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WHAT  REALLY  
BUG' ME

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*Problem Finding & Solving*



**Submitted by:**

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### **Early Book for 4-8<sup>th</sup> grade readers**

**Title:** What really bugs me!

**Concept:** Starting from a problem (BUG), a group of friends learn how to solve the problem and create a design solution for it.

**Learning outcome:**

Children will understand the vocabulary of creative problem solving and doing a design. They should be able to draw a flow map of the process and create a sketch of their design.

**Visual:** pictures and the book should look like a student's notebook. Have pictures that look like drawing done by the owner of the notebook. Drawing of what his/her friends look like, some changes that reflect trying something and them changing based on the outcome.

#### **Outline:**

A group of kids that get together after school each day at the park, one of them starts an exciting adventure when he talks about what "Bugs him".

What was the problem that appeared? Did other children have BUGs of their own?

- Discovery /Beginning
- Research
- Forming a learning team
- Framing the problem
- Developing the requirements
- Brainstorming many solutions
- Narrowing and Deciding
- Testing & Redesign
- Reporting

#### **Key Items:**

- Discover the children's characters and traits and explain
- Learn new things by similarities to other areas- A team to a sports team
- Team made up of different nationalities and how does that help them.



Let's build a matrix of personalities for each friend

Friends name		Seriousness	Curiosity	playful	outgoing	Determined / Grit
Jada	F/B					
Sophia	F/H					
Mike	M/A					

Tough's book outlines seven-character traits that he says are key to success:

- Grit.
- Curiosity.
- Self-control.
- Social intelligence.
- Zest.
- Optimism.
- Gratitude.

Vocabulary:

Word	Description



## Discovery/Beginning:



It was a rainy afternoon that found the group of friends under an overhang at the school playground. The rain came down quickly with large drops that stopped their game. The drops made a nice sound on the metal roof above the group as they begin to chat. The sound made it exciting and the cool breeze felt nice after all that running during the game, but something was not right.

Matthew was the first to speak. **“This really BUGs me** when this happens. I just don’t like to stop in the middle of a game when you don’t expect it”.

Hannah spoke up and said “I haven’t heard that word before; what does it mean “Bugs me”; where did you learn it”.

I think my mother uses it a lot at the engineering company she works at. It is a problem you have that needs to be solved. My father says he had to learn some new vocabulary words to talk to my mother, but I guess that happens with any job. Well in that case, Hannah said, “I also have a BUG”. “I always have a problem with my alarm clock because I don’t know how to set it to ring”. Then Cal said, “that his BUG is taking off his shoes at the door of his house”.



## Research:

Everybody started to talk about their BUGs. When it quieted down, Matthew said “we ought to speak to Mr. Liu at school to discuss with him what we should do about all these BUGs”.

It was fortunate that they all were in Mr. Liu’s Literacy class at school. The first day they were free to talk, the group approach Mr. Liu and discussed how they all had Bugs’ and asked him what they should do about it. He asked the group if he could have some time to think about what they said and discuss it next week. But, in the meantime, Mr. Liu suggested that each keep a notebook with them at all times and jot down when something bothered them or was a new experience. This way each of them, over the next week, will come up with few items that they can share. Elizabeth thought this was a neat idea because she likes to keep notes about what interesting things she does. The other day she remembered that she learned to skip rope with Dahlia and how much fun it was. It was like her special vault where you can look back and recall interesting points in her life.

Mr. Liu thought about what just happened after the group left his room. He felt proud of his students for taking the initiative to bring him their thoughts. He was excited to support them in their quest about solving problems. It brought memories of when he was young and exploring things in Literature. He remembered how he would find characters in books that had problems that he liked to help by solving their problem. The excitement of picking a character he wanted to help in the story gave him more interest in reading the book.



NORMING



### Forming the Team:

During the following week, the group could not wait to update their book and to see Mr. Liu. The group agreed to become the “BUG team” and work together like they do on their sports team. They agreed to make Matthew their leader and be more responsive to each other and make up a list of one BUG from each of them and pass it to all for review.

### Things we must do:

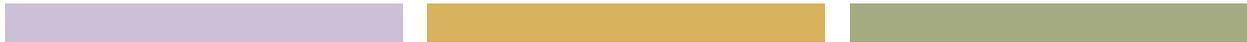
- Changing from a sports team to a problem-solving team
- How is a sports team and problem-solving team similar?
- What agreements we need to make?
- What are our values and norms?
- What is our goal?
- How do we use questions in our process?
- What principles do we want to operate as a team?

### The Team

		
Emma	Dahlia	Others

What are our set of principles that we want to operate as going forward the group asked?



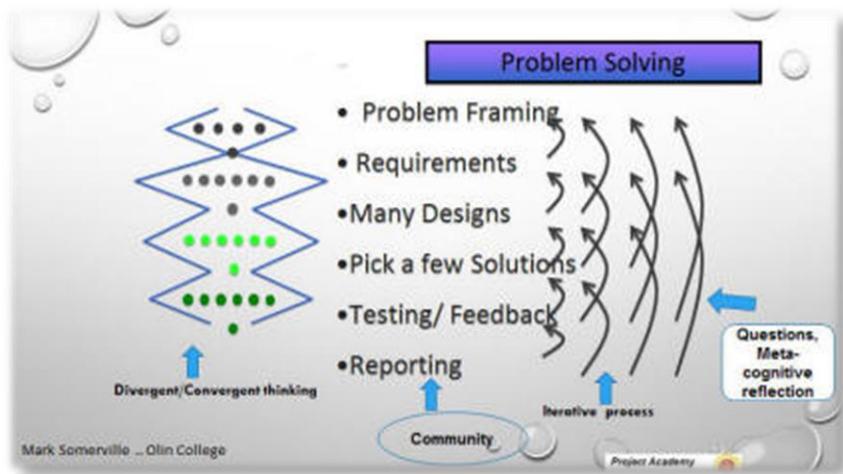


<b>Definition of Principles</b>	a fundamental truth or proposition that serves as the foundation for a system of belief or behavior or for a chain of reasoning
<b>Principle 1</b>	<b>Wisdom</b>
<b>Principle 2</b>	<b>Responsibility</b>
<b>Principle 3</b>	<b>Make the world a better place</b>
<b>Principle 4</b>	<b>Loving kindness</b>

**The (Only) Seven Spiritual Principles We Need to Succeed**

- The Principle of Gratitude. Every day is a gift; every breath is a gift. ...
- The Principle of Humility. ...
- The Principle of Optimism. ...
- The Principle of Generosity. ...
- The Principle of Forgiveness. ...
- The Principle of Intention. ...
- The Principle of Expectation.

**Problem-Solving Process:**



Explain the problem solving process ( series of steps) it is iterative and each step has both divergent and convergent thinking

Elizabeth decided that she wanted to be the scribe of the team and record the history of the groups venture about BUG's. She recorded in her journal the list the group came up with.

Name	Main BUG
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Matthew	Stopping in the middle of a sports game
Emma	Doesn't know what to wear when she gets up in the morning depending on her mood
Cal	having to take off his shoes at the door of his house
Dahlia	My juice box is warm when I take it out of my lunch box
Elizabeth	The first part of climbing a tree is difficult. I want to make it easy to climb the tree.
Madeline	The baby chicks from my brother's room come into my room
Hannah	have a problem with my alarm clock because I don't know how to set it to ring at a certain time

When they finished the list, they were even more excited to talk to Mr. Liu about what is the next step.

"Can you think of exciting, or silly ways to solve these BUG's of your friends?", asked Mr. Liu. First, I found out where the use of the word "bug" came to be for a problem Mr. Liu said. It happened many years ago when a piece of equipment failed when an engineer tried to do a test. They first thought that a real bug got into the equipment and that made it fail. So, from then on, Engineers called problems BUGs.

From this list we should decide which BUG we will work on. Mr. Liu thought about his youth growing up in Taiwan and how he had a group of friends that did things together. Was his group as collaborative as this group he wondered?

The team were excited to work together to create more possible solutions and build on ideas that others have. Many times, when I hear an idea from one of our friends, it makes me think of another possible solution. They took the list of BUGs and added a discussion column to add more detail to help them sort which BUG to work on.

We have to be careful to understand what problem the person is really having before we rush to solve the issue.

The group went off that week to look at all the BUGs and see what they can modify any to make it more common. The group agreed to pick one BUG to work on that seem to fit the groups need.

#### List of BUGs with discussion:

Person	Main BUG	Discussion
Matthew:	An unplanned stoppage in a game	Not everybody is bothered by this.
Emma:	List of clothes to wear based on your mood when you wake up	Everybody could see the use of this 



Cal:	having to take off his shoes at the door of his house	Some mothers do not do this
Dahlia:	My juice box is warm when I take it out of my lunch box	We all bring juice to school
Elizabeth:	The first part of climbing a tree is difficult. Make it easy to climb the tree.	A real problem for all
Madeline:	The baby chicks from my brothers room come into my room	A problem for Madeline but not anybody else. Group says she should close her door.
Hannah:	has a problem with her alarm clock because she does not know what time it's set to ring	Is a good problem but most of us don't use an alarm clock.

It came down to two (2) BUGs that the group felt that they would like to work on. They decided to do the juice problem first as some of the team felt that designing a method to climb a tree might not be appreciated by their mothers or fathers.

### Add more items about being a team, I.E What are our goals, Listening more



#### **Framing the problem:** Starting the Design effort ... Framing (Defining) the problem

The friends got together after Mr. Liu's class to discuss what they were going to do about solving the issue of keeping the juice cool.

Mr. Liu saw the group discussing their next steps and suggested they follow a simple creative problem solving process. It starts with knowing what problem you are solving, finding lots of possibilities, narrowing the possibilities and then design and testing your solution. He thought to himself how he was inspired by Albert Einstein, the physicist, who said it is very important to spend the time on problem framing (what is the real problem) before you rush to finding solutions. "How do we state the problem" said Cal. 'Can we freeze the juice as a solution' asked Elizabeth? 'Will freezing the juice cause problems with the juice container or damage the juice'? Asked Elizabeth. 'How long does it have to last being cool' wondered Madeline. It seems that there were lots of things the group needed to discuss to decide on the specific problem before they worked on solutions. 'Is there something that we can buy in the store to solve the problem" said Madeline again.

Matthew said, "Many times we go and try to find a fix (solution) to what we think the problem (Bug) is but it is not the right answer". "Let me give you an example of what happened with me last year. I told my father that I was lonely, being a great dad, he went off and tried to solve the problem by organizing a few play dates for me. Although they were fun, I still felt the same. My mother asked me some **questions** and it comes



out that my being lonely was really I wanted to find some friends that had the same interests as me to play with". "But how do we do this;" said Hannah?

Everyone looked at each other when Emma said, "maybe we can use questions to ask Dahlia about her Bug to see if there is something else that is the real problem". "That is a great idea" said Hannah. I want to go First!!! She thought for a minute ... "So Dahlia, you said that your juice box is warm when you go to drink it with your lunch? Is that the problem"? (Clarifying the problem) "

Yes when I put the straw into the juice box it is warm", said Dahlia. "Does it make a difference what type of juice it is" asked Elizabeth. "No" say Dahlia. Matthew then summarized the facts we know (...presenting the facts of the case):

- It happens between when her mother packs the juice box and when she has it in school for lunch.
- The juice does not taste good warm.

"What does warm mean" asked Emma? Is it a certain **temperature**? Shouldn't we know it so we can test our solution. Also, how long is the time between packing the lunch box and lunch time. Matthew then said "we have lots of questions such as the temperature of the day and its effect on the juice. What about the initial temperature of the juice, how does that effect the final temperature"? We need to create a **list of Requirements that we want our solution to meet**. This will be how we measure the different solutions we come up with.

### **Developing the Requirements**

Then Cal broke the spell when he said "what's the big deal, just drink water from the cold water fountain" When Mr. Liu heard the story, he thought of the word "**Empathy ... Walking in someone shoes**" that Cal did not display. We have to listen to others when we look for reasons. Mr. Liu thought this was not only important in problem solving but in living your life. A good lesson to learn.

### **Add a few more values**

Everyone agreed that they now had a problem to solve and they would do it together the next time they meet. They agreed that the problem or bug they had to solve was "**How to prevent the juice box from getting to a certain temperature by 12PM starting at a temperature= () at time ?** They felt it was important to express it as a question. It was couple of days before they met again was exciting for many of the team. Ideas would pop into their heads at all times. One of the groups, Madeline even went and used her note book to **capture** her ideas because she was forgetting some of the good ones.



At school, they all agreed to meet at Dahlia house to try and come up with a list of possible fits. Dahlia said “she would see Mr. Liu and ask him what they could do to get lots of ideas to fits the problem”.



**Picture:**

**finding lots of potential solutions...**

When they meet, Dahlia told the group what Mr. Liu had said to her. “He explained about Brain Storming and Brain-Writing as a way to get good ideas”. Mr. Liu “said that each of these methods could help us get many potential ideas”. He said “that to do it right, we had to follow some rules”. The rules weren’t hard to follow but we had to do it. The rules were:

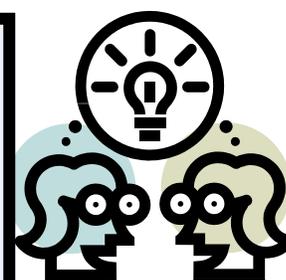
**Rule 1: Postpone and withhold your judgment of ideas**

**Rule 2: Encourage wild and magical ideas**

**Rule 3: Lots of ideas counts at this stage, not how good they are**

**Rule 4: Build on the ideas put forward by others**

**Rule 5: Every person and every idea has equal worth**



No idea was bad/wrong and we should not judge what each of us said when we gather the possible solutions to the problem. We should not be limited in our ideas but think **magical** about possible solutions. Also we should look for quantity and not worry about being right or the best idea. We should try to build on ideas from each other and all of us had equal worth. This sounded like some good advice from Mr. Liu. When we brain-storm, someone writes the ideas we have and puts them up on a wall with sticky note paper.

The brain–writing was very similar to brain-storming but we wrote the ideas on a card and passed the card to the next person on our right. We would read the card and then write our idea on another card. These kept getting passed around until we reached our goal. This all sounds complicated but I think we can do it. Mr. Liu could see the excitement in the group and thought of his love of science coming from his excitement in doing experiments when he was younger. He wondered how can we keep children excited about learning.

The team decided that we need to listen more to each other and have trust in our team-mates. These are values that will help us in all our classes.

: The team got together the next afternoon after school all excited about trying this out. Many of the group had some ideas and couldn’t wait to tell the others. “How are we going to do this” asked Matthew? “We need some rules”, said Emma who had been thinking about this said; “we need someone to be the person to write each idea on a



sticky note when it's said". We should go in turn and we should put the rules up on the wall so all will see them. Hannah said "she would like to be the person to put the ideas on the sticky note as she like to spell different words". Cal said "he would like to be the person or **facilitator** who made sure we following the rules and our discussion followed the questioning approach". It seems to the group like when they play a game, they decide on rules and choose who is going to do what in the game

The group agreed upon the problem of the following:

**How to prevent the juice box from getting warm when lunch time came about.**

This meant for 6 hours, assume Dahlia took her lunch at 6AM and had Lunch at 12PM. We also had to figure out what at what temperature the juice box needed to be above for Dahlia to say it was OK. Cal said he had a temperature gauge so they could measure the juice at different points to see which one was the minimum level for being OK. They agreed that they would measure a glass of juice **temperature** starting from the refrigerator over a 30 minute time to see at what temperature the juice was not cool enough for Dahlia. Dahlia would take a sip every 5 minutes and say if it was still cool for her. Once we have this temperature, said Matthew, we have a way of testing whether we have solved the problem. If our design keeps the juice cooler than the temperature from 6AM to 12PM, we have a solution. It is interesting, said Madeline, that by thinking about the problem, we came up with the test method to see if our design works.

Picture: Showing the test and agreeing on ?? degrees F

The group met in Dahlia's house to do the **brain-storming** to get lots of ideas. They reviewed the rules and started:

<b>Build a very small refrigerator to keep the juice cold</b>
<b>Freeze the juice box before putting it in the lunch box</b>
<b>Put the lunch box in a cooler at school</b>
<b>Have your mother delivery the juice just before lunch</b>
<b>Drink cold water from the water fountain at school.</b>
<b>An insulating sleeve that keeps the juice cool</b>
<b>A straw that cools the juice when you drink thru it</b>
<b>Special juice box that keeps the juice at the correct temperature.</b>
<b>A special lunch box that keeps the juice cool using a freezing pack</b>



Once we had the list of possible design solutions, Mr. Liu said we should discuss which one or two which best fits our needs. We should also look at combining some of them To make a better possible solution.

### Discussion around the ideas

Idea	Discussion
Build a very small refrigerator to keep the juice cold	Seems too magical for the team to do
Freeze the juice box before putting it in the lunch box	Promising idea, but would the box take freezing with out breaking and would the juice be too cold?
Put the lunch box in a cooler at school	Have to get school permission which would be difficult
Have your mother delivery the juice just before lunch	My mother works so this is out
Drink cold water from the water fountain at school.	I don't like water with my lunch
An insulating sleeve that keeps the juice cool	Sounds like a promising ideas
A straw that cools the juice when you drink thru it	Sound magical
Special juice box that keeps the juice at the correct temperature.	This would be interesting to get the juice company to design a box that does this
A special lunch box that keeps the juice cool	This could be done with an ice pack in the box

**The group settled on the following two ideas to continue to work on:**

1. putting it in an insulating sleeve.
2. designing a lunch box that had space for the juice box and an ice pack.

### How are we going to decide ?

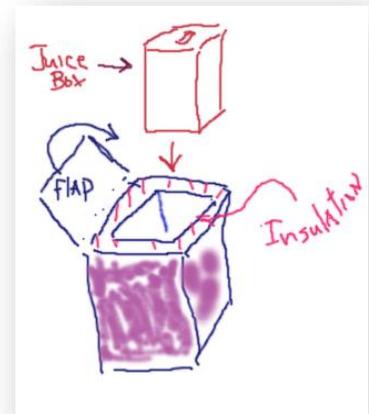
Everybody was excited that they actual had two good ideas to work on. This problem solving is lots of fun and we are getting results said Matthew. But Madeline asked how do we pick which one to work on. How about if we had a list of **requirements** that we want for our design said Cal! Emma was confused about what a requirement was and how it applied to our activity. Matthew said that in his history class they studied how some



inventors made lists of things they wanted to have for their designs. This could be like the requirements.

Dahlia thought about **safety** and said that could be a requirement like no sharp edges to cut your finger. Another one could be that we use ready available material and don't have to find special things to build our design. The group was cooking with ideas about requirements they need to think about for their design. This will help us when we begin our design said Matthew. They quickly came up with three more areas; it should be re-usable, Not cost lots of money and be easy to use.

Requirement	Importance
Safety	Very important
Available material	Important
Reusable	Very Important
Cost	
Ease of use.	
Insulation	
Flexibility	

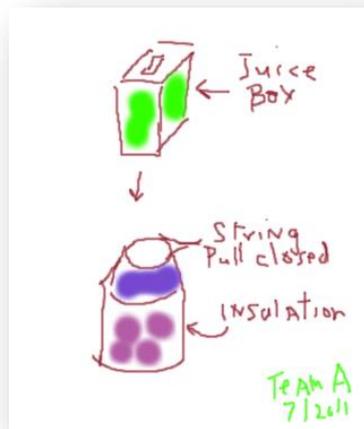


Looking over the requirements it appears that the insulating sleeve is the item we should try to design.

### creating the blue-print “Sketch”

Mr Liu said that before we build anything we should sketch out our design with a drawing and annotation showing what things are. The group split up into two teams and created their drawings. Looking over the two concepts they seemed similar except the top cover. The group agreed that a string closure was the best approach. They need to figure out the insulation for the product.





The group was very proud of their sketches and all wanted to bring home a copy to show their parents. Mr Liu was also impressed. He noted that it would be good to date the sketches and sign our names on the paper. This way we have a record of the time and who did the work. Also, when we have to change our drawing, we would put a new date so we had a record of the history of the design.

### Design, Build and Test

Elizabeth said her mother did a lot of sewing and they might have fabric and insulating material for the group to build its' product. We ought to think about a list of materials we would need to do this project, Emma said. Madeline took her notebook and started to create a list of materials. We will need fabric, insulation material, glue, string, seizers, a temperature meter, and a clock. **What makes an insulator good or bad?** "Do we have the measurements for the juice box that we can give to my mother" asked Elizabeth. I think we need some buttons to add a little style said Emma who always was thinking of her moods and its effort on her dress. "How are we going to know if it works" said Matthew? Cal said that after they build the first version, they would get a juice box and put it in the refrigerator for a day and then put it in the case they designed. Every hour they would measure the temperature of the juice box in the case to see how it stays cool. Emma asked what things we have to worry about to make the test true to real life? If it's a hot day, that would affect the juice box temperature versus being a cold day for school. "Do we know what temperature is cool?" Asked Emma

### Testing and reporting

Matthew said that they should break up into three teams and get the following information:

- What temperature is it when it goes from being cool to warm?
- What are the measurements for the thermal sleeve?



- What is the ambient temperature that we should use when we test the sleeve?

### **Making our presentation to Mr. Liu and other teachers:**

Matthews father had given us an **outline for the presentation**. It was from his mother that they used in her company to sell ideas to others.

- Intro-About us
- Problem you are solving
- Goals
- Product/Services you are providing
- Uniqueness
- Benefits
- Summary/Next steps

### Constraints on the story:

1. Each page has to create some suspense that is answered by the next page
2. Need to develop a **vocabulary** (highlighted words) of key words in the story
3. Need to ask **Bloom higher order** thinking questions around the story.
4. Picture on the page that shows where this fits into the total picture. ( like a road map)
5. A game the students can play around the theme.
6. Less than 40 pages ( text plus picture)= 20 text pages
7. Teacher's templates, examples
8. Poem or other literacy activity





Additional items:

Page: Vocabulary

Page: Higher order thinking questions

Page: Reflection

Page: Games

Create your own list of what bugs you

Flow map of the Problem-Solving Process

Review of Book:

