Royal Academy of Engineering

MANCHESTER 1824
The University of Manchester

Ask – Problem Finding

Looking around to spot things that aren't working well or could work better

Download the full report:

Bianchi, L. and Wiskow, J. (2023) Progressing to be an Engineer – The Approach. Royal Academy of Engineering.

Informed by work from Rode Heath Primary School, Cheshire

The Progressing to be an Engineer Cycle

Overview

Ask – Problem Finding is where everything starts. Without the ability to observe how things work and ask pertinent questions of users, effective product design would be very difficult to achieve. Problem finding at this stage is very different from that encountered in the final stage of the Engineering Design Process, where the emphasis is on testing and improving.

ILOs	Key learning	Suggested activities
What do we want pupils to understand about Ask – Problem Finding?	Consumers buy products to solve real world problems for themselves. The first step in the engineering design process is therefore identifying a problem that needs to be fixed. It is vital to find a real problem; otherwise there will be no market for your product and it will fail. Problem finders are observant – they pay attention to the world around them. Problem Finding enables designers to build better products. It's a way of making sure every design decision fits with the problem the user wants to solve.	**Reverse thinking:** Looking at a finished product and seeing what problem it solved. **Activities:** 1. What's the problem? 2. Classroom scavenger hunt
How do we want them to apply their knowledge?	Finding real problems can be difficult sometimes. A good place to start is by talking to would-be users. Carrying out real-life observations is important too. Looking closely at the world around you and understanding how things work in your immediate surroundings can reveal existing problems. Once identified then asking the following questions is key: ■ What is the problem that you need to solve? ■ Who are you going to solve the problem for? ■ Why are you doing this? ■ How are you going to proceed?	**Identifying & responding to problems:** Looking closely at different examples of a product regularly used in school and identifying existing and potential problems. **Activities:** 3. Tap trouble 4. Exploring solutions

	From	To	Towards
	Suggested 5–7 years	**Suggested 7–11 years**	**Suggested 11–14 years**
Pupils should be taught to:	Make observations to inspire the asking of simple questions, finding out more information about how things work.	Identify problems and ask questions to better understand their cause.	Critically examine problems, asking questions to understand their cause and how they impact different users.
Success was demonstrated when pupils:	■ identified the key reasons for a problem using observational evidence.	■ used technical vocabulary to describe the problem, e.g. pressure/temperature. ■ organised and communicated their thinking effectively.	■ tailored their solutions to suit the audience, group or user.

Generic task

Initial learning activity – eliciting and developing understanding

Activity 1: What's the problem?

The pupils were shown a series of photos of products and asked to identify what problems they thought were being solved. They were encouraged to comment on which solutions were most effective and where improvements could potentially be made.

"This generated some interesting conversations about other products the pupils had come across."

Generic task

Initial learning activity – eliciting and developing understanding using a generic task (continued)

Activity 2: Classroom scavenger hunt

This led to a search in the classroom for products that solved problems.

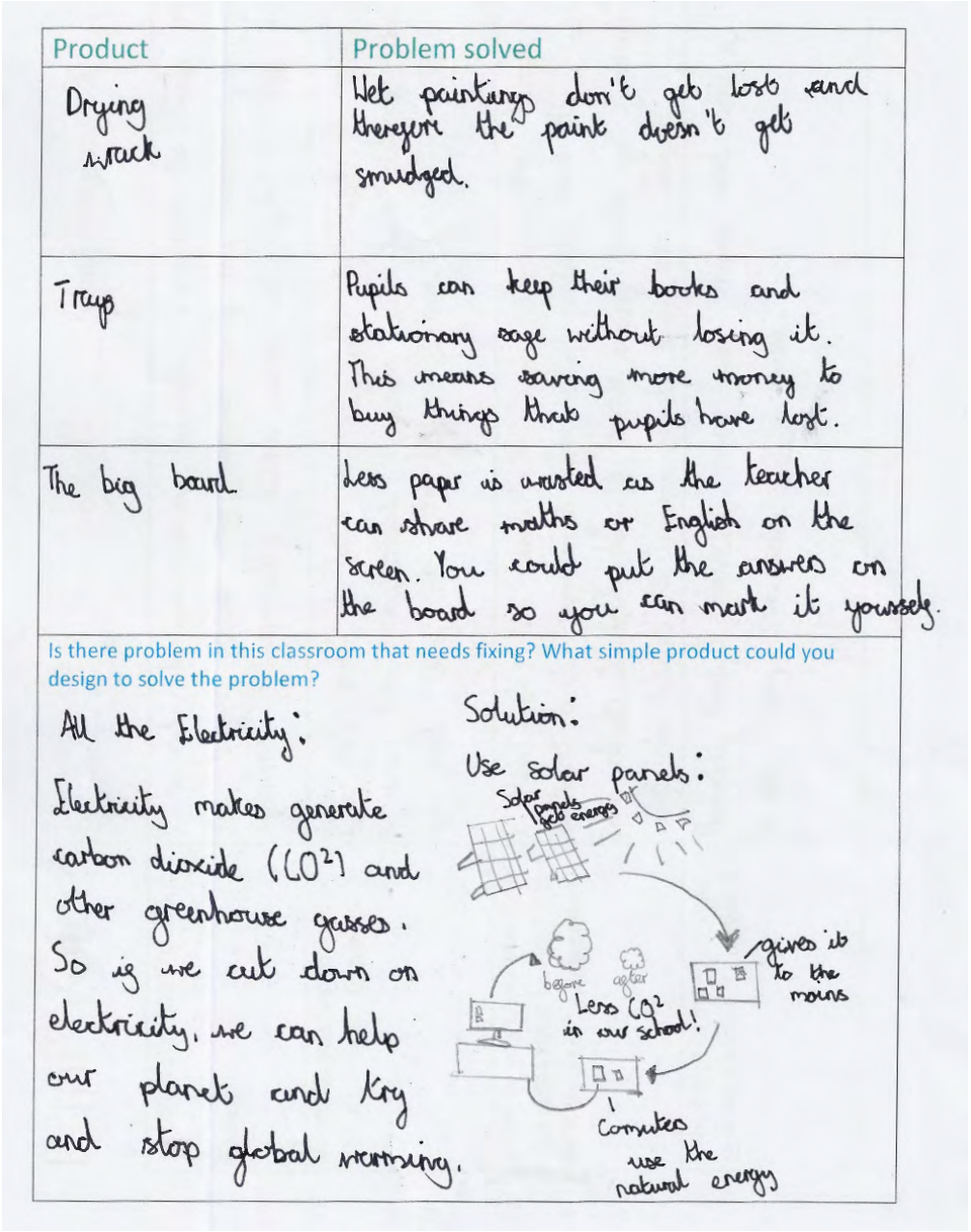
"Some pupils found it difficult to identify problems around the classroom.

When they picked an example of a product, they tended to try and identify a problem that the existing product had rather than thinking about why it was designed in the first place."

"This pupil shows a good understanding of the question being asked.

She has actually responded to the problem that is being solved by the product she has chosen.

She has also found her own problem to solve; although her problem is on a much wider scale."



Product	Problem solved
Drying rack	Wet paintings don't get lost and therefore the paint doesn't get smudged.
Trays	Pupils can keep their books and stationary cage without losing it. This means saving more money to buy things that pupils have lost.
The big board	Less paper is wasted as the teacher can share maths or English on the screen. You could put the answers on the board so you can mark it yourself.

Is there problem in this classroom that needs fixing? What simple product could you design to solve the problem?

All the Electricity:

Electricity makes generate carbon dioxide (CO^2) and other greenhouse gasses. So if we cut down on electricity, we can help our planet and try and stop global warming.

Solution:

Use solar panels:

Embedded task

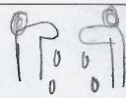
Exploring Ask – Problem Finding in context

Activity 3: Tap trouble

Pupils were asked to gather data about the different types of taps found around school and research the evolution of tap design. This led to them identifying the problems they and other consumers may be having using these taps and considering how adaptations and improvements could be made to 'make things better'.

TYPE OF TAP	LOCATION	HOW IT WORKS	PROBLEMS
BRASS OUTDOOR TAP	Garden	Twist handle to the right to open and left to close.	Can freeze in winter.
Bath tap	Bathroom	twist left lever for hot/right for cold	Can use up all hot water
Coffee machine	Kitchen	Push button	Can burn your hands
Kitchen tap	Kitchen	twist one handle for hot /cold	It randomly drips
Bathroom tap	Bathroom	twist one of the handles for hot/cold	- No problems.
Downstairs toilet tap	Bathroom	Push lever for warm/cold water	It makes hot water weigh too hot.
Eunsuet tap	Eunsuet	twist for warm/ cool water	-No problems.

Pupils went on a Tap Trail at home and at school to investigate the different types of taps and how they worked.

LOCATION	HOW MANY? SKETCH ONE	WHO USES IT/THEM?	PROBLEMS DETECTED?
Library		~~Twist~~ Kidsand teachers	gets stiss
Infant Bathrooms		little kids	The taps get stuck and won't turn oss.
Staff room		Staff	gets too hot and cold.
Staff room		Staff	really can't tell tempeture
Kitchen		chess	high water pressure
Kitchen		cheff	Small
kitchen		Sheff	high water pressure

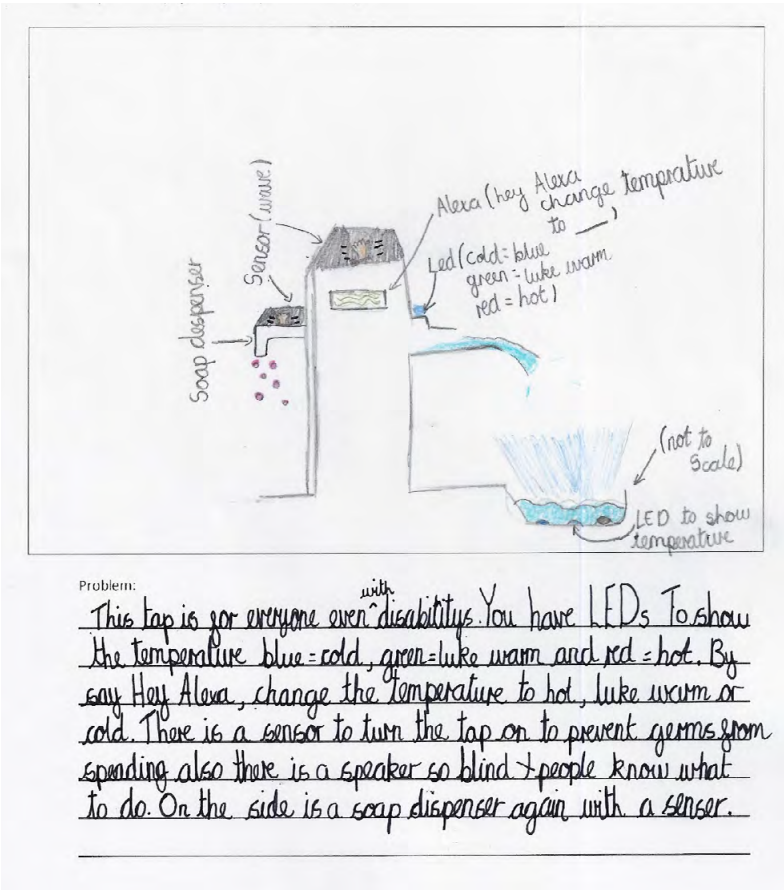
They were encouraged to talk to users to see if they were experiencing any problems with their taps.

Embedded task (continued)

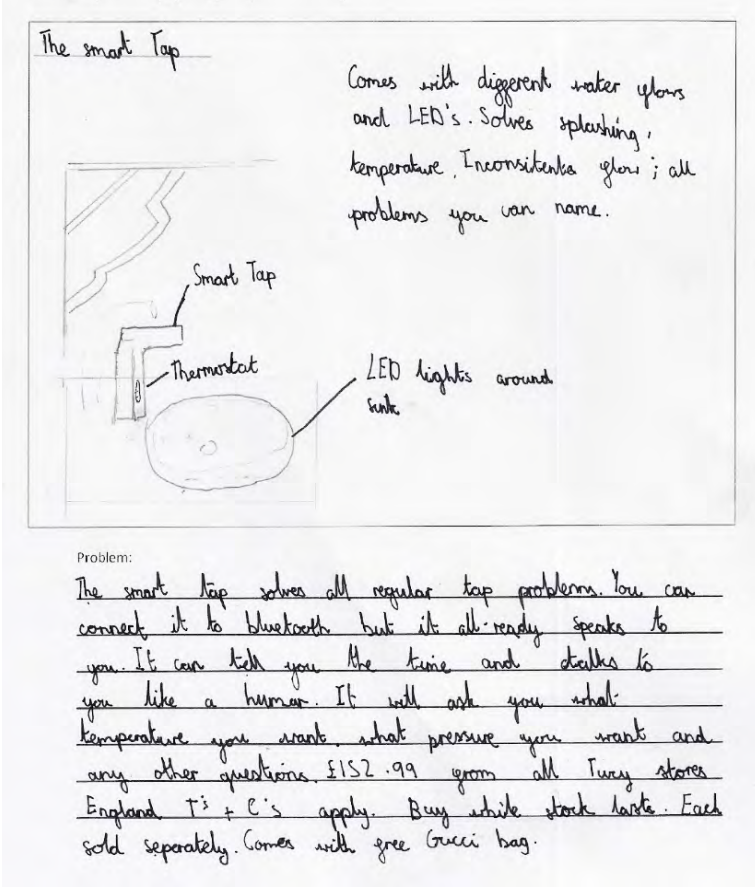
Exploring the EHoM in context

Activity 4: Exploring solutions

Pupils were asked to choose one of the problems with existing taps that they had discovered, and record why and who it was a problem for. They were then challenged to devise an adaptation that would make the tap work better for the user.



A number of pupils incorporated Alexa into their designs, reflecting their knowledge of technology.



Pupils had improved their understanding of *problem finding* by the end of this session and were able to write more confidently about their designs.

Teachers' ideas to extend and support thinking

Extending

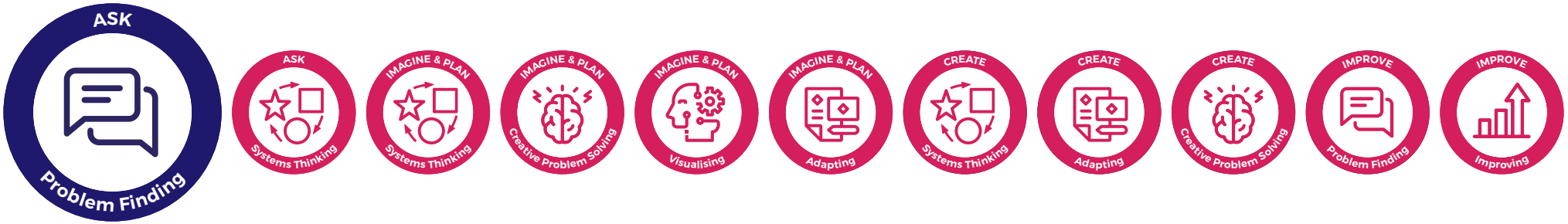
Lion Lights – the story of Richard Turere's invention to solve the problem of lions invading his Maasai settlement.

The Boy Who Harnessed the Wind – the story of William Kamkwamba who built a wind turbine from materials collected in a local scrapyard.

Further support

Pupils may struggle to identify products in their own classroom which have solved problems. If this is the case then examples need to be modelled by the teacher.

E.g. a paperclip – what problem was this designed to solve?



Ask – Problem Finding

Looking around to spot things that aren't working well or could work better

FROM – making observations to inspire the asking of simple questions, finding out more information about how things work.

TO – identifying problems and asking questions to better understand their cause.

TOWARDS – critically examining problems, asking questions to understand their cause and how they impact different users.