Back to the Future: Can we reverse a quarter-century of regression?

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Abstract

25 years on! Thoughts on the future constructed from a mistily remembered past. The cause of present predicaments is analysed from the perspective of a traditionalist ascendency. Eurolog87 aspired to change teaching. In the spirit of '87, but now with resources, a call to arms is voiced.

Keywords

Logo, primary education, constructionism, traditionalism, teaching method, medium, reflection

Introduction

The first Constructionist conference, nee EuroLogo, took place in Dublin, Eire at the beginning of September in 1987. Thanks to the hiatus before Constructionism 2010, this biennial European conference now has a silver jubilee. A time for reflection on what might have been and the forces that derailed the hopes of the early 1980s. From the author's perspective, that of a teacher focussed on the primary phase of education, this period has been one of powerless frustration trapped between the rock of educational traditionalism and the hard place of the short-term projectism of a fragmented academe; not forgetting the commercial pressures from a hard-selling ICT industry. However it is the former that are most germane to this discussion, which will begin with 1987 and conclude with 2012.

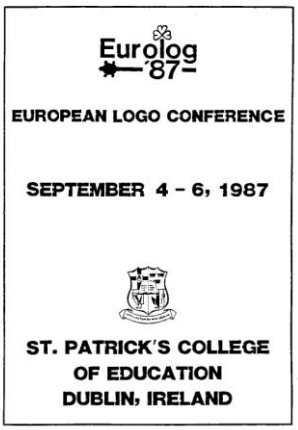
The intervening years have seen much technological development. However, on the basis of two recent major reports in England: The Cambridge Primary review (Alexander 2010) and the Royal Society Inquiry into Computing in Schools (Furber 2012) it is possible to assert that in real educational terms there has been regression rather than progression. Many factors contributed to this, some of which arose from the Constructionist community (notably the conflation with educational philosophy). The major regressive influence, however, originated in the educational traditionalist reaction to so-called progressive education. Although the English experience of the traditionalist agenda will form the basis of the discussion, the zeitgeist means that the analysis has general application. This is seen in the terminology that has been inflicted on education: first IT (information technology) then, with the Internet, ICT (add communication) and now merely "technology," which must be new. Thus, pencil, paper and book are not in this sense technology, whilst the latest hardware, whether laptop, whiteboard or tablet, is. The notion that the computer in the classroom was a new medium with an entirely different relationship to the developing mind of the learner from the text media that were the stuff of schooling (Doyle 1986) was rapidly lost. In such an intellectual environment constructive thought is difficult. However, let us begin with Eurolog87 and compare then with now.

Eurolog87

The Dublin conference was conceived as a meeting place between educational academics and the practising teachers who must convert their ideas into practical classroom activities: lessons. The

Eurologo biennial conference tradition was established by an informal group meeting at the 1986 British Logo User Group conference in Birmingham in 1986. Its timing was designed to coincide with the school long summer holiday so that teachers, who seldom receive conference funding and never receive career points for attendance or presentations. The Birmingham conference was also notable for the first European presentation of LogoWriter by Brian Silverman and that year also saw the launch by LEGO of its Interface A and LEGO TC Logo, soon to be teamed with LogoWriter as LogoWriter Robotics.

Eurolog87, note the absent final 'o,' produced no proceedings. All that remains are a few individual notes and the odd programme. The cover of the latter is reproduced below, with a list of the presentations.



A. Martin	Adaptable Microworlds for the History Classroom
C. Morgan	Introducing Logo to Young Children
J. Arias	The Intergalactic Turtle
Twomey/O'Dowd	LogoWriter for Beginners: Workshop
Butler/Close	Logo and Mathematically Gifted Children
N. Flavin	Logo in Secondary Education
P. O'Sullivan	Logo and the Primary Curriculum
M. Costello	Logo for Beginners: Workshop
K. Johnson	The Brain-Damaged Programmer: Effects of Exposure to BASIC
J Staines	Turtles: Past, Present, and Future
C. Kranz	Teaching Deaf Children with Logo
R. Eyre	Control Logo Master Class
J. MacNemara	Logo in Irish Primary Education: The Pilot Project
M. Valke	Report on the Integration of Logo into the Mathematics Curriculum of the Primary School
M. Holland	Logo with Mildly Mentally Handicapped Children
T. Olsen	Simplified Logo for 4-6 Year-olds
B.Denis	Teacher's Profile in its Relation to the Attainment of Specific Objectives in a Logo Environment
N. Fernandes	Heuristic Learning with Logo
H. Leibling	3 Dimensional Logo Master Class
J. Hardy	Logo: Storms and Beacons
R. Penny	Logo and Design for Non-advanced Further Education Students
E. Murphy	The Use of Logo to Develop Meta-cognitive Mathematical Skills
H. Loethe	The Space Turtle and Spatial Imagination
J Mallatratt	The Lancashire Logo Development Project: an Attempt at Curricular Integration
M. Doyle	An Evolution of the Physical Turtle
A. Martin	Adventure Games Master Class
Jansen/Kock	Developing a Curriculum Informatics in a Modular Logo System
M. Sweeny	Cognitive Development: with and without Logo
G. Enright	Logo with Disadvantaged Children
Close/Butler	Children's Problem Solving Processes in Logo
C. Kranz	Logo in Second Level Education in Luxembourg
H. Pinxteren	LCN Logo

Figure 1. Eurolog87 programme cover and presentations

The themes are not dissimilar from those at Constructionism2010. However, a little historical perspective is needed to interpret the presentation titles. To begin with, the word "Logo" did not necessarily imply the use of the programming language. An unintended consequence of the focus on turtle graphics in *Mindstorms* was the conflation of "Turtle Talk" with Logo. This meant that a majority papers were actually on the theme of turtle graphic commands and the use of floor turtles to implement them. In cases where mathematics was included in the title, particularly at primary school level, Logo was synonymous with turtle graphics. Where control technology was involved, Logo also may not have been the programming language. Often a so-called Logo-like interface, one that copied Logo vocabulary and some punctuation without implementing list-processing, was used. In England, such software was written in BBC Basic, with which the

machine was supplied as standard. The pictures below illustrate these two major strands of Logo:

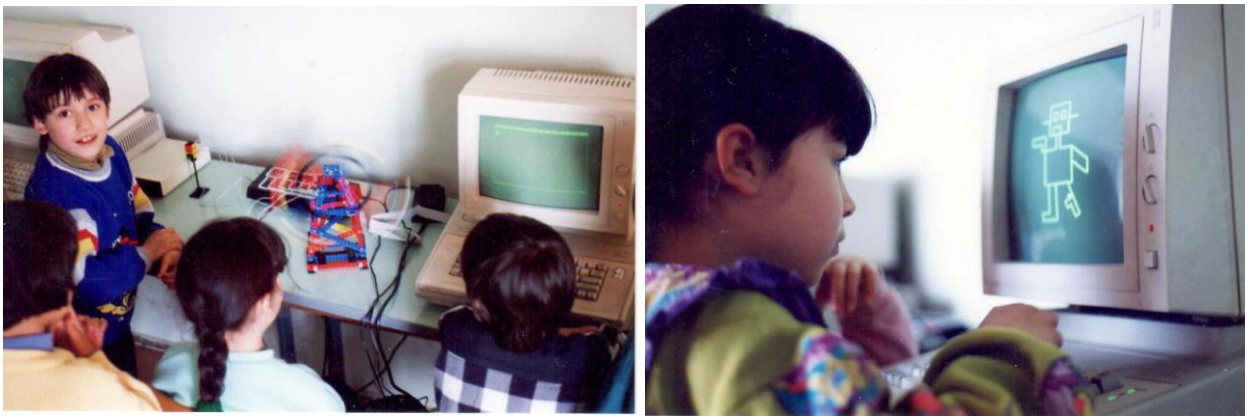


Figure 2. Control technology (LEGO Interface A) and turtle graphics

on 8bit pre-mouse microcomputers.

The third strand, characterised by LogoWriter, was the text/literacy aspect. The adventure games were a popular text-based activity as was the proposed use in the history classroom. LogoWriter, however, structurally went further than this. Alone amongst Logo implementations, it emphasised the change in the medium. With the programmable word-processor commands children and teachers were provided with a powerful tool actively to explore text. Nowhere was the difference between a sheet of paper and a screen made more obvious. The procedures page was a delightful exemplar. Below is a segment of a program as it might appear on this page, which in other implementations is the editor. Note that the same type and layout is used as for body text. This is because it is the words that matter, not the chosen font or formatting.

The procedures on this page illustrate the “square/diamond” effect and make use of turtle graphic commands. First we need a square:

```
to asquare
if equal? :count 4 [stop]
forward 100 right 90
make “count sum :count 1
asquare
end
```

Note: because this draws a square by counting the number of times the segment side/turn is carried out, it is necessary to zero the counter before beginning. To do this, type: make “count 0 before drawing the square. This may be done automatically with a slight change in procedures, as follows:

```
to square
clean home
drawsquare 0
end
```

This is the calling procedure. It calls the procedure below with the counter set to zero.

```
to drawsquare :count
if equal? :count 4 [stop]
forward 100 right 90
```

```
drawsquare sum :count 1
end
```

The diamond procedure is now simple to write:

```
to diamond
clean home right 45
drawsquare 0
end
```

Alternating the square and the diamond is trivial:

```
to squarediamond
square wait 20 diamond wait 20
squarediamond
end
```

This makes a very clear statement about the intended audience for the text. Between a "to" and an "end" the audience is the computer. After "end" and before "to" a human audience is the target. For a child in primary school this makes far more sense than the computer scientist's semicolon comment convention. It encourages making of the link between natural and computer language and helps the child to explain what they are trying to do in (Vigotskian) internal language. It also fits the Logo, eat the elephant in small pieces, approach. And, with a little care over "intelligent" double-quotes, the text above may be copied directly into the editor (both LogoWriter and the current Microworlds) where the natures of procedure and narrative are clearly demonstrable.

Readers will have noted the emphasis placed on primary education. This is because it is what it says on the tin: primary education. This phase of education is the basis for all that follows; and if something is not included in the curriculum in these years, it will not be available for building upon in the secondary and tertiary phases.

The Interregnum

The paper "Storms and Beacons" had an apposite title. As it was being presented, the educational traditionalists were cooking up the first English National Curriculum for over a century. Imposed from 1988, is prescribed what should be taught in schools in the country. Thus, England stepped into line with most jurisdictions where educationalists implemented executive instructions. In these statutory documents Logo, officially, ceased to exist. Logo for the BBC Microcomputer had a single monopoly supplier and politico-commercial interests ensured that what might be deemed a brand name should not appear in government publications; notwithstanding the fact that there were multiple turtle graphics packages masquerading as Logo. This suggests that lack of official support for Logo was associated with a dislike of programming on behalf of the traditionalists.

Traditionalism ruled not only within the national curriculum but also in the executive's response to perceived poor standards of literacy and numeracy. In both these core aspects of the primary school curriculum the legislators prescribed traditional methods of teaching and proscribed the use of computer technology. The potential of the new medium to assist learners went explored in an agenda that relied on assessing traditional attainment achieved through traditional methods.

The current nostalgia about early computers in school masks some critically important factors. The old eight bit machines had small memories and lacked a mouse. There was only one in each classroom, if you were lucky. The cost of computing was high and the notion that a child might have their own was inconceivable. The advent of the mouse and windows had a significant effect

on Logo. The first casualty was turtle graphics. Offered a mouse and a paint package, primary school teachers quickly abandoned turtle drawing, with which many had been uncomfortable. The death of LEGO-Logo was more lingering. It began with the RCX programmable brick in 1998. Some three years after the launch of Windows 95, the fashion for GUI interfaces led LEGO to abandon Logo and embrace a child-oriented graphic programming environment based on NI LabVIEW, a professional engineering environment. Although there remains Logo support for both the RCX and NXT, it is not supplied with the product and must be sought out. Thus, by the end of the twentieth century, Logo had lost its place in school – almost. Some suppliers embraced the new graphical world and produced new implementations. Microworlds and Comenius Logo, from LCSI and Comenius University in Bratislava, and MSW Logo, were notable. The Comenius implementation included graphics as first-class computer data. Animation was now on offer.

As computers became more ubiquitous, it began to become apparent that children needed to be taught to master the medium. Most jurisdictions had a curriculum framework that was difficult to modify. Bulgaria, however, had three levels: obligatory, obligatory elective, and elective. The last was a curriculum that was approved for use in schools but the teaching of which was optional. For this latter category a curriculum which would lead to mastery was written by Ilieva (Ilieva & Ivailov 1999) for all four years of primary school. Comenius Logo was used to write a collection of supportive small programs. Turtle graphics did not feature, but LEGOLogo did. Some progress has taken place as a similar curriculum, with the control technology removed for economic reasons, was elevated to the obligatory elective grade in the mid 2000s. Here it was one of a selection of options that must be chosen. However, as in other countries, the traditionalists hold sway and it is not likely that mastery of the computer as a medium will become obligatory. Although standards are set, as in England there is no quality control and children enter secondary education with widely differing competences. The curriculum and its software and method were reported to Eurologo conferences beginning with that in Sofia in 1999 and concluding with 2010. In this context, it is notable that the curriculum originated in a primary school and was developed by practising primary school teacher rather than a university researcher or academic.

During this period the notion of Logo as "a philosophy of education and a family of programming languages," the former derived from Piagetian concepts and the latter from Lisp and thereby the Lambda calculus, metamorphosed into constructionism (LCSI 1999). Focussed on making not talking, the core of the philosophy was the creation of a public object open to inspection (and thus dissection). This was not unconnected with the informal finding that in third world countries, it was practical people rather than educators who grasped Logo concepts most readily; echoing the situation with the traditionalists in England. Unfortunately, constructionism, like its forebear constructivism, lacked the science base that Piaget (1971) had longed for and for which Papert later expressed hope (Harrel & Papert 1991). Nonetheless a re-baptism was imposed: in 2008, EuroLogo became Constructionism. Teachers were notable by their absence from Paris in 2010.

Twenty five years on

Technology has developed considerably since 1987. Tape loading of software has given way to online download, CD and USB stick. Memory and displays are vastly improved. Where the BBC Micro had 32KB the modern computer has 2GB. CRT displays have given way to flat LCD high definition colour screens that react to touch. Teachers have multimedia projectors instead of chalk boards. Computers are no longer a scarce resource: perfectly serviceable Windows 95 machines hit the dump some years ago and are now being followed by their XP successors. The notion of personal ownership of a computer by a child, at home if not at school, has become the norm. But, to quote Richard Noss (2011), the influence of AI on education over the past twenty five years

has been extremely small. Where do we really find the EuroLogo community situated now? Let us first consider the areas covered in 1987.

Turtle Talk, the mainstay of Mindstorms, is mere shadow on the classroom wall. MicroworldsEX has no turtle on its page unless you put one there. It does, quietly, retain the procedure page design of LogoWriter and all the text primitives have returned. There is support in the Robotics version for LEGO RCX and NXT but not for Control Lab for which LCSI wrote the software. Imagine does not have the same range of primitive facilities, though LogoWriter may be written with the inbuilt primitives and there is serial communication which could make the RCX and Control Lab operable from it; but its strength is in programmable graphics.

Children now arrive in school with excellent mouse point-and-click and browsing skills. But the failure of traditional education to address keyboarding seriously has led to children have limited skills in this area. The lack of the one and the presence of the other motivated a point-and-click, drag-and-drop approach, to which both the Logo and LEGO community succumbed.

WeDo from LEGO and Scratch from MIT nicely illustrate the effects of the last two and a half decades. Below is an illustrative WeDo model with LabVIEW-style and Scratch screens.

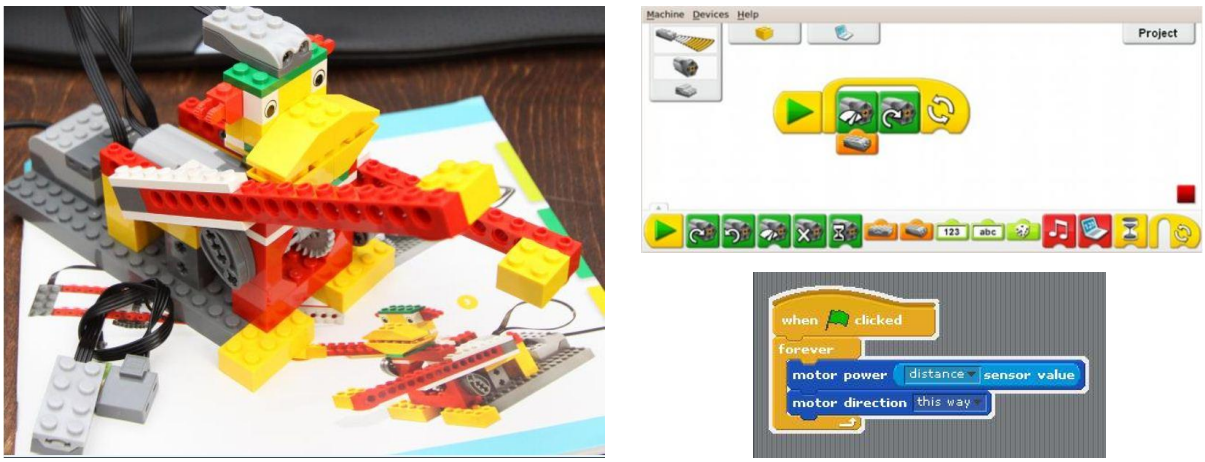


Figure 3. LEGO WeDo and its drag and drop programming environments

It is instructive to compare the WeDo projects with those for Interface A

LEGO Dacta Technic 9700	LEGO Education WeDo 9580	
three colour traffic light	spinning top	sitting-up lion
car with bump sensor	dancing birds	flapping bird
inclined plane start gate and timer	drumming monkey	goalkeeper and ball kicking mechanism
turtle-style buggy with line follower	hungry alligator	jumping soccer fans
fairground roundabout	rocking boat	giant that stands up when winched by a crane
supermarket conveyor with item detector	aeroplane which changes engine speed with tilt	
washing machine with door interlock and indicator lights		

Table 1. Comparison of LEGO WeDo and Technic school projects

The 1987 projects related very clearly to “robotics” that children met in everyday life and which they could discuss before, during and after construction. The Logo programming environment enabled them to turn their words into computer programs. The 2009 WeDo projects all came out

of the toy box. The same is true of the software. NI LabVIEW has been turned into a kid-friendly toy version of itself. The ethos is like a little girl dressing up in mummy's clothes and pretending to be adult. Drag and drop Scratch is the better indicator of the real situation. Because children did not learn how to program in primary school, draggy dropping was seen as the solution to lack of capability. Unfortunately with the graphic interface came a degree of inelegance and the link to language was broken. The control blocks, typified by the loop, have all the intellectual content of a BASIC goto. Look at the two programs in figure X: do they relate in any way to the behaviour of the drumming monkey or are they just isolated motor instructions? How does a child know that this program is for the monkey? There are no links to the core curriculum of primary education. From the perspective of a professional primary school teacher tasked with providing a broadly based education whilst focussing on literacy and numeracy, Interface A and its projects attached to an aged Win95 computer running LogoWriter Robotics is the sounder educational option.

In an attempt to attract children to their subject, the engineers, with the toymakers, pandered to a consumerist entertainment obsessed marketplace where humanoid robots inhabit fantastic futures. The promise of 1987 had faded and the computerists all retreated to the technology ghetto where they were not challenged by, and could avoid challenge to, the traditionalists. Lost on the way was the spirit of '87 where robots were seen as disembodied devices designed to help people.

Traditionalist ascendency

The present situation is well summed up in the words of the two reports cited in the introduction. Alexander, a committed primary school traditionalist in the Vigotskian mould, led the team that produced the most comprehensive report on English primary education in a generation. His view on "ICT" encapsulates the present traditionalist position. The relevant section of the summary report is reproduced in full below:

> **Language, oracy and literacy**
>
> This domain includes spoken language, reading, writing, literature, wider aspects of language and communication, a modern foreign language, ICT and other non-print media. It is at the heart of the new curriculum, and needs to be re-thought. Literacy empowers children, excites their imaginations and widens their worlds. Oracy must have its proper place in the language curriculum. Spoken language is central to learning, culture and life, and is much more prominent in the curricula of many other countries.
>
> It no longer makes sense to pay attention to text but ignore txt. While ICT reaches across the whole curriculum, it needs a particular place in the language component. It is important to beware of the perils of unsavoury content and long hours spent staring at screens, but the more fundamental task is to help children develop the capacity to approach electronic media (including television and film) with the same degree of discrimination and critical awareness as for reading and writing. Therefore it demands as much rigour as the written and spoken word.
>
> The Review disagrees with the Rose report's decision to establish ICT as a separate core 'skill for learning and life,' especially in the light of some neuroscientists' concerns about the possible adverse effects of overexposure to screen technologies. Placing it in the language component enables schools to balance and explore relationships between new and established forms of communication, and to maintain the developmental and educational primacy of talk.
>
> Every school should have a policy for language across the curriculum. If language unlocks thought, then thought is enhanced and challenged when language in all its aspects is

> pursued with purpose and rigour in every educational context. Language should have a key place in all eight domains and children should learn about the uses of language in different disciplines.

The more technical aspects and uses of computers, he believed, would properly be included in the technology curriculum. With this viewpoint, the Royal Society Inquiry appears to concur. In his introduction, Furber wrote that:

> We aspire to an outcome where every primary school pupil has the opportunity to explore the creative side of Computing through activities such as writing computer programs (using a pupil-friendly programming environment such as Scratch)."

Both these statements, (other than the parenthetic reference to Scratch), could have been made in 1987. Papert had argued for programming by young children long before that and Logo had been developed for this purpose in 1967. That today it remains an "aspiration" tells the whole story.

The Alexander extract echoes in its focus and language the 1988 Kingman report on the teaching of the English language, from which the following extract is unashamedly reproduced:

> Round the city of Caxton, the electronic suburbs are rising. To the language of books is added the language of television and radio, the elliptical demotic of the telephone, the processed codes of the computer. As the shapes of literacy multiply, so our dependence on language increases. But if language motivates change, it is itself changed. To understand the principles on which that change takes place should be denied to no one.

Oracist that he is, Alexander omitted reference to the fourth aim of Kingman, the one that offered Logo an entrée, were it to elect to accept it:

> to teach pupils *about* language, so that they achieve a working knowledge of its structure and of the variety of ways in which meaning is made, so that they have a vocabulary for discussing it, so that they can use it with greater awareness, and because it is interesting.

This was interpreted by traditionalists as the requirement formally to teach grammar. The narrow focus of the Logo community on mathematics and computer science meant, fortunately given the resource issue, that the potential of Logo to contribute to this went largely unexplored. But this, understandable, myopic focus became demonstrably maladaptive in the intervening years

Whilst Furber, the originator of the successful ARM processor and designer of the iconic BBC Micro, now seeks to use school to attract more students to his university courses; Alexander, a one-time member of the educational "three wise men," is blind to technology and joins with our Neanderthal cousins in elevating speech to the level of thought. The depth intellectual failure exhibited by these reports from the English Establishment is breathtaking. It is as if Alan Turing had never raised the question of the relationship of the computer to the human mind.

Reviewing the situation

What might be rescued from the debris of the past quarter century and what would better be discarded? LEGO has provided a focus for much of this discussion and may now be employed as a metaphor for primary education. LEGO is a system. Sold in toyshops as isolated models, the bricks can be assembled into a multitude of constructions. Both Interface A and WeDo (and the intermediate Control Lab, RCX and NXT) were similarly sold as isolates and similarly may be combined with the elements of the system to build scenes. An example of this system approach was presented a Constructionism2010, from which the example below is reproduced.

Figure 4. LEGOLogo embedded in the LEGO system to teach thoughtful construction in primary school

By embedding the robotics elements in a scene built using the system, a more cohesive whole is produced, compared to the positioning of isolated models against a hastily scribbled background. Here, the full educational benefits of the construction system are realised.

Primary school is a system in which minds are made. It is possible to develop splinter skills in the manner of isolated models. Much more preferable is for all activities to contribute to the overall objective. The most powerful tool for making minds is technology; not technology as think we know it but the making of meaningful marks. These may be letters, numbers, or other drawings. Children do not express their ideas by cutting and pasting pictures but by creatively writing and drawing. They do not write by taking whole words from a dictionary but by creating them letter by letter. This brings us back to a theme in Eurolog87: Logo in Primary School and to a particular presentation: Teacher's Profile in its Relation to the Attainment of Specific Objectives in a Logo Environment. This may be recast in terms of how programming (writing for the computer as an audience rather than for the teacher to correct) might contribute to overall literacy and numeracy; and what are the prerequisites for a teacher to possess the capability to work this way?

Throwing down the gauntlet to the traditionalists

Primary education is the foundation upon which all learning is built. It must be broad, balanced and strong. The teachers who help children to build their minds must employ the best methods and materials if the foundation is to be sound. At present the book, the old town of Caxton, offers little assistance to the beginner. This poor learning medium makes the apprenticeship in literacy and numeracy extremely onerous. Teachers have had to devise a multitude of techniques to work around this fundamental defect. Success in literacy correlates most highly with experience with text (Adams date). This may be achieved most readily by using a keyboard and the interactive capacity of a multimedia computer. Programming, where text is active, is an obvious entrée to the world of literacy and numeracy for the beginner. The implication is that teaching method and materials need to undergo a massive change. In 1987 the materiel was unavailable. It is now. The

computer is the new educational medium. The children's wait for change should be over.

- The constructionist community has provided a curriculum for teaching mastery of the medium; with software written in Comenius Logo and a teacher training course.
- There are two serviceable implementations of Logo that can provide an appropriate environment for children from kindergarten through school.
- The first step is to challenge the institutional failure systematically to teach children mastery of the medium that has become the city surrounding the ancient town of Caxton.
- The second step is to challenge the educational establishment and expose the traditional teaching it methods promotes and employs as inefficient, abusive, and failing.
- The third is to forget projects and focus on the sustained research and development needed to implement method transition in primary school. The final result of relegating the old book technology and using the computer first will be to make the book accessible and enjoyable.

We have steadily retreated into our ghetto since 1987. It is time to recapture the spirit of that time and, choosing our ground carefully, to challenge thoughtless traditionalism and displace it.

Acknowledgements

The author would like to acknowledge his debt to colleagues in the British Logo User Group and within the participants of Eurologo from 1987 to date; particularly to Vessela Ilieva of NSOU "Sofia", Bulgaria.

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