

MACIMISE

MACIMISE is a collaborative research and development project led by PREL and the University of Hawai'i at Mānoa. Founded on ethnomathematics research, the project aims to increase the mathematics learning of first-, fourth-, and seventh-grade elementary school students in ten Pacific Island states and territories. Over the past five years, team members have developed and field-tested culturally and linguistically sensitive grade-level curriculum units in specific mathematics topics, such as numbers and counting, division of whole numbers and fractions, and elements of geometry, each focused on the indigenous mathematics learning experiences embedded within each of the ten island communities.

Increasing the learning of mathematics through culturally sensitive methods.

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When Issack and Sabrina are offered the materials to build themselves a small traditional Chuukese house, they and their friends embark on an adventure that explores the rich indigenous knowledge of a master builder, a *Souimw*.

The story of "The Little Crooked House" introduces the reader to traditional house building while raising questions about the embedded mathematics, questions that are explored in a series of lesson plans available through Pacific Resources for Education and Learning.



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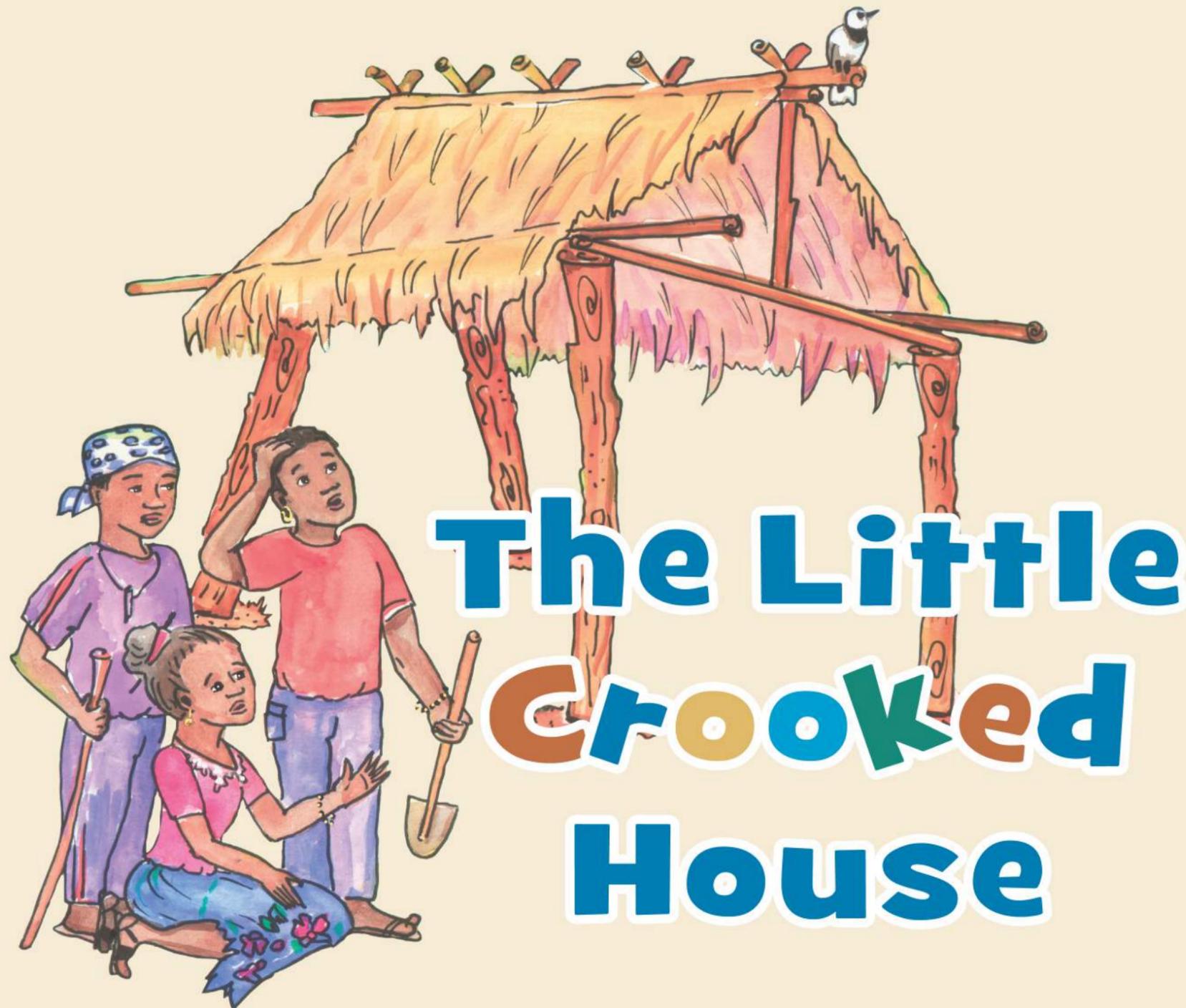


Island Research &
Education Initiative
(iREI)



The Little Crooked House

iREI



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The Little Crooked House

It was a day like any other as Issack and Sabrina made their way home from school. Then, as they neared Issack's auntie's house, a wonderful smell of baking met them. And there was Auntie Bea at her door welcoming them in!

The sweet buns were still hot and so delicious. Auntie Bea couldn't get over how the two friends had grown. "We're in grade seven now," bragged Issack. "You'll soon be a man Issack," said Auntie Bea. As they enjoyed the sweet buns, she told them how when she was young every boy needed to learn how to build two things: a boat and a house. Issack wasn't sure he could build a boat but he thought building a simple traditional house, an *iimw*, looked quite easy.

It was then that Auntie Bea changed the day from ordinary to spectacular. She offered Issack and Sabrina a pile of materials stacked up in her yard, enough to build an *iimw* if they wanted to try. The materials, she explained, came from a house that had been so damaged in the last typhoon they had thought it safer to take it apart. "Better to use the posts and beams before they rot on the ground. The thatch is no good any more so you'll have to get some more made. Let me know when you're ready to thatch and I'll see what I can do."

As they examined the pile of materials, the two friends' excitement grew. "Let's get Jake to help us," said Issack. "And Enson" added Sabrina. "We could build our own club house. Thank you! Thank you Auntie Bea!" "And thank you for the snack," added Sabrina as they left for home.

Issack couldn't get to sleep that night. He kept thinking of the house they would build and imagining the steps in the construction. "First the corner posts, then the wall beams, ...," and finally sleep came.

The next day at school the four friends could hardly keep their minds on the lessons. They talked about where to build the house. Sabrina suggested some land near her house and not too far from the pile of materials at Auntie Bea's.

After school they rushed over to Sabrina's, found a good flat piece of ground, and set to work clearing it. With some difficulty they managed to drag the materials they needed over to the site: four good posts for the corners, four long beams for the sides and ends, two shorter posts that could be cut to make good king posts, and lots of thinner wood for the rafters. It took all four of the friends to carry over the best and longest pieces, wood they would use for the ridgepole and false ridgepole.

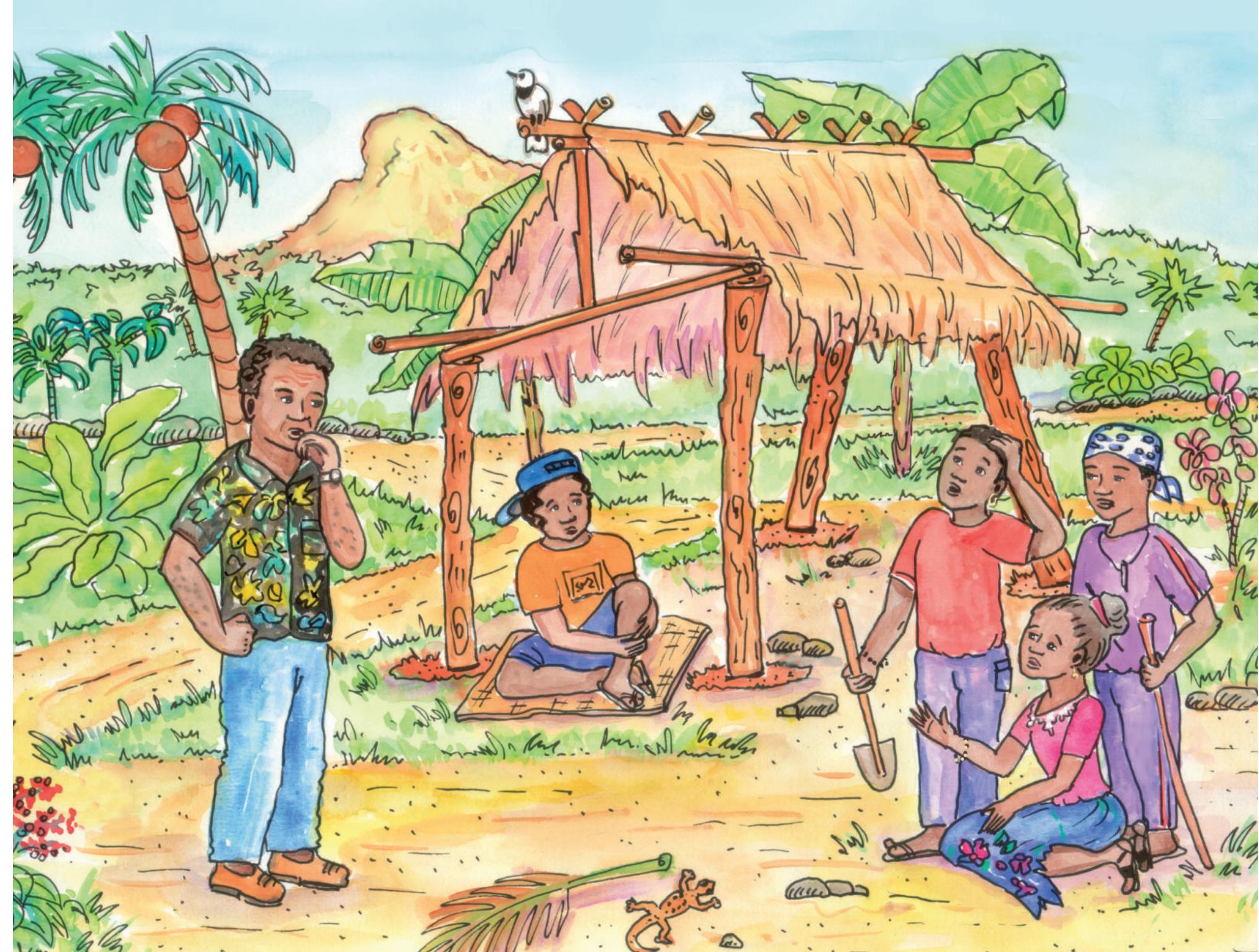
"We'll need *singóón* for tying. I can get some," offered Enson. Sabrina said she could borrow a shovel for digging the holes for the corner posts and Jake said he would bring his machete. They promised to meet at the site the next day after school and to get started on the construction.



On the weekend, and every day after school, the four friends worked on their house and in a week it was finished. But something was very wrong. Their house was so crooked it looked like it might fall over. Sabrina's Uncle Curtis came by just as the four friends were realizing that there was a serious problem with their building. Now Uncle Curtis was a *souimw*, a master builder, and he frowned as he walked around the house examining every post. That embarrassed the four friends and made them feel a bit ashamed. But their shame turned to gratitude when the *souimw* offered to help them fix the house.

The *souimw* told them that because there is a problem with the *úúr*, the corner posts, they would have to carefully take the whole house apart and start over. He offered to meet them at the site on the following Saturday morning. In the meantime, they should take the house down, pile all the materials nearby, and fill in the holes they made for the posts. He said he would bring the ropes they will need for the measuring.

"Measuring?" said Issack after the *souimw* left. "What is there to measure?" wondered Jake. "Maybe measuring can make our house straight," added Sabrina, though no one was quite sure how.



Now it is not nearly so exciting taking a house apart as it is building one. But the four friends stuck together and did everything the *souimw* had told them. When Saturday came, the building site was totally cleared and ready. The *souimw* congratulated them on their work. He suggested they sit down and discuss how they would build their house. They responded to the *souimw*'s questions about the size and orientation of the house. Where would they want the *nukenifew*, the center of the house? How long would it be? Where would the entrance be? These were important questions for the *souimw*, questions the friends had never thought about.

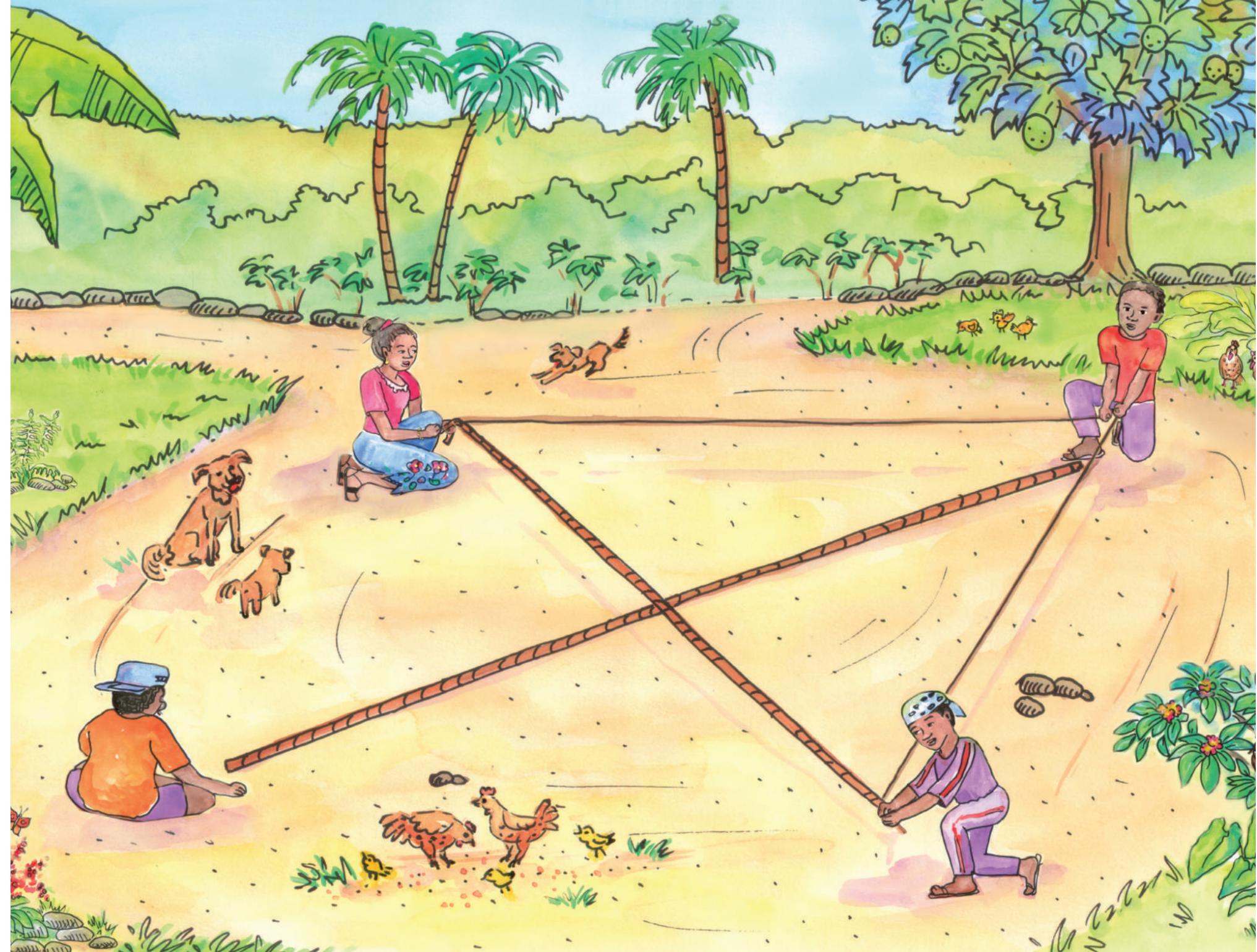
They picked a spot for the *nukenifew* and put a small stick in the ground to mark it. With the *souimw*'s help they agreed the length of the house would be *fengaf* and the width, according to the *souimw*, would be *ruengaf-etineupw*. The *souimw* took the heavy measuring rope and measured off *ruengaf-etineupw*. He then showed them how to find the middle of the rope by folding it in half. With another rope he measured off *fengaf*, four arm lengths, and gave it to Jake and Issack to find and mark its middle. He instructed them to lay it on the ground so that its middle was lying on the house center and it was more or less in the direction of the length of the house. Sabrina and Enson then laid the width rope over the length rope with their middle marks touching and the width rope in the direction of the house width.



Souimw Curtis explained that they now needed to be sure the ropes made a perfect cross and he showed them an amazing way to do this. Under the *souimw*'s guidance, they stretched a rope between Sabrina and Jake and another between Enson and Jake, who was at one end of the length rope. Jake tied these two ropes together. He then pulled on the loop of rope letting it slide in his hands until it would go no further. He marked the position of his hands and moved the end of the length rope to this new position. Issack slid his end of the length rope to make it straight. Everyone could see that the ropes now formed a perfect cross even if they weren't sure they could explain why. Sabrina was certain there was something they had learned about triangles at school that might explain it and she decided to try to figure it out when she got home.

"Now we are ready to locate the four *úúr*," said the *souimw*. "Sabrina, Jake and Enson, I want you to pick up the rope triangle you are holding and circle around until Jake is at the *nukeniféw* and the middle of the width rope is where Jake was before." The three friends circled as instructed and the *souimw* announced that Sabrina and Enson were now standing exactly on the spots for two of the corner posts. He put sticks in the ground to mark them.

For the two other posts, Jake stayed at the *nukeniféw* and Sabrina and Enson circled once more until the middle of the width rope was lying on the other end of the length rope where Issack was sitting. Once again they marked the spots where Sabrina and Enson were standing.



Enson dug the hole for the first corner post and the *souiimw* helped him put the post in the ground and fill in the hole around it. The post was straight and the same height as the *souiimw*. The friends put in the other three posts in the same way, always checking the height of the post above the ground by asking the *souiimw* to stand beside it.

The posts certainly looked straight and in the right positions but the *souiimw* explained that it was worth taking the time to be sure. He stretched a rope from one post to a diagonally opposite post and asked Issack and Enson to find and mark its middle. Then he laid the same rope on the ground with its middle over the *nukenifew* and the ends at the other diagonally opposite posts. The rope fit perfectly and the *souiimw* seemed satisfied that the posts were in the right spots.

Giving the same rope to Sabrina and Jake, he had them do the same test at the top of the posts. Once he had made sure the middle of the rope each time was directly above the *nukenifew*, he declared that the posts were vertical. The friends were a bit puzzled by all this checking. Why did the *souiimw* do all this rope measuring? And why did it make him so certain that the corner posts were perfectly installed? This time it was Enson who thought he would look in his math notes to see if there was anything he had learned about rectangles that might answer their questions.



Enson remembered to bring more *singóón* rope to their next meeting. The *souimw* had promised they would prepare and fasten the wall and end beams when they met. They knew the two wall beams, the *tinéw*, would have to be cut longer than the *fengaf* of the house length so that they would stick out past each end of the house. The *ouchamw*, the end beams, could be cut using the width rope because they would not extend beyond the posts. The middle mark on the width rope could be used to mark the middle of the *ouchamw* where the king posts, the *pwéét*, would be placed.

Before they started working on the house, they sat with the *souimw* and discussed their plans. The *souimw* demonstrated how to tie the beams with the *singóón* and everyone practiced using a couple of small pieces of wood. Jake was assigned to the job of cutting the beams after Sabrina and Issack had measured them with the ropes. Enson offered to help the *souimw* place the beams on the corner posts. When everyone was sure they knew what to do, the *souimw* suggested they get started.

Once the *ouchamw* were cut and their centers marked, they were placed across the corner posts. Then the *tinéw* were laid over the ends of the *ouchamw* so that they extended about the same distance at either end of the house. The *souimw* supervised, and the others watched, as Sabrina tied the beams to the first *úúr*. It took a few tries before she got it right and they were satisfied that the beams were securely fastened. Then Jake, Issack and Enson had their turn at the other three posts.

By the end of the afternoon they all looked proudly at their very solid house frame and looked forward to their next meeting when, the *souimw* promised, they would start work on the roof.

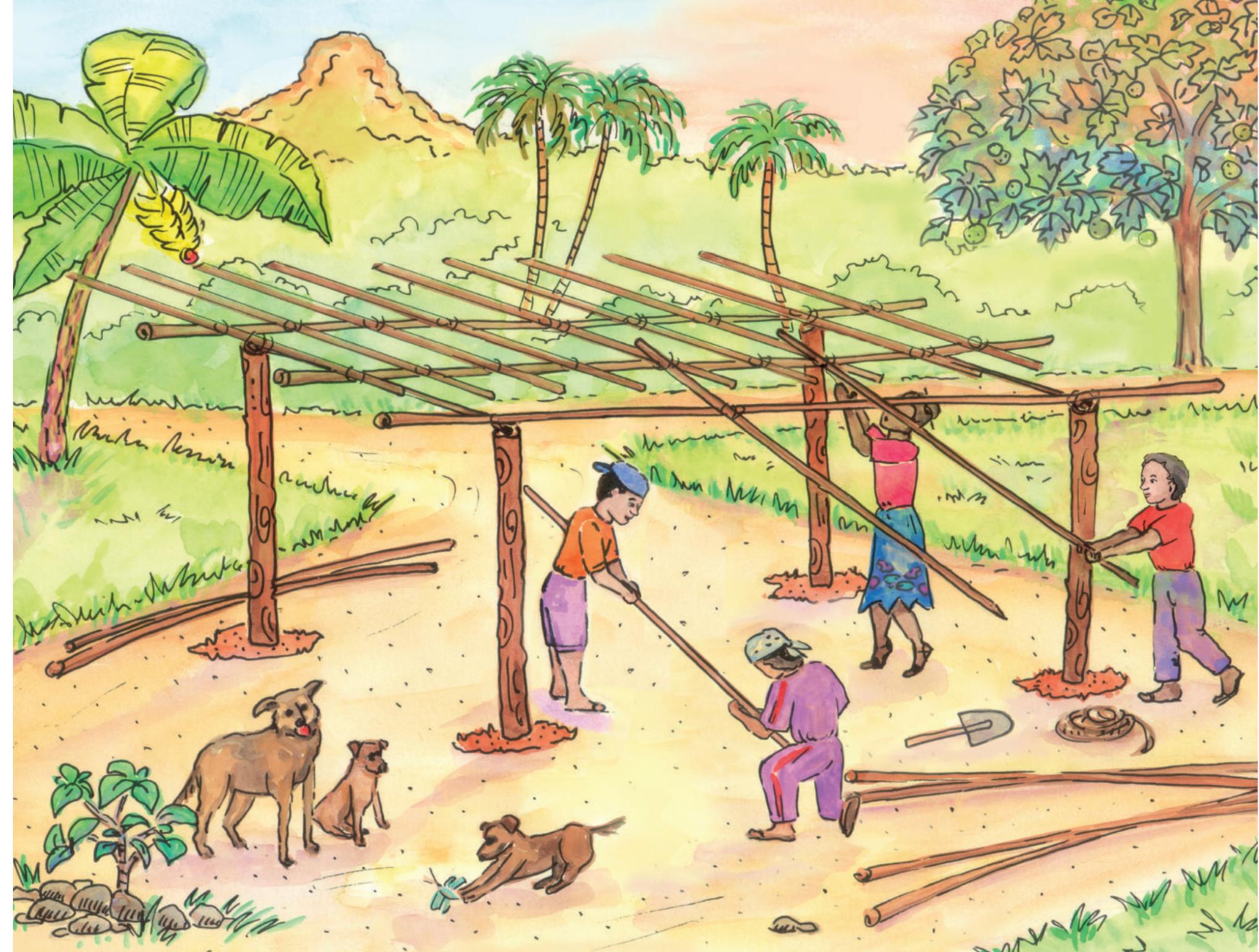


The *souimw* was counting the rafters, the *eitiitá*, in the pile when the four friends arrived. “We have some estimating to do today,” he told them. “We’re going to need to place the *eitiitá* evenly along the *uung* and close enough together to support the thatch. First let’s prepare and place the *uung*, the ridgepole, and then we can figure out the *eitiitá*.”

Once the *uung* was lying across the marked middles of the end beams, the *souimw* asked how many *eitiitá* they would need if they were *engaf* apart. “Four, no, eight because there are both sides,” said Issack. “But what about the ends?” asked Sabrina. Meanwhile Enson was drawing on the ground with a stick. “Ten” he concluded, “because the length is approximately *fengaf* and you need an extra pair for the end.”

“Good!” said the *souimw* “and now suppose we want the rafters *etineupw* apart?” “Twenty?” asked Jake. Sabrina, who had copied Enson’s drawing on the ground and made marks between each *engaf*, concluded “Eighteen because it only takes 8 more.” While Sabrina and Jake selected the best rafters from the pile, the *souimw* marked the positions for the rafters on the ridgepole starting at the center and then successively halving the remaining distance to either end.

The *souimw* demonstrated how to tie the *eitiitá* to the *uung* (ridgepole) and supervised the friends as they tied all 18. Their arms were aching from all the reaching and pulling. Knowing they would have to tie these same *eitiitá* to the wall beams once the *uung* was raised, they were relieved when the *souimw* suggested they raise the roof the next time they meet. The *souimw* said he would bring ropes to steady the *uung* as they raised it.

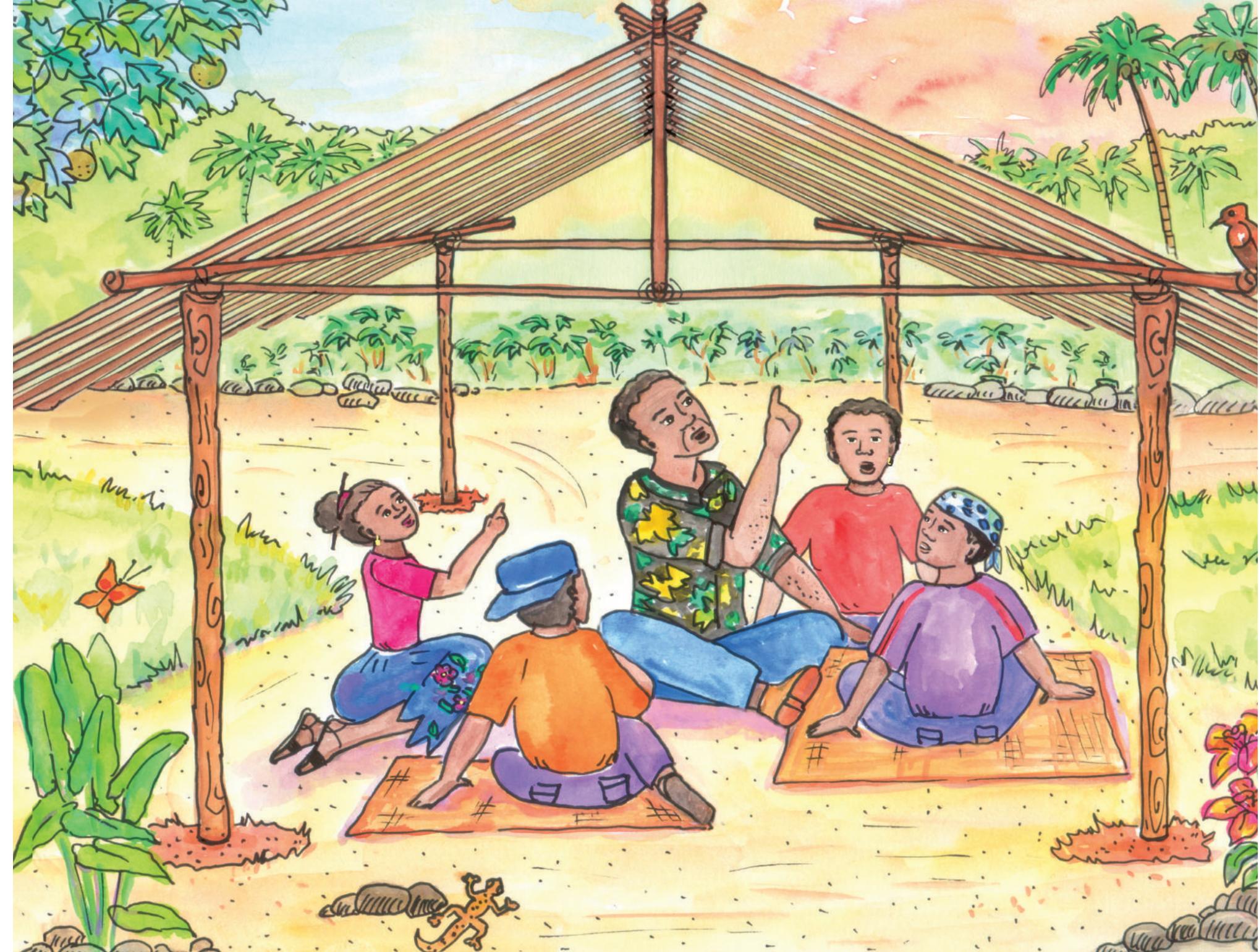


Sabrina was the only one who was not surprised when the *souimw* arrived with a helper on the following Saturday. It was her father and he had come to help the *souimw* raise the ridgepole and rafters. Before they started, the two men lay the false ridgepole, the *kuning*, over the *uung* and *eitiitá*. Sabrina's father positioned Sabrina and Jake at one end of the *uung* to which he tied two ropes and handed an end of each rope to them. "These ropes are for steadying the *uung* and keeping it centered while I lift it with the *pwéét*, the king post." The *souimw* did the same with Issack and Enson.

When the *pwéét* were prepared and placed at each end of the house, the two men each positioned his *pwéét* under the *uung* on the spot where it had been resting on the *ouchamw* and began lifting the roof. Keeping the ridgepole centered was not as easy as it looked but finally the *pwéét* were high enough above the *ouchamw* that they could be lowered exactly onto the middle of each and the ropes could be released. The *pwéét* were standing vertically on the two *ouchamw* and supporting the *uung* and its fastened *eitiitá*.

The *souimw* reminded Jake how they had tied the beams to the posts and then helped him climb up onto the *ouchamw* to tie the *uung* to the *pwéét* at both ends of the house. With the roof secured, they said goodbye to Sabrina's father and thanked him for his help. There remained now the job of tying the *eitiitá* to the *tinéw* as they had done the previous day when they tied the *eitiitá* to the *uung*.

With the house frame completed, there remained only the thatch to tie to the *eitiitá*. Sitting in a circle around the *nukeniféw*, the friends discussed with the *souimw* the preparation of the next and final step, the thatching. The *souimw* helped them calculate the number of thatch lengths they would need for the roof. This calculation took a while because they had to consider the length involved in the overlapping of thatch, the length of the wall beams, the number of rows of thatch, and the lengths of the *singóón* needed to tie it all to the rafters. They calculated they were missing six lengths of thatch and the *souimw* said he would contribute those. The four friends were charged with collecting more palm branches to cover and protect the thatch.



Over the next few days the friends wandered the area gathering long palm branches and added them to their pile. On Friday the *souimw* came by and carefully unloaded from his truck the six lengths of woven thatch he had promised.

Saturday morning each of the friends came with a length of *singóón* and when the *souimw* arrived they got right to work. Laying the pieces of thatch across the rafters on the outside of the house, they tied them to the rafters from inside the house. When they got to the top rows of thatch they had to stand on a bench to reach the rafters. The friends agreed that this was the most demanding stage in the whole construction. The thatch lengths needed to be handled so carefully and there was so much tying involved as they worked their way up each rafter.

The sun was particularly hot that day and once the thatch was completed Sabrina suggested they stretch out under the new roof while she got a jug of water and some snacks from home. The *souimw* said he would leave them and come back later in the afternoon to see how they were getting on with attaching the palm branches over the thatch. Suddenly the friends looked a little worried. Enson spoke for all of them when he asked, “Could you show us how to do it before you go?”

So while Sabrina got the refreshments, the *souimw* showed the boys how to place and secure a palm branch over the thatch. Then he left them and the friends rested, lying on their backs and looking up with pride at their new roof.



When the *souiimw* returned later that afternoon, the friends had almost finished covering the thatch with the palm branches. The *souiimw* could see that the friends were pretty tired. He gave them a hand at finishing up and tidying the site.

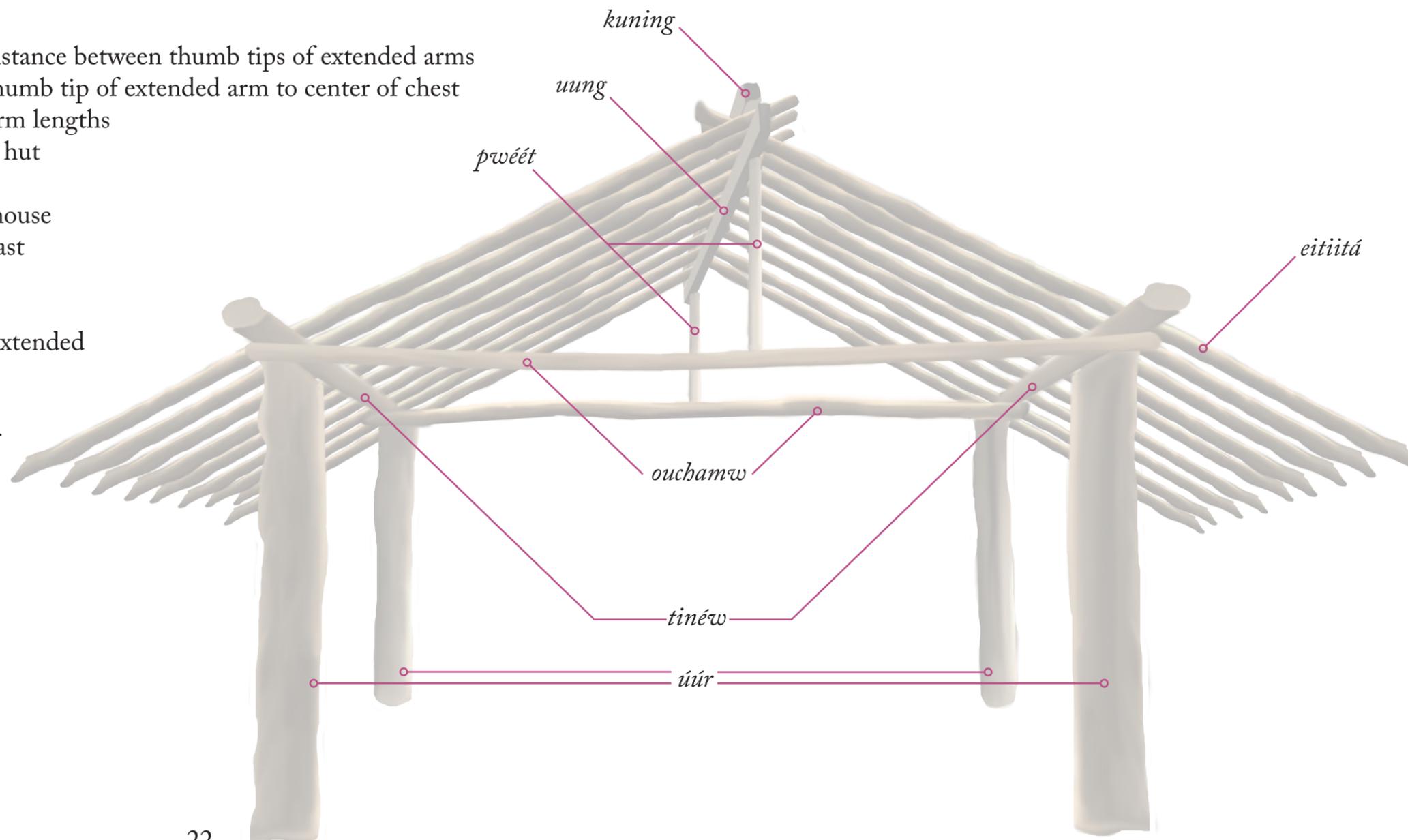
As they all stood back and proudly admired their beautiful *iimw*, Sabrina exclaimed “We must have a celebration, an *ósópw*” and everyone agreed. “A feast to honor the *iimw*,” said Jake. “And the *souiimw*,” added Enson. “And everyone who helped us with materials, advice and encouragement – especially Auntie Bea,” concluded Issack. “Maybe she’ll bring some of her sweet buns,” added Sabrina.

The *souiimw*, like us, left them sitting proudly in their “straight” house excitedly planning the menu for their *ósópw*.



A Glossary of Chuukese Terms

<i>eitiitá</i>	rafters
<i>engaf</i>	arm span, the distance between thumb tips of extended arms
<i>etineupw</i>	distance from thumb tip of extended arm to center of chest
<i>fengaf</i>	four extended arm lengths
<i>iimw</i>	house, building, hut
<i>kuning</i>	false ridgepole
<i>nukeniféw</i>	the center of a house
<i>ósópw</i>	a completion feast
<i>ouchamw</i>	end beam
<i>pwéét</i>	king post
<i>ruengaf-etineupw</i>	two and a half extended arm lengths
<i>singóón</i>	rope for tying
<i>souiimw</i>	a master builder
<i>tinéw</i>	wall beam
<i>uung</i>	ridgepole
<i>úúr</i>	corner post



For additional information about traditional house-building in Chuuk, photographs, videos, and teacher lesson plans, please visit

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