This issue: Science in ALBE

Features

Regulars

Erratum

The cover of the last edition was subtitled incorrectly 1999, not 2000.

Editorial

Welcome to the second edition of *Fine Print* for 2000. This edition addresses the issue of Science in Adult Literacy and Basic Education. It has been some time since this issue was explored. Much has been made of the 'clever country' but on the surface there appears to be little interest from government, business and society to secure a sound scientific future. Is this the reality?

Fine Print wanted to know who was doing what in this area in order to answer the question—where did the enthusiasm of the early to mid 90's leave science in relation to literacy? Many leaders within ALBE were associated with the push for other studies to become essential components of the curricula.

We start with a definition of being scientifically literate provided by Pat Beattie who uses this as an introduction to a discourse. Pat's experience with Indigenous Australians 'forces one, as an adult literacy practitioner, to dig more deeply into the notion of what it actually means to teach "literacy"'. Many will recognise that to be literate 'requires mastering strategic, meaning-making behaviours…This process may or may not involve print'.

Reflecting on earlier times Syed Javed offers a beacon of hope: 'Even now, there are these enterprising teachers bringing in science topics within their literacy classes and in some places it is being taught as a preparatory or bridging program' while lamenting as a 'major shortcoming' the lack of development of ALBE science teaching resources. He feels that computing has replaced many of the other studies of which science was one.

The future does not look healthy for science education if the tone of Rod Fawns' article holds. He contends that young students are not attracted to a career in teaching 'on account of a shortage of resources to do the job, oversized classes, poor working conditions and low pay'. Where are the politicians that sing the praises of teachers? How will students remember scientific knowledge, or any knowledge, if they have no opportunity or reason to apply it?

The next article allows insight into the thoughts of five practitioners as to what they include, and why they do so, in introducing science to their students. One contributor is from Northern Ireland. Each articulates a blend of theory and practice. Is the negative response with which science is often greeted a result of teaching at the secondary level? 'How do they make it so utterly boring and impenetrable?'

For those wishing to incorporate science into their programmes ARIS provided *Fine Print* with a list containing almost seventy ' science for adults' resources from which we present a selection.

Technology, the not-so-poor relation of science—if a relation at all, does not suffer the same barriers, and contributions to Open Forum offer practical ideas to utilize this medium to enhance literacy and numeracy learning. Josie Rose identifies the technological skills required for students to undertake online learning.

Along with the above you will find all our regular columns and, as may be deemed appropriate for this issue, the Foreign Correspondence is an Eritrean web article.

In order to raise the profile of science we invite readers' responses and comments to any of the features of this issue—good, bad or indifferent.

VALBEC aims to lead the adult literacy field through identifying issues of importance to practitioners and facilitating positive change. This is achieved through networking, professional support, the sharing of information and the promotion of best practice.

On being scientifically literate:
Initiation into a discourse

by Pat Beattie

Literacy means more than understanding words and letters. It also means the mastering of strategic, meaning-making behaviours involving a decoding or encoding of 'text' in order to accomplish a social purpose.

Defining literacy

Working with Indigenous Australian students, for many of whom English is a foreign language, and for most of whom the institutions of western society are foreign cultures, forces one, as an adult literacy practitioner, to dig more deeply into the notion of what it actually means to teach 'literacy'. However, while my experience is with Indigenous students, I believe what I have to say is also relevant to those teachers working with ESL and native-speaking students.

Batchelor Institute of Indigenous Tertiary Education offers a range of courses to meet the needs of rural communities for self-management. Some of these courses, for example in the areas of health, natural and cultural resource management fields, are science-based.

As elsewhere, staff continually express concerns about students' literacy or rather, students' difficulties with literacy. These concern range from an inability to read journal articles or write reports to a worrying lack of accuracy in calculations and measurement, to problems with terminology, and so on. As subject specialists, the problem for them lies with students' poor literacy and the solution is (usually for someone else) to provide remedial assistance with reading, writing and mathematics.

However, time spent in classrooms has led me to define the 'problem' somewhat more broadly than simply a lack of skill on the students' part, though this is also undoubtedly the case. I have come to see it, in large part, as a problem of mystification and confusion.

Many students seem genuinely mystified. It seems to me that they may be operating in 'a cloud of unknowing' because the broader context of what they are required to do is not sufficiently accessible to let them connect what they do in the classroom with its application in the wider sphere. This means the students' meaning-making potential is significantly restricted. After all, knowing where things fit, that is, 'seeing' relationships and making connections, is essential literate behaviour.

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Nor is it always clear to students which of the activities/processes they engage with in the classroom, are related to their science-based subject area and which is study-related. Boundaries between fields of operation are blurred and in my view this confusion compounds the mystification.

Being literate for me, as an adult literacy practitioner, requires mastering strategic, meaning-making behaviours involving some kind of decoding or encoding of 'text' in order to accomplish a social purpose. This process may or may not involve print.

Within this (I admit) very broad definition, being literate can therefore be understood as operating effectively within each of the different sociocultural environments one moves in, in order to meet one's social needs and obligations.

More than reading and writing

According to this definition, 'literacy' is not something one possesses for all time. Instead, it is relative to a sphere of operation. Being literate means employing an effective set of strategies for making meaning of the different social worlds we inhabit. Hence, being literate in a particular context, including a scientific context, certainly involves, but goes far beyond, the ability to read and write.

This is why I find James Gee's use of the notion of Discourse so helpful in opening up possibilities for reconceptualising the teacher/student relationship and for clarifying what literacy in a particular sphere of operation, whether scientific or non-scientific, actually entails. For sphere of operation or field of knowledge or discipline, he uses the term Discourse.

> Each Discourse involves ways of talking, acting, interacting, valuing, and believing, as well as the spaces and material props the group uses to carry out its social practices. Discourses integrate words, acts, values, beliefs, attitudes, social identities, as well as gestures, glances, body positions and clothes. (Gee J. 1992)

For Gee, being literate in a field of knowledge or Discourse is a saying-doing-valuing-believing combination.

With the notion of Discourse, Gee shifts the traditional classroom relationship of teacher and student to one of field practitioner and novice, i.e. with the responsibility of initiating the novice into his/her discipline or field of knowledge. The evidence for attaining literacy is therefore increasingly successful participation in all aspects of that Discourse[1].

Literacy and science

So what does this mean for the teaching of literacy or rather, literate behaviour in the field of science or in science-based courses?

For me, it means introducing students to the scientific field in its broadest sense: to the spaces in which the business of the field is carried out; to the nature of the social identities constructed by the field; to the ways in which knowledge is 'grown' and disseminated in that field; to the issues which preoccupy (and divide) the field; to the routines and practices (Genres) engaged in daily by practitioners; to the technologies and tools which enable the practices; to the concepts, values and beliefs which underpin the practices; to the print texts which are generated by the practices (genre); and finally to the discourse (small 'd') which encodes and facilitates all of the above.

> '*Gee shifts the traditional classroom relationship of teacher and student to one of field practitioner and novice*'

To do all this, the literacy support person and field expert (subject specialist) must work closely together. The task of the literacy teacher as I see it, is to assist the field expert to 'know' what s/he knows about the field and to articulate to students what s/he knows so that the bigger picture of the field is revealed. Essential connections must be made for students so that everything they are doing 'makes sense'.

Bringing reality into the classroom

This also means that somehow, the field must be brought into the classroom: perhaps by means of videos which document the reality of practice; perhaps by means of guest speakers who are practitioners. Opportunities also need to be created for students to make forays into the field.

For students in the courses in which I am involved, initiation into a science-related course may mean a knowledge of spaces such as the health clinic, the laboratory, the hospital or the bush. This 'spatial' literacy means knowing the characteristic features of that space, knowing the purpose of the activities which take place in that space, knowing the rules which operate in that space, being able to access the resources available in that space, and so on.

Initiating students into a Discourse involves developing in them an understanding of the notion of social identity or 'role', an appreciation of the hierarchies within which practitioners in the field must operate and an awareness of how new knowledge is proposed and challenged within the field, for example, by means of 'conversations' between practitioners that take place within (and without) the field, in journals and at conferences.

It means providing the opportunity for students to become increasingly involved in the kinds of routines and practices characteristic of the field. For example, gathering, recording, organising, analysing and classifying data, reading and interpreting statistical information, conducting surveys, discussing findings, writing reports or keeping records.

Many different 'texts' of both a print and non-print nature are generated by the business of a field and students need to be given the opportunity to 'read' and 'construct' these during their 'apprenticeship'.

Some of the non-print texts students at Batchelor must engage with include bodies, agar plates, landscapes, thermometers, spoor, tree cross-sections, paintings and the scene of an accident.

Print texts from the field include labels, instructions, reports, Acts, pamphlets, policies and guidelines, catalogues, journal articles, reference books, procedure manuals, medication, field notebook entries and data bases.

It is in the area of teaching about print text that genre theory has been so useful. Genre theorists have alerted us to the need to be explicit about the different types and functions of print texts and to the need to teach their patterns and characteristic features explicitly and systematically. However, I would argue that there must be more explication of the wider social practices from which texts like these are generated, hence the usefulness of conceptualising literacy as participation in a Discourse.

The reading of non-print texts on the other hand, is a less well explored area and needs the expert 'reader' (the field practitioner) to articulate to the novice over many examples, what s/he is 'seeing'.

The discourse of the field

Another measure of literate behaviour for me is increasingly confident use of the discourse of the field. Students should understand that the 'jargon' has not been invented simply to alienate them, or to make life difficult for them (although it can be used in those ways), but because their fellow practitioners have found the need to coin new language in

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1   Gee of course is building on the work of Foucault who saw social 'Institutions' as key players in society and with a powerful role in shaping these societies and positioning the members of these societies in particular ways.

order to talk about unique concerns which arise from a very particular view of reality. They should be aware that appropriate use of the discourse of the field will be taken as evidence of developing competency.

Students can be helped to see that embedded in this discourse are the concepts and beliefs that underpin the work of the field. For example, Discourses involve commonly used metaphors which reveal the world view on which the field is premised. From such fields as health or natural and cultural resource management, we encounter, 'low energy beach', 'remnant vegetation', 'fire regime', 'biological control', 'eradication of disease', 'body's defence mechanisms', 'this patient suffers from', 'normal flora', 'culture', 'host', 'land rehabilitation', 'waste management' and 'treat the symptoms'.

These snippets of discourse reveal ways of constructing reality, for example, in terms of energy, in terms of the past, in terms of hostile invading organisms, in terms of the body as host or as garden, in terms of mastery over nature, in terms of the patient as acted upon rather than as actor.

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They also reveal ways of acting on the world which are highly valued in the field of science, for example, observing, controlling, eradicating, managing, preserving, restoring, intervening and implementing systematic programs and schedules to address problems. Above all, practitioners are to adopt a 'problem-posing, problem-solving' approach to the world around them.

While the metaphor of initiation or apprenticeship is a useful one, we are not talking about uncritical assimilation. Literacy in a Discourse should involve an appreciation that all fields of knowledge operate on theories or suppositions about the world. In addition, while a particular theory can be useful for a while, in time, it may have to be discarded.

No field of knowledge has exclusive access to the Truth. It sees partially, from a particular position. In fact, Discourses limit what is possible. They position their practitioners in particular ways, constraining their ability to 'know' in other ways. This must also be acknowledged.

Competing for an audience

Students need to be aware that their field is only one among many competing for society's resources and for the right to be 'heard'. They need to be aware of which other Discourses impact on the work of their own. Discourses 'talk' to each other. Some Discourses have more powerful voices than others. Students could be encouraged to discuss how successful the field of science is in communicating its right to be listened to.

Even within each Discourse there are dissenting voices. It would be good to make students aware of the ideological divides within the field—the issues, some perennial and some new, which preoccupy many in the field.

As well as this, the literacy teacher must also focus on apprenticing students simultaneously into the complementary but different field of academia with its own distinctive routines and practices, discourse, underpinning concepts, values and beliefs which need to be clarified.

Students should understand that they are being apprenticed not into one but into two discipline areas and that they are being initiated into the routines and practices of two discrete (but complementary) fields.

A field-related practice would be one which prepares students for the workplace or which could be required of students at the workplace— that is, as practitioners in the field. A study activity on the other hand, is one which would require them to 'know what they know' about the field—it would involve metacognition, metadiscourse and critique. Study-related practices are practices that require discussing, describing, defining, arguing, explaining, justifying, clarifying, summarising, researching, theorising and evaluating. These might include deconstructing and discussing a journal article together, presenting findings, using a library, participating in discussion or formal debate, evaluating course experiences, writing an argumentative essay.

Both field expert and adult literacy practitioner can reinforce this distinction by being explicit about when they are requiring a field specific practice and when they are requiring a study-related practice to avoid cloudiness. The criteria for assessment may well be very different and the criteria for assessment need to be made explicit.

Some questions to ask

While they are novices and may be asked to suspend judgement until they become more familiar with different aspects of a field's operations, adult students, especially those from the cultural margins, can be invited to critique or challenge practices. For example, they might address such questions as:

- Are these spaces the best spaces to serve the needs of the people I know?
- Will these hierarchies work to support or exclude non-mainstream practitioners?
- Are the underlying beliefs and values of the field compatible with my experience or the experience of my community?

- How do the routines and practices construct me as a practitioner and the people I know as clients?
- What other ways of looking at this problem are there?

In conclusion, I have tried to broaden the concept of literacy teaching using the field of applied science as a context. I have used James Gee's idea of literacy as increasingly effective participation in a field of operation. This seems to me to be a particularly fruitful approach because it contextualises what students do in the classroom in real-life terms and enables them to see the sense of what they are being required to do. It minimises mystification and maximises the connections they are able to make as part of the meaning making process.

In effect, becoming literate involves developing a range of literacy types—spatial, visual, gestural, technological, discourse, print, mathematical, landscape.

Of these, print literacy is undoubtedly the literacy which causes the greatest angst among both educators and students and which seems to demand most time and energy. While it must be kept in perspective, the work that needs to be done in this area will, in fact, be greatly supported and informed by students having a broader understanding of the Discourse.

The work of deconstructing and constructing key text types with students, will be enhanced by students' greater understanding of the social identities, roles and functions of practitioners within the field, of concepts central to the Discourse, of the issues and debates within the field, of the special discourse of the field, of the texts which are generated in the course of carrying out the business of the field, and of the audiences and social purposes for these texts.

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Maintaining an ongoing commitment

Syed Javed of Victoria University talks to *Fine Print* about his work in the field. We also reprint an edited version of Syed and Sue Helme's article which developed out of their work in the mid 1990s. We are sure you will see that it remains as relevant as it was then.

An interview with Syed Javed

What is your background in science?

I have a strong background in science but ironically I have learned more about science only after finishing my stint as a science teacher in secondary schools. I studied chemistry for my masters' degree in India before turning to teaching. I started as a science teacher in 1981 in Nigeria. There (in Nigeria) I was posted to a newly built remote school. There was no science lab and I had to improvise quite a bit to teach science for up to year 10 classes. We used old condensed milk cans to improvise spirit lamps for heating purposes and used everyday chemicals from grocer's shop. It is a long story. After a couple of years I moved to a teacher training college and taught chemistry for teacher training students. There it was more formal lab work and I taught some education subjects as well as organic chemistry. I was there until 1989.

When did you enter the adult education field and why?

After moving to Melbourne in 1990 I enrolled in Melbourne University and planned to pursue postgraduate studies in education while working part time in secondary schools. I was introduced to Compensatory Education, Footscray TAFE via a Melbourne University program. This was a good break for me. I was given the job of introducing science in adult basic education classes. At that time ALBE field was an intellectually stimulating place. CGEA was being conceived at that time and there was a real momentum in building ALBE as a new sector of education. Working with Rob McCormick and Daryl Evans was intellectually stimulating. It was a new window for me to learn science from a different perspective. I learned a lot from works of Lemke, Halliday and Martin. Later I joined the department of adult basic education as a full time teacher of science, technology and numeracy.

What science was going on in ALBE before the funding in early to mid 90s?

I am not sure about the state of the play pre 90s. I am told that at some places science was offered as an elective subject but only as a preparation course. Some teachers were trying

> ' **Some teachers were trying things like 'fun science' and 'science you can eat' sort of stuff** '

things like 'fun science' and 'science you can eat' sort of stuff in their literacy classes but there was nothing formal as such. I reckon that not much has changed in this regard. Even now, there are these enterprising teachers bringing in science topics within their literacy classes and in some places it is being taught as a preparatory or bridging program.

What, and who, was the catalyst for the 90s funding at that stage?

I think the main catalyst was the International Year of Literacy 1990. As I remember it, there was a lot of discussion and debate on definitions of literacy. One work that stands out is the discussion paper by Bradshaw et al on ALBE into the 1990s. I think by this time numeracy had gained a significant presence in the ABE sector and a certain section of ABE (Bill Bradshaw, Dave Tout, Daryl Evans, Rob McCormick, Rosie Wickert, etc) were keen to see more content areas as part of ABE curriculum.

The CGEA has also been a catalyst to a certain extent. It has enabled provision of General Curriculum Options subjects based on Myer competencies, which has allowed many providers to teach subjects like science and computers as part of CGEA.

What studies/government reports informed it?

Theories of Genre developed by Halliday and Martin had a special focus on science content. Lemke's publication of Talking Science provided a new way of looking at the language of science. These developments in theories of language coincided with the reshaping of the ALBE field in the early 90s. Science was being mooted as the next area to be included in ALBE programs after numeracy.

I don't think there was any separate funding for science during this time. At ABE Footscray TAFE, OTFE funding enabled us to run literacy, numeracy, general studies and science classes as part of our general education program for adults. In more recent times, the demand for computer courses has surpassed other general studies areas and now we are offering literacy, numeracy and computer classes as our main program delivery.

How was your project received? Do you have any follow up reports on the outcomes of your STEM course for example? Is it still going? (as part of a Grad Dip?)

The project Science Technology and Mathematics (STEM) was a professional development project for ALBE teachers and was funded by National Priority (Reserve) funding of DEETYA. It was a Victoria University initiative in providing professional development for ALBE teachers. We applied for this grant to develop science and technology literacy subjects for Victoria University Graduate Program in Language and Literacy Education.

The pilot project recruited interested ALBE staff from Victorian community education and TAFE providers and conducted professional development workshops in science and technology literacy. As the project was about developing content for graduate level subjects for Victoria University, it focused mainly on theoretical underpinning and methodologies. It did not develop teaching resources for ALBE science. I think this was a major shortcoming. The ALBE field needed more teaching resources for introducing science for adults rather than professional development.

A tangible outcome of the project was a handbook on Science and Technology Literacy: Professional Development Course. This booklet is obtainable from ARIS or the Department of Education, Victoria University. Currently, VU is revamping its undergraduate and postgraduate program and at this stage I am not sure about the status of Science and Technology literacy electives.

Thanks for your time Syed. We certainly hope that we see the development of these resources you refer to.

Unpacking science and technology

An edited version of a key article in the field by Sue Helme and Syed Javed.

What is science?

When we put this question to a group of ALBE students, some of the typical responses we get are: science is doing experiments to find answers; science is problem solving to improve the quality of life; science is an activity of scientists who are busy looking for answers to improve their understanding of nature; science is…

The responses generally portray science as an activity something to do with *experiments, nature, understanding and quality of life*. The common response suggests that science is held in high esteem, is valued, and is associated with finding unbiased truths about nature.

Science builds on traditions of inquiry that can be traced back to Greek, Chinese and Arabic cultures. Many events in the world occur in patterns that can be investigated and systematically studied. How things work can be explained or predicted by the development of theories which can be tested objectively against evidence and through the development of testable hypotheses, careful observation and logical reasoning.

Openness to new ideas, intellectual honesty and scepticism in evaluating arguments are fundamentally important. Present understandings need to be continually re-evaluated and imaginatively transformed to provide better understanding and greater predictability. These attitudes and the application of these processes have produced, and continue to produce, a body of knowledge about the physical and biological world. This knowledge and these ways of inquiry and their use by individuals together constitute a unique system we call science.

Barry Jones—a former Minister for Science who writes extensively on scientific issues—in defining science for a popular science magazine, offers us a comprehensive summary of the popular view of science:

> Science is a pursuit of knowledge: the word science (scientia) was synonymous with knowledge. Science is an intellectual activity international in operation, depending on free exchange of and access to ideas and research, cooperative rather than competitive, operating in a timeless context, a way of understanding the world, a methodology of problem solving, an indirect determinant of beliefs, values or social priorities, both accumulative and demolitionist as old paradigms are replaced by new ones, and lacking in direct economic, national or regional impact. (Jones, 1994, p.9)

In the popular notions, as exemplified by the National Statement and the quote from Barry Jones, science is represented in its most idealised and sanitised form. This notion of science presents it as unambiguous, cooperative and free from prejudices and personal interests. It assumes that the world out there exists independently of the particular scientific methodology used to study it. The advance of

science consists of scientists discovering eternal truths that exist independent of them and the cultural context in which these discoveries are made. All areas of life are presumed to be amenable to scientific inquiry and truth is supposed to emerge unambiguously from scientific experiments.

Such a view persists not only among the general public, but among science teachers and scientists despite the fact that it is held by most historians of science, philosophers of science, sociologists of science and science educationalists to be, at best, simplified and misleading and at worst, completely erroneous (Latour, 1987; Fensham, 1988; Shepherd, 1993).

Arguing that this idealised view of science is misleading, many researchers claim that science is similar to any other human activity in that it is subject to influence by political, economic and cultural factors. The knowledge produced by scientists is often subject to different interpretations, the community of scientists exercises a strict control over the right to publications, and the results of military research are seldom made public knowledge (Latour, 1987; Bauer, 1992; Ziman, 1980; Brown, 1988).

Science does not discover truth or reality: what it produces are just useful models of reality which partially satisfy our needs of understanding and are subject to change (Billingsley, 1994). Science is a competitive enterprise where fierce competition occurs between research agencies and in many cases the rush to publish results leads to premature judgements (Bauer, 1992). It has also been argued (Shepherd, 1993) that many scientific ideas and concept-ualisations result not from objective analysis of experimental results but from intuition and the realm of the unconscious.

One of the emerging views on science during the 1990s is that there is no single universal interpretation of science and that science is what is recognised as such by the scientific community. To understand science we need to understand scientific explanations in their fuller context. That is, we need to know how these explanations are arrived at, at the frontier (research) stage and how the frontier science changes into valid (textbook) science. We need to understand that scientific explanations do not tell us the truth about nature; they only tell us the scientists' interpretation of nature.

In the context of ALBE we recognise the importance of conveying to students that science is not a fixed body of knowledge and that like any other human activity it has inherent ambiguities.

In summary, we would like to offer the working definition of science that we have adopted in this project. We see science as a body of knowledge about the physical and biological world which is collaboratively constructed by a community of scientists applying techniques of investigation usually referred to as the scientific method. This body of knowledge provides useful explanations about natural phenomena and may or may not have direct practical, social or economic relevance.

What is science literacy?

Science literacy is generally considered as a desirable thing for a variety of reasons. Most advocates of science literacy argue that literacy in science is desirable in terms of its benefits to the individual, society, the economy and to some extent science itself. We found it quite interesting to explore how varying interpretations of science literacy are form-ulated and here we discuss three such perspectives.

1 Science Literacy: Appreciation of Science
One of the most popular arguments for science literacy is presented by researcher John Durant (1989). He rationalises science literacy in the following terms:

- Science is arguably the greatest achievement of our culture, and people deserve to know about it.
- Science affects everyone's lives and people need to know about it.
- Many public policy decisions involve science, and these can only be genuinely democratic if they arise out of informed public debate.
- Science is publicly supported, and such support is (or ought to be) based on at least a minimal level of public knowledge.

Such an argument for science literacy assumes a minimal level of public knowledge, and suggests that science literacy involves having some basic understanding of some of the major scientific constructs and their applications.

2 Science literacy: learning about science
This view of science literacy comes mainly from recent sociological and ethnographic studies of science. The science, technology and society movement in its educational model proposes science literacy as a broad-based understanding of science situated within the familiar context of everyday life and covering a range of historical, philosophical, sociological and cultural contexts of science. This view suggests that science has generated a number of myths about itself (ie, it is objective, unbiased and discovers the truth) that need to be demystified. Science literacy involves not just learning about the basic fundamentals of science. Equally important is learning about how science is carried out by scientists, that different interpretations are possible, and how scientists work as a community. Science literacy also involves learning something about the history and philosophy of science.

To be literate scientifically, a person needs to understand that scientific concepts are constructed out of observations of the world and these obser-

> **'Science does not discover truth or reality: what it produces are just useful models of reality'**

vations are subject to human error and that falsifiability is central to scientific method… An appreciation of what science is and isn't, of what it can be and cannot be, or what scientists may or may not claim for science, is surely an essential element of literacy… A literate person must also command certain facts and general concepts about our universe, in addition to understanding the processes of scientific reasoning and testing… Appreciation of science and thinking of it as fun and exciting surely is the beginning of literacy. (Zen, 1992, p.19)

This view of science literacy has relevance for ALBE because it adopts a critical perspective. The about science view suggests that we can gain useful understanding of science by understanding how science is done, and how scientific knowledge is constructed.

3 Science literacy: the discourse of science

In this view, science is conceived as a communal activity and one of the marks of this scientific community is the specialist style of language which it has developed for internal communication. This specialist style arose in response to the needs of emerging scientific communities and to serve a range of communicative functions. Access to the communities which use them depends on demystifying and mastering their particular linguistic styles. Thus, literacy in science implies developing those skills that enable an individual to enter the discourse of science.

From the ALBE perspective the linguistic view of science literacy is important because students need to be able to make sense of science texts and produce similar texts themselves.

Conceptualising science and technology literacy in ALBE

The previous discussion emphasised the socially constructed nature of science and technology, as well as their fundamental impact on peoples' lives. It seems to us, therefore, that science and technology literacy is central to understanding contemporary society. Without going into further detail, these reasons provide a powerful argument for the inclusion of science and technology literacy in ALBE programs.

In a literacy class, students could be engaging in literacy activities around a scientific text. They might examine the language used to explain a scientific concept, or evaluate the arguments in relation to a scientific issue such as the implications of the hole in the ozone layer.

In a science class, students would also be engaging in activities which develop concepts and knowledge. Using the previous example, students would investigate the chemical

structure of ozone, how it develops and why it protects the earth from ultraviolet radiation.

When we address the issue of what is important for ALBE students to know *within* the discourse of science, two dimensions of science literacy seem to be gaining prominence: *learning* science and *learning about* science.

> ' science is conceived as a communal activity and one of the marks of [this]…is the specialist style of language '

Learning science involves the development of concepts, skills, knowledge and understanding within these disciplines, using the language, techniques and methods of the discipline.

Learning about science involves critiquing science. This would include, for example, an understanding of how scientific knowledge is constructed and becomes accepted, and how accepted knowledge has changed throughout the course of history, and the impact of science on society.

These two dimensions should form the basis of any model of science and technology literacy.

Syed Javed is at Victoria University and has been involved in science and ALBE since 1990. Sue Helme is currently a research associate with the Education Faculty at University of Melbourne.

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'**science and technology literacy is central to understanding contemporary society**'

A crisis in class?

by Rod Fawns

Much is happening in science in the schools sector, and it is not all good news.

A most important job

The call for Australia to be a scientifically literate community is not new. However, it is important for a science teacher to believe that his or her subject has considerable and special value for the students he or she teaches. It is important that the science teacher represent the scientific and technological civilisation.

In a fundamental sense, the job remains as it has always been—communicating the utility, wonder and discipline of science. Science remains a tapestry of interlacing strands, showing fascinating detail when examined up close and significant patterns when seen from a distance. It is a thing of wonder and beauty. Science helps us to understand ourselves and our world and it helps us understand our place in our world.

However, science provides a variety of ways to understanding. While the nature of science has long been seen as an important, indeed central, component of science education during this century, efforts to integrate an authentic view of the nature of science into the curriculum have often met with little success.

There are competing views of science which suggest alternative approaches for integrating nature of science issues into the school science curriculum. The goals and methods of microphysics can be presented as distinct from those of cosmology, the nature of evidence used to support claims in evolutionary biology as different from evidence for models of cellular respiration.

Students should begin to see that what counts as knowledge depends not on some universal rationality or algorithmic operation, but rather on the specifics of the phenomenon and research methods in question. It is the particulars of practice that must complement the existing structure of the science curriculum in ways that will help students see the many processes of science, but also enhance the meaning of the subject matter itself and its social uses. Each instance can build towards an understanding of not what science is, but rather what science includes.

Both State and Federal budgets in 1998/9 have increased funding for science education on account of the positive,

> ' **The renewal of science teaching is important —in a real sense our future depends on it** '

practical intelligence that science teaching promotes. We have yet to hear an Australian political leader speak in a television advertisement like that of Tony Blair in which he 'remembered a good teacher' (New Scientist, 27 June 1998) but we have more recently seen well produced AEU advertisements, funded by the Government, which acclaim the the broad social contribution of individual retiring teachers.

The gap widens

However, in other respects the gap has widened to a chasm between the teachers' belief in the social significance of their work in representing science and interpreting science and the reality in teaching. They feel betrayed and isolated by political leaders who promote changes which make no difference to the prospects of their students. They are fed up with policies that lack educational vision, shift accountability and create overload, intensification, guilt, uncertainty, cynicism and burnout. The situation in Australia, like that in the USA and Britain is one of crisis: there are more jobs and places on training courses for science and mathematics teachers than there are qualified people coming forward to take up a teaching career.

The renewal of science teaching is important—in a real sense our future depends on it. The common government view is that the science curriculum is the means of reproducing a technical class in society and students instructed in specific, job-related skills will solve all kinds of problems to do with the nation's economic viability. But the science curriculum in schools is just one of a number of knowledges struggling for students' attention. Forgetting is at least as central a curriculum problem as teaching. However efficiently we deliver factual knowledge in science, it will not be remembered unless students have reason to exercise it. I am reminded in this regard of the one of Patrick White's cut-to-the bone characters who, when challenged about their lack of knowledge, observed, 'I dunno. I don't remember what I was taught, I only remember what I learnt'.

The career structure for teachers has been so flat and the recruitment/contracting practices so inefficient, that an estimated 25 per cent of graduates from teacher training have abandoned plans to teach within three years of being trained. The departure of science teachers from the

profession is a major problem. Government expedience and parsimony leaves school systems with a particularly acute problem in these areas at a time when graduates are finding fulfilling work outside schools in industry training. Research shows that teachers who leave teaching often return after a period of either family leave, travel or outside work. However, the proportion of science and mathematics teachers who return is minimal. Other attractive offers are made to retain them.

The situation overseas

Other countries have also hit the educational wall. Canada has responded by increasing teacher salaries to successfully attract young and graduates of high ability into teaching. To deal with teacher shortages in science and mathematics in particular, the Department of Education and Employment in Britain has been running one-week 'taster courses' to attract people into the profession from jobs in industry and commerce. Agencies representing the NZ and UK government have been recruiting heavily in our newspapers. The USA is now offering Australian science and maths teachers six-year working visas: 'Science teachers, join computer programmers and other information technologists in this priveleged employment category'. The Education Secretary in Britain has promised 1500 extra teachers by the year 2001 (The Times, 8 June).

Similar short to medium term projections can be made in Australia, but it is difficult to imagine how this can be achieved. International comparisons recently published of student achievement in science and mathematics and related social factors found Australian teachers felt significantly less valued by their society at large and by parents as well as children than any other country surveyed. The National Union of Teachers (NUT) found in 1998 that 18-year-old students in the UK found teaching unattractive as a career

'**The USA is now offering Australian science and maths teachers six-year working visas**'

on account of a shortage of resources to do the job, oversized classes, poor working conditions and low pay.

Despite the intensification of teaching and associated experiences of restructuring which parallel experience in public service jobs, many science teachers remain committed. Many continue to find enjoyment in the challenge of making science interesting and find excitement in trying innovative ways of presenting complex issues. Roughly one third of science teachers trained after 1975 have trained themselves in information technologies. With these qualifications, and their skills and experience in communication and training, many have been attracted out of school into industry and commerce in the last 10 years.

There continues to be only about 25 new qualified physics teachers trained each year for the whole of Victoria. Country schools and other socially disadvantaged schools find they are almost impossible to recruit and hold where short term contracts are all that can be offered. The government used to provide a bursary scheme to attract new graduates in science and mathematics and other areas in short supply.

While such a scheme operates as a loan scheme in the UK now, no such assistance is offered in Australia although this is likely to change. New graduates faced with large HECS overdrafts from their university education will need some more tangible encouragement to make a decision to teach, to feel that theirs is a job worth doing that is valued by society at large and that education as an industry is going somewhere.

Dr Rod Fawns is a Senior Lecturer and Head of the Science Education at Melbourne where he has coordinated science methods teaching for 20 years.

Science prac

Fine Print asked practitioners to let us know what they are teaching. These are their responses.

Using the media

by Debbie Prescott

I'm using a range of topics based on local issues as they arise and 'Science Week' and 'World Environment Day' as an excuse—if I need one. My training is in biology and junior science and I'm committed to environmental issues so I've chosen articles on water use, conservation, salinity problems and nuclear waste dump vs storage. I've also followed up concerns of students such as disease, smoking (and passive smoking) statistics and motor vehicle technology.

I use the local paper as a jumping off point but also bring in *The Age* or the *Australian* to provide a balance and a way to compare different coverage of the same event.

I look for articles that use numbers, decimals, percentages and fractions to supplement numeracy sessions in an everyday news context. Just reading out some of the longer numbers is good practice. Some students are studying 'Critical Reading' and 'News and Views' so I use articles to help students frame active, critical questions and opinions. Even if there is a non-reader in the group, they contribute through discussion. For general reading skills, I choose articles that use headings, key words and graphics to help students scan effectively. On nuclear waste disposal in South Australia I found many articles and gave a different one to each student with target questions for which to scan. These questions directed the discussion and made each student feel they had something to offer. Sometimes I can get short videos, news spots or audio recordings to complement the handouts.

The student response is mixed. Usually my introduction is greeted with groans and resignation or good natured ribbing (I think) of 'oh, not another…' Almost immediately, though, the discussion is animated and students show a good deal of interest. One young woman almost always brings back a comment from her partner and friends about the topic we'd been discussing. I'm frustrated by most comments, though, as the students seem to be resigned to the inevitable. Their solutions are invariably passive-aggressive and ignore the complexity of the issue. A local politician published a ballot to allow his constituents to have their say on nuclear waste. After our discussion and research, most students filled in the ballot but one student quipped, 'can I add a tick box for "Don't Care"?'

Debbie Prescott works at the South East Institute of TAFE, Mount Gambier Campus

Greetings from Ireland

by Rod Hodgins

I am writing from Northern Ireland, where I work in Brownlow, Craigavon—an area listed as TSN (Targetting Social Need) in Eurospeak (European Union funding terminology).

> ' **Their solutions are invariably passive-aggressive and ignore the complexity of the issue** '

In partnership with the local women's centre—Chrysalis Women's Centre—we ran a series of programmes over the past two years aimed at raising awareness of and interest in science. The work was primarily project-based and the response was mixed.

One of our projects was done in conjunction with the Armagh Planetarium. They were very supportive and lent us some high powered people who ran a couple of workshops on astronomy. We took people to the planetarium where everyone had a look at sun spots through their big telescope and toured the adjacent observatory. The viewing of the night sky over Lough Neagh (the biggest lake in the UK) was a wash out as rain closed in and spoiled everything.

We had 70 people turn up at the local library for a talk on black holes and time warps. To our surprise, a number of middle aged men in the audience turned out to be really well informed. Most of these men were unemployed and unknown to each other. Working through a solitary process, each had amassed a lot of background on a narrow and very technical area of science. It was fascinating to see it happen, but we weren't able to build on it. They said they would come back to more events, but never did.

A project we were really proud of was the raft project. The challenge was for a team of women to build a raft to their own design and race in a local raft race. Using facilities at the local further education college, the women designed and built the raft. It was a fascinating project to watch. First, men on the staff just couldn't keep out of interfering with the design process. It took some heated exchanges to

get the women a bit of space to express their own creative and fabrication skills.

One day there was a discussion over whether the thing would float. The men on the staff went in to an office and worked out on paper where the waterline would be. At the same time, the women discussed among themselves where they thought it would be.

After 10 minutes the men were back triumphant in their mathematical prowess. The women pointed to an imaginary line of the plastic barrels and said 'about there'. The men looked at their figures and had to agree, that was what they had calculated. I enjoyed that moment, not least because it confirmed my own sense of where adults are with science. Everyone knows this stuff through an undefined experiential process. When we try to structure that process we erect barriers that frighten people away.

That raft did float and won the women a lot of admirers. When the thing first went to the water a lot of men were asking for a chance to race it. The first moments of pulling away from the quayside, that raft was full of men. They just couldn't wait to get in to it—despite their jeers that it would never float!

This year I am planning an integrated ABE curriculum comprising on-line learning (Internet-based stuff) with communication (English), problem solving (maths) and project work (science). The science will be a series of projects like building a windmill to charge battery cells and run a TV, grafting branches on to trees, wild fowl counts on the lake, water purification testing in the local reservoir, filtering sewage through reed beds, and so on.

I am hoping that we can pose everyday problems such as 'how do they count the number of golden eye birds on Lough Neagh?' and draw adults back in to science as a process of discovery. Project-based work is ideal for ABE students as it doesn't mater if people miss a week (or weeks). Unlike a syllabus-based programme, the information of one week doesn't depend on attendance at the previous week.

Anyway, those are just a few thoughts. If you want to know more, do write back. I'm really interested to know what others are doing. My own background is self-taught in science and technology. I was a failure in those areas at school, but I always knew I loved the stuff but couldn't work out why we never got round to doing anything interesting in the class room. How do they make it so utterly boring and impenetrable? I've never met anyone who wasn't interested to know how a yacht sails against the wind or what makes an electric light bulb glow!

Rod Hodgins manages a community-based adult education project in Northern Ireland.

Science in the CGEA

by Janet Nicholds

At Kangan Batman TAFE, science is offered as a CGEA general curriculum option in the New Beginnings Course. New Beginnings is a half year course offered to women returning to study needing language, numeracy and other skills as a basis for further study, personal development or to improve their employment options.

' **A major topic, one the students enjoy and work very hard on, is human genetics** '

Science covers a range of topics, partly dictated by the group's interest and chosen to allow the demonstration particular skills for assessment. A major topic, one the students enjoy and work very hard on, is human genetics. This topic is chosen because of its currency and the opportunity it provides for students to integrate knowledge, as well as helping to develop research and problem solving skills. Besides, there is a very real interest shown by students in this study. It offers the possibility to design an assignment for the assessment of competency in a variety of learning outcomes over a range of curriculum areas

The topic is initially approached through traditional teaching of the fundamentals of genetics. Examples from human genetics that are meaningful to the students are discussed and wherever possible 'hands on' exercises are incorporated. Modelling sex determination in humans as an example of an inherited characteristic providing a wonderful springboard for demysticising inheritance. There are many educational videos and other materials available. Throughout their science study, students search out, critically read or watch, and report to the class on relevant media items of interest. During the genetics topic this is restricted to articles on genetics, there being no shortage of these.

The study culminates in a major assignment to be used as a platform for assessment in the CGEA subjects of maths, English, language and computers as well as science. The students are given the challenge of selecting, researching and presenting information on a human genetics condition. The final written report is prepared on a computer and allows demonstration of ability in the learning outcomes: Can solve problems and Can use technology for Language and Computers. Statistical data is researched and presented in the report to address Numeracy for interpreting society—data. An oral presentation of work in English means that Oral communication as well as Reading for knowledge and Writing for knowledge can be demonstrated. In Science the Learning Outcomes assessed are Can collect, analyse and organise information and Can communicate ideas and information.

The student response to this topic is enthusiastic as it invokes a real interest. Students will often research a condition that

has effected friends or their own family. There is huge reward for their hard work as they make sense of a broad range of resources including the Internet, texts and literature produced for community consumption and then share this understanding with their peers.

Janet Nicholds teaches at Kangan Batman TAFE

Science on the web—using web publishing to teach science ideas

by Mex Butler

Student walks into the computer lab and says, 'How does gravity work?'

Holy cow! How do I answer that one?

'Uh… I don't think they really know exactly,' I hedge.

'What, *no one* knows? They *must* know!'

'Well, let's look it up on the Internet then.'

We asked Jeeves *(http://www.askjeeves.com)*. Jeeves said:

> We do not know…some think that it is made up of particles called gravitons which flit about at the speed of light just as photons do. In any true fundamental sense, we do not know what gravity is. We only know how it operates in various corners of our universe. Without gravity, there would be no space and time.

I won't go into details about what Peter asked next. It wasn't pretty seeing me trying to explain. I am not a science teacher. What is did though was send me (and the students) to the 530S section in the library downstairs.

> '
> **Keeping the tone impersonal was particularly difficult for these students**
> '

Over the next few weeks, Peter and his class did quite a lot of research using the web to find information about astronomy to feed into this class and one with another teacher. They researched each of the planets in our solar system, looked at photos from NASA and borrowed books from the library. They learnt a lot about using the web as a research tool, and picked up a few skills in paraphrasing. They learnt a lot they didn't know about how the solar system works and what it's made of.

Peter made a web page using pictures from various websites that he visited, and put in some comment of his own about the role of humanity in the universe. (See below left.)

Most of our literacy students have a fondness for animals—at least, that was the reason they gave for wanting an excursion to the Melbourne zoo. I made them promise there would be good work as a result, and a couple of them actually came through with the goodies.

The trip was a real success. The students took notes, marked information on maps and picked out particular animals to do more research on when we got back to class. We talked about the reasons for zoos, what endangered species means and the relationship between environmental degradation and the loss of species. They all remembered zoos as being very different places years ago, with smaller enclosures, more concrete and less natural environments.

Back in class, we discussed the different way in which scientists write about things. We talked about the use of latin nomenclature, the third person to achieve a more objective tone, and careful observation and reporting without jumping to conclusions. They tried to incorporate some of these elements into their own writing.

Keeping the tone impersonal was particularly difficult for these students. Much of the writing that they do is in some way a recount or an opinion piece. Looking for a way to make this more acceptable within a scientific genre, I found

http://www.vicnet.net.au/~flemrw/peter/marsbar.html

http://www.vicnet.net.au/`flemre/zoo

a field journal that had well written, interesting entries which the students could relate to and use as models. Two students produced web pages on their trip to the zoo, and both incorporated some of the language features we had discussed. There was probably a bit of plagiarism, but at the stage they are at, it's not too serious (in my opinion at least). (See previous page bottom right.)

I suspect that astronomy and zoology are two of the more popular areas of science covered in adult literacy teaching and learning. An offshoot of the students making web pages of their work has been their interest in colour and how to create them for web page text and backgrounds by using the hexidecimal codes. These are the six digit codes that define how much red, how much green and how much blue should be used. Hexidecimal means you count up to sixteen before adding a new column to your number. They do it like this:

0123456789ABCDEF

The first two digits in the code represent how much red, the next two are how much green, and the last two how much blue. Low numbers mean close to black and high ones mean close to white. #000000 = black and #FFFFFF = white. So #FF0000 is full on red with no green and no blue. #FF00FF is a mixture of full red and full blue, so it's purple. Get it?

So how is this science? It's more like mathematics initially, but there are many tracks leading off from this point, and one is to investigate properties of colour further. There is a good fun website with lots of interactivity and clear information at *http://www.sanford-artedventures.com/study/g color.html*. It's called 'Sanford—A lifetime of color'. On one page they has some fascinating experiments to do with colour perception.

Another track is simply experimentation with the hexidecimal codes to see what you get with different code combinations. We played guessing games to see who could get closest to the code for a particular colour. We started from codes and guessed what colour it must be. We looked at browser-safe colour palettes to choose schemes that would look as good as possible on different machines.

None of this is going to get my students into a university science course. But my aim is to encourage questioning, the belief that we can find out what we want to know about and the idea that science is fun and fascinating. They keep asking questions, so I guess we're on the right track.

Mex Butler works at Carlton Adult Reading and Writing Program

Literacy in science

by Sue Bettens

As a teacher of the GCO (General Curriculum Options)—Science stream in the CGEA in a Kangan Batman TAFE course run for women returning to study, I was aware of the wide range of abilities my students presented including many with limited language skills.

> **' Rather than teaching science in isolation every effort was made to integrate the topic...with the other subjects '**

Ideally, any literacy-based task needed to be presented so that it could be completed successfully at different levels. Rather than teaching science in isolation every effort was made to integrate the topic being taught with the other subjects, ie, numeracy, English and computers. In addition, the topics chosen were dependent on the interest of students. Immunisation was one such topic taught by this integrated approach. As many of the students had children of their own this topic was intrinsically interesting to them and gave them an informed understanding of immunisation.

In science it was necessary for students to have an understanding of the immune response before they could understand how immunisation works. After a series of traditional classroom lessons which involved brainstorming what they already knew, discussion, notes on terms, video watching and practical work students were asked to complete a 'link map' of the concepts we had been covering.

Link maps are a variation on 'concept mapping', except the concepts or key words are written on circular pieces of paper which can be shifted around. The papers are not fixed until the student is totally happy they are in the right location. Linking statements are written on paper arrows. Blank arrows and circular pieces of paper can be included for students who wish to add their own ideas. The concepts/keywords and linking statements should also vary in difficulty to cater to the needs of the students. Students then manipulate the concepts and linking statements until they get the best arrangement.

On the next page is an example of some of the concepts and linking statements used.

Link maps have an advantage over concept maps because students can experiment with different combinations before they have to commit themselves and are ideal for students with limited language skills. Link maps can be displayed around the room and shared. They can also be used as a cooperative learning task.

Students understanding of a topic can easily be diagnosed with the use of link maps. Misconceptions can be identified in individual maps or as a class. The greater the understanding of a topic the more connections a student

should identify. It should be pointed out that each students map may be different yet still correct.

Another literacy-based task used in this unit was a piece of creative science writing which involved the students imagining they were a 'white blood cell patrolling your body'. A series of structured questions could be given to help some students plan their essay. The final assessment asked student to prepare a pamphlet on immunisation. The audience for the pamphlet had to be stipulated, ie, either preschool children preparing for their five-year immun-isation or to parents of new babies explaining how

immunisation works. Some students chose to complete both tasks.

In English, students were involved in a debate on pros and cons of immunisation. In numeracy, they were presented with statistics and completed graphs of death from diseases which could be prevented by immunisation. In computers, they were given time and assistance to type and format their essays and pamphlets.

Sue Bettens is from Kangan Batman TAFE.
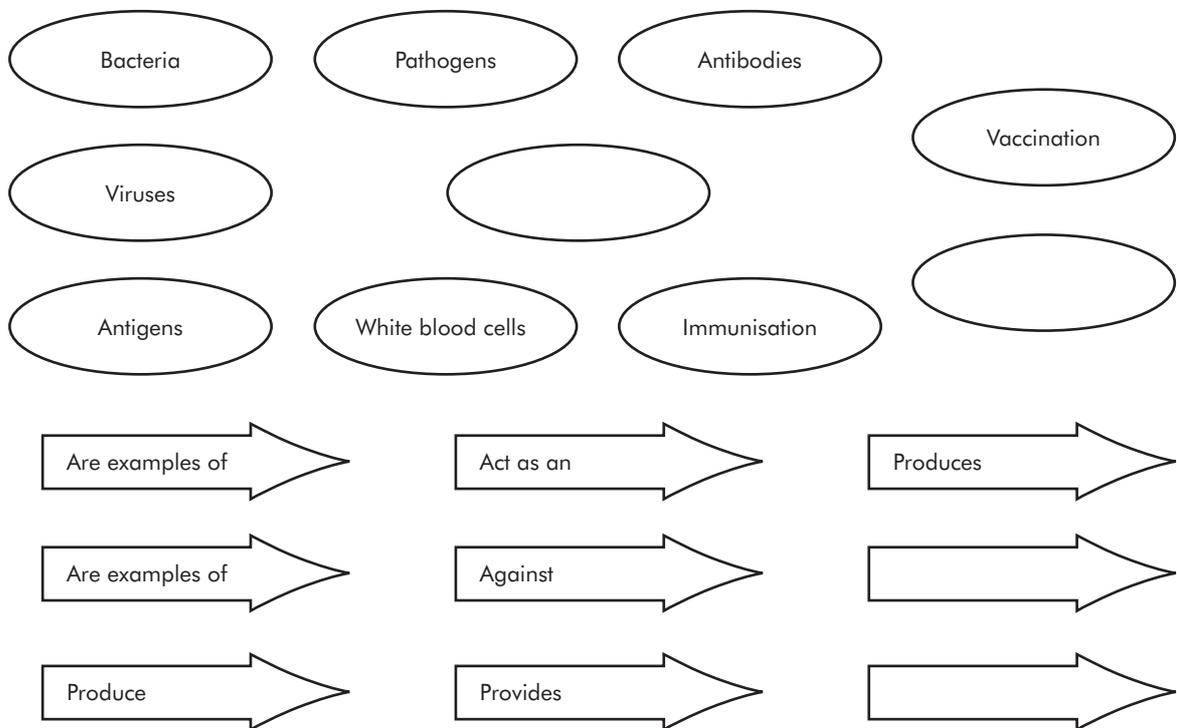
Examples of some of the concepts and linking statements used

A science library:
A selection of reading resources

Fine Print **contacted ARIS and asked for a list of 'science for adults' resources. ARIS promptly provided us with an annotated list of almost seventy resources, and here we present a selection of Australian science resources from that list. We thoroughly recommend that you contact ARIS for the full range of resources if you are interested in introducing science into your classes. See the bottom of this article for contact details.**

Lands parks and wildlife management certificate: reading about botany—module 3, Jabiru, NT, 1996(?)

This resource explains, in easily followed English, how to read and understand key botanical terms. The methods utilised here can be extrapolated to other science sources. This is a self-access resource with exercises. It requires final desktop publishing.

Certificate III in science (bridging), incorporating Certificate II in science (bridging), Box Hill Institute of TAFE, Box Hill, Vic, 1998.

The certificate in science course prepares adults wishing to undertake further vocational training in mathematics, science and technology. Through this course, a learner should gain the skills needed to enter a degree course in the health science field, or the science area of TAFE certificate IV and diploma courses. Streams include chemistry (atomic structure, ionic theory); physics (waves and optics, electricity); biology (cell biology, environmental science); mathematics (introductory mathematics for science, mathematics 1 & 2); learning skills (study skills); communications (presenting reports, job seeking skills); computing stream modules (computer fundamentals, scientific spreadsheet applications).

Crunch time environment, David Arnold (ed.), Western Metropolitan College of TAFE, Footscray, Vic, 1994.

This is a collection of student writings on the environment. The standard of student writings is such that the material could be used as content material in ALBE classes studying the environment. Topics include the Australian environment, the Maribyrnong River, global energy, ozone layer, recycling, and personal experiences of environmental issues.

Understanding farm chemical labels: support materials for the farm chemical users' course. Lilian Austin and Margaret Fraser, Eastern TAFE Workplace Language Unit, Wantirna South, Vic, 1996.

These materials have been written to underpin and support the key steps in reading and using farm chemical labels.

The material can be used directly with those enrolled in the farm chemical users course or by literacy or numeracy teachers looking for integrated literacy/numeracy assessment task examples. The book also contains clear examples of occupational health and safety practice. The materials in this booklet are designed to allow a range of delivery modes, including self-paced learning. A set of trainer's notes accompany the workbook.

Breast cancer: my personal diary, Marianne Bateup, Tumut, NSW, 1994.

Written by an adult literacy teacher, it is her story of her experiences and how she coped with breast cancer. 'Marianne is an adult literacy teacher and her book is written with an Adult Basic Education teacher's understanding of how to write for a wide readership. The organisation of the book into diary extracts allows the reader to enter the book in a number of ways. The language is clear and everyday but neither patronising nor simplistic, and technical language is used where appropriate.' (Rosie Wickert)

Effective report writing 4: writing technical and scientific reports, Pauline Baylis, Helen Joyce and Diana Slade, University of Technology Sydney, Centre for Workplace Communication and Culture, Broadway, NSW, 1994.

This module aims to help employees who need to write technical and/or scientific reports as part of their duties, and presents detailed information and activities about the structure and language of technical and scientific reports. Topics covered include technical vocabulary, abstracts, theoretical backgrounds, methods and procedures and conclusion and recommendations.

Slices of science: a resource for adult basic education, Avril Blay (ed.), Adult Community and Further Education Board, Melbourne, Vic, 1994.

This is a practical resource for practitioners and students on science in everyday situations. The resource includes theoretical information, and ideas for teaching and workshops. Topics covered include food, light and electricity, environmental issues, memory and science in society.

Family science project, Australia: activities kit, Susan Cumming, Swinburne Institute of Technology, Hawthorn, Vic.

A collection of activities to demonstrate scientific concepts to school children. Many of the activities can be used with adults. Each activity has information on what is needed, what to do and discussion questions designed to promote scientific understanding in a cooperative working situation.

One world—ESL and the environment: a topic approach, Carmel Davies, Adult Migrant Education Service and the Environment Protection Authority, Melbourne, Vic, 1993.

One World is a workbook and cassette package for adult learners of English as a second language. It aims to provide information on environmental issues while at the same time providing a meaningful context for language teaching and learning. Issues covered include the greenhouse effect, the ozone problem, packaging and recycling and energy consumption. Language activities include comprehension, vocabulary, grammar, listening, pronunciation and graph interpretation.

Adult literacy and health: reading and writing as keeping-well practices, Peter Freebody and Jill Freiberg, Language Australia, Adult Literacy Research Network (ALRN Qld.), Melbourne, 1997.

This monograph attempts to explore the significance of literacy in the everyday community domain of health practices. It summarises some of the research in the area as it relates to communication generally, and literacy in particular, and outlines some issues that adult literacy teachers might consider in their work.

Writing science: literacy and discursive power, M.A.K. Halliday and J.R. Martin, Falmer Press, London, 1993.

This book focuses on the use of language and literacy issues in scientific research and in science classrooms. Working within the theoretical framework of systemic functional linguistics, the book explores the evolution of scientific discourse, and the apprenticeship of students into this discourse in secondary schools. The book also looks at how students can be given access to scientific knowledge.

Issues for the nineties: what about the environment? Kaye Healey (ed.), Spinney Press, Balmain, NSW, 1994.

This Australian series, titled 'Issues for the Nineties', attempts to offer up-to-date information about contemporary social issues. Each title is a collection of items from Government reports and statistics, newspaper reports and features, magazine articles and surveys, and literature from lobby groups and charitable organisations. A comprehensive list of organisations to contact for further information is included in each book. *What about the environment* is Vol.31 of the series. Articles and items are grouped under the headings

The Greenhouse Effect and Biodiversity. A useful series for students working at Level 3/4 of the CGEA.

Science and technology literacy: a professional development course for adult literacy and basic education practitioners, Syed Javed and Sue Helme, Victoria University of Technology, STEM Project, Melbourne, 1995.

Aimed at people involved in the training and professional development of ALBE practitioners in TAFE or higher education, this package is illustrative of an approach that can be taken to raise practitioners' awareness of: science and technology literacy; what they mean in the context of ALBE; how practitioners can develop science and technology literacies in their adult students.

Health and lifestyle: healthy living, certificates in general education for adults (CGEA) level II—resource manual, Jan Kindler and Dave Tout, Open Training Services, Footscray, Vic, 1998.

This resource manual contains learning activities and assessment tasks that cover some of the learning outcomes in the reading and writing, oral communication and numeracy and mathematics streams of the CGEA at Level 2.

There are three units in this manual:

1   Eating Well—This unit of work examines issues around nutrition, food types, and normal height weight ranges. The learner is required to read and write factual information, use maths ideas, listen to and record TV advertising, and measure, to ascertain height and weight ratios.

2   Smoking—This unit discusses opinions relating to smoking, requiring learners to read and write opinions, articulate a personal point of view, and calculate with numbers and money.

3   Medicines—This unit looks at issues around taking medicines, reading instructions, working out dosage and time intervals between dosages. Learners cover reading, giving and writing instructions, and reading and using numbers.

Science and the environment: chemicals around the home, certificates in general education for adults (CGEA) level IV—resource manual, Jan Kindler and Dave Tout, Open Training Services, Footscray, Vic, 1999.

This resource manual contains learning activities and assessment tasks that cover some of the learning outcomes in Oral Communication IV and Numeracy and Mathematics IV. There are three different units in this resource manual.

1   Maths and chemicals around the home—This unit emphasises the importance of numeracy and mathematics

when handling and applying chemicals in and around the home in a safe way.

2   Chemicals in the garden—Instructing someone on the use of weedkiller in the garden requires precision, and feedback that the instructions have been clearly understood. Learning is about giving spoken instructions and answering inquiries.

3   Exploring new ideas—This unit is about recent developments in science. Learners will undertake activities relating to identifying key points and supporting information by listening, taking notes and evaluating a radio show segment.

Health and lifestyle: getting fit, certificates in general education for adults (CGEA) level IV—resource manual, Jan Kindler and Dave Tout, Open Training Services, Footscray, Vic, 1999.

There are four units in this manual:

1   What is fitness?—In this unit, learners look at different types of fitness programs, and what fitness means for different people. Assessment tasks are provided for reading factual information and writing explanatory texts.

2   A training program—This unit offers more information about getting fit and looks at a training program. Assessment relates to reading and writing instructional texts. Includes explanatory notes on features of texts, tables, glossaries and writing for an audience.

3   Keeping tabs on your fitness—This unit relates to using numeracy skills (statistics and mathematics) to record and maintain an effective fitness program.

4   Maths and fitness—This unit uses fitness and sport as a means of examining the place of mathematics as an important and useful tool in relevant and real contexts. Learning in this unit relates to developing and using formulae and graphs to describe and represent relationships.

Women's health: learner's guide—module one, Diane Linard, Hazel Rice and Marion Romig, Box Hill Institute of TAFE, Box Hill, Vic, 1999.

This module in women's health, while acknowledging that there is already a lot of material around on the subject, presents itself as a user-friendly resource for intermediate level English language learners and (with some adaptation) for CGEA Level 2/3 students. Units are healthy living; diet, leisure, stress; breast cancer and menopause.

This learner's guide includes a variety of activities for the independent or classroom learner to undertake. They include vocabulary work, questionnaire format responses, writing tasks, filling in forms, multiple choice, critical analysis, reading and cloze exercises..

Fitness literacy package: muscular and skeletal systems for New South Wales correctional centres, Louis Magee, Inmate Education Programmes, NSW Department of Corrective Services, Sydney, 1993.

The language associated with physical fitness (human anatomy and physiology) is often difficult to come to terms with. The topics covered include a brief introduction to the structure of cells and tissue, the skeletal system and the muscular system including muscle types and how they operate. Types of literacy exercises included are cloze, dictionary use, crosswords, spelling correction, labelling diagrams and class or group activities. Most of the diagrams are clear and easy to follow and the layout makes the book easy to use. The book includes a teacher's guide and student photocopy masters. The book has wider applicability than correctional settings.

English language support: first aid, Fran Munro, Western Sydney Institute of TAFE, Foundation Studies Training Division, Sydney, 1996.

The aim of this package is to provide tutors who are teaching the NSW TAFE first aid certificate with material to support the mainstream curriculum. The materials are designed to be used in conjunction with the syllabus document, NSW TAFE First Aid English Language Support module. The materials are neither exhaustive or prescriptive and teachers are encouraged to adapt them to meet the needs of specific groups of students. Section one of the package contains notes on the learning outcomes from the First Aid English Language Support syllabus. For each of the learning outcomes this section provides learning outcome definition, relevant text types, sample skills, socio-cultural issues and sample activities. The worksheets in Section two include samples of teaching activities for use as a basis for developing classroom materials.

Positive thinking: language, literacy and numeracy resources on HIV/AIDS for teachers of adult education, Dilys Norrish, Western Sydney Institute of TAFE, Foundation Studies Training Division, Blacktown, NSW, 1996.

This is a collection of stories, articles and worksheets on issues surrounding HIV/AIDS. It is intended to be informative and useful for adult LL & N students. Some of these learning materials are original, others have been adapted for adults from the many excellent learning resources on HIV/AIDS which have already been produced.

Literacy in industry research project: stage 1 scientific literacy, David Rose, David McInnes and Henrike Korner, NSW Department of School Education, Metropolitan East Disadvantaged Schools Program, Erskineville, NSW, 1992.

This book documents research by the Write-it-Right industry project into the nature of the literacy demands within and across scientific industrial sectors. It relates the findings to literacy in the NSW secondary Key Learning Areas and develops a model that relates the language demands of

science in schools with those of manufacturing (literacy learning at each stage of education from junior secondary to post-graduate tertiary is systematically related to literacy demands at each level of manufacturing industry from machine operator to research scientist). It also describes the language features of scientific writing in industry at each of the eight National Training Board competency levels. This resource would be useful for workplace trainers or to tutors of integrated science/literacy programs. Much of this would have links to the four domains of the CGEA reading and writing streams and the ways in which the procedural and report writing needs of the science field are linked.

The spray-rite kit: a guide to using chemicals on the farm, Nick Stevens, Joanne Campbell, Karen Mainwaring and John Fenwick with Jennifer Gibney (ill.), Victorian College of Agriculture and Horticulture, Distance Learning Centre, Warragul, Vic, 1991.

This literacy and numeracy resource was designed to assist rural adult literacy students. It deals with chemicals on the farm and aims to help students understand the technical language, concepts and maths concepts associated with spraying safely and effectively. The kit has two main sections: understanding labels, and measuring for spraying.

Science and the environment: how does your garden grow? Certificates in general education for adults (CGEA) level II—resource manual, Loise Wignall, Jan Kindler and Dave Tout, Open Training Services, Footscray, Vic, 1998.

This resource manual contains learning activities and assessment tasks that cover some of the level 2 learning outcomes in the CGEA. There are three different units in this manual:

1   Growing plants—covers oral communication and the General Curriculum Options' learning outcome to do with planning and organising activities. As the title of this unit suggests, activities and assessment tasks revolve around growing plants.

2   Billie's Vegie Patch—designing a vegetable patch and making a compost bin. These activities enable students to use shapes and metric units for measuring and to read instructions.

3   Maranoa Gardens—finding your way around a native plant garden. Activities are about using maps, following and giving directions, using scales and drawing maps.

Certificate 1 in food processing (manufacturing at Cadbury): physical parameters—learning manual, Valeria Wressell, Cadbury Schweppes in conjuction with Hobart Institute of TAFE, Flexible Learning Centre, Claremont, Tas, 1997.

This is part of a package for self-paced learning which includes a study guide, computer managed learning (CML)

training manual and access to videos. The chapters cover measuring parameters, measuring acidity or alkalinity, pressure, density, heat and its effects, viscosity, evaporation and condensation, boiling point and solubility. Students are required to read texts provided, watch portions of videos, and complete written exercises and periodic computer-based tests. A lengthy glossary is appended.

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Foreign Correspondence

Fine Print **presents a slightly edited version of an article from the home page of the World Education Forum in Dakar** (*http://www2.unesco.org/wef/en-leadup/findings adulteduc.shtm*)**.**

Education for All —adult literacy in Eritrea

The importance of literacy

As illiteracy is a stumbling bock to the technical revolution in agriculture, industry and the social transformations in Eritrea, the coverage of literacy programmes needs to be considered in Education for All (EFA). In the strategic plan developed, the promotion of literacy can be seen in three major dimensions. The first is the need to improve economic productivity and growth. This is particularly true in the rural areas where much effort is needed to transform agriculture and raise productivity. The second is literacy's role in fulfilling the basic human right of every citizen. Literacy expands personal choice, control of one's environment, and allows for collective action. Thirdly, the ideological goals of literacy in Eritrea are also considered as central. During the national liberation struggle, literacy programmes were used to acquaint the people with political, social and economic policies, create political mobilisation, and assure the greater participation of the people in the social transformation and the liberation struggle.

> ' **Literacy expands personal choice, control of one's environment, and allows for collective action**

Success and impact

The rate of success of the literacy programme conducted is promising, but more effort needs to be done in terms of introducing more relevant programmes, appropriate teaching methodology and organisation. In the last for four years it has been found that only 70% of the those enrolled complete the literacy programme, the completion rate for male being lower (about 48.4%) than for females (71.3%). The literacy programme conducted in limited coverage was however very instrumental in its impact rather than in its coverage. An overall evaluation of the programme was conducted through the joint effort of providers, funding agencies and other stakeholders and the following findings will be worth for future tasks:

- The participants were able to read, write, keep their own accounts, fill forms, read road signs and deal with money transactions confidently and independently
- Many were able to help their children with school work by checking the exercise books, look after their health and sanitation and help them in their studies especially in lower grades

Educational radio programme

The educational radio programme related to adult literacy is broadcasted in two languages to support and strengthen literacy programmes and help adults develop basic knowledge, life skills and values required for better living. The depth and scope of the programme is seen across four basic areas—health education, agriculture education related to food security, citizenship and environmental education related to promoting environmental security.

From 1995 to 1999, more than 450 educational messages have been broadcasted in about 2732 hours of airtime. The programme is conducted in two of the nine local languages. In the past five years, it has been evaluated that the programme has reached 60% of the intended target audience. It is believed those students in the formal basic education, out-of-school youth and the army are among the special beneficiaries of the programme.

There are plans to expand and consolidate the radio programme. One of the major issues is to extend the coverage of the programme by establishing more listening centres. A comprehensive study needs to be made on the organisation and effective use of the listener centres and the type of low cost and reliable radios to be provided. The coverage of the programme has also been limited to two languages. Providing education through the other languages to support the ongoing adult literacy programme in all the remaining languages is of great significance. Other issues include the consolidation of the monitoring system of the programme and its resources, to raise coverage in terms of airtime and the need to develop alternative low cost means of sustaining the activities of the listening centres.

Expenditure in adult literacy

In general, the public expenditure on adult literacy is small compared to other components of the education system. The main reason is that adult literacy has been conducted in limited scope at a pilot level. Expenditure in adult literacy increased by about 112% since 1997. The distribution by object of expenditure shows that in the last three years most of the money has been used for salaries and needs assessment. More than 56% was used for salary items in 1999. This raises two issues in regard to conducting future adult literacy programmes. First, in order to introduce cost cutting mechanisms, efforts must be made to use existing

Table 27: Financial expenditure in adult literacy, MOE: 1997–1999

Activities	1997 in Nfa	1998 in Nfa	1999 in Nfa
Training	31,150	350,000	486,000
Salaries	377,600	592,000	1,846,880
Stationery	29,025	120,500	127,000
Needs assessment	480,589	799,800	107,000
Mobilisation	480,589	799,800	107,000
Transportation	25,480	305,000	400,400
Others	136,781	379,700	244,000
Total	1,561,214	3,346,800	3,318,280

Nfa = Nakfa (Eritrean currency)

basic education institutions and resources. Second, adult literacy programmes are the collective responsibility of all agencies, organisations and government bodies. Efforts must be made to involve the whole society and community participation should emphasised.

Non-formal basic education in evening schools

There are two major issues here. The present capacity of the government means providing education in the formal school system to every citizen in a very short time is not possible. The unsatisfied demand for middle school and secondary school level, and the fact that the number of primary school leavers is growing highly every year, requires the use of non-formal practices of education. Increasing educational access and equity to basic education in rural areas and other groups, such as drop-outs which are not reached by the formal school system, is also necessary.

This condition raises the importance of learning provision through supplementary education. It helps adults to be compensated for their lost opportunity without separating them from their work and daily living activities. The other major issue is the maximum utilisation of available resources with additional efforts to reach adults and raise their educational level. It is essential to create a literate work force and deal with the past generation's literacy backlog.

Training in essential skills

The depth and scope of the training provided was diverse. In general they could be categorised into income-generating skills and development-oriented skills.

Income-generating skills include weaving, leather craft, fibre craft, wood working, carpet making, distributed sewing and tailoring, horn craft, knitting, embroidery, pottery, bricklaying and masonry, elementary electricity, plumbing, general auto mechanics and driving (car, truck, heavy machinery).

> ' The impact of the training is significant in light of the country's great need for semi-skilled labour '

Development-oriented skills include forestry, soil conservation, gardening, seedling nurseries, animal husbandry, bee keeping, health education, traditional birth practices, and reproductive health education. All activities are interrelated and interchangeable between categories. Training skills range from two weeks to nine months depending on the age, experience education and demand of the participants. In general, the provision of technical minimum skills at basic education level is a continuation of the adult literacy provision. In several cases participants are enrolled without the basic literacy and numeracy skills, which they take after joining the programme.

The impact of the training is significant in light of the country's great need for semi-skilled labour and the rapid national reconstruction effort now going on. Many of the graduates have already started their own business, while many have been employed across the various sectors, though accurate data has not yet been compiled. Local communities, employers and sponsors highly appreciate and value the training given. One of the major dimensions not yet studied is the market job relevance of these skills and their effectiveness and employment prospects in the market. There is a clear need to assess how the different technical skills training at basic education level have performed in relation to their costs and to examine how they have been sustained. Another major concern is the prospects of continuity of such types of training and the need to upgrade the trainees to build up their skills as part of the spiral education process in the system.

Education for living

This includes the whole aspect of the informal section of the education system deemed necessary for better living and sustainable development. Its effectiveness in terms of behavioural change has been very high. One of the important areas is the impact of the media in educational and cultural development. Media coverage in educational, cultural, political, recreational and other areas has been raised in terms of airtime, relevance of content, organisation

and effectiveness. There has been a threefold increase in the media's capacity. A survey made in 1997 showed that about 70% of the young and adult population followed the radio programmes. The scope and coverage of programmes related to education has increased to about 50% in the last three years because of expanding the capacity of the media in the country. The radio programmes are broadcasted in eight of the nine Eritrean languages inside the country. The capacity and coverage of TV is also growing.

Another area given due importance is the collection of oral literature and the development of literary work in all the local languages. The attempts made are minimal and much needs to be done so that the people can use and expose their cultural heritage. It is also important to develop and standardise the languages.

Basic issues and problems of EFA in Eritrea

The three considerations here are political, economic and social issues. Some of the issues that should be raised in relation to the strategies outlined above give some insight into the nature and extent of the problems in the country. From the analysis made it has become evident that there are major political issues related to the development of EFA in Eritrea. Despite major interventions and results in quite a short time, equity of educational provision is a major concern. Thus, bridging the gap between regions, narrowing gender disparity and the provisions of education in rural areas are central issues.

The overall efforts of expanding the Education for All strategy and promoting its quality raise several economic issues and problems. Though accurate figures on expenditures of secondary education, technical education, non-formal education and tertiary level education have not been available, the general belief is that there is imbalance in expenditures in relation to the per capita allocations. Thus, there is a need to address the greater allocation of resources and expenditures in EFA because of its importance in terms of economic growth, productivity and the creation of a literate work force.

A particular concern in is the issue of over-aged children in the formal system which influences the opportunity cost and the indirect cost of education. On the other hand the demographic issues related to population growth and all other health problems and hazards should also be taken into consideration. Another critical problem is the high wastage in the system. This has enormous cost implications, and reducing wastage should be considered as one of the essential measures in the future.

The resources and focus given to minimum technical skill training at basic education level is, despite its good start and impact, very low in its coverage. In economic terms,

'**Despite major interventions ... equity of educational provision is a major concern**'

the emphasis on vocational skills training in various occupational areas at the basic education level should be made higher, and measures for its cost-effectiveness must be studied, especially in relation to the integrated rural development schemes. Assessments of the last few years show that education is an investment that requiring huge inputs in manpower, finance, material and organisation. Thus, the effective mobilisation and effective use of available resources is a central issue. It is in this light that international support based on partnership could help in consolidating the internal dynamics, local efforts and creativity.

Finally, the role of the private sector and its involvement in promoting basic education is of particular significance. In a country like Eritrea, which is in the take-off stage in economic terms, the participation of a strong private sector is vital in the provision of education—especially in promoting education for adults and technical vocational skills in rural areas. The reality now is that there is no sound private sector involvement, even in the formal school system.

Coming issues
Fine Print in 2000

In 2000, *Fine Print* seeks to examine a number of different perspectives on Adult Literacy and Basic Education.

The autumn edition considered the question of just what a community is, and how language and literacy help to create and sustain it.

This winter edition focuses on the place of science in ALBE.

The spring edition will look at what pathways exist within ALBE. And as the end of the year approaches, the summer edition will explore issues surrounding Indigenous literacy.

If you have ideas related to these themes and you wish to contribute an article which adds to the discussion, please see the details on the back cover about contributing to *Fine Print*.

Open Forum

Please feel free to respond to the articles featured in *Fine Print*. See the back cover for details.

In this edition's Open Forum, Ann Dunn has a brief look at the challenges of teaching science-related literacy with a scarcity of appropriate resource materials, Josie Rose shows how time, patience and teamwork helped a class learn to draw on the Internet's educational benefits, and Chris Anderson introduces students to the stock exchange via the Internet.

The challenge of science

I'm tossing in my hat here. I'd love to teach some science— I certainly include a fair bit of humanities 'content' because I'm very aware that people with low literacy skills have been denied a lot of knowledge which society regards as 'general' and which is important to understanding and accessing power at all sorts of levels.

The trouble is I think I hang back from science for the same reason that I'm tentative about teaching numeracy. With numeracy, I arm myself with Beth Marr's stuff, gird my loins, and venture in. However, not being a maths type, I run into problems when we get into the nitty gritty. I know how to do the tasks myself, but usually only one way to do it, and I 'teach' that.

But what do I do if the students don't understand? With any aspect of English, I have a variety of tactics and strategies for approaching any given area; I have different strategies for different learning styles. We can come at the problem from a range of points of view, depending on the students and the situation.

With any given numeracy problem, I have 'a' (that's one single, solo, isolated) strategy, and if that doesn't work, I'm sunk—and then I get that cosy glow that results from having confused a student more deeply and confirmed their belief that they're dumb! People wonder why so many literacy teachers shy away from teaching numeracy! Or happily do the map stuff and the other 'life skills' numeracy, but once you get a little further along, you're in trouble. I'm not talking quantum stuff here —it's things like teaching percentages. I can do it for myself, but I'm not too hot at teaching it.

Similarly with science. I'm sure heaps of people would love to teach more science, but having the materials to do so is often the problem.

I've taught reproduction biology to a group of adult women, some of whom were pregnant, who had no idea how their babies were developing. I used books from the kid's section of the library, and scraped together stuff from here and there, but it was not the best it could have been.

Then again, I don't have time to drive all over the place collecting and developing materials. Besides, I'm a sessional teacher—I can't afford to spend great slabs of time developing materials for a class.

We adult community education types teach pretty much in isolation, working from our cars, dealing with minuscule budgets and we are pretty much thrown completely on our own resources. I can make up curriculum materials for the areas I know well, but when it comes to science, sure it's important, but which aspects should we teach, and how, and where do we get the materials, and so on?

Papers telling us why we need to teach science are fine, but if you really want people to do it you need to provide us with classroom materials that we can take in and use, plus the strategies to go with them.

What would be great is a central resource place, where units of work were built up (we could all contribute) and all ACE teachers could go there, browse, photocopy and borrow, or even phone up and ask to have units of work sent out.

If the materials are provided in a cheap, useful and accessible format, we'd all be teaching a lot wider range, and much better than we are currently.

Ann Dunn is a sessional teacher at Preston Reservoir Adult and Community Education (PRACE).

Learning to learn online —an interim report card

In 1999 a group of level 3/4 CGEA students and I set out on an learning journey which required us to work closely together as a team, and also required me to really push myself and my capabilities as learning facilitator.

As more of my students were coming to the end of their CGEA studies, and were picking up a tremendous amount

of computer skills, I saw an opportunity to help them explore another dimension to their lifelong learning journey—the choice of learning online, should they so desire.

The students have been together for a few years and built up strong friendships, developing a lot of trust in each other and in me as a teacher. They met in the CGEA class and then there was a natural transition with me to the computer class. Our computer class first started out as an extension of what they did in the literacy class. Learning the basics of MS Word, using multimedia CD ROMs to explore ideas and strengthen grammatical concepts, to communicating online and using the Internet to research topics for written assignments.

Last year the focus changed as we had an opportunity to become involved in TAFE VC learning network. After some discussion and consultation we decided to explore learning online in a teacher-facilitated classroom, and see where it would take us. This would be our first experience in teaching and learning online. From the outset I encouraged the students to not only direct, but also to comment, critique and adapt their learning as we went along.

It is now six moths later and we have decided that learning online requires a very complex and sophisticated mix of skills, knowledge and attitudes. Our online learning experience—it was mainly the TAFE VC version—was an enjoyable, yet sometimes confusing, and often frustrating one.

Here are some observations regarding the process as experienced by my students and I.

We found that learning online required a great deal of patience and support of each other which helped us through the more challenging times and made the good times fun.

What were some of the more challenging times?

- Although we have a relatively new computer room and two 33k modems with a multiplexing system, we still found that ten students going to the same site required a lot more download speed than we could offer. This resulted in students waiting for information to download. Using the waiting time productively—if that is possible—was a real test for me.
- Despite the fact that we had a lot of support from the learning network management, enrolling in a course online was quite a feat, and a process that I could not have completely prepared for.
- I have always spent a lot of time checking and rechecking lessons that require an online component. I have learned the hard way, finding that lesson prep took longer, as I now had to put lessons on the VC.
- Putting lessons online required me to rethink the methodology and the sequencing of tasks. I needed to explain (what I saw as) complex procedures in small, simple steps. Although I would be there when they

accessed the lesson, I wanted those who identified themselves as independent and more capable to go off and explore on their own if they wanted to.
- Coming to grips with the terminology of online learning, and determining the prerequisite skills a particular activity—and if students would require specific teaching in this before they went online—was something we had to grapple with. We had a debriefing session at the end of the lesson, which helped students voice their frustrations with particular aspects and suggest changes to subsequent lessons.
- The fact that the students only come once a week, and very few have access to computers at home, made the uptake a lot slower.
- Coming to grips with different passwords and logins—there is no way of avoiding that— was very difficult for some students. Knowing what they were doing and which password/login they needed took a long time to get used to.
- Having to deal with two online environments open to them at the one time—the VC and the web sites/ activities they needed to access during the lesson also needed to be addressed. Although this facilitated some very timely and valid teaching topics such as how to manage having multiple windows open or the concept of multi-tasking. It still caused frustration when the wrong window was closed by mistake and students had to step through the whole login procedure again.

On the positive side I can say that the students did enjoy the experience and were excited by the possibilities it heralds. They appreciated the opportunity to explore and have their efforts evaluated. They were keen to examine this dimension of the Internet as they can see that it is a means by which younger generations are likely to want to learn.

Some students developed very quickly and have taken a lead role in helping and mentoring others. They are all now a lot more confident in many operations of the computer, and quite capable of getting themselves started without much help from me.

The past six months we have been very active online but in a very different way. Our experiences have alerted us to the fact that there were four areas in which we needed to develop very specific skills. They are:

- email and chat
- windows
- word processing
- general Internet techniques.

We have divided our class time so that we can spend equal time on building skills, while still exploring language and other issues online. Everyone is keen to start working on online materials through the VC next term.

A defining moment for me was when the entire class was logged on, logged in and absorbed in their tasks, and I

realised that we had done it! I suddenly felt very lonely— what should have been a great sense of satisfaction was tinged with a keen feeling of loss and loneliness. I was no longer needed in the classroom! Time to plug myself into a computer too!

Josie Rose is Educational Technology Manager at the Narre Community Learning Centre

The Internet, email and numeracy

I would agree with Michael Chalk that the use of email within a general education class is certainly worth the effort and the occasional frustration with the technology. Some students do have trouble logging into a generic email account and others forget their passwords, but the benefits are numerous. Usually even the most timid pen-to-paper writers will type a greeting and send it off. The joy that this brings is usually only bettered when they receive a response back.

Currently, I have a combined class of students studying levels II and III of the CGEA, some of whom I had during 1999 when they were first introduced to email. Previously some had heard of email but were not familiar with using it. Two or three of these students were reluctant to submit any information about themselves when first setting up an email account. They would even make up first and last names to enter (for those who may have an in-house email, and haven't used any of the generic email systems available, the only personal information you give is your name and that is so the receiver is able to identify you before opening the email.). However, after they had the opportunity to use the system for a few weeks in a row they became less suspicious especially as they saw their classmates using it enthusiastically and suffering no consequences.

I have the same class for Numeracy and Mathematics II and III, and one of the tasks they were set was to 'purchase' some shares and follow the price movements weekly for five to six weeks. They were encouraged to choose companies from within the top 50 listed on the Australian Stock Exchange. The values they used were the closing prices each Friday. The students have access to computers on Tuesday mornings and can calculate the required inform-ation by accessing share prices using the Internet. The web site they mostly use is *http://www.comsec.com.au*, but others are also suitable. Once students had the necessary information, I asked them to send me an email with the weekly details. As the task is nearing completion many are now adding comments as to how their shares are going.

The web site provides daily price information in table form. For each company five values are listed: Open, High, Low, Close and Change (calculated from previous Close). This allows for plenty of comparisons within and interpretations of the data:

- Were there more rises than falls?
- For which company was the range of values the largest?
- Did any company Close on the Low value for the day?
- Which company would have provided the largest profit if it was bought and sold on that day?
- Would the profit have been worth the 'risk'?

Another benefit in using the Internet to view such web sites is that a considerable number of language learning opportunities will automatically arise, especially regarding vocabulary. This can range from company names, share market terminology, the language of comparison, and so on. Often these sites offer opportunities for skill develop-ment in reading for practical purposes as well. For example, to obtain quotes for car insurance, also accessible on the above-mentioned site, a student needs to enter and select information such as make of car, postcode and suburb. Up to three quotes are given along with contact details for each company.

As Michael wrote, when the students are proceeding through tasks like these they are learning many valuable computer skills as well.

Chris Anderson teaches at at Holmesglen TAFE

Policy Update

The concept of lifelong learning will be of little value without the inclusion of science education. As this article explains, technacy—scientific and technological literacy—will become an essential feature of everyday life.

Science education for adults —an issues paper

Lifelong science education

The world is changing quickly. Knowledge is progressing so fast that most adults are in danger of being overwhelmed by new science and technology soon after they leave formal education. Adult education providers are facing the challenge of making sure adults keep pace with major technological and scientific developments. That they do so successfully is especially important for people who are not part of the paid workforce, because they have fewer opportunities to keep up to date with rapid developments in scientific knowledge. Unemployed people of all ages, retired people and those who are employed full time in bringing up children must not be left behind.

We need an education system to match the demands of the 21st century. Lifelong learning should include a comprehensive approach to science education.

Who needs science education?

Maintaining an up-to-date skills base is obviously important for unemployed people if they are to maximise their chances of getting a job. Employers will continue to give preference to technologically literate applicants and an increasing number of jobs will require workers to be skilled in those areas. It is now more important than ever before that 'an education system must provide us with a workforce that enables the nation to grow, compete and prosper. The system must prepare individuals to make their way in a technologically sophisticated society' (Roe 1987).

In addition, the importance of educating people who work with young children cannot be overestimated. In the United States, the Lawrence Hall of Sciences, University of California at Berkeley carried out a three-year project to develop a science and mathematics education course and science curriculum for early childhood educators. This project was developed in response to the need for improving the science and mathematics knowledge and teaching skills of adults who work with young children.

Because parents are role models and children learn from them, they need to keep abreast of the developments in science and technology and understand the social and moral implications of, as well as the benefits accruing from, technology. Technologically literate parents will be better able to support their children if they keep up with important health, educational and employment advances.

'Science activities offer interesting materials and topics that motivate both teacher and the child to investigate the world around them. Furthermore, such early explorations promote interest in science which can remain with the child throughout life' (White and Hosoume, 1993). This statement applies to all parents as well as professional educators and children.

Science for all

All of us come into contact with science and technology every day of our lives as consumers. But do we interact intelligently with the scientific and technological goods and services we buy? Anyone who watches or videotapes a film, uses a washing machine, drives a car, writes an email, visits a doctor or buys pharmaceutical products is exposed to science and technology. Is it necessary to understand anything about the science behind the technology or is it enough to know how to access it and use it?

Most of us are aware that indiscriminate use of science and technology can lead to social problems. Anyone who is concerned about air quality, the integrity of the environment, use of pesticides, overuse of antibiotics, vaccination programs, alternative energy sources, genetically engineered food, contraception, toxic waste and organ donation understands that science and technology have a social context. We must deal with those and many other issues and we must be informed about them in order to make intelligent decisions. The alternative is to abrogate our responsibility as citizens and allow various scientific and commercial lobby groups to make decisions based on their limited set of values and interests.

An image problem for science

Many adults believe they cannot keep up with the fast pace of change and expansion in the fields of science and technology. They are awed by the amount of information apparently needed to deal with science-based issues. They think they have to know higher mathematics to understand technology, and consider science too difficult for the 'ordinary' person. These misconceptions give science and technology a bad reputation.

Consequently, there is a lack of public understanding of, and support for, science. Alienation from science is greatest among disadvantaged groups such as women, the unemployed, older people, early school leavers, Kooris and people from culturally diverse backgrounds. Given the importance of science and technology in all of our lives, one way to empower disadvantaged groups is by developing their confidence in science. Often confidence comes with an understanding of the language scientists use.

Towards science education

Governments everywhere are concerned about the declining interest by students in science, engineering, mathematics

and technology subjects. This is not only because there is a demonstrated link between a country's present and future economic strength and its level of scientific and technological development, but also because science literacy, or 'technacy' is becoming increasingly important for everyday life. It is now recognised 'that science *training* is good preparation for a wide variety of societal roles'. (From *Analysis to Action, Undergraduate Education in Science, Mathematics, Engineering and Technology, Report of a Convocation*, 1996, Centre for Science, Mathematics and Engineering Education National Research Council, US*)*.

In Australia, there is a drive towards science education from many quarters. Dr Robin Batterham, the Chief Scientist of Australia is quoted in *The Age*, 10 June 1999 as saying that we need to boost science awareness in schools and the general community. 'We have got to excite people. We want them to think about scientific matters—if only to cope with change. Without science literacy, you have really no chance of playing the world-wide game of ideas', Dr Batterham said.

The Commonwealth Government, through its Science & Technology Awareness Program (STAP), provides financial support for community science projects. The objective of STAP is 'to increase awareness and understanding of the central role which science and technology play in Australia's economic and social well being. The ultimate vision for the program is a nation whose citizens are well informed about and comfortable in debating science and technology issues, and whose young people are giving due consideration to extending their formal education in science, engineering and technology beyond the compulsory years of schooling'. (*Guidelines for Applicants, National Science Week 2000 Project Grants.*)

Foundation for lifelong learning

The Australian Science, Engineering and Technology Council views technacy as the technological equivalent of literacy and numeracy, both of which are strongly supported by ACFE providers. Technacy grows increasingly important in our daily lives and it is expected that the worker of the future will be a knowledge worker rather than a process worker—technologically literate and proactive in identifying and solving problems.

ACFE providers are well placed to provide science and technology literacy courses through a foundation studies curriculum. The ACFE Board's strategic direction of lifelong learning in community settings is crucial for the technological generation, which must be able to adapt to constant change. Lifelong learning in scientific and technological literacy will become a requirement for adults who want to meet their civic responsibilities, keep pace with the changing technology and remain employable.

It seems a logical extension of literacy and basic education provision to augment that approach through courses that teach scientific and technological literacy. Scientific and technological literacy courses would be flexible and issues-based. They would teach the basic skills of science and demystify the scientific method. Most importantly, students would learn science communication and research skills. An objective would be for students to develop enough confidence to independently access and interpret scientific and technological information.

Such courses could prepare people for further studies in a broad range of accredited vocational courses and more advanced science and technology courses delivered by ACFE providers. There could then be ready access to Bridging Certificate in Science for graduates of foundation studies courses. Some of the existing Bridging Certificate courses bypass VCE and lead directly to TAFE and university and thus provide alternative form of entry to tertiary institutions for adults.

Science literacy courses can give non-English background people with tertiary science, engineering and technology qualifications a chance to refresh their skills and to learn the English scientific language. People who have completed such courses have an increased chance of passing exams to gain full accreditation for their qualifications, of obtaining work, or of articulating into further studies. At present, there are very few courses in this category.

There is a widely used approach to literacy and numeracy education known as the Certificates in General Education for Adults (CGEA). The ACFE Board's publication *Transforming Lives Transforming Communities* provides a conceptual framework for further education. The conceptual framework and the approach of the CGEA offer the chance to generate outstanding science-based foundation courses for adults. Access to science for adults and disadvantaged groups, and to pioneer innovative science courses and new ways of teaching science is a real possibility.

Challenges and opportunities

There are real opportunities for the ACE sector and all ACFE providers to build on the vision 'to combine a broad general education with specialised knowledge and skills' and to 'develop the capacities needed to undertake work' (*Taking ACE to the Year 2000*).

The ACFE board's vision statement predicts opportunities for ACE in the 'attention by governments to the connection between education and training and the strength of their economy and society' and 'growing government recognition of the need for workers with multiple literacies'.

If ACFE providers develop a framework for teaching science curriculum, they will be fulfilling their obligations to the community and meeting the ACFE Board's stated aims to widen participation in ACE and augment learning structures.

ACAL

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Beside the whiteboard

Kaye Elias has been involved in adult literacy teaching at the Council of Adult Education since 1985. Here, she talks to Katrina Lyle about on her diverse experience in the field.

Could you describe your teaching experiences since joining the CAE?

I began in 1985 as a sessional teacher for evening maths classes before moving to other literacy classes in the Return to Study Department. Workplace Basic Education was evolving and it became a big part of my teaching. Workplace Education was started by people with strong principles regarding paid literacy education for workers, so the classes were run in work time and supported by the employers. The organisation was a tripartite setup and the teacher, workplace and the workers formed a coordinating group. Literacy needs were identified, a program developed, and ongoing monitoring put in place.

We taught in different environments: aged care, working with kitchen staff and personal carers; in manufacturing, working with process workers at places like Nylex; and local and state government authorities, working with cleaning, garden and outdoor staff. Literacy needs were tailored to workplace needs. This was all before competency-based training, so we drew on a wide curriculum for individualised programs. While there wasn't the scope for recognition through accredited certificates, it allowed us flexibility in developing appropriate literacy learning.

Since the CAE's Workplace Department finished about five years ago, I've shared my workload between General Education and the ESL Departments. I'm currently teaching CGEA level 3, some GCO's, and CSWE II.

How did you become involved in LOEB teaching and how has this influenced your teaching?

The CAE has a large number of literacy students, so our programs can specifically address the literacy needs of LOEB learners, as well as those of English background learners. At about the time Workplace Education closed, I completed a graduate diploma in TESOL and ALBE, which enabled me to ground my teaching practice in LOEB methodology. My teaching methods differ in each area. Shared reading and pronunciation is more overt in LOEB classes, and I do a lot of choral reading, moving through a text with students repeating phrases I've modelled. This helps students learn the natural elisions between words, the subtle stresses of phrasing and so on. I would never do this in a mixed LOEB/EB class. It would bore the pants off English background literacy students.

My experience with LOEB students has influenced my general classroom practice. Oracy is very important for my English background literacy students, who must use speech to develop ideas, and I use small group oracy tasks to help them do this in a risk-free atmosphere before moving on to more formal classroom discussions. Holding a public meeting where students take on the role of stakeholders in a particular issue helps them develop confidence and understanding of community events.

What else influences the way you develop a curriculum?

The literacy field has changed since the advent of the CGEA. The development of the four domains puts students in touch with the different genres, meaning we are clearer about text when working with students. Knowledge of the structure, purpose and tone of the different genres shows students how to become the authoritative voice and thus control the text.

I draw on current events, which have their own vocabulary, setting and characters. Understanding these helps students participate in other texts outside the classroom, giving them a broader engagement with the world.

What do you find rewarding about being an adult literacy teacher?

It is a stimulating and creative process not restricted by set curriculum, althougb we're guided by the CGEA. It's exciting to have students with various backgrounds and strengths, and come up with a curriculum that will benefit and engage them.

The CAE has a strong program that offers curriculum development and sharing across departments. We also have a community of sharing and mutually supportive teachers. Getting the perspectives of others is stimulating and rewarding. Competition in the field is making this sharing harder to establish.