



## “Butter comes from Buttercups, I think?” Teacher’s Research on Children’s Working Theories

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**Abstract:** This article looks at two teachers’ research into the ways we work to develop children’s scientific thinking in our curriculum and how we build children’s skills in theorising and reasoning. The research was undertaken as a means of allowing us to examine our practice with the intent of improving it and, as a result, improve learning outcomes for the children in our centre. The research follows the children’s investigation of a theory that butter comes from buttercups and their teachers’ growing understanding that trying things out and seeing what happens is at the core of scientific experimentation. As a result of this inquiry, we were able to rethink and reconstruct our image of ourselves as teachers, and understand that it is not necessary for us to have all the “right answers”; rather it is through a journey of discovery with the children that meaningful learning is able to happen.

**Key words:** early childhood, working theories, buttercups

### Introduction

In 2011 our teaching team began thinking about how we were supporting children to develop their own scientific understandings and, more specifically, how we were enabling children to investigate their own working theories about the world. For some time we had been talking about how we saw ourselves as teachers, and examining our role in facilitating children’s learning. As we discussed our teaching role in science learning, we felt more and more that science is about being uncertain, and investigating ideas without predetermined outcomes. We wondered if we were able to let go of having to have all the “right answers” and instead provide opportunities for the children to share, test and modify their own theories. *Te Whāriki* (Ministry of Education, 1996) talks about children’s working theories being “increasingly useful for making sense of the world, for giving the child control over what happens, for problem solving and for further learning” (p. 44). This was exactly what we wanted, so we began to listen even more closely to children’s ideas in the expectation that we would hear theories that would offer us the possibility to work with a small group of children to test, challenge and redevelop their hypotheses. In June of 2011 one child’s ideas about buttercups gave us the opportunity to do exactly this.



## The Theory

Both Sudha and I have our own stories about how Jayden may have developed his theory that butter comes from buttercups, but they are different stories and Jayden never confirmed either one. Sudha had observed Jayden's interest in mushrooms for some time and would often look through plant books with him and talk about the different plants they saw. So for her, the beginning of this theory came when he saw a picture of buttercups one day and began talking about his idea that butter is made out of them (see Figure 1.) Jayden and I share a passion for stories,



Figure 1

particularly traditional tales, and for about six months we had been reading and re-reading the story of *The Little Red Hen*. One of his favourite pictures was the Little Red Hen taking the bread out of the oven, buttering it and eating it, and he told me as we were reading one day that he had the recipe for butter, and that butter was made out of buttercups.

## The Investigation

### The teachers' role.

Sudha and I began talking about how we could investigate this idea and the possible learning that might be involved in this type of investigation. We thought, and the rest of the teachers agreed, that this idea would give the children an opportunity to be actively involved in investigation and sustained exploration. We also felt that because it was not our idea the children had a greater level of control over what would happen and so they would be taking responsibility for their own learning. We wanted the children to see that trying things out and seeing what happens is an important approach to scientific learning, that they could test out their own theory and modify it if they needed to. Most of all we wanted the children to see themselves as *Te Whāriki* (Ministry of Education, 1996) suggests, "as explorers, competent, confident learners who can ask questions and make discoveries" (p. 9). So if the children were in control of what was happening, we needed to decide exactly what our role as teachers was.

After discussion we decided that our teaching role was to work alongside the children, asking questions that might challenge some of this theory, and providing the resources that would provoke their ideas and encourage them to explore at a deeper level. We had worked like this in a previous investigation, when children had tried to produce paint from flowers, but in that investigation we didn't really have any idea what would happen, so allowing the children to lead the process seemed quite natural. This time the challenge for us was that we already knew that butter didn't come from buttercups, so letting go of having the "right" answer was much more difficult. A few years ago at this point we probably would have brought in a butter churn, or a blender and beaten some cream until it turned into butter, but this time we decided to see how Jayden wanted to investigate this theory and see where it would lead.

### The children start to experiment.

Jayden was pondering his theory, as were we, too, and so when he asked if we could make bread like the Little Red Hen we decided that maybe we needed to start there and see where this approach would lead us. Sudha brought her blender from home with some wheat, and a small group of children began grinding it to make flour. The flour was then sieved to remove the husks, and soon we had recognizable flour and we were ready to move on to baking. We decided that making bread

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may take a little longer than our morning session, so we opted instead to make cake, and the children were very satisfied with this decision. Then, as we had been thinking about ways we could incorporate more scientific thinking and attitudes, we began looking at the Little Red Hen's bread-making process from the very beginning. As a result of this, we thought that if we went back to the growing process we would be able to encourage children to offer some theories about that as well. Sudha's wheat had come in two forms: some grains had had their husks removed, while other grains still had their husks on. After lots of discussion by Jayden and friends, it was decided that they would plant both types and see what happened. We asked the children to think about which grain would sprout first and to make some predictions, then we planted the grain and watched. We talked about this as our experiment, and that in experiments we need to observe what is happening each day and to document our findings, that this was how science worked. Luckily for us, the children's observation process was not too protracted – things started to happen quite quickly and soon we had wheat. To our surprise, and contrary to most of the children's predictions, the grain without husks was the first, and only, wheat to germinate (see Figure 2).

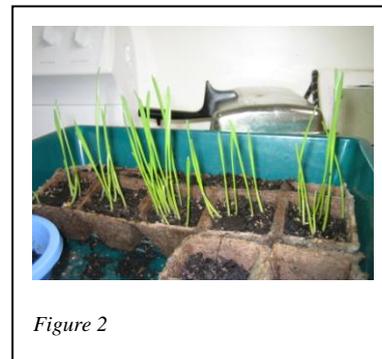


Figure 2

his

Jayden had definitely enjoyed the process of baking bread and growing wheat, but he continued to talk about his recipe for butter. One day as a small group of children and teachers were out for a walk around the estuary, Jayden found some buttercups. He was really excited, and so were we. So we proposed this new investigation to the group and soon everyone was looking for buttercups. The initial collection process was not without problems and questions. Trying to decide which of the flowers we wanted required discernment because many children thought that all yellow flowers were buttercups; we had to decide how we could tell which ones were the right flowers to pick. Over time in our investigations we have seen these kinds of problems as fantastic learning opportunities, and we immediately saw that this was an opportunity for some children to be the experts and support others as they decided which flowers we wanted. Sudha and I asked who were the buttercup experts, and if they could help their friends decide which flowers were the ones we were looking for. With their expertise established to Jayden's satisfaction, we now asked our buttercup experts to pair up with other less-knowledgeable friends and help them choose the right flowers. This tuakana-teina approach to learning, with more-skilled children assisting less-skilled children, also fits well with our desire to incorporate bicultural values and perspectives into our teaching and learning. Soon we had a basket full of buttercups and were ready to return to the kindergarten to try out the recipe.

Jayden's recipe for butter was in the form of a story, which he now told his friends:

"I found buttercups in my garden. I picked the petals and put them in a bowl with some water. I put it in the fridge for a hundred years and it turned into butter."



His friends all liked this recipe and began helping to pick the petals off and put them into the water. We could already see that Jayden was making connections to his learning in our Capturing a Colour investigation as he explained to his friends that the butter was going to be yellow so we could only put the petals into the water – no stalks or green bits! (see Figure 3). Sudha started to talk about the time element of the recipe with the group because we knew we didn't have a hundred years for the experiment. Jayden wasn't very happy about this difficulty but when Sudha made a suggestion that we put it into the freezer he thought that might have been worth a try, so after carefully picking the petals off and putting them into a cup of water we put the cup into the freezer. When Jayden's dad came to pick him up, Jayden was really excited about sharing the news that we had begun an experiment.



Figure 3

### Modifying their method.

The next day when Jayden came to kindergarten he immediately checked on the butter. He was surprised to find that instead of butter he now had “frozen water with petals”. He was not very happy, and felt that this was probably Sudha's fault because she had made the freezer suggestion. I then asked if perhaps we could use the blender that we had used for the wheat, to grind up the ice and see what would happen. Jayden considered this for a while and then decided that maybe this would turn it into butter, so he and his friends wanted to give it a go. It was a big challenge to his theory when what we produced was not butter, but rather a “buttercup slushy” (see Figure 4), and he quickly decided that the teachers' ideas weren't working. Over the next day or two he thought about the reasons why the experiment hadn't worked and decided perhaps the problem was that there had not been enough buttercups so we needed to gather more buttercups and then we could try again. This time he said we would not put it in the freezer but instead put it in the fridge for “seven days, not seven years because seven years takes too long”.

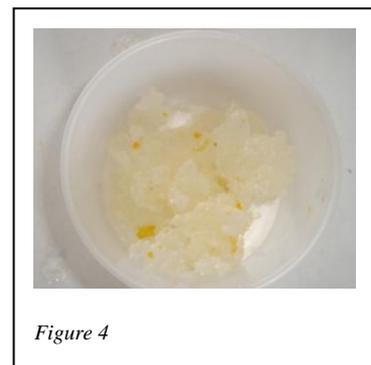


Figure 4

### Modifying their theory.



Figure 5

After this second attempt at producing butter was unsuccessful we encouraged Jayden and his friends to think of ways to modify the theory. Soon they began to wonder if the buttercups just didn't know they were supposed to turn into butter, and thought a possible idea was that if we added butter to the water and buttercups it would work, because then the buttercups would know what they had to become. The children's ideas about time also began to be modified, so with some encouragement from his friends, and from us, Jayden decided to make a calendar to keep track of the process and progress over the

next week (see Figure 5). We were very happy with this new twist as it introduced more depth to the documentation of the experiment and the children would be using number in a very real and practical way. This next stage of the experiment also failed to produce butter, and the group began wondering if there was something about butter they had not considered. We had

been putting out lots of books that might challenge this theory and while Jayden was reading a book with his friend he found a story (Jackson, 1997) about making “yellow, mellow butter” (p.25) and learned that milk was part of the process.

The theory was now modified to include milk in the recipe. Sudha and I also brought the churn in the yellow, mellow butter story to the children’s attention by wondering out loud if the churn could be important. We then suggested that since we didn’t have a churn, we could try using a shaker with the milk. This new suggestion was judged to be a good idea, so the children added frothy milk to the cup of water, butter and buttercups and put it back in the fridge. After a few days they noticed that it didn’t smell very nice so decided perhaps we needed to change the recipe again. This time the children felt they needed to talk to more people – mums and dads would probably have lots of ideas, they thought, and so the children agreed to talk to their parents at home that evening and to share their ideas the next day.

After research and discussion with the mums and dads, and a bit more with us, too, the group decided that milk was probably the major ingredient in butter, but it had to be the right milk. Colour was a very important factor in this theory and Jayden particularly wanted Sudha to make sure she got the correct milk, namely the milk with a yellow top because then he was sure it would turn into butter. Sudha and I talked about how to provoke the children to move to the next step and decided that when she purchased the yellow top milk she should also purchase some cream. We decided that we would just place the bottle of cream on the table next to the milk without saying much to the group. It took a lot of energy to shake the milk, so this became a very collaborative process as the children passed it around to all their friends to take a turn. After shaking the milk for a long, long time the children were disappointed that nothing had changed. They had noticed the cream bottle, but discounted it a little because it has a red lid and that was not seen to fit with the colour theory they had developed. However, after more shaking of the container with the yellow milk, they took another look and decided that the cream itself had a yellowish colour and that could fit in with their ideas.

Everyone was tired after all this shaking, and also a little discouraged, so a wider circle of children who had been observing and listening to this process now came to give support and lend a hand with the process. After a little while shaking the cream, Jayden noticed that there was a different sound coming from the shaker and when we opened the lid to take a look the group found that the liquid was getting thicker and starting to look like whipped cream. This was now beginning to look a little more promising so with renewed energy they began shaking harder... then another sound change and when we opened the lid this time there was yellow butter (see Figure 6). We were all very excited. It was not beautiful creamy butter, and not quite the buttercup butter Jayden’s original theory, but it was butter that was delicious on our toast anyway.

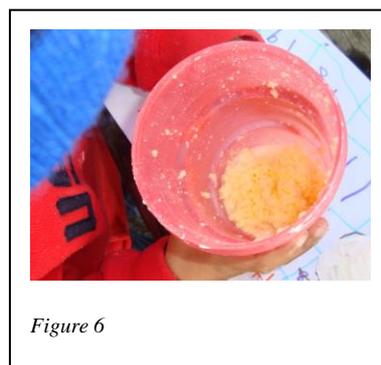


Figure 6

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#### Full of more ideas.

This process of exploring children’s theories had rewarded us all: the children were very proud of their discovery and now seemed full of ideas that needed to be explored, and we had seen children deeply engaged, challenging each other’s ideas, and working together in very collaborative ways. Ann Lewin-Benham (2008) argues that significant



work “has these qualities: It is intentional, highly articulated, purposeful and absorbing, responsive to a child’s interest, and transcendent, meaning it has the potential to branch to numerous other subjects that are directly or tangentially related” (p.5). We certainly saw in this investigation that following Jayden’s questions and theories allowed us to become deeply engaged in very significant work. Because he had such interesting questions, and had over this time developed an amazing focus on research, we were sure that Jayden would have follow up questions – and sure enough he did:

“If cows eat green grass, how come their milk is white?”

Then a few days later ...

“I know a recipe for jam.”

## Conclusion

During the course of this investigation we came to see that this rich experience only happened because we slowed the process down and went at the pace that the children set. We could have leapt ahead and gone straight for the last step in the process, cream turning into butter, but that would have meant that much of the learning would not have happened. We were able to rethink the image we had of ourselves as teachers, and see confirmation that it was not necessary for us to have the “right answers”. Instead we needed to see that the real learning was in the journey of discovery that the children took. We saw that being able to explore their own theories, change their minds when things didn’t work, and then try again with a modified theory had allowed the children to see themselves as powerful forces in their own learning processes – and had allowed us to see how important that is for children’s ongoing learning.

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