According to a Parents Guide to Mathematics through the Michigan Department of Education, mathematics is the science of patterns and relationships. Mathematics is a subject that progressively gets harder as the students advances through the grades. In second grade the students are to know the “times table” up to 5 x 5. In third grade the students are able to calculate multiplication with efficiency and accuracy, up to 10 x 10. In fourth grade they are to take the information they have learned about multiplication and apply it to solve a problem of two-digit numbers multiplied by a one-digit number as well as multiplying a three-digit number by a two-digit number.

This a Piagetian study based on scaffolding and cognitive structures. I used my niece in this project as my helper. She is 9, almost 10, and will be entering fourth grade when school beings in the fall.

I began this activity by having my niece write down everything that she remembered from third grade about mathematics. She began by breaking the numbers down and telling me each trick for the numbers that she remembered. Anything times zero equals zero, anything times one equals that number, and multiples of two are doubled, for example 2 x 2 =4. She also told me some rhymes to help her remember “OLIVIA READS (6 and 8 rhymes)”

After talking about the ‘tricks’ of multiplication I gave her as paper that had a fourth grade type of problem on. Before she was asked to solve the problem I asked her to tell me what strategies she would use to solve the problem and write them down. She solved 16 x 3 using a strategy that she had learned in her third grade class.

I was unfamiliar with this strategy so I had to have her explain it to after she solved the problem. She was surprised that I had never heard of it before, she called it a lattice box or lattice multiplication.

I then gave her another multiplication problem, 69 x 8, which she attempted to solve using the distributive property. She multiplied 8 x 9 and then 6 x 8, her product was incorrect but the attempt was successful.

 I then gave her a harder problem to solve which was 77 x 8. I asked her to solve this problem without using a strategy. She was a little uneasy with this assignment. She didn’t believe that she could solve the problem without using a strategy, but I asked her to try anyway. I also had her talk it out while she solved it. She definitely had a difficult time and in fact solved it with a number that was 500 off from the actual answer. She answered the problem of 77 x 8 as 112. As I had hoped she was unable to solve this problem without using any strategies. She wasn’t sure how to go about solving it. Her cognitive structures were present, but I had thrown off her mental equilibrium by asking her to solve the problem without using a strategy that she had used before.

Using the same problem 77 x 8 I broke the problem down for her. I told her that first she had to solve the problem by multiplying the one 7 x 8. She told me that it was 56. I then gave her a mental connection to addition problems. Regrouping with multiplication is very similar to regrouping with addition. You leave the one and carry the ten over to the tens column. I then told her that she had to multiplying the 8 by the number that was in the tens place with was 7 again. She said that the answer was 56. I told her that she couldn’t forget about the 5 that we had carried over and she needed to add that to 56, she came up with an answer of 61. With one on one help she was able to find the correct answer to 77 x 8 which was 616.

She took this information and applied it to several more problems. She was ale to assimilate the steps and gain her mental equiliubrium again. Now it was time for harder problems, using her new skills to attempt harder problems. She then solved three digit numbers multiplied by one digit numbers. She was able to move through these problems with ease. Again, I threw her equilibrium off by telling her we were going to move onto multiplying three digit numbers by two digit numbers.

We started with a fairly simple problem…189 x 14. She was able to solve 189 x 4 and then moved onto the tens number. I showed her how to set up her numbers underneath the multiplication problem, always keeping the numbers in nice columns so that adding would be easier. I also wrote on her paper where to write the ones multiplication problem as well as the tens multiplication problem, we used a star to show the empty space because I didn’t want her to accidentally place a number there when it didn’t belong. While solving this problem my niece was able to show me scaffolding. She was able to gain new skills and build upon the skills that I had previously taught her.

Again, we went through many problems where my niece was able to stop and ask me questions if she were confused and I was able to help her one on one to encourage her learning this harder math.

At the end of this project my niece’s equilibrium was completely restored with this harder fourth grade math. She was able to solve a very difficult problem of 697 x 89 and she accomplished it completely on her own.

I asked my niece this question…”What do you think helped you solve the fourth grade problems the most?” She said that I taught her strategies to solve the multiple digit problems. Multiply the ones first and then the tens next…up and then over. When doing a three-digit number by a two digit number you have to do the ones first all the way through the three digit number and then go back through the tens. She was able to practice it a couple times which helped her get the hang of it. One on one helped as well , she says that “you get taught at your own pace when it’s one on one, if you don’t understand something it’s easy to ask your questions and you don’t have to raise your hand and the teacher won’t go on without answering your question, your question gets answered right away. Small groups are easier to work in as well. Thee aren’t as many people and it’s easier to see if someone needs help and is struggling.

This was an example of Piaget’s idea of using cognitive structures to make thinking and learning possible. My niece was able to interiorize actions and build up a scheme to perform the fourth grade problems set in front of her. This also showed Piaget’s ideas of assimilation, accommodation, and equilibrium in an experiment that required the learner to acquire a new concept.