Problem Solving Strategies

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ETP Type: New Lesson **Subject/Grade:** IB Design Technology 11/12th

ETP Instructions for each section
ETP Rubric
ETP Prompts
Active Stem Learning

Abstract

Career Technical Education makes students aware of a wide variety of engineering and technical jobs and the skills needed to be successful in achieving a particular career goal. Troubleshooting problems towards customer satisfaction is a sought after skill. This lesson introduces students to problem solving strategies, explores real world problems, and guides students to develop the skills that employers in Silicon Valley find valuable.

Focal Standard(s)

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Students practice interviewing customers, developing help desk, genius bar and product support roles as well as analysis of real problems, development of solutions or referrals to a knowledgeable next level expert.

Measurable Objective(s)

Students will perform the following tasks.

Critical Analysis

Students will be expected to research and report on a current technology topic, problem or trend of their choosing. After locating a technology-related video or article on a credible blog or news website, students should write a three paragraph critical analysis of the article and post it to their personal classroom blogs.

Client Services

Students will write clear, unambiguous and complete follow up responses and question to a customer's situation statement in their personal classroom blogs. The writing should distinguish between symptoms and root causes and demonstrate the process of narrowing down to the likely problem area, possible root causes and potential solution approaches. Developing soft skills such as manners, empathy and active listening are key parts of the lesson.

Formative Assessment(s)

Checks for understanding will be applied throughout the lesson and will relate to the different levels of troubleshooting and analysis discussed.

Problem solving strategies.
Locate smaller and smaller areas where the source of the problem exists compared to the symptom location.
How to ask clear, unambiguous and probing questions that may lead to potential answers.
What makes something unambiguous? What makes it clear? How do you know if something is missing?

Summative Assessment

There are several entries expected in their personal classroom blogs from this lesson.

1. S: DO NOW: Vocabulary Table for Troubleshooting terminology
2. T: I DO: Steps for repairing a bicycle tire -
3. Ss: WE DO: Peer discussed problem/solution description
4. S: INDEPENDENT: Critical analysis of a new product: Three paragraphs - Started in class.
5. Ss: A Question sequence to isolate the cause for a new problem scenario - to completed as homework.

Students will be given a new scenario and asked to develop a written question list to the interrogate the customer in order to determine the problem exists, isolate it and develop a potential solution all while maintaining the customer as a loyal supporter.

21st Century Skills and Applications

Students will develop problem solving strategies and techniques that can be applied to many different real world problems.
How To Get 5-Star Customer Satisfaction Ratings when interacting with people using soft skills.
Good Manners to elicit background and relevant information
Helpful suggestions focusing on defining the problem
Step by step procedures and tests to validate the problem.
Analysis of test results leading to next step procedures.
Presenting a solution or next step for follow up.

Fellowship Description

I am working for Lockheed Martin Space Systems in their Mechanical and Development testing laboratories. This fellowship gives me the opportunity to make things and then break them and interact with customers and help to solve design and materials problems in a very similar manner to the class content on troubleshooting described here.

Fellowship Connection to School/Classroom

Silicon valley offers a wealth of technology opportunities for careers. Many students that may not fully embrace engineering can provide vital technical support roles in industry by performing help desk and other support roles. The Next Generation Science Standards describe that being able to read and understand technical materials and applying engineering skills and knowledge are an important aspect of science learning. Students use their phones for many "just in time" learning situations and then apply the new knowledge. Becoming confident and polite in such problem solving interactions with others will help secure a place in the workforce.

Instructional Plan

Engage, Explore, Explain, Extend (or Elaborate), and Evaluate.

Do Now activity: (10 minutes)

Find useful definitions, images and write your own sentence using the term.
Put an alternate language term in the parenthesis below those words.

===COPY TABLE TO THE TOP OF YOUR BLOG===
Date: _____ DO NOW: Problem solving vocabulary

Word/Phrase (alternate language)	Short definition from academic source.	Image relevant to terms.	Sentence using the terms in context.
troubleshooting			
Symptom ()			
Root cause ()			
Strategy ()			
Problem solving ()			
Isolate the problem			
Open ended questions ()			

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I Do: (15 minutes)

Discussion - Access Prior Knowledge (APK).

NOTE: Random student selection is achieved using online random dice.
https://www.random.org/dice/?num=2
The room is laid out with 6 rows and 6 seats a row and use the two dice roll to pick a row and seat, and hence a student. Students enjoy working out if it is their roll showing on the front screen. Empty seat is my choice of student (or 6x6 = always empty).

T: You look at your bicycle and intend to ride it to school.
The front tire is flat. What do you do?

T: How many of you have encountered a flat tire on your bike and fixed it yourself?

T: CFU What questions might you ask yourself?
Write on the board/screen in sequence - Anticipate: Is it a puncture? Did someone let the air out? Is it a slow leak? Do I need a new bike? Is there a nail in the tire? Do I need a new wheel or tire or inner tube? Do I have a pump? What valve type is it? Do I have a repair kit? How can I test if it just needs more air?

T: How can I test it? Anticipate - feel it - is any air in it still under pressure? Put the inner tube in water and pump it up.

T: What is an open ended question? (Anticipate - one with many possible answers that you cannot necessarily predict).
T: What is a closed ended question? (Anticipate yes or no type answers or specific answers $100)

Label the above questions - Sequence # and O or C for open or closed.
Let's look at the sequence you came up with the questions.

Anticipated questions:
T: If you said do I need a new bike? Would the best solution be to ditch school and go and buy a bike?
What does a new bike cost? A wheel? A tire? An inner tube? A patch repair kit? A pump? A bowl?

Put numbers on each level. Explain why some are there...for those unclear on how to repair.

From the questions and those with experience define a process sequence to TEST and REPAIR the tire. Create or show example flow charts. Set the task to research and devise a list on how to repair the tire. It should look like this.

1. **Inspect outside of tire carefully for holes or metal objects in the outer surface.**
2. **Pump air into tire (to see if it is just low) and wait 5-10 minutes. Is it low again? (No - go to school) Yes #3**
3. **Carefully remove inner tube from tire with appropriate tools (round end of metal spoons often works).**
4. **Pump air in tube and hold under still water - look for bubbles arising.**
5. **Note where the bubbles come from but check the complete tube for other holes.**
6. **Dry portion with hole. Apply glue and rubber patch. Hold firm for 10 minutes (or use plastic bag clamp).**
7. **Clean out tire and either precheck the tube - or reinsert in tire, affix tire on rim and then inflate tire. Hopefully you are good to go.**

T: Many times when you contact a company about a product that is not working, they may suggest first that you purchase their latest product to replace it and also we are having a special with X%

discount right now.
T: Does that seem like a reasonable strategy? If you like this approach, you might be suited to join the marketing and sales team at a company. Refer to upselling/cross-selling techniques.

Is the hole in the tire the "root cause" of the problem?

If not, what might it be? Perhaps you keep riding your bike through some push pins you did not pick up in the garage? Perhaps you drove over some sharp metal, or a nail in the street?
Some root causes you can fix (or clean up). When you are aware of them, you might find yourself picking up nails and sharp objects because you recognize a problem that can cause you grief later.

For each question - what is the next follow up question that would help to ISOLATE the problem OR devise a TEST that will help solve the problem - have you tried pumping the tire with air? Did the tire stay inflated for more than 5 minutes? Have you taken the inner tube out of the wheel? Have you pumped the inner tube and put the is in a bowl of water? Do you have a patch repair kit?

Random call upon/selection of two or three students to recount their experiences in troubleshooting situations from start to finish. Check that they have the following components.

Sometimes the company will ask you a series of such follow up questions after first asking details about who you are - Name and contact details (in case you get cut off or your battery dies).

Real world technical support questions may include (some are closed ended and others open). Describe why these questions are important:

What is the make and model of the product?
Serial number?
When did you purchase it?
How or where has it failed?
Have you tried... ? The company has experience and may suggest tests like for the bicycle tire.
Did you do this ….?

In general, these types of conversations are important to help define the problem and then develop a solution pathway.

Solving? How and where do you start on the solution to the flat tire?
T: Do you start working on the rear tire? No - it is not flat.
T: Do you start working on the saddle? No it is not related to the issue.
In essence you focus on the symptom location and work around that area.
NOTE: Many symptoms are remote from the root cause and isolating the problem is a key way to determine the source along with following the connected parts of the system.

T: Do you pump up the tire first to see if it just "needs" air?
Try a pinch test - is it flat or low pressure?
Potentially have a wheel per group with a low pressure tire.

Some flat… give students opportunity to fix if they never done so before.
Could be an assessment.

We Do, You Do, You Do Collaboratively: (30 minutes)

1.) Discuss with a partner a help desk scenario and the following questions:

When you talked to someone, how was their attitude when you asked them for help?
Similarly, how was your own attitude when you were asking for help?
Anticipate: Angry, annoyed, judgemental, snippy, neutral, kind, helpful, cheerful, amazing.

What is the best way for the person with the problem to interact?
Neutral (with a sense of injustice perhaps)

What is the best way for the help line person to interact?
Neutral to amazing - as the helper

Which kinds of interactions do you remember the most? Anticipate the extremes, anger or complete satisfaction.

What happens if a customer goes away feeling angry because they were treated badly?
Anticipate: Lost customer or worse an active bad mouther of your company which will affect reputation.

What happens if a customer goes away feeling completely satisfied?
Anticipate: Gained a loyal customer who will tell everyone of their experience.

How does this relate to how you talk to each other and treat each other at school and in class?
Anticipate: The more positive the interaction the happier we will all be and more willing to help others.

What causes the negative situations?
Anticipate: Frustration, impatience, disrespect, adrenalin, confrontation, loss of money, opportunity. Prejudice against the negative people and company. Unmet expectations.

So, how do you think companies want you to feel about their products?
Anticipate: SATISFIED to OVERJOYED.

Ss: At the end randomly selected students report out and describe a real support situation (10 minutes)

How many of you have had a problem and googled it and found an answer that you then put in motion and completed?

Talk to your neighbor about the situation and the solution. How well do you trust the sources you

found? How easy was it to follow the solution?
Were you happy?

Document the situations your group discussed in detail - up to THREE paragraphs.
You may include links and other information to support the solution you came up with.
Use SNIP tool to show examples of the solution you found.

Three random report outs of the complete story your neighbor told you.
Rows 1-6, Seats 1-6 Dice Rolls. (6x6 is empty - teacher's choice).
https://www.random.org/dice/

What you did by "googling" is referred to as "Level ZERO" support and companies just LOVE this (in most situations).
What are good sources for such help? Anticipate: Google - Youtube - Company website's customer support pages - Independent User forum - Yahoo answers etc. Yelp?

Why would companies prefer this approach? Anticipate - they are not directly interrupted or bothered by the customer but can monitor and improve their products by following such use and comments posted. Hopefully the cost of keeping information and solutions on the internet is relatively cheap. It is "Just in time learning" for the customer - something we are all becoming familiar with in our lives.

Many of the resources we "google" are "user groups or product forums" customer support reports and often their is an option to "chat directly" using instant messenger with someone at the company - this is the new "level 1" support. Are you sure that the answers you are getting from "Instant Messenger" interactions are from a real person? Some use Artificial Intelligence software to try and help you.

How long would you spend to find a solution to a problem? Anticipate a range 2 minutes to 2 hours (fixing a car).
What factors impact that time? Anticipate: Cost of replacement, frustration level with product…?

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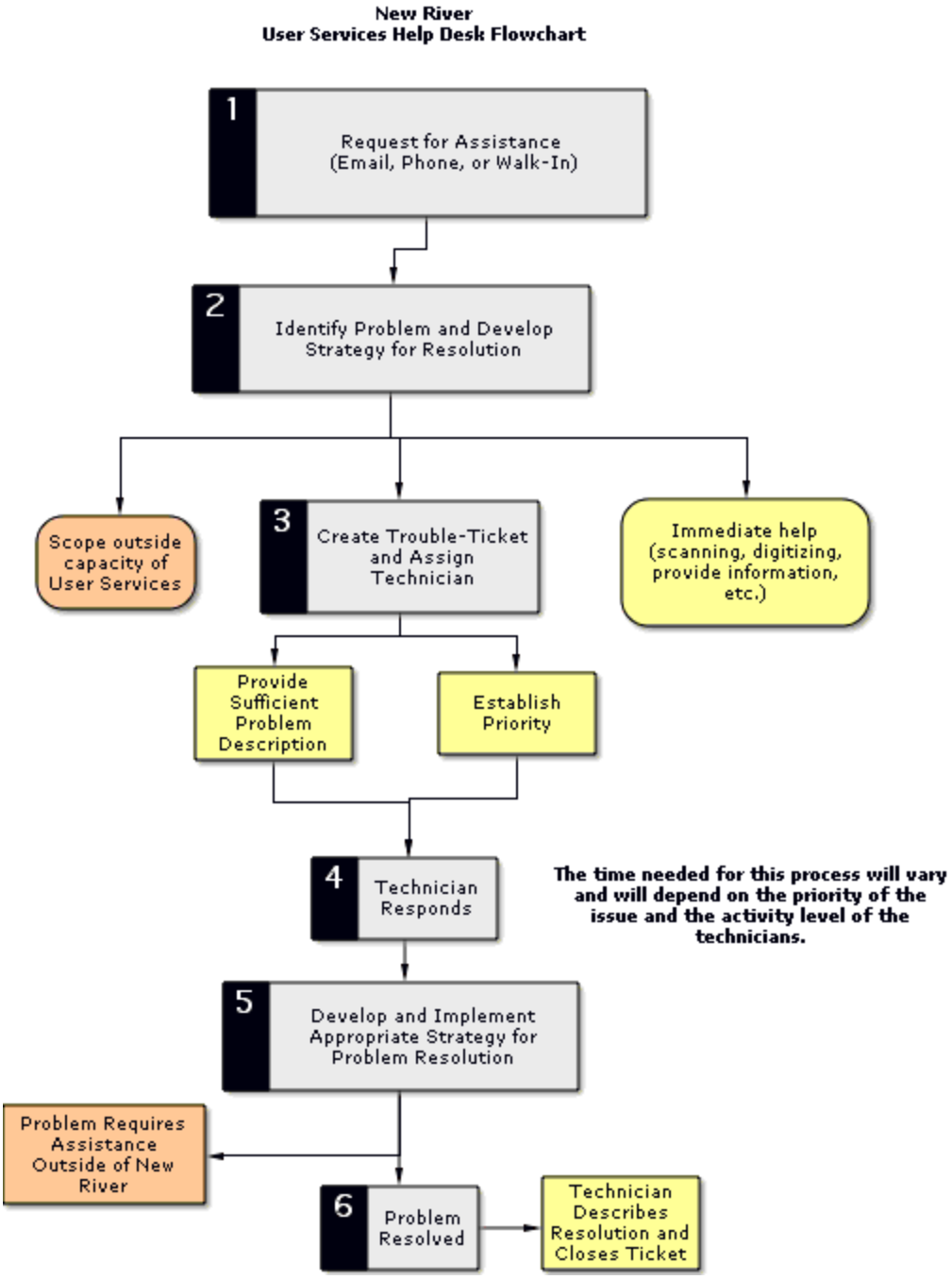
Support level descriptions.
Level 0 support – Automated or self-service solutions that users can access themselves without the aid of the Help Desk.
Level 1 support – Filters Help Desk calls and provides basic support and troubleshooting.
Level 2 support – Generally reserved for product/device support but it may also share work with Level 3. Level 2 generally handles break/fix, configuration issues, troubleshooting, initial root cause.
Level 3 support – Troubleshooting at a systemic level that determines root cause and implements the solution. Employee has a view of the big picture and history of the product.
Level 4 support - Rarely used, but often an external support provider or third party outside of the company.



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Many people prefer to talk to real people and use the phone to solve problems.

Professional phone calls.
Telephone manners are important to convey the positive message "I am here to help you." Sometimes you cannot answer the problem but you can "refer" the customer to the next level person or provide other suggestions that may help. Try to SMILE while you talk. Be KIND and UNDERSTANDING about how the customer is feeling.
LYFT and UBER drivers are rated on how they behave and it is in their interest to get a high rating every time they meet a new passenger.
Doctor's offices or hospitals, or vets, have "TRIAGE" technicians who talk to people about their SYMPTOMS and discuss the CAUSES and EFFECTS of various problems. They are trying to assess how serious the problem is so they can advise if something is LIFE THREATENING - URGENT or to what degree it is less of a problem. The same is true for Police and Emergency services dispatchers.

So you can see that many different types of employment involve having important and clear communications. Things to aim for

CALMING - Have a calm tone and try to empathize.
CLARITY of speech. Speak slowly, and loudly enough (do not shout for people that cannot hear).
POLITE. Always say "Sir, or madam" and show respect. Please and Thank you help too.
PLAYBACK. Say back what you just heard in your own or different words. This helps to confirm you heard and understand what was said.
PROBE. Ask questions that will help you isolate and narrow down the location of the problem.
REFER. IF you are unable to find a solution readily, refer the person to the next level contact.

INDEPENDENT PRACTICE.

Develop YOUR OWN scenario (JUST ONE) of a dispatcher/help desk/customer service type conversation for homework.

Pick one of the following scenarios (or your own).

1. Game station move.

Have you ever taken your game station (Sony, Wii, etc.) to someone else's house and tried to set it up? Write down clear answers and follow up questions to solve the likely problem(s).

Caller	Help Desk
My game station setup is not working?	Do you see a green light on the game station box?
Yes it is on	When did it work last?
Back at my house, yesterday.	So you have moved it to a new location?
Yes, I wired it up at my friends house	Is the TV set to the correct input for the game console?
(complete or pick another situation).	

2. Playlist swapping

You want to share your latest playlist with a best friend.
How would you do that if they do not use the same phone as you?

Caller	Help Desk
I want to share my iPhone playlist with my friend but she has a Samsung phone	(research this and provide a best fit solution).

If you prefer, pick another real world scenario and discuss that process. List the steps you need to take. Did it work first time? How did you solve it?

Other scenarios.
3. TV does not turn on?
4. Computer will not start?
5. Screen is blank?
6. Car won't start?
7. Cell phone screen is blank.
8. A scenario you may already be familiar with…

Closure: (10 minutes)

Homework assignment: (5 minutes) Complete the work in progress on your scenario, such that a solution has been described.
Consider what does a company do when it gets a large volume of calls about a problem for a product? Anticipated Answers: Cars get recalled if a safety issue. The designers revisit the product and design around the problem for the next version.
We will be reviewing the homework in class next time.

Independent Practice:
Additional to the homework, you may try these games.

Interactive games…
Customer service sequence - EDITs required for the audience.
https://www.quia.com/rd/306379.html?AP_rand=1703934199

Communication Skills/Problem Solving
https://www.quia.com/jg/2819197.html

Supply List

Computers (one per student)
Multiple Flat tires/pumps/repair kits (optional)

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Keywords

See vocabulary list in DO NOW:

Links to Files in this ETP