# A Case for Agricultural Courseware in International Instruction

D. R. Minnick

In Third World scenarios, an agriculture instructional need to extend technical information between the researcher and client populations that utilize the researchers' discoveries. Because of constraints, the two populations communicate at different levels and parameters within a respective language. Constraints can be greatly circumvented through a strategy of instructional courseware development.

Courseware includes the things that help document and disseminate information/knowledge. The term especially refers to instructional or training materials. Examples of courseware used to transfer information are books, flipcharts, posters, slide-tape presentations, slide projectors, cassette tapes, or computers and computer-based instruction. Courseware normally consists of two parts, *hardware* and *software*.

Hardware is the apparatus that operates a medium through which the message is sent. Examples are projectors, tape recorders television sets and microcomputers. Hardware is usually associated with electronic media.

Software is the medium which contains the message. Examples would be a slide, audio cassette, overhead transparency, floppy diskette, and especially paper. In electronic media the software is dependent on, and displayed through, the hardware.

## Importance of Courseware

Courseware are important in the information transfer process because they:

- unlike oral communication, document information/knowledge for perpetuity, which oral communication can not do;
- package such information to be readily transportable ('disseminatable').

They are especially important in the development of *human resources*, because if certain rules are followed they:

- can increase the efficiency of inputting knowledge by up to 50%, when compared to the lecture;
- allow a change in training methods that enhance problem-solving;
- assist learners in attaining knowledge independent of a teacher or human disseminator.

Because of these advantages, learner-driven self-study courseware is becoming an important tool in information dissemination.

## Hardware/Software Advances

Because of the recent technological discoveries in hardware and software, courseware media devices are going through drastic advances. These advances address four basic areas:

- storage
- access
- individualization/interactive dialogue
- multisensory communication

For example, in the areas of storage and access, the knowledge base contained in the 23-volume printed Encyclopedia Britannica can now be stored on a 5.25-inch compact disk called CD ROM with space to spare. This disk will hold 270,000 typewritten pages of information. Information can be accessed in 5 seconds. Glossary or index windows assist the user in this process. This storage advance in courseware development can literally place a library of paper information at an individual's fingertips with almost instant recall. The library can be readily transported and explored at a time and place designated by the user. Thus, the courseware can be designed for use by the individual--a knowledge exploration along learner-motivated efforts.

In the realm of multisensory devices associated with courseware development, the CDI is the latest advancement. Again a compact disk is used, but this time it is programmed to be interactive with computer programs and peripherals. There are audio peripherals that can listen and talk to the user; touch peripherals that make the user interact with the hardware/software by touching the screen, and, soon to be incorporated, optic peripherals that will lead users through our visual world.

## Advances

### Cognitive psychology and courseware

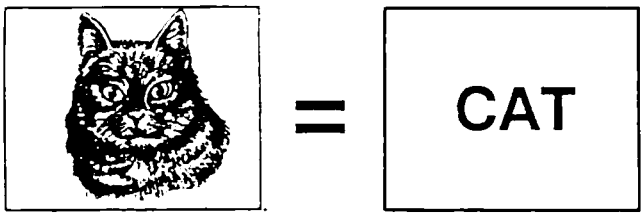
All these advances are exciting vistas in courseware development in relation to the storage, access, and methods of knowledge acquisition and dissemination. However, some previous tracks of scientific progress are equally important. They deal with the psychology and techniques of *how* we communicate today. Investigations into the *way* messages are put together in the software are providing breakthroughs in communication.

These discoveries are based on the research of a Swiss psychologist Jean Piaget. His research is associated with knowledge acquisition/development. Although most of his work was done in the 30's and 40's, it is central to message development in courseware production. Piaget found that knowledge development in the human being goes through a series of sequential stages:

- sensorimotor
- preoperational
- concrete operations
- formal operations

The first stage, the *sensorimotor* ages, are from birth to about 2 years. It is a "touchy feeling" world where the child

Minnick is a training specialist and head of the Training and Technology Transfer Department, International Rice Research Institute, P.O. Box 933, Manila, Philippines.

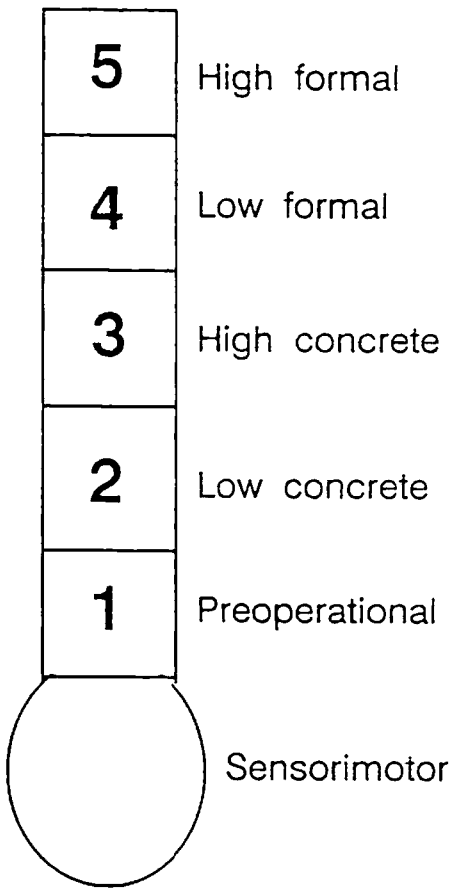



explores by hand and mouth the concrete world of "reality". In this world they continually pick up and feel objects, put them in their mouth, taste, and throw them to initialize and catalogue a memory system of their world around them -- a basic world of concrete associations.

Next is the *preoperational* age, from about 2-7. In this stage, the individual starts to replace/substitute concrete objects with abstract representatives. The picture of a cat is not a cat but stands for a cat. The word cat is even farther from the concrete cat but, nevertheless, stands for the reality that purrs, scratches and rubs on your leg.

From this preoperational stage of dealing with abstracts, individuals go through a *concrete operational* stage between the ages from 7 until. Until, because with many, there is no time limit. Much of the world's population remains locked in this stage where they must manipulate concrete objects or input concrete information to maintain their "reality" and livelihood. They obtain some abstract tools, like speech and simple mathematics, but their world is a concrete reality of seeing and touching rather than the abstract.

Some of the world's population go on to the *formal operational* stage. In this stage formal language skills, mathematics, logic, and sequential analysis are learned. Most of these skills are obtained in a formal environment referred to as a school. In fact, most schools teach very little of the concrete but are steeped in the formal languages of mathematics, hierarchical relationships, and abstract knowledge acquisition and storage. The high one goes up in the formal ladder the less concrete (more abstract) are the communication vehicles. Some contend that the description of knowledge acquisition in these formal areas deserve a more elevated word that training -- the word is ***education.***




In summary, then, Piaget found a path of knowledge acquisition and relationships. This path is extremely important in courseware development. Message comprehension and communication depend on where an individual is in these developmental stages. For example, a farmer with little education does not understand that the circumference of the water tank he is building is C=2(radius x pi). It should be remembered that although Piaget described these four stages in cognitive development, they are not discrete as such but all four stages are in a continuum. To better define this continuum, for future references, we will divide two of the stages in half so that we have a low and high concrete, and a low and high formal stage.

With these divisions, we have a barometer for information dissemination and training methods consisting of, if we discount the sensorimotor, five population categories.

**Right and Left Brain Discoveries**

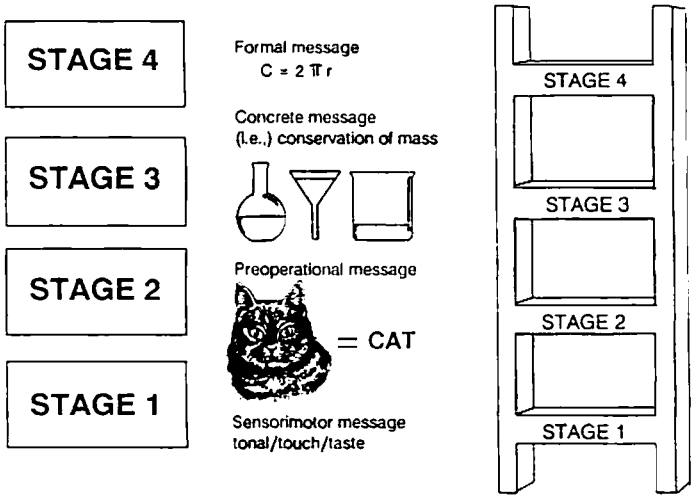
In the 1950's, there was a very significant discovery in brain function by Roger Sperry and his colleagues at California Institute of Technology. Sperry's research gave us further insight and another barometer for message development.

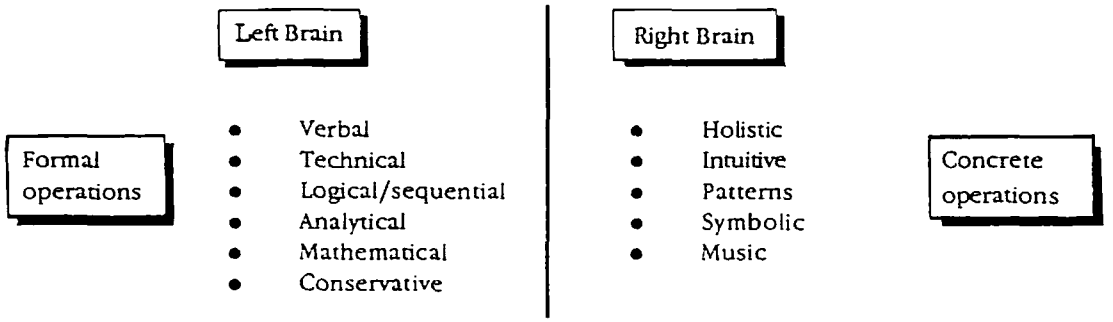
Briefly, he was one of the initiators of subsequent investigations that found the human to possess a left and right brain, that these two hemispheres can be divided into sectors, and that different sectors perform different functions. The sectors and related functions are outlined on the next page:

Notice that these sectors of the left brain are developed by the formal operational or training categorized by Piaget. The implication of these findings in courseware and message development is that there are two basic types of messages: a left brain message and a right brain message. Left brain messages are verbal and mathematical; right brain, spatial and pictorial.

In general, people have two vocabularies that are developed to different degrees; a verbal vocabulary and a pictorial vocabulary. On a scale, verbal vocabularies tend toward the abstract; the pictorial, toward the concrete.

Other research has revealed that because of the optic chiasm or the crossover of the optic nerves, courseware layout should present the pictorial component on the left and the text on the right side of the page or content frame.






**Integration of Cognitive and Right/Left Brain Findings**

If we combine Sperry's findings with those of Piaget, we end up with a generalized courseware barometer for message construction of courseware materials that looks like this:

In the scientific world, high formal messages are the standard format. The pages are filled with verbal codes, or words, and with mathematical and statistical symbols. The only examples of spatial communication are graphs or tables.

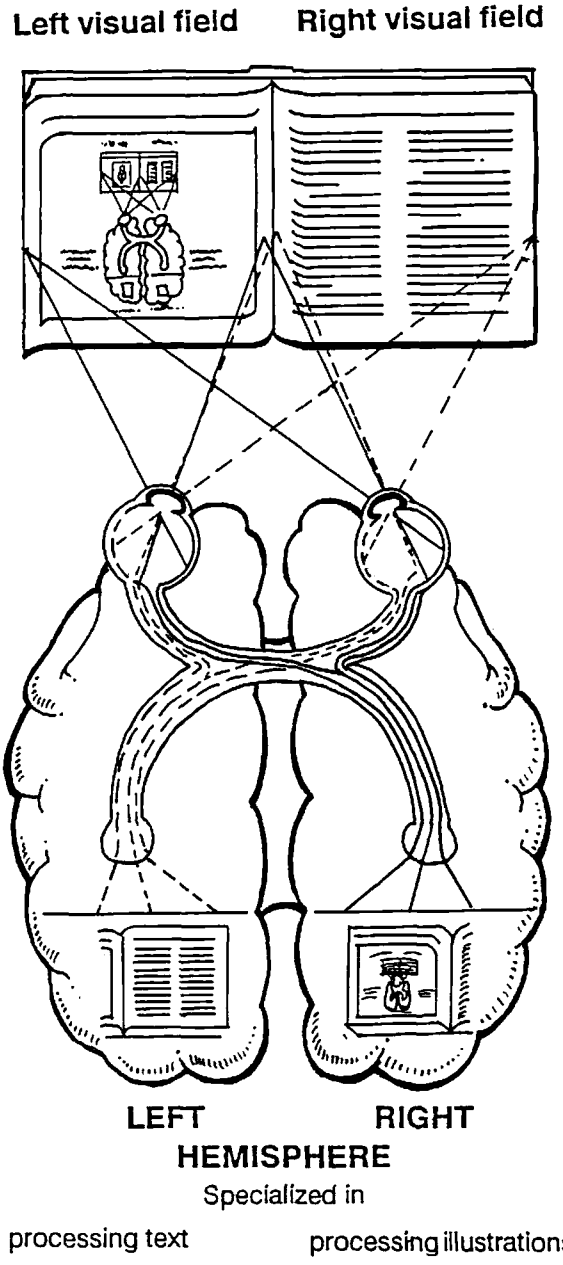

The verbal coding is complex and designed for those with a high formal education. By contrast, concrete messages contain an array of spatial designs which accentuate a pictorial communication. Color communication is important in accentuating concretion.

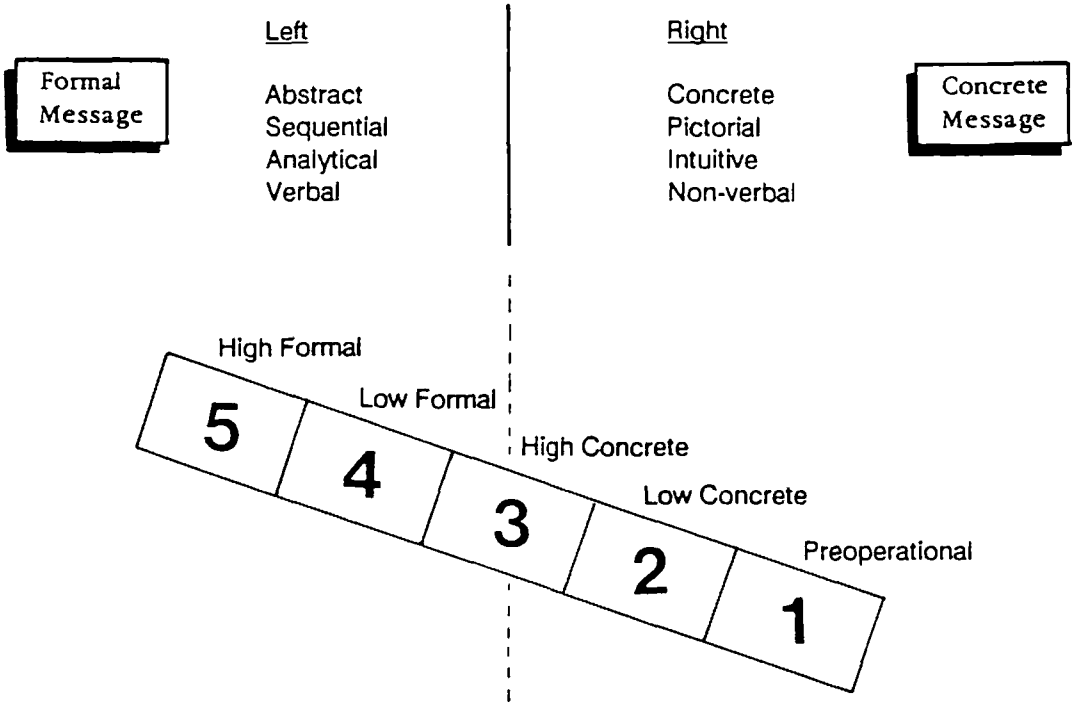
## Making Messages to Fit

High formal audiences constitute an extremely small part of the population needing information or technology. Thus technological messages written/designed for these different audiences outside science are few. In fact, it is difficult to decipher messages about scientific discoveries and technology because of the diversity of disciplines, each possessing its own vocabulary. Subsequently, there has been a trend toward a proliferation of technical journals with their respective specialized audiences and languages.

Conversely, instead of providing messages for the elite class of scientific researchers, messages can be "designed/translated" to communicate with others needing technology: its processes, products, and concepts. (In many countries the farmer-contact agent may have a 6-8 grade education.) The general, technical community and even many lay people can comprehend complex technical messages if they are presented in small sequential steps which are concrete (pictorially oriented). Thus, the audience for the technology is expanded to include the extension specialist and, in some cases, the extension agent. Even more important, concrete messages can form a matrix that the extension agent can use to further translate for his client population -- the farmer.

In many parts of the world, almost all links in the lower part of the technology transfer communication chain are oral. This creates a dependency on personal contact for






information. Extension personnel are often competent in agricultural technology but lack even the rudiments of communication training and marketing skills. Many extension programs rely almost solely on demonstration and lack any semblance of media use in their technology transfer efforts. Yet, surveys conducted by the author in many struggling Third World countries (i.e. Nepal, Vietnam, Madagascar, Bhutan, etc.) indicate that there is at least a 50% literacy among many target farmer populations and it will increase in the next generation. It is the correct time to produce and use learner-driven instructional extension courseware as a vehicle for technology transfer. Competent courseware designers must be trained in extension services. Also, much of the courseware could be used as learning materials in the schools, thereby sensitizing the next generation of farmers to rely on documented communication.

## References


Cain, Bonnie. (1986). Saying with Feeling: Photonovels and Comic Books in Development. *Development Communication Report #55*, pp. 1 & 2.

Ofiesh, Gabriel. The Seamless Carpet of Knowledge and Learning. In *CD ROM: The New Papyrus* by Lambert, Steve and Suzanne Ropiequet. Redmond, WA: Microsoft Press, 1986. pp. 299-318.

Hermann, Ned. 1988. *The Creative Brain*. Brain Books, Lake Lure North Carolina, USA. 456 p.

Kulik, J.; Kulik, C.: Cohen, P. 1979. Research on Audiotutorial Instruction: A Meta-analysis of comparative Studies. *Research in Higher Education*, 11(4): 321-341.

Munoz, Milton. (1986). *Understanding Visual Literacy*. University of Wisconsin. 94 p.

*Newsweek*. (February 7, 1983). How the Brain Works.

Niemic, Richard P.; Madeline C. Blackwell, and Herbert J. Walberg. (June 1986). CAI Can Be Doubly Effective. *Phi Delta Kappan*.

Novak, Joseph D. (1977). *A Theory of Education*. Comell Press. Ithaca, NY, USA. 295 p.

Springer, S. and G. Deutsch. (1981). *Left Brain, Right Brain*. W.H. Freeman & Co., San Francisco, USA.


Left - High formal

Right - High concrete

$$M = \frac{\sum_{J=1}^{K} (X - X)}{K-1}$$