New-looking learning curve seen at Sunrise

by LIDDY NEVILLE

Kate is generally very successful in her exploits. She doesn’t need to hear the whole explanation. After being given a few clues she interprets what is happening or being said from her perspective and completes the sentence or scene with some impatience towards those who are less able. Explanations are not very interesting to Kate. She always finds out how to do it before other people. Perhaps building an intelligent vehicle has hit something and then they can command the car to back off from the obstacle.

To make the car drive the other way, the teacher uses the command REVERSE.DIRECTION. This is a command to a pair of power sockets and the effect is to reverse direction of the car’s motor which is connected to the computer. Kate is comfortable with this command as what she wants is to see the car going in the opposite direction from its original direction. She wants the motion of the car reversed in direction and achieves that with this command to the motor. This is an oversimplification of the situation, however, as she finds out later.

IF SENSOR? = “TRUE [REVERSE.DIRECTION]

The command to act on the information received from the sensor is typed into the computer. That will work, but what would happen if it read simply

IF SENSOR? [REVERSE.DIRECTION]

This is a syntactic problem with the language in which the car is being commanded. Behind it lies a logical problem. In this particular case the sensor registers if it has a particular state, for instance ‘on’. In other cases sensors may register a change of state. Later Kate gets confused by this difference.

On other occasions many students have been confused by the command KEY? which registers a keypress. This command is connected with the pressing of any of the many keys on the keyboard. Confusion arises when students want to identify which key has been pressed. For instance, when the pressing of ‘R’ is chosen as a way of directing the turtle

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What in the name of technology are we doing to education?

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to turn to its right, they want this key only to activate the turn, and inactivity for all others. Achieving this is easy if the first syntax has been used and the student is familiar with it. Often users find themselves with all keys active because they have muddled the logic.

It is not just a matter of syntax. The syntax has been chosen carefully so the user must come to recognise the predicate as a 'black box' which provides a value for the program. Finding that variables are not the same as their values is something which users of Logo do frequently.

It is considered desirable, if students are to build understandings about variables, operations and predicates, that they have many everyday experiences with them. The aim is to help them build knowledge about abstraction as a process. The belief is that this knowledge will make it easier for them to appreciate some of the many abstractions which are presented to them in school.

Another problem confronted Kate. The car reversed direction when it hit the obstacle but continued until it fell apart as its wires were stretched to their limit. She needed to be able to tell it to go back a fixed distance. The command to turn on the motor which drove the car (powered from port A) was:

TELL "A" ON

Kate wanted it to go only a certain distance so she used the command

ONFOR 10

and then followed that with RD so it would start going forward and soon enough hit the obstacle again. This was good except that the car fell apart again; this time when it hit the obstacle. The bit holding the sensor had become extended with a rod which protruded like a unicorn's horn but its housing was merely pushed down onto the chassis.

Kate was stumped. She moved the sensor and its bits back further so they didn't stick out so far. Again it fell apart on impact. She made it lower, higher, whatever, ... it did not save the car. Only with prompting did Kate think about what was behind the sensor housing and what happened on impact. Finally she built a firmer support behind the section and solved the problem.

She decided it would be fun if lights flashed as the car headed for its doom. First she wrote a little procedure to control the lights:

TO LIGHTS
TELL 0 FLASH 30 30 END

This procedure tells the lights (connected to port 0) to start flashing with off/on intervals of 20 units. Then she amended her DRIVE procedure:

TO DRIVE IFELSE SENSOR? [RD ONFOR 10 RD] [LIGHTS] DRIVE END

This procedure was to provide two forms of action for the car. If the sensor registered, the car should REVERSE.DIRECTION and go for 10 and then REVERSE.DIRECTION again. Otherwise, it should have the lights flashing.

Some of the boys who had been watching became impatient at this point. They could not accept the word END at the end of this procedure when it was so obvious that the computer would not actually reach the end, having been sent back to the beginning by the command DRIVE on the second last line. Again what appears to be a bit of syntactical fussiness has important meaning. Very many programmers fail to understand the difference between looping back to some part of a program to run the bit again and recursion. In Logo, when the command DRIVE has been given in the second last line, that procedure is finished. It is another version of the DRIVE procedure which is called into play by the DRIVE command.

These boys are competent BASIC programmers and spend a lot of their spare time programming. They are likely to want to develop their interest in computer science as they progress through school. They are very likely to find difficulties later if they maintain the model of looping they have shown on this occasion. Unless they have opportunities to experience the inadequacies of the model they may well find it very difficult to understand much of the programming which they will encounter later. They run the risk of reinforcing their model to the point where it becomes a scar

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on their mind rather than a stepping stone to a superior model. These boys rarely listen to explanations either. They will have to learn from personal experience too. They are sure to have their model challenged soon in the Sunrise School.

Kate added a little procedure to start all the action:

TO START
TELL “A ON
DRIVE
END

The car was set in motion. It crashed into the obstacle with its lights flashing. The lights continued to flash but the car did not back off from the obstacle. Kate was truly stumped this time. She had failed to return the control to the car’s motor after she had had the lights turned on. She could not understand that the car’s engine would continue endlessly as it had not been turned off, and now couldn’t be turned off, and that was why the car failed to REVERSE DIRECTION.

It’s hard to say what Kate was doing. She had not listened carefully to the teacher’s explanation in the beginning and was now having to ask for help. This time she had to listen all the way through.

Kate did not seem to have very much formal knowledge about motion and had been greatly confused by the concept of continuous motion. She had found the idea of turning motion ON and then it continuing until she actually turned it OFF, a confusing one. Sure, that was what happened with the switch on the vacuum cleaner, but somehow motion was not the same.

Perhaps it’s true. Cars have engines which are on even when the car is stopped. So does the vacuum cleaner. In the case of LEGO the motion was being directly related to the engine and Kate was trying to command motion. She found the ideas very difficult.

The situation in which Kate found herself brought her naive ideas about motion into direct conflict with her intuitive understanding of what was happening. The conflict had to be resolved or the car wouldn’t work. Struggling to make sense of her fuzzy understandings was learning. The learning was taking place at several levels. Kate had to find a set of explanations which produced the results she wanted. She also had to recognize that she was not going to be able to succeed if she tried to keep all her original views.

At another level Kate was working on maths, physics, engineering,...

At another level Kate was learning about her own problem solving strategies. She expected to be able to guess the correct answer to a problem and was finding that the problem couldn’t be avoided because it was her problem but nor would the answer just appear.

In the name of technology, Kate’s teachers have exposed her to learning experiences which throw light on the process of learning in many ways. The teachers cannot help questioning the practice of ‘teaching’ algebra to students who are so clearly in possession of contradictory knowledge sets. These students need time to evaluate their own knowledge in the light of other or new ideas. More, they need an environment in which they can model their ideas and those being offered to them and so actively make choices between competing sets of information.

The LEGO materials linked to the Logo computer make an ideal environment for this sort of work.

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As technologists, we need to know how to use the materials, including the intelligent plastic blocks and the programmable computer, to provide these experiences. This is not about how to do LEGO (or Logo).

What does it mean?

It is suggesting to us as teachers that we should stop being (and feeling like) inade-quate providers of knowledge and participate with our students in the process of learning. It means that we as teachers find ourselves needing to be prepared to support activities we personally cannot understand. We find we often need to remind ourselves of experiences we have had to justify our encouragement of the sorts of learning we are advocating. We need to be prepared to let our students do what we do when we learn; use strategies which suit their individual learning styles.

We are battling very hard to establish a suitable classroom environment in which this sort of learning can take place. We face the usual difficulties with those students who do not spontaneously work as Kate did. (This is not a new situation and perhaps the new materials should not be blamed for it.)

In the Sunrise classroom we want to establish a genuine sense of legitimacy about the sort of work in which Kate was engaged. We have to demonstrate to some of the students time and again that this is not just a different way of making the demands they are used to in school. Not all the students want to take the responsibility we would like to see them display. Some of them are not prepared to trust their teachers (this confidence will be hard won but also hard earned as we as teachers still frequently question what we are doing).

Finally, the students in the Sunrise School are in an interesting position with respect to assessment. In this, as in many other things, they are not different from many other students in classrooms across the country. Still, the final assessment of student achievement is based upon individual performance, often in isolated contexts, using traditional media and criteria. Somehow this does not seem altogether appropriate. In the short term it is essential that the Sunrise students maintain their position on the scales which are used to decide their future in their main school and their career options. We are already wishing we had some other more appropriate way to evaluate the students’ learning.

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