

#### **Alicia's Diary**

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Published with support from Xanana Gusmão Reading Room and the Andrew MacNaughtan Foundation.

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#### Foreword

Science and mathematics are all around us. They are in our homes. Just ask your mother or your big brother about where the water in the pot goes when you boil rice to cook. They are in your back yard. Just look at what happens when you plant a tomato or other seed in the soil. They are in the sky. Have you ever noticed a rainbow form after a rain shower? Some people think you can only teach and learn about science and mathematics in a laboratory with sophisticated equipment. Alicia, the main character in this book, knows that the best laboratory is the world around us. And the best way to find out about science and mathematics is to ask many questions and not be afraid of experimenting. Sometimes learning new concepts can be difficult and confusing. That's why it is important to learn those new concepts in the language you know best. For some kids, it is Tetun. For others it is Mambae, Makassai, Baikeno, etc. The language your parents and grand-parents speak contains many secrets about our environment, nature and culture. And in all of these things there is science and mathematics! Just ask your grandmother how she knows how to weave the lafatik. Just ask your auntie about the colours she mixes to dye the threads for her tais. Science and mathematics are all around us. Just ask Alicia!

Kirsty Sword Gusmão Timor-Leste's Goodwill Ambassador for Education

# Note from the author

Hey, kids! It's true you can learn many things at school, but you can learn even more outside of school! Alicia learns every day from everyone she meets and everything she sees. When she has a question, she find someone who might know the answer and asks them!

Alicia also loves to read. If you read and ask questions, you can learn anything! Go for it! Don't let anything slow you down!

Gabriel

## Note from the illustrator

Good day kids! I drew the pictures in these stories so that you can follow Alicia's example of how she does so many things every day. I'm happy when you are happy and playing freely. Aside from playing, I also want you to be able to watch the time, study hard, and help your mom and dad with chores. You should also rest and eat well in order to become smart.

I can see that this girl Alicia loves to write her own stories. She is always looking to learn something new. She not only loves to write and read, but she also loves mathematics, drawing and painting, singing and playing music, writing poetry and more. Alicia talks freely and loves to tell her wonderful stories to her mom and dad and her friends. Alicia also loves to travel to interesting places. You must know that when you travel and enjoy new places you can get smarter, because you can see and do new things with your friends, such as playing in the ocean, looking for fruit in the forest, catching frogs in the ponds, or playing tag and football.

Ok, that's all! Read well, and also play well!

Pele



Yesterday my family was driving back from Liquica and we stopped to buy salt. We asked the woman selling it how it was made.



Her name was Tia Rosária and she spoke up with enthusiasm: "Come with me and I'll show you the whole thing! My daughter is working there right now."

We walked with Tia Rosária toward the ocean and saw a large flat area.



We saw people shoveling up the topsoil. Tia Rosaria pointed to her daughter putting soil into a cart.

"The dirt out there gets soaked with sea water twice a month when the tide rises very high, and then it dries out when the sun shines on it. The water evaporates and leaves all the salt in the soil. Can you can see the soil there has white streaks in it? That's the salt."



Tia Rosaria then helped her daughter push the cart with the salty soil to a big pile of dirt with a wooden structure on top. We tried to help, but the cart was really heavy.



At the top of the pile, they dumped the buckets of dirt into the wooden structure. The pile was taller than a house!

"We built this filter with local wood," she said as they continued dumping the dirt into the box and spreading it out.



Then her daughter went after the sea water to pour over the soil. They carry the sea water in two-meter lengths of fat bamboo balanced on their shoulders. Tia Rosaria pointed out old men and women also doing this work at other structures nearby under the hot sun. They were so strong!



When her daughter came back, they dumped the sea water over the salty soil they had just put into the box on the structure. "You see, when the sea water flows through the salty soil it dissolves the salt from the soil into the water so the water becomes even more salty!"

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Tia Rosaria and her daughter scooped up the water after it came out the bottom and poured it back over the soil several times to dissolve all of the salt from the soil into the water. I tasted it with my finger and it made my lips burn!

Then they used the fat bamboo to carry this super-salty water to a little shack nearby.



In the shack was a big wood fire with a giant tray on top of it. Tia Rosaria explained, "We made this tray from the steel of a 200 liter drum, using just a hammer and a machete. We don't have much money, but we can make many things ourselves and we're proud of it."

Her daughter carefully poured the water into the tray and we stood there watching it until it boiled. The fire was big, so it boiled pretty fast and the water began to disappear. Soon the water was nearly gone and we could see the salt crystals forming.



"When it's done, we'll put it into these baskets. We make them from local materials too!"



Tia Rosaria pointed to several small baskets sitting by the wall. She pointed to the palm trees on the other side of the road and showed us how she weaves baskets out of the leaves.

When the salt was mostly dry, they separated the dirty parts out and put the clean white salt into each basket. Each basket sells for 2 dollars. "Our family doesn't make much money on this and we have to work pretty hard, but this is the best way to make a living in this town. My family has been doing this for at least two generations."

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"Where did your ancestors learn how to do it?" I asked.

Rosaria shook her head. "Nobody is sure where the process originated, but people from Mozambique may have come here and showed our grandparents how to do it many years ago."

When we found out how interesting the salt-making process was, we bought even more salt. We're planning to give it to all our friends and tell them about how Rosaria's family makes salt from the sea!



# Tinker with Salt!!

- Mix a lot of salt with one liter of water and stir it well.
- Make a hydrometer to test the water's density. Tie a straw's end shut with a rubber band.
- Tie it well so that air can't get out or in.
- Put a paper clip onto the rubber band.
- Drop it in the salt water until it floats upright. Maybe you'll have to increase or decrease the paper clips to change the weight.



- Mark the level of the top of the water on the straw.
- Take it out and drop it into some fresh water to make a comparison.
- Put it in oil or kerosene or alcohol also to compare.



# What's going on?

Anything that's dropped into a liquid will float at a certain level depending on that thing and the liquid's density. You can use density to determine how much salt is in salt water. When there is a lot of salt, the water's density will increase, and the thing will float a little higher in the water. Oil and kerosene have lower densities than water, so things will float lower in them.



On the way back from Lospalos, my mom and I had stopped at a little stand beside the beach road. They were barbequing fish on little fires and the smell was great.



Just then an old grandma came out of one of the little shacks by the beach and was coughing terribly. We saw smoke coming out of the shack. We asked the fish seller what was the problem.

"Grandma is always coughing!" said the woman selling fish.



"There's a reason for that!" said another woman who was walking by and had stopped at the stand. She looked like a nurse.

"Her kitchen shack has no hole for the smoke to escape! Who built that for her?"

The woman at the stand looked embarrassed. "Sister Nurse, my husband put that up quickly last week. He didn't have time to make a chimney hole yet. We didn't think it was that important." 2.4

The nurse said, "We have so much respiratory sickness in this community, and one of the main reasons is that people are too lazy to make a decent kitchen!

"It makes me angry because usually men make the kitchens but women have to work in them. If men had to work in them, they'd make them a bit better, I think!"

Grandma was still coughing and spitting out phlegm.



I asked the nurse, "Why does smoke make you cough?"

"Well, it's just like dust only smaller." explained the nurse. "It's made of tiny particles of dirt floating in the air. When they go down into your lungs, the particles stick to the sides of your lungs. This irritates your lungs and so they produce mucus.

"There are tiny hairs in your lungs whose job it is to push that mucus with the particles back up your wind pipe and into your mouth. Then you get this disgusting taste and spit it out."



"It sounds like a good system!" I said, amazed.

"It is!" said the nurse. "But some of the particles have bad chemicals and can stick in your lungs and they can cause damage. That's how some people get cancer."



My mom asked the nurse, "What are the other ways people get respiratory sickness?"

The nurse said, "Well, kitchen fires make smoke every day, but people also burn their trash, which makes even worse smoke because trash has plastic and other things with chemicals in it. And people sometimes burn their fields, so the whole community is choked with smoke for hours. I hate smoke!"



A high-school student came walking down the road, smoking a cigarette. The nurse shook her head.



"Then some people choose to smoke cigarettes, which is like taking a slow poison. Sometimes people smoke for 30 years before they get cancer and die a slow, painful death. I want to scream at these kids who start smoking! If they could feel the pain of death by cancer, they'd never pick up the cigarette! But once you start, it's hard to stop. The chemicals in cigarettes make your body want more!" The woman at the stand added, "It's expensive too! My husband smokes and I get mad at him for giving our hard-earned money to some foreign cigarette company. We need it for our kids!"

The nurse nodded. "That's right. And not only is he wasting money now, but if he gets sick from smoking, you'll have to spend even more money to try to cure him!"



Grandma had stopped coughing. The woman cooking the fish told her they would fix the shack today so the smoke could go out the top. The grandma nodded and then went over to the trash pile and started to light a match.

"Wait, stop!" yelled the nurse. "That's just going to make more smoke!"



The woman and the old woman looked at the nurse. "What are we supposed to do with the trash? If we don't burn it, it just piles up!"



The nurse shook her head again, "Look, every kid in school knows the answer to that question. It's in the curriculum now."

She looked at me. "Do you know?"

I said, "Yes, I think so. I think you're supposed to separate it into organic and inorganic parts, and then bury them in different holes. Is that right?"



The nurse nodded and smiled. "See, even the foreign kid knows! The organic stuff is like leaves and food scraps and even cardboard: anything that will turn back into dirt. Put that in a hole and it will make great soil. The inorganic stuff is like plastic, glass and metal. Put that in a hole and just let it sit. Eventually it will disintegrate.

"The key is: Don't burn it! It just gives off stinking smoke that makes us sick!!"


I added, "Yeah, and the smoke from the fish barbeque smells so good, you don't want to cover that up!"



## **Tinker with Smoke!!** BE CAREFUL WHEN YOU DO EXPERIMENTS WITH FIRE! DO THEM ON THE GROUND OUTSIDE!

- Light a candle and stick a spoon into its flame. Try to make the candle produce black smoke.
- Then look at the backsides of the spoon.
- Burn other things and observe: Does it give off smoke? Try paper, leaves, wood, etc.
- Blow out something that has been burning and have a look: Is there smoke or not?









▶ Try also to burn something that's a bit wet and see if it makes smoke.



## What's going on?

Something gives off smoke depending on its composition and also if there is water within it. Smoke also depends on the heat of the fire. Many times when the fire is not too hot, there is more smoke. That's why when you blow something out, many times the part that is still burning a bit will give off lots of smoke, sometimes more than when it was burning well. And when you disturb the candle's flame with the spoon, it will start to give off smoke that will make the spoon black.

When something is a bit wet, many times it will give off more smoke than when it's dry. This makes sense, because smoke is composed of tiny water droplets and tiny bits of dust and dirt.





I went with my friend Eugénia to her family's home in Bobonaro town. It was rainy season and we sat on her family's veranda watching the clouds form. She told me Bobonaro is so high on the mountain that the clouds often form below the town!



As we watched, Eugénia asked her big sister, "Where does rain come from? I mean, I know it comes from clouds but what are clouds and where are they from?"

Eugénia's big sister Lita had a degree in chemistry and worked for the Ministry of Agriculture trying to understand Timor's climate so farmers can make better decisions about what to plant and when. Lita said: "Well, let's start with a pot of boiling water. That's got a cloud on top of it, right?"





Eugénia laughed, "Don't tell me there is a giant pot somewhere that is boiling water to make clouds!"

Lita shook her head, "Not exactly, but the ocean is a lot like that pot of water. Ocean water is heated by the sun and is always evaporating into the atmosphere. That means the water is always changing from liquid to gas and going into the air, just like the water in the boiling pot."





Eugénia said, "I thought you couldn't see gas. I can't see air and it's a gas, right?"

Lita said, "That's exactly right, and important to know: when water is a gas, you can't see it. That means clouds are not water gas, but rather liquid water. That's why you can see them!"

Eugénia said, "Hold on now, how is the liquid water staying up in the air to make a cloud? Why doesn't it all fall to the ground?" She took some water from her cup and flicked it at the floor.

Lita said, "Think about the boiling pot again: where does the steam go?"

Eugénia thought about it. "It goes up! But then it disappears."







Lita said, "Yes, and look at those clouds forming down there. See how the wind is blowing up the mountain toward us, lifting the cloud nearer and nearer to us?" Eugénia continued to think out loud: "When the water is in liquid form, it's in tiny droplets, right?"

Lita said: "That's right, clouds are made of tiny droplets, but soon they move around and stick to each other and become bigger and bigger drops!"





Lita answered: "Yes, a little bit, in the form of gas. And whenever it has a lot and the temperature drops, it changes from gas to liquid and makes a cloud!"



Eugénia asked, "But why does air sometimes have a lot of water and sometimes a little? What makes the difference?"

"Now there is a big question," said Lita, frowning a bit. "Scientists know one thing that makes a big difference is the temperature of the oceans right around Timor."





"If the ocean is a bit warmer, more water evaporates – like the boiling pot – and more water goes into the air. This will make more clouds and more rain. During rainy season, the ocean is a bit warmer."



"So the temperature of water way out in the ocean makes it rain or not rain in Timor? That's so strange!" Eugénia shook her head.



Lita agreed, "Yes, very weird. Scientists still don't understand well why the ocean is sometimes hot and sometimes cold. They're trying to understand this better to help farmers know the best times to plant and harvest."

Eugénia, Lita and I sat watching the clouds surging up the side of the mountain.

I wanted to get it all clear in my mind. "So water evaporates from the ocean into the air, the wind blows this air full of water over here, it comes up the mountain, the temperature drops, and the water gas condenses into clouds. Then when the clouds' droplets get big enough, it rains. Is that right?"







Eugénia said, "Well I hope this air is not carrying much water, because I want to go play soccer soon!"

## Tinker with Rain!!

- Get a large water bottle and cut its top off.
- Add a bit of water, then some salt and bit of soil.
- Also put in a small cup, or the bottom of a small water bottle to float on the water.



- Turn over the bottle top and put it back in, then tape it shut tightly with packing tape.
- Put some ice or cold water in the top and leave it under the sun.
- Wait 30 minutes.
- Take off the top and taste it! Is it clean or salty?
- Put the top part back on and wait 3 hours, then try the water that's dripped down into the little cup.



## What's going on?

The sun's heat makes the water in the big water bottle turn to gas. This is called **evaporation**. You can say that the water **evaporated** from liquid form to a gas. Then, when this gas touches a cold place, it turns back in to liquid. This is called dew, or **condensation**. You can say that the water gas **condensed** to become liquid again.

When water goes through evaporation to become gas it leaves behind dirt and salt. When it condenses again, it's pure, no salt or dirt to be found!

This is one way to get drinking water from ocean water or dirty water. You have to wait a long time! Maybe you'll get a little thirsty! This is also the process that happens to rain: water evaporates from the ground and the ocean then condenses into clouds and makes rain.



My family stopped in Beali coming back from Manatutu last week. We saw all the wonderful woven things: baskets, mats, purses, hats, even folders for paper. Some were the color of dry palm leaves and others were died bright colors. There were many different designs. The women there know how to weave anything!

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I met a woman named Faustina who was weaving a basket she called 'mamafatin'. She had more than 60 strips of leaves and she was nearly completed with the base of the basket. I asked her to explain what she was doing.

She thought about it. "Well, first I make the base of the basket, starting from the very center. Then I go outwards toward the edge of the basket, adding more strips as I go."



The base of the basket was made up of hundreds of tiny shapes. I recognized the shape from my geometry class: it was a rhombus, and looked like the suit of diamonds on playing cards. Each diamond was part of a 6-pointed star. There were so many 6-pointed stars I couldn't count them all.



"The whole basket is made from 6-pointed stars!" I said.

"Not quite!" Faustina said. "Keep watching!"



I watched carefully to see how she would make the walls of the basket. She began by folding the basket over and putting in 6 corners. Faustina showed me how each corner had a 5-pointed star, which made the weaving turn up from the flat base.



After going around to put in those 5-pointed stars, she started weaving like before, making all 6-pointed stars. This was because the wall was also flat, even though it made a circle around the basket.

"So there are both 6- and 5-pointed stars," I said.



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"Yes, and even more kinds of stars too!" She put down the basket she was working on and grabbed two other ones.

One was called a lafatik, the basket they use to winnow rice, that is, to separate the grain of rice from the hull. It also had 5-pointed stars in the corners around the base.



"Now check out the corners there!" She showed me that on each corner of the walls there is a 7-pointed star where the basket flares out a little.

"The 6-pointed star makes a flat surface, and the 5-pointed star makes a corner, but the 7-pointed star makes the basket open up more at the top." I was amazed.


Then she showed me a fancier mamafatin with 6 little pointy feet at each corner. She told me to look at the feet very carefully. Each foot was formed from a 3-pointed star, which made a sharp point, much sharper than the corner formed by the 5-pointed star.

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"That's amazing! How did you learn so much about geometry, Grandma?" I asked her.



Faustina smiled. "Well, I never got to go to school. When I was young I helped around the house and then when we were done with the house work, I sat under this same tree with my grandma. I learned all this knowledge about weaving from her. She was a very wise woman and knew how to make many, many baskets. She died many years ago."

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I thought about that. Her grandma must have learned it in turn from her grandma, and on and on back to the very first grandma who developed this sort of basket, and before her, the very first one who realized that you can weave from strips of palm leaf.

I told her, "I'm amazed that there were such inventors and mathematicians in Timor-Leste's history!"

She smiled again and said: "We need these baskets for our daily lives. Someone invented them because we had a need. In the old days, there was no plastic. They took the resources that we had, the palm leaves, and made them into what we need!"





I nodded. "Those women who invented these things were smart, but so were all the women who passed on this knowledge to generation after generation and still do it today." not be lost.

I saw the local girls learning to weave, too, and I was happy because I knew that this mathematical wisdom would

## Tinker with the Rhombus Weave!!

- Make two strips, a bit long. You can cut poster paper or use palm leaf strips.
- Put one on top of the other, and fold one under the other like the photo here. TRY TO MAKE IT EXACT, SO THAT THE THREE STRIPS ALL COME TOGETHER AT ONE POINT!
- Fold one on the side over so that two are parallel in the center and two are out the sides.
- Begin weaving the two side strips back and forth around the center two, always going over and under, always putting two parallel when they're together. You can also turn it over.h









To weave a corner, take a strip from the center two and weave it to the side, leaving two others as the center pair. Continue weaving on the center pair to get a 120° angle.

- You can also bend it even sharper. Do the 120° turn, and then take another center strip to the side to create a 60° angle.
- You can make all kinds of shapes and figures with this simple method.



## What's going on?

The angles in this sort of weaving are all either 60° or 120°. With these two angles, you can make many figures, as well as making the betel nut basket and the winnowing basket!



Today my mom and I took a minibus to Dare to visit Sister Lourdes. The cassava was growing tall, and we noticed a lot of people tending their cassava patches.

I already learned that cassava is one of the big three staples in Timor, together with rice and corn.



We decided to walk back to Dili the long way behind the mountains and down into the Comoro River valley. It was a great walk and we saw a lot of people farming cassava.

I read that cassava is originally from the Americas, and that people around the world rely on its hardy ability to create a lot of carbohydrates from marginal soil, sometimes on the sides of mountains, even when it is very dry.





In my country, you can't even find cassava in most food markets! But here in Timor, I have learned to love it: boiled, roasted and fried, and also its tender young leaves, especially when prepared with coconut milk, mmmmmm.



One farmer we passed was taking out all the weeds from his cassava patch. We sat resting and watched him a while. We noticed he was also raking the leaves and dead grass away from the plants so the ground looked clean; only dirt was left. Soon, his daughter came to help him, but she was not happy with what she saw.



"Dad! Why are you taking the leaves and grass away from the plants?"

"Mimi, we have to make the cassava field clean. The plants will grow better that way."





"Dad, think about it: all that stuff sitting on top of the soil keeps the soil from drying out, it keeps the ground cooler, and it keeps some of the small weeds from growing back."



"Dad, that doesn't mean it's the best way! Look, let's do an experiment! We can clean off one side of the field completely, like you've already done. On the other side, we can pull out all the weeds, but then leave the leaves and grass to cover up the soil. After 2 or 3 months we can see which side is growing better!"



The two noticed us sitting on the side of the road. They came over to see where we were going.

I spoke up, "I heard Mimi talking about your cassava plants, and I read about that too! The stuff you leave on top of the soil is called 'mulch'. I read that it helps keep the weeds down and the water in the soil. Some people even use certain kinds of live plants, like velvet bean (lehe) or sweet potatoes to do this job. It's called 'living mulch'!"



Mimi responded, "That's right, and the result is better production, more and bigger cassavas. That's what we want, isn't it dad?"

Her dad said, "Sure Mimi, but it seems like if you plant living mulch, it might take some of the nutrients from the soil so that the cassava won't grow well. What about that?"



Mimi said, "The teacher told us that you can't just plant them at the same time. You have to plant the cassava first and when it is growing well, then you plant the mulch crop. She told us you can also do that in the corn field."

Her dad replied, "Now we've always planted pumpkins in the corn field. But I thought it was just because we don't have much land, so we have to plant them both in the same place."





Mimi said, "But they help each other grow: each one gives something to the other one. The corn gives a little shade to the pumpkin and the pumpkin covers the ground for the corn. They also put different nutrients back into the earth." The father was laughing. "I guess I'll put you in charge of the field now, Mimi. Now you're the head farmer!"

The girl laughed. "Ok! I just want to be sure we have a lot of nice cassava to eat this year!"



## **Tinker with Planting Vegetables!!**

- Try planting something in a bottle! You can try potato, taro or sweet potato; just put them in water.
- If the sweet potato's leaves and stems multiply, try replanting the thin white roots to get another sweet potato.
- Also try shallots, garlic or chayote by just putting them in damp soil. Water them daily with only a bit of water.
- Plant only one part of a cassava stem just in water.
- Try also carrots! Cut off the carrot, put the stem and leaves in water. Wait for another carrot to form.
- All these things can be replanted in the garden to produce more food!



## What's going on?

Each plant has a particular way to reproduce. Some use seeds, but many don't need seeds. Some, like cassava, will grow straight from a section of stem. Sweet potatoes, taro and potatoes will grow from a complete one. One more example is the carrot. When you cut off the root, it can make another root from the stem and leaves.



Three types of foods come from under the ground:

1. <u>All sorts of onions</u>: the stem is under the ground, and leaves that wrap it up in layers. (Bulb in English, bulbo in Portugues.)

2. <u>Potato, taro, canna, ginger and turmeric</u>: these also have their stem under the ground, but not with layaers, just a consistent body (Tuber in English, tubérculo or caule subtereneano in Portuguese).

3. <u>Sweet potato, carrot, cassava and jicama</u>: these are real roots with large bodies (Portuguese: raízes tuberosas).

All these kinds of food come from plants that store away food for themselves to live well. We people can take advantage of this.

