run by the Institute of Engineering and Technology. This event included 18, year 8 students (aged 12-13 year olds), 12 of whom consented to be in the study, working in groups of 6. This immersive day had students design, model and pitch, engineered solutions to a 'real world problem' set out in a launch video.

The methods used were:

- A student focus group of 4 students interviewed at the beginning and the end of the project
- Data from a questionnaire that all students completed at the beginning and the end of the project
- Photographs of students' work
- The Penryn Partnership Creative Skills Wheel: a data collection tool designed for the Penryn Creativity Collaboratives project. Around the edge It includes the five-part definition of creative skills developed during year 1 of the project, with each skill broken down into three detailed sections. Inside the wheel, teachers or students can mark whether they noticed each of the skills being used a little, some, or lots
- Reflections from the class both during and at the end of the project
- Teacher Journal extracts during the project

Analysis of Information

Data analysis was carried out via immersion in all data, followed by transcription of selected audio data. Photographs were coded using the See, Think, Wonder technique from Harvard Project Zero. All data was then systematically coded using low level through to higher level coding which led to a thematic analysis. This is written up below in this report.

Ethical Research Practice

Ethical research practice was ensured by following the ethical guidelines of the University of Exeter ethics committee which are grounded in the British Educational Research Association (2018) guidelines; protocols involved seeking informed consent for all research activity from all participants alongside careful data protection practices.

MAIN FINDINGS

The findings were analysed in relation to the Penryn Partnership Creative Skills Framework and were focused on three areas of this framework in particular: Honing and Developing Ideas; Empowered Action and Generating New Ideas That Matter.

Honing and developing ideas

There is good evidence to suggest that when being creative, students feel just as powerful in their understanding if they are adapting a given design as if they came up with their own. My reflective journal notes that students were also more engaged, suggesting this method may be more successful in developing understanding and confidence in design. Student reflection showed that students are generally better at, and more confident with, adapting rather than starting from scratch; they like to have a safe space to start from and come back to if it goes wrong.

> *"Because I already have a framework to build on that I know works and don't have to create a new idea that may not work."*
>
> Year 10 student, post project forms questionnaire

Without a working prototype as a reference point, students reflected that failure becomes much more likely and so higher levels of resilience are needed to still engage creatively.

During discussion with students and through teacher observation throughout both parts of the project, it was clear that when working creatively it is important to give time, to have the student be and feel successful. Students feel rushed in many lessons and feel that when there is a time limit, they get given the answers, this reduces their feeling of success, so they feel less powerful in their understanding.

> *"Yeah, teachers kind of give you, like, five minutes and then they're like, 'Right, I want the answers. If you haven't got them all written down, just write them down.'"*
>
> *Year 10 student, Mid Project Interview*

Empowered action

From observations made during both the Allen and Heath project and the Faraday challenge it was clear that students will engage creatively if they feel confident but are more likely to if they have a clear starting point; a blank page is very daunting and most need to build experience before feeling able to take risks.

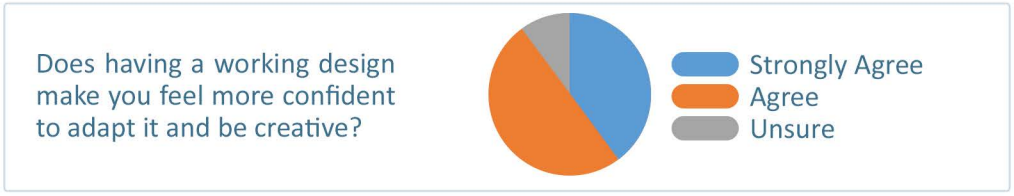

Figure 1: Year 10 students, post project forms questionnaire

Previous successes made a big difference in students' likelihood to be autonomous in a new project: it seems this could recursively broaden the gap between students without careful management.

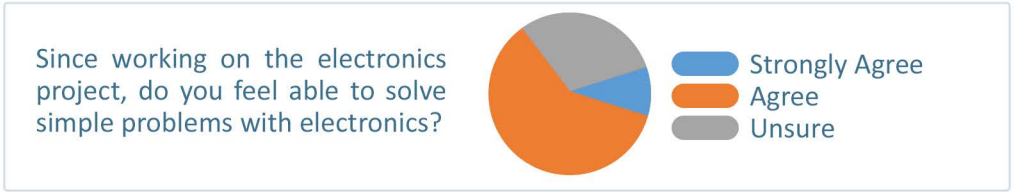

Figure 2: Year 10 student, Post project forms questionnaire

Students know that they will need to try new things and to adapt: the closer to previous experience the new problem is, the more likely they are to feel able to try new things and adapt previous knowledge. Figure 3 shows the adaptation of a known design to miniaturise it (bottom right). Students were able to do this as they felt they understood the initial design.

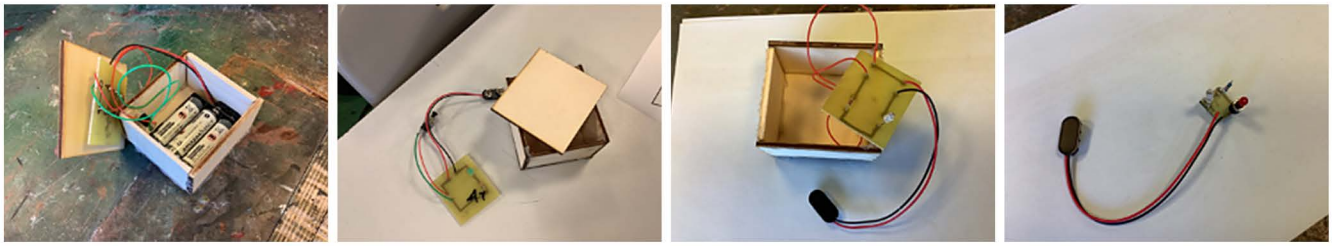

Figure 3: Year 10 student, Allen and Heath project

Having a way to formalise this process increases empowerment as even with new problems, they have a known structure to follow.

> *"Because you know you can do it and you know that it works and that allows you to want to change it and make it better."*
>
> (Year 10 student, Post project forms questionnaire).

Generating new ideas that matter

The evidence shows that students feel powerful when they solve real problems. This could be because they have a tangible outcome that they believe mattered. The students doing the Faraday challenge were clear that they felt successful and that it being a real task was a factor.

> *"I have felt more powerful in my knowledge after creating a product with a brief and solving problems that came on the way, independently and collaboratively. As well as this me and my team came up with an idea from a simple brief with no assistance whatsoever."*
>
> (Year 8 student, Faraday Challenge reflections).

After the Allen and Heath project, students felt successful. This made them feel more confident to develop the idea, leading to them being better at finding a purpose for this circuit.

> *"As I know what I'm able to do and can adapt it to work better or for a new problem."*
>
> (Year 10 student, post project forms questionnaire)

In subsequent lessons it was observed that students came up with more applications for the electronics that they would not have come up with a solution to before. This may have been just that they now had a broader experience of this area of engineering but also that they are feeling more powerful in the understanding as they had made a working circuit. They cared about being able to make the light work because they knew it had a purpose.

DISCUSSION AND IMPLICATIONS OF THE PROJECT AND FINDINGS

Creative Pedagogies for STEAM

It was noted for students to feel powerful in their understanding when faced with a new problem they need three main things:

- Knowledge, experience and expertise in similar areas to the problem they are trying to solve
- A method of breaking a problem down; identifying its traits and parts; assigning previous knowledge, experience and expertise to these parts and building back a solution that works
- To believe that being able to solve the problem matters, feeling powerful only happens when a student can do something they care about

If we want students to feel powerful and to be able to solve complex problems, then it seems they need all the above criteria. Firstly, so they can solve the problem using the knowledge and understanding but also the method of applying that to a new problem. The third criteria, 'agency', must come from the task; solving real problems makes students more likely to value the solution and care about being able to do it, this in turn drives engagement.

The evidence in this study suggests that students preferred adaptation to raw innovation in engineering. This limited creativity in some ways as the changes are more incremental but made success much more likely and made students more likely to take action and be successful with novel problems afterwards. Students were more likely to utilise and develop creative skills when supported with previous knowledge and with a working start point.

> *"Because it gives you an idea around the basics of the design but you still have to be creative with some different parts."*
>
> Year 10 student, post project questionnaire

The Faraday challenge evidence showed that with a group of confident students, the boundaries can be widened and they will still feel able to be successful and therefore still fully engage. These students will enquire and find out the information they need to bridge the gaps because they have been successful before and have the confidence in their ability to learn. With a taught and learned structure for problem solving we may allow a larger number of students to do this autonomously.

The 'Pyramid of Understanding' (Figure 3) is something that we will be developing in its use both within GCSE Engineering and across the school curriculum moving forward.

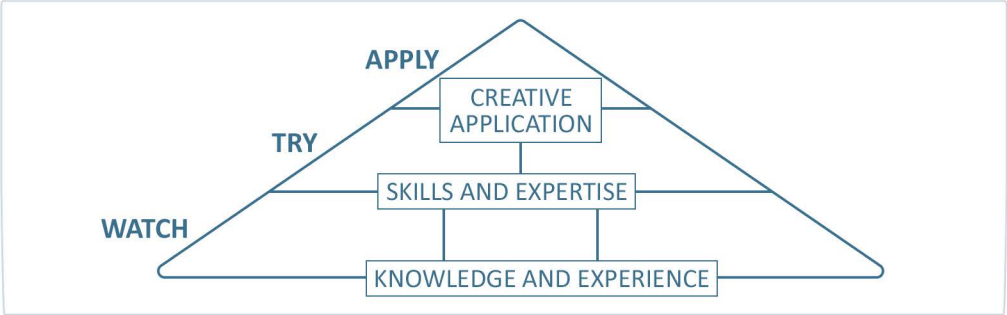

Figure 3: The pyramid of understanding

Implications Moving Forward

If we define creative skills within an engineering environment as the combination and application of previous knowledge, experience and skill to solve a novel problem, then it makes sense that without these things in place creativity cannot happen. Within engineering, for an idea to matter it really does need to 'work' or at least to have the possibility of working, otherwise it has not solved the problem. This idea of it working leads to a clear and concrete feeling of success which in turn leads to a feeling of power for many students. These thoughts have been at the core of my research and have led to some interesting concepts for me to explore further next year.

- Adaptation of current designs can be as powerful for students' confidence and understanding as coming up with new ideas
- Having a structure to work within allows students to be more confident when solving new problems as it allows them to map out how their current knowledge and skill may apply
- Success brings confidence and confidence brings creativity; whatever students work on they must be given the time to complete it and feel successful
- How do we record, assess and celebrate these new problem-solving skills? Do they fit into our current qualification system, or do we need a different way to show students' abilities here?

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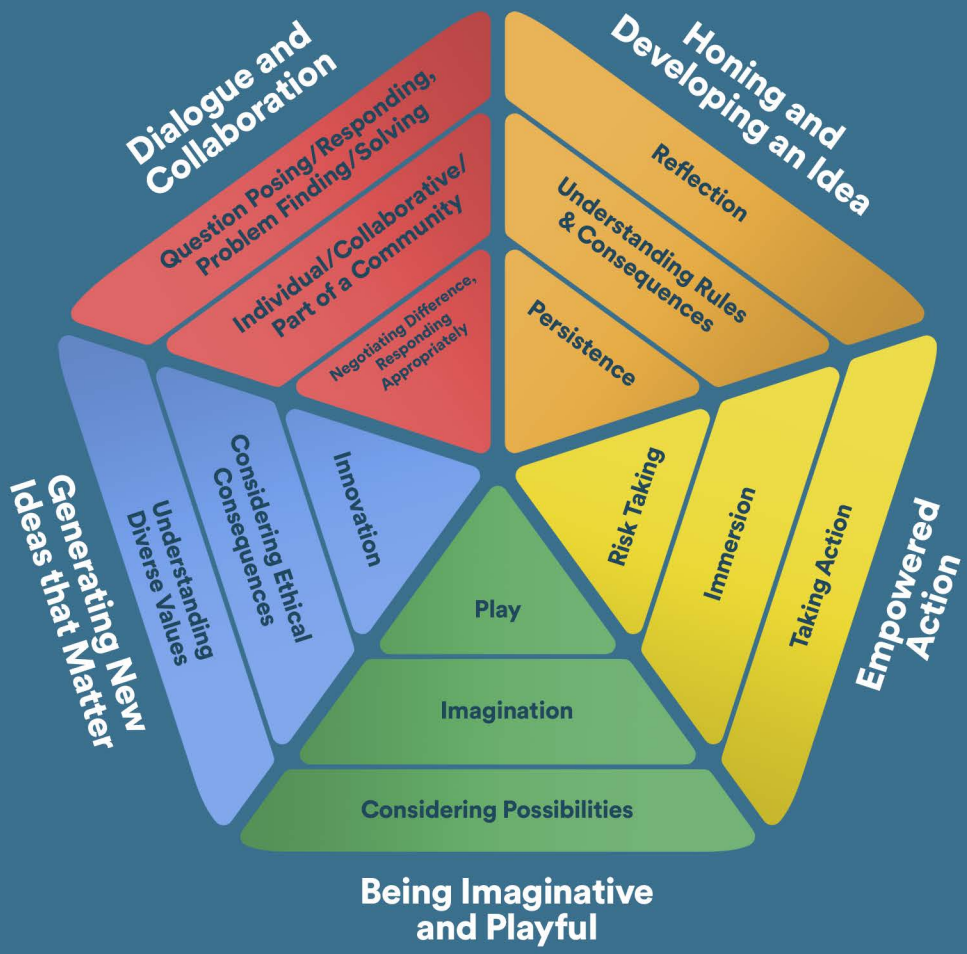
Creative Skills

PENRYN PARTNERSHIP

"Does teaching creativity across the curriculum lead to young people who are better prepared for their future in a changing workforce?"



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