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Mathematics and Information Technology Communication

The study into the use of Roamer in promoting basic concepts in geometry for a group of Year 2 pupils

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Abstract

Acknowledgement

I would like to thank the school in which I carried out my teaching placement and for all the support the class teacher gave me through the time I spent there.

I would also like to thank my family and friends for helping me thought the rough times I had trying to complete this project I know I wasn't the easiest person to get on with but look I've finished now.

Content

In year four of the M.Teach degree, I am required to carry out a school-based research project. I have decided to explicitly explore an aspect of children's learning within the Mathematics component. This research project is a study into the use of Roamer in promoting basic concepts in geometry for a group of Year 2 pupils.

Rationale

The reasons for choosing this investigation was because of the class I was placed in for my teaching experience. It was in a Year 2 class. Before the serial practice started, in January, I was able to become familiar with the all children in the class.

I knew at the end of the year the children were to take their SAT's and according to the National Curriculum (NC)

"*the majority of children aged seven years are expected to reach a level 2 descriptor in all core subjects.*"[1]

Luckily for myself, my specialist subject is Mathematics and it is one of the core subjects that children will sit for the SAT test. Therefore I knew this would be an opportunity for me to advance my own subject knowledge and examine a particular feature of the curriculum components.

In Mathematics the level descriptor for Attainment Target 3: Shape, Space and Measure states that pupils should be able to

"*Use mathematical names for common 2D shapes and describe their properties, including number of sides.*"[2]

Unfortunately some of the children in the Year 2 class found it difficult to understand the concepts of different shapes for example being able to recognise a square because it has four equal lengths of sides. Taking this into consideration, I tried to think of

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[1] DfEE (2000) Page 9 Introduction
[2] DfEE (2000) Page 13 Level Descriptor

something that could be used to increase children's knowledge of shape and thought of the Logo program.

I believe Logo can help develop children's understanding within lesson topics as well as help teachers within their teaching of topics such as counting and properties of numbers, measures, shape and space.

After discussing my ideas with the class teacher, we came to the conclusion that this Year 2 children had not actually experienced using a Roamer within a lesson or the Logo program. Therefore, I felt that Roamer would be an interesting aspect to examine in this project.

A Roamer can help capture children's attention and can be used to motivate their learning of mathematics concepts. The pupils in the Year 2 class find it quite easy to adapt to new commodities and can adjust easily. It would be a new and exciting resource for children to discover, which can furthermore strengthen the teaching and learning of a particular topic.

Contextual Analysis

My research reflects present opinions, I have read about different learning theories to help in this project which will allow me to discove serveral views of how children think and learn.

If we examine Vygotsky's work closely it can help us understand how some of the way children understand maths in later life. The way children learn fits in very well to the different stages included in Vygotsky's theories. He says that children start to learn by using loose criteria such as colour, then the child moves on to use more scientific mathematical concepts such as the number of sides a shape has. Vygotsky's work suggest that children learn in movement of understanding by being given the opportunity to experience and make sense of something. For this reason he felt that learning was not always predictable. It is therefore thought that he would not have been a great supporter of the National Curriculum as it leaves little space for this.

Vygotsky's work emphasised the role of group work and the child's social environment on their learning. An important contribution his work can make to maths is to support for the idea of group work, something which is possibly not seen as much in maths as in other subjects. Vygotsky said

"What a child can do in co-operation today, he will be able to do alone tomorrow." [3]

According to Bruner, a learning theorist said that children are 'Tabula Rasa' which means that children have a blank slate when they are born but with the aid of education their slate fills up with knowledge.

Bruner has extended Vygotsky's ideas and applied them in the education context, where the concept of scaffolding has influenced Bruners thinking. Bruner had 3 modes of representing the world that a child can experience in their lifetime. These are known as Enactive, Iconic and Symbolic. Bruner believes that language and interpersonal communication, also an active involvement of an experienced peer helps develop a child's way of thinking. However, Bruner believes that language provides a framework within which the growing child comes to interpret and understand experience. The use of language is at the heart of the child's capability to think abstractly and to make knowledge their own.

According to the psychologist Jean Piaget, children's intellectual level develops over a child's life. He states that there are four stages towards developing cognitively. These stages are :

"Sensori-motor stage 0-2 years,
Pre-operational stage 2-7 years
Concrete- operational stage 7-11 years and
Formal Operational stage 11 upwards." [4]

[3] Eysenck, M.W (2000) Page 409-426
[4] Gross, R (1996) Page 629

All the stages occur within the age mentioned above, depending on the child's maturation. The stages I shall explain will be the pre-operational and concrete stage because it relates to children aged 6-7 years which happens to be children in Year 2

The Pre-operational Stage

This stage affects children when they are aged between 2 to 7 years. During this stage children are required to think logically that is dominated by perception however sometimes errors and misunderstandings occur. During this stage Paiget had stated that children go through what is known as conservation, where the child was unable to understand that

"*certain aspects of an object remained the same in spite of various changes.* "[5]

When children have understood conservation then they can move onto the next stage known as **the Concrete stage**.

This can occur when children are aged between 7 and 11 years. During this stage children's thinking becomes much less dependent on perception but more towards the various cognitive operations in respect to concrete situations. The main element of children's thinking during this stage is relating to direct and concrete situations.

Children perform the operation in the presence of the actual objects. They must be able to look at the object or even be able to manipulate the materials used to understand a concept.

Knowing the way children think and learn, for example if they are able to manipulate an object, they may be able to understand a concept. Therefore, children can be presented with a resource/object such as a Roamer. A roamer was devised through the Logo program. Logo can help enhance children's learning of various mathematical concepts in topics such as counting and properties of numbers, measures, shape and space.

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[5] Eysenck, M.W (2000) Page 426

Allan Martin states that Logo was developed at the Massachusetts Institute of Technology in the late 1960's. Cynthia Soloman, Wallace Feurzeig who had thought of the name and also Seymour Papert (who is widely known with the connection of Logo) created Logo

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The Logo program introduces a language for the teaching of mathematical ideas to children through computer programming. The most well known feature Logo offers is turtle graphics, which is a constructing designs or pictures to a drawing head which is a 'turtle'. Roamer is a floor robot that resembles the shape of a turtle. The turtle can be represented on the screen as a small triangle or a floor turtle. It still has the same outcomes as logo where the user has to use the same computer language to make the Roamer move but it work independently from a computer. Allan Martin states that logo is ideally suited as it contributes to the way in which learning happens in schools, he quotes that

"*It will assist in the development of the child's thinking*"[6]

I believe Logo is not only taught because it is useful but also because it should be a source of wonder offering children intellectual excitement and an appreciation of its creativity.

Research Setting

"*A caring community, enthusiastic for everyone's success.*"[7]

The school I intend to carry out this investigation is located in Teddington. The school has excellent facilities for all infant education. It is a three-form infant school for all children from reception to year 2, which means there will normally be three classes in each age group. The school also has a nursery class. The nursery has its own playground that is separate from the main playground especially as the children in nursery are so young and finds school a new novelty. Two classes from year one and year two are situated in the main school building, however a year one and two

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[6] Martin, A (1986) Page 9
[7] Opening statement in the School's Prospectus, Teddington

class has been situated outside in a hut. The school contains a Special Needs unit to support children with disabilities that is in the main building.

The school gives priority to those living in its locality and to those with sibling already attending the school. There is a junior school that use the same playing fields as the Infant but is separate from the infant school.

Project Setting

This study will contain children from Year 2 who have been assessed as having a mixed attainment level, which range from not being able to level a child according to a NC level descriptor to level.

The investigation shall be conducted in the ICT suite in the main building and not in the hut. The room is a communal room. (See plan in Appendix) The class already has tables and chair like a normal classroom. The year two classes are either side of the ICT suite whereas the hall and toilets are the other side, which means that year two children have to go through the ICT suite to go to the toilets, the hall.

Implementation

Research methods are essential when collecting evidence and data. Primary data allows personal input to be made to the project as it uses motivation and to a certain extent initiative. It is necessary for me to use several different methods as different aspects of this project require specific research tools that are going to be outlined.

The case study approach has been decided because of the time I had to gather all information from my sources. The length of time was approximately one day a week for at about 10 weeks which did not leave a lot of time to gather relevant data for the study.

I intended to use qualitative primary data for this case study approach as it is an interpretative study. The case study will allow me to gather and discover new facts from a group of six children (where you will find in the next chapter that they have been named child 1 to 6). By randomly selecting the children for the study meant that a cross-section of the class participated. The group of children shall be divided into two groups, an experimental and control group. By placing children into a experimental case study it allows me to repeat the study again using the same conditions. However if the children discover they are being experimented on they may act differently affecting the results to the study so it is important that the study is carried out in a lesson form. Unfortunately after a pilot study the lessons were not conducted in the form of a Numeracy hour as the information I wanted the children to learn did not fit into the 20-30 minutes activity session that has been recommended in the National Numeracy Strategy.

This research strategy is where the children are going to be assigned randomly to groups, which are then provided with experiences that vary a long some key dimensions. The experimental group of children shall be given a special treatment that intends to produce some specific consequences. The control group of children shall receive either no special treatment or some neutral treatment.

The data that shall be gathered will be qualitative, which is often about attitudes, opinions and values. The advantage to qualitative data is that the area of study is subjective but it is not very scientific.

All data collected will be descriptive, as it will be obtained through lessons that shall be observed and taped recorded. The lessons designed for the children to carry out, have required me to be a participant observer as well as naturalistic and also due to the age of the children and the activities it seems as though teacher interaction will be necessary. The lessons planned, require teacher interaction but once the children are able to take control I shall became a naturalistic observer during the lessons.

The children will need teacher guidance in some of the activities as they have never experienced using the resource: Roamer before. This was an advantage to the study as the children were not affected by my presence as they were used to guided lessons from teachers and I was able to answer questions asked as well as promote mathematical learning.

At the start of the study, I wrote down what children were saying and how they behaved according to body language and interaction with one another. However this revealed that both elements by hand resulted in vital parts of the conversation being missed. I then decided to tape-record the lessons so that my evidence gathered was more reliable. Also I was not going to be able to write down every single word a child was to say during every lesson. Therefore I took the opportunity to observe children's movements and tape-recorded what children had said leaving me to write up my transcripts after the session.

It is important that children remain anonymous through this study as I believe children should be made to feel safe and secure in their school environment especially as this document becomes published in the university library. Also if my results were lost on the school premises and found by a parents it would not be ethical as a child's achievement should solely be discussed with their parents.

Children will be de-briefed and thanked for taking part in such an important study of the MTeach degree so that they know why they have been selected from the rest of the children in the class.

Research Plan

Firstly the children to carry out the study were selected from a formal mathematics assessment (appendix)conducted on the whole class and to help me select the group of six children who are named child 1 to 6 that were needed for the study. The children were split up into two groups. One was the experimental group and the other was the control group.

Both groups carried out a few more assessments in the lessons that were planned (appendix) eventually finding out what 2 dimensional shape they knew and their properties. From the evidence obtained this helped me plan lessons for both groups.

The children in the experimental group were given the special treatment, which was the use of Roamer. The lessons that were planned involved using Roamer with the learning intention of being able to recognise the 2D shape they have been asked to draw. The children as a group, are to draw the shapes that they could not identified from the assessments given. Then use a large cardboard shape to help then instruct Roamer to draw round and write down every instruction inputted in Roamer.

Whereas the control group had to make a picture using only one of the shapes (in each lesson planned) that they were not able to identify from the assessments. These children had to measure the sides and record their findings.

The experimental group then carried out a sequence of 4 lessons (Appendix) that involved using Roamer to help the children identify certain shapes. During each lesson observations were conducted as well as the lesson taped to note the language children were using.

The controlled group had a sequence of 2 lessons (Appendix). The children learnt about two shapes in one lesson because the activities were shorter than expected. The

children in the control group used other resources such as card, paper and plastic shapes to learn about 2 dimensional shapes and their properties. Again the lessons were observed and the language they used to during the lesson was noted down.

I concluded with an assessment (see lesson plan 9 in Appendix)to find out what children had learnt during the different activities planned and analysed whether there were any significant differences due to the difference circumstances.

Due to the code of ethics I shall not reveal the schools name. The children will be referred to as Child 1, 2, 3, 4, 5, 6 in this study and full names will not be used to keep children's identity from the reader. Also following the schools policy to provide a safe and secure environment for children it would not be appropriate to mention the children in this study. Throughout the time spent in the school I have discussed all procedures with the class teacher and shared all evidence I have gained from the study so that the class teacher is thoroughly informed with what I am doing with the children when I take them out of class.

The lessons were planned to help promote basic geometry shapes and evidence was collected. All shall be presented, analysed and interpreted in the next chapter

Presentation, Analysis and Interpretation of Data

During this chapter I will present a series of assessments taken place at the beginning of the study to find out what the children knew about 2D shapes. Followed by a brief analysis and interpretation of the lessons conducted on an experimental and control group. To conclude I will present the assessment results taken at the end of the study which will show the group that had learnt about shapes more productively.

Results from Lesson 1

The table below shows the group I had selected from the whole class

	Circle	Triangle	Square	Rectangle	Pentagon	Hexagon
Child 1	Yes	No	Yes	No	No	No
Child 2	Yes	Yes	Yes	No	No	No
Child 3	Yes	No	Yes	Yes	Yes	Yes
Child 4	No	No	No	No	No	No
Child 5	No	No	No	No	No	No
Child 6	Yes	No	Yes	No	Yes	Yes

Yes= children were able to stick 2D shape to the correct name.
No= children were not able to stick 2D shape to the correct name.

This activity was difficult for these children to complete as some of the children were not able to comprehend what the 2D shape names were, however it helped me choose the group I was to work with.

The results above show the children who were not able to place the correct shape to the correct name, which resulted to being my sample group. This was a fair test as I conducted the assessment on the whole class and did not assist any of the children after giving them the task to complete.

Results from Lesson 2

From the sample group of children another assessment was conducted to test whether the children could visual a 2D shape.

	Circle =3	Triangle =3	Square =2	Rectangle =3	Pentagon= 3	Hexagon =2
Child 1	3	3	3	1	3	1
Child 2	3	3	4	5	0	0
Child 3	3	2	3	2	1	1
Child 4	3	2	2	4	2	1
Child 5	3	1	3	2	1	6
Child 6	1	3	3	4	5	6

This lesson was an assessment. It was also a visual stimulant to be able to recognise 2D shapes. All the children were not able to recognise the difference between a rectangle and square which makes me believe that children are able to recognise those shapes but can not tell the difference between the two which leads onto knowing the properties of a shape. This lesson started well but did not actually help me find out what children knew what shapes and their properties. Therefore I knew I had to design another assessment that would show me the children who knew the shape names.

Results from Lesson 3

From the sample group of children an assessment was given to write the correct shape according to the description read out by the teacher.

	Circle	Triangle	Square	Rectangle	Pentagon	Hexagon
Child 1	Circle	Triangle	Octagon	Pentagon	Square	Diamond
Child 2	Rectangle	Triangle	Square	Square	Circle	Rectangle
Child 3	Circle		Square	Square	Hexagon	
Child 4	Circle	Triangle	Diamond	Octagon	Square	Rectangle
Child 5	Circle	Triangle	Rectangle	Rectangle	Hexagon	Pentagon
Child 6		Triangle		Square	Hexagon	Octagon

This was my final assessment on the children. The results above states that most of the children know the description for a Circle and Triangle but are confused and mixed up with the square and rectangle. Most of the children again were mixed up with the Pentagon and Hexagon, but some did not even have a clue what these shapes were.

These assessments were necessary so that I could find out what the children knew about 2D shapes and their properties. There was no point in me carrying out a study to promote basic geometry using a roamer if the children already knew how to distinguish 2D shapes. The results above state that the lessons I was to plan for both groups was going to be promoting a rectangle, square, Hexagon and Pentagon. The next step was to divide the group into two to carry out a series of lessons.

Lesson 4

This lesson was introducing the Roamer to the experimental group of three children. During this lesson the children had told me that they had not used or knew what a Roamer was.

The children were very enthusiastic when I had introduced the Roamer and when I asked if they wanted to have a go and play around with the Roamer they all shouted

Children: (Shouts) Yeah.

Child 2 and 3: (moves closer to the Roamer)

Child 3:   Can we make it move now?

Child 2:   Yeah I want to have a go.

The children were so eager to have a go straight away. This made me feel as though I needed to introduce the Roamer and its instruction as quickly as possible. The children though they were going to play with Roamer and not do any work. One of the children had commented

Child 2:   Are we going to do this instead of work Miss Shah?
               This is cool.

Child 1:   We don't have to do any work.

This helped towards getting the children to enjoy playing with Roamer and making the activity fun for them to experience. The activity was also an icebreaker to see if the children were going to be able to get along with one another. Some of the children became dominant

Child 2:   Ok. Stand over there and I'll make it move to you first.
               (moves Roamer by his feet and looks at the instruction sheet.)

but they soon rallied together helping each other out.

Child 3:   My turn (presses forward 2 go) Here you go child 2 (looks disappointed) It didn't move.

Child 2:   I know. You have to press CM first to clear what Child1 had put in. (walks over to child 3 to show)

Child 3:   Oh yeah.

This lesson proved to be a huge impact on the children because they were so enthusiastic and motivated. The children wanted to know what Roamer could do. Therefore I knew the next lessons I planned needed to challenge children's knowledge as well advance children's mathematical skills.

From Lesson 5, 6, 7, 8

The children again were very eager to start programming the Roamer, even one child became quite dominant that they were to go first.

Child 2:   I'm doing the first instruction.

After a bit of time they came together and took it in turns to program the Roamer so that they all had equal amounts of time playing with the Roamer.

Child 1:   Can I have a go?
Child 2:   Yeah. We can all take it in turns.

I found that the children worked as part of a team to figure out how to program the Roamer to draw the shapes required. During this activity the children were able to draw a rectangle without any of my help this could have been due to the instructions given last lesson or at the beginning of the lesson as a recap. At one point the children were getting excited and wanted to see what the Roamer was doing for every instruction that was input into Roamer. The children needed reminding that they were working as part of a team and needed to work together.

Child 3:   My go now (moves child 2 out of the way)
Child 2:   Oi careful. (pushes child 3) You pushed me.

The children started to get a bit too big for their boots where they thought they knew what to press when programming Roamer and did not want to listen to the other children. However by the child not taking advice from the other member of the team, the child had instructed the Roamer incorrectly.

Child 2:   No you want it to go the other way. (uses hand to show what way)
Child 3:   No I don't
Child 2:   Try it then. (sits back) I bet it's going to go the other way.

Luckily for child 3 he was willing to admit he was wrong, so he tried again following the trial and error theory.

Child 3:   Ok. I can do that again. (picks up Roamer and moves it back the way it was)

It seemed as though towards the end of the first lesson the children were picking up positive traits from one another and willing to listen. During the lesson the children needed guidance rather that intervention.

During lesson 6 the children seem to have a major break through in understanding how to draw a Hexagon. However, before the lesson started I needed to recap what the children had done the week before as this help consolidate children knowledge of a rectangle. The children needed questions so that it made them think about what they were doing and geared them onto the next progressive step. The children had used the correct language to describe the shape. The children even used correct descriptive language such as

Child 3:   I had four sides.
Child 2:   It turns 90 degree.
Child 3:   All the sides are the same lengths.

At first though children used their knowledge from the previous lesson to make the Roamer turn a corner for the Hexagon.

Child 3:   It needs to turn 90 degree.

However through sight recognition one of the other children thought it was the wrong angle. At this point I thought it would be a great opportunity to intervene and get the children to think about the angle they had to change. I had input some mathematical knowledge into children's thinking mode at the beginning of the lesson, which would aid the children for when they were to draw a Hexagon. The children attempted many different other angles but then child 3 had moved onto the next logical mode of thinking. Child 3 was able to explain his theory of working out an angle of a Hexagon

Child 3: When you add all the number of sides in a rectangle up it adds to 360 and that was the same for a whole turn. It works the same for this shape I think. A rectangle has 4 sides but if you then have 360 and share it with 6 sides you get 60.

This was amazing as child 3 had understood the concept and relationship between the number of sides a shape has determines the angle the Roamer is to turn to make that shape.

In lesson 7 the children had to draw a square. I believe they remembered how they had drawn a rectangle and used the same principle, although I had added that the sides on a square are the same lengths. This relates to conservation in Piaget pre-operational stage of cognitive development.

Child 1: Turn right it will be 90 won't it then?
Child 2: Yes that's right. All of them will be the same like when we drew that first shape.
Child 1: Oh yeah the rectangle.

Throughout the lessons children worked collaboratively which helped them achieve the learning objectives for each lesson. All three children's knowledge was shared amongst them where ideas were experienced and developed.

Lesson 5a and 6a

During these lessons the fun element of doing no work came across positively. Children prefer to believe they are playing rather than working. Children believed that gluing shapes on a paper to make a picture was not work. These lessons were very quiet and it seemed as though children were concentrating hard. Some children tried to get out of this work by asking to go to the toilet

Child 4:	Can I go to the toilet?
Teacher:	Have you drawn your picture using only the Hexagon shapes?
Child 4:	No
Teacher:	Finish drawing the picture and then you may go to the toilet.

Some children need motivation and encouragement in order to complete a piece of work that the teacher has asks them to do. This was evident during these lessons. The children were very eager to draw pictures rather than do or write any work.

Child 4:	Can I do the other picture now?
Teacher:	Have you measured all the lengths and then written a statement underneath about the shapes used in the picture?
Child 4:	No but all the shapes look the same, they have four sides.

At one point though children were becoming unmotivated and talking about random things that were occurring in the day which was distracting them from the learning aspect of the activity. I had to interrupt their conversation and stir them back to what I wanted the children to learn from the activity.

Child 6:	Are you going swimming?
Child 5:	No
Child 4:	Miss Shah have we got swimming today?

Also

Child 5:	This looks like a house already. I have to stick one on the paper and that's my picture.

Overall the activities planned were a learning experience for children however they did not capture the children's attention as much. The activities were not challenging children's thinking and making the children want to find out something new about shapes.

Results from Lesson 9

The table below reveals the results from the assessment given at the end of the case study. It shows whether children were able to name the 2D shapes on the assessment.

	Circle	Triangle	Square	Rectangle	Pentagon	Hexagon
Child 1	Yes	Yes	Yes	Yes	Yes	Yes
Child 2	Yes	Yes	Yes	Yes	Yes	Yes
Child 3	Yes	Yes	Yes	Yes	Yes	Yes
Child 4	Yes	Yes	Mixed -- ---- up		No	No
Child 5	No	No	No	No	No	No
Child 6	No	No	Yes	No	No	No

You will see that child 1, 2, 3 were able to name all the shapes on the assessment sheet whereas child 4, 5, 6 were not. In conclusion the children who used the Roamer were able to recognise what shapes they were because the influence and engagement they had with Roamer.

The table below reveals the results from the assessment given at the end of the case study. It shows whether children were able to describe the shapes on the assessment.

	Circle	Triangle	Square	Rectangle	Pentagon	Hexagon
Child 1	Yes	Yes	Yes	Yes	Yes	Yes
Child 2	Yes	Yes	Yes	Yes	Yes	Yes
Child 3	Yes	Yes	Yes	Yes	Yes	Yes
Child 4	No	No	No	No	No	No
Child 5	Yes	Yes	Yes	Yes	Yes	Yes
Child 6	Yes	Yes	Yes	Yes	Yes	Yes

In conclusion the children who used the Roamer when learning about 2D shapes were able to name the shape and describe their properties correctly. Whereas only child 4 was unsuccessful. This could have been because the activities did not motivate child 4 learning.

Reflections

A Roamer has been designed to provide children the opportunity to explore and discovery new skills for themselves. Logo is most effectively used with groups and if children are placed into groups when working on Logo is enables the learning benefits of group activities to be obtained. Discussions arise and group members can contribute their ideas and suggestions that others can try to understand.

"*Logo encourages an exploratory style of learning,* "[8]

Exploration and discovery are the essential parts of the experience which schools can offer children. Children experiencing new resource are always very curious and excited when new things arrive. Resources can help children learn mathematics with understanding, therefore using a Roamer aims to grasp children's attention to make an impact on their learning.

Psychologist such as Bruner, Piaget and even Vygotsky all believe children are operative in their own learning. Piaget believed that children learn according to when they are freely allowed to explore the activities that take place whereas Vygotsky believed that learning took place if they were instructed to do something for example when teachers intervened to assist them in an activity.

I believe children need instructions in order for learning to take place otherwise children's knowledge would be very minimal and no progression would occur to enhance their development. Children need a focus in their structured lesson to progress development, with the help of others children can develop their knowledge bringing out their strengths and weaknesses.

Child's potential for learning is revealed and indeed is often realised in interaction with more knowledgeable others. The art to interaction is developing children's own knowledge because children's ideas are then reflected to others.

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[8] Surrey County Council (1990) Page 3

Bruners and Vygotsky's theory of learning is that learning is a developing process that is influenced by teaching. Vygotsky highlights that if children have a gap in their ability, as in what they can achieve, then with the help of other that are able to share their knowledge and understanding then the gap starts to be filled. However according to Piaget children learn in stages, and can not progress onto the next stage of cognitive development no matter how much teaching has been implemented.

I believe that children do learn in stages but with the appropriate teaching these stages can develop and advance at any given age. Liebeck also states that

"Mathematical ability of seven year-olds to vary roughly between the ability if an average 5 year old and 9 year old."[9]

As more information is taken on our views and opinions change, which affects what we first believed and thought of. This can be expressed within classroom teaching; therefore it needs to be taken on board when planning. Planning with progression seems to demand a high level of assessment and record keeping in order for the progression to be apparent.

"Planning for Progression requires a vision of where we are going."[10]

When planning teachers need to also focus about assessments, as they are an important part of teaching these days. Assessments allow teachers to have a record of what children know and have learnt. Assessment is now formally required in primary schools. The task of assessment is an important part of the teacher's role, which should inform the work, selected for individuals or group work in order for learning to take place in children's development.

The research methods used in this study were appropriate especially in the length of time I had to conduct the study. By using the case study approach it allowed me to monitor children's learning and thinking. However to know if the Roamer was affective in the long term memory I would have had to go back to the study and made

[9] Liebeck, P (1990) Page 245
[10] Wragg, E.C (1993) Page 29

another assessment, which would mean that the study would have been a longitudinal study which I did not have the time for. I should have also asked teachers opinions on whether they had used a Roamer in the classroom in the form of a questionnaire. This would have shown a more meaning study and insight into classroom teaching.

The value of the research had made me see the potential a Roamer can make to children's thinking in mathematics. It motivated the children and also they were willing to learn about shapes because they were given a challenge that they had to solve.

If I had the opportunity I would have devised a book for the school emphasising the benefits a Roamer when using the Logo program can have in teaching children about shapes. To extend the study I could have investigated the use of roamer in other National Curriculum subjects no only maths.

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Appendices