Abstract
Research shows that children learn most effectively by constructing knowledge through the world around them. Unfortunately, the constructivist model of learning is not often used in the American public school system. During the course of two months, a classroom of fifteen language minority first graders participated in an open-ended constructivist based project in hopes of fostering critical thinking skills, creating independent and motivated learners, and meeting the state of Virginia’s SOL’s. Individual student conferences, photos, group discussions and reflections, surveys, and formal assessment were used to document the project. At the end of the project, we found that students were engaged in the constructivist approach to learning.

Introduction
Not long after completing a Master’s Degree in Elementary Education, I began teaching first grade at Glen Forest Elementary school in Fairfax County, Virginia. I was fortunate to have acquired a great amount of knowledge on how young children learn and even had the wonderful opportunity to visit the Diana School in Reggio Emilia, Italy, when I attended the Reggio Emilia Conference. I knew the importance of children being actively involved in their learning and given the opportunity to construct their own knowledge. I knew a student-centered, interactive classroom was important and I knew my job was to be a facilitator who empowered students. I was looking forward to being able to put these practices into action in my own classroom, and began doing so at the start of the school year in August.

The first few months were challenging, exciting and rewarding for me and the children. However, after the November break, I began to see some changes in my group of first graders. I also began to see changes in my teaching. It was dramatically different from the way I was teaching at the beginning of the year. I felt this was due to the impending stress of dropping test scores at our school. The pressure “to teach to the standards” was affecting my teaching along with my students’ learning. Our daily routine had changed. I did not feel there was time for our “morning meeting”, and I noticed more fragmentation in our schedule due to my wanting to “push” through different standards. I felt rushed to “cover” a wide range of separate subjects, instead of linking or integrating them into other areas. The outcome was unhappy learners, and a frustrated teacher wondering, at the end of the day, what standards had truly been met. I met with my mentor and shared my concern. She helped me reflect on my teaching, sorting out what
was successful and what was not. We realized I was using a more “constructivist” approach to my teaching earlier in the year, as children were given more time to explore their ideas at their pace. It was then we decided to conduct an action research project. Along with the guidance and expertise of my mentor, I developed a question that might help answer some of the dilemmas I was facing as a new teacher. How could the constructivist approach to learning be used in my classroom to attain academic standards?

**Connections to Literature**

Twomey Fosnot (1989) defines constructivism by reference to four principles: learning in an important way depends on what we already know; new ideas occur as we adapt and change our old ideas; learning involving ideas rather than mechanically accumulating facts; meaningful learning occurs through re-thinking old ideas and coming to new conclusions about new ideas that conflict with our old ideas. Constructivist teaching fosters critical thinking and creates motivated and independent learners. It is based on the belief that learning occurs as students are actively involved in the process of knowledge construction and meaning, instead of passively receiving information. Constructivist classrooms allow for a democratic environment, interactive/student-centered activities, and actively involved learners who are responsible and autonomous. Philosophers and psychologists of the 1800’s and early 1900’s, Piaget, Vice and Khan are credited as having provided the foundation for the constructivist movement. (Good, Wandersee, & St. Julien, 1993; Matthews, 1994; Phillips, 1995; and Yager, 1991). Applebee (1993) states that “rather than emphasizing characteristics of the final products, process-oriented instruction focuses on the language and problem-solving strategies that students need to learn in order to generate those products” (p.5). Constructivist teaching is an exciting way to teach; students are motivated and actively involved. The classroom is democratic, and more teacher-student contact is possible. In a constructivist classroom, negotiation is an important aspect. Smith (1993) explains that negotiating curriculum means “custom-building classes every day to fit the individuals who attend” (p.) 1. Zemelman, Daniels, and Hyde (1993) tell us that learning in all subject areas involves inventing and constructing new ideas. They suggest that constructivist theory be incorporated into the curriculum, and advocate that teachers create environments in which children can construct their own understandings. Lindfors (1984) suggests that how we teach should originate from how the students learn. A constructivist-centered approach places more focus on students learning than teachers teaching.

From a constructivist view, knowing occurs by a process of construction by the knower. Constructivist teaching emphasizes thinking, understanding, reasoning and applying knowledge while it does not neglect basic skills. It is based on the idea that children construct their own knowledge rather than reproduce someone else’s. Chaille and Britain (1991) point out in a constructivist classroom, the teacher is no longer the transmitter of knowledge, but the facilitator of learning. The facilitator of learning keeps in mind that instruction will
vary depending on the learners’ prior knowledge, current interest, and level of involvement.

Student Background
Glen Forest Elementary school spans pre-school through fifth grade and has over 900 students, 70% who are ESOL, i.e., English Speakers of Other Languages. Within my classroom of 14 children, 12 are ESOL. The languages represented are Spanish, Urdu, Arabic, Laotian, and Chinese.

Teaching a population of language minority students poses many challenges, along with the vigorous challenge of teaching the state’s SOL’s—Standards of Learning. All learners, especially ESOL, need background knowledge and the ability to link information, before exploring new topics of study. Linking information and making connections are especially important for those who are lacking in exposure to everyday experiences. I wanted to meet the children’s needs and foster motivated, happy, and independent learners as the students learned the SOL’s. I set out to find if the constructivist approach would meet these goals.

The Project
Measurement was part of our first grade curriculum and the Virginia SOL’s. As I reviewed the first grade math and science SOLs, I paid extra attention to what appeared to interest the students in my classroom. One topic the class appeared very interested in was “measurement”. A few students in the classroom had checked out books from the school library on measurement, and a volunteer storyteller brought in a number of books on the subject to share with the class, sparking their interests even further.

The study began during a class meeting, as we discussed starting a “project”. I informed the children that I needed to locate a rectangle table and a desk that matched the ones in our classroom exactly. After a brief discussion, the children were asked what it meant to “measure” an object. Some responses were as follows:

- “How long; how tall it is.”
- “It’s like fifty feet and one-half.”
- “One foot is twelve inches.”

From their initial responses, it was evident the students were bringing many different levels of understanding to the project. The room was buzzing with excitement, and the class was curious to find out how this project was going to take place. The children were free to choose which of the two objects they wanted to measure for the project. They were also encouraged to use any manipulatives in the classroom they thought might help them measure the objects. I asked the students to record their findings each day on paper so we could discuss them with each other at a later time. Out of the classroom of the present twelve first graders, six students volunteered to research the
measurements of the desk and six students volunteered to measure the rectangle table.  

Students quickly set out to find out more about the measurements of the table and desk. I placed myself in close proximity to the groups to facilitate, but far enough away to be able to listen and observe. Some students chose to work along with the group, while other students worked parallel with the group, participating, but not engaged in conversation with the other children.  

Soon, the children began to form hypotheses about the measurements of the two items. One group asked to use the “links” from the math shelf. The links are a math manipulative, which can be locked together to make a long chain and are a great manipulative to perform non-standard measurement. Luckily, the children had spent time during the first few months of school exploring these links, allowing a better use of them now to acquire knowledge. Students began to line up the links and explore different ways to lay them around the table (Refer to Attachment 1). The children began to compile more and more numbers from lining up the links in different ways. Some students took the next step and began to record the numbers on paper, while other students tried to remember all of the numbers in their heads. I ask the students how they were going to remember all of the different numbers they were finding. “We need paper!” shouted a few of the children. As the children worked, they became more engaged and focused. They began to notice the difference between the length and width of the two items. The first day ended with a few rudimentary drawings of the table and desk, recordings of their length and width and a classroom of happy children (Refer to Attachment 2). 

The next few days of the project were filled with some confusion from the students. They were excited about the project but they needed more guidance. Part of the constructivist approach includes the important role of the teacher. The teacher is a guide for the students, posing questions that will further their discovery without frustrating them.  

One student began using his fingers to count the height of the desk, and others followed along. At this point, I asked, “How will I know how far apart to move my fingers when I measure the desk”? “What happens if someone with really big fingers measures the desk?” “What will happen if other children don’t move their hands the same way you just did?” The students soon realized their present method was not a reliable form of measurement because each person would come up with different numbers. They moved on from this theory to find a new method for measuring.  

Through the project, many other theories began to arise in the classroom. Each day we would meet to discuss what each group was working on that day. The basic measuring themes that developed were:

- *measuring with body parts  
- *measuring with the links  
- *measuring with yarn or string  
- *measuring with unifix cubes  
- *adding and totaling all the measurements of the object
• *using string and yarn to measure the table
• *using the letter “L” to represent links in their drawings (Refer to Attachment 3)
• *drawing three-dimensional shapes to represent the table, legs, inside of the desk, etc.

Within the next few days, one group located a small ruler that one of the students had in his desk. The students were now comparing the links to the ruler and were curious to see how tall the table was in “inches”. A few of the students appeared to have some experience with rulers. To help introduce the children to standard measurement, our next discussion centered around rulers and their use in our society today. Many of the students’ parents used rulers in their jobs and homes. I was impressed with their knowledge, and introduced them to more rulers.

At this point, the project shifted to a focus. Some students instantly began to work together lining up the rulers across the table and the desk. When one student asked how long the ruler was, we discussed “twelve inches” being equal to one foot”. The “desk group” had already figured this information out. The drawings from the groups began to reflect their development of formalized measurement (Refer to Attachment 4).

The scaffolding taking place within and between the groups was very exciting. It was evident the students were exchanging information and learning from each other. They began to develop a great deal of measurement vocabulary, and taught each other about their findings everyday. Each group held individual meetings, working together to better understand how the ruler and link measurements were related. (Refer to Attachment 5).

At the end of the measurement project, I gave the students a formal measurement assessment. The children were given the rulers they used during the project to complete the formal assessment. Some students performed very well on the quiz, and others had a difficult time measuring the lengths of the objects. Nine of the twelve students were able to measure, answering 90% of the questions correctly. Three other students had a very difficult time, and answered less than half of the questions correctly. I held individual conferences with each of these students, and we worked through their difficulties.

Overall, the students were actively involved and had successfully mastered the measurement standards using the constructivist approach to learning. (Refer to Attachment 6).

Data Collection
Many different methods for data collection were used during the action research project.

Anecdotal Records/ Conversations/ Note-taking
Throughout the action research, I took anecdotal records of my students’ work and conversations. This enabled me to assess their knowledge, and form questions to further their investigations, as well as assessment.
**Group Discussions**  
Each day of the project was launched with a group discussion of the previous day’s events. Students were guided into new paths of understanding, as new questions were raised. Children were engaged in listening and speaking as they were strengthening their oral language skills.

**Survey**  
Another mode of data collection was a class survey. I met with each child and asked a series of questions about the measurement project (Refer to Attachment 7).

**Informal Assessment**  
While students were working on their project, they were asked questions about their understanding of measurement. Their questions and answers helped guide class meeting discussions and helped evaluate their progress.

**Formal Assessment**  
At the end of the project, students were given a paper and pencil assessment on measurement (Refer to Attachment 8).

**Pictures**  
Photographs were taken and developed during the project. These pictures were shown to the children and used to guide group discussions. The pictures allowed children to reflect on different events that had taken place during the project and helped boost self-esteem (Refer to Attachment 9).

**Reflections**  
The assumptions I had about the way children learn had been realized through the measurement project. My students were able to reach the academic standards of learning by working on an open-ended project together. During the project, I noticed there were times the students would stumble in certain areas; however, with my guidance, the excitement for learning would grow stronger and rekindle.

I was impressed to see the children’s global understanding of measurement and how the project had influenced their overall impression of learning. They felt positive about their friends helping them learn and everyone working well together. All students, with the exception on one, were interested in working on a future projects (Refer to Attachment 10).

Throughout the project, I liked playing the role of co-learner as opposed to a “distributor of knowledge”. I was working and listening along with my students; I was part of their exploration team. There was not a set outcome for each part of the project, just my overall goal to have the students learn more about standard and non-standard measurement. This is the way I envision my teaching in the future.
Implications

The findings of this project showed all the students had responded well to the constructivist project approach to learning. The students were able to work through their problems together, and better understand standard and non-standard measurement. These findings relate to Glen Forest Elementary School in many ways, an important one being the openness to conversation in the classroom. As language minority students, these children needed many opportunities to talk to each other and engage in conversation. Throughout the project, the students were free to communicate and explore ideas openly. They were exploring different aspects of measurement and all the while conversing about the project.

I would like to continue to use the constructivist theory in the future. It would be beneficial to begin earlier in the year, and get other team members involved to collaborate with planning. Upper grade teachers could use this theory to teach their students and surround them in a rich, hands-on, problem-solving environment, providing opportunities for them to become actively involved while attaining academic standards.

References


Attachment 1
Picture of lining up the “links” around the table
Attachment 2
Rudimentary drawings of the table and desk with links
Attachment 3
Drawings of using the letter “L” to represent the link measurements
Attachment 4
Drawings of formalized measurement

1 - 2 ft. - 7 1/2 Inches
2 - 4 ft. - 11 1/2 Inches
3 - 1 ft. - 10 Inches
Attachment 5
Group meeting to discuss development within the group
Dear Ms. Stenger,

When you get to the store, this is how it looks like.

Tahli

_inches → 4 feet 10 inches
29 inches
29 inches
17 inches

↑ 4 feet 10 inches

Attachment 6
Drawings of measurements of the rectangle table at the end of the project
Attachment: Student Survey

Child's Name:______________________________________
Date:_____________________________________________

What did you think about the desk and table project?

What did you like about working on a problem with your friends?

What did your friends teach you while you were working on the project?

Would you like to do another project in the classroom?
Attachment 8: Formal Assessment

Guess How Many Inches

This pencil is 3 inches long.

Guess the lengths of the other pencils. Then, cut out the inch ruler below. Check your guesses.

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| 2. |  |  |
| 3. |  |  |
| 4. |  |  |
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Name ________________________

Skill: Inches guess and check

Inches
Attachment 9: Pictures taken during the project
Attachment 10: Survey Results

What did you think about the desk and table project?

“It was good because we had to measure the table.”

“...we get to measure the table and desk and we have everyone to help us if we don't know what to measure.”

“I liked it, because I got to know more stuff about measuring.”

“...get to write stuff, inches and centimeters.”

What did you like about working on the project with your friends?

“Measuring the top of the desk and they help me.”

“Because I just like them (friends) and the project.”

“We had to use all of the rulers from everyone.”

“Telling them the answer.”

What did your friends teach you while you were working on the project?

“How to be a team.”

“How to measure.”

“No, I teach my friends. It felt good.”

“They teach me to work together.”

Would you like to do another project in the classroom? What do you want to do the project on?

“Yes, a bug and insect project.”

“Yes, how to build tables.”

“Yes, space or plants.”

“Yes, on seeds.”