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Literacy in the age of information: a model

1. Background

This paper describes an application of cognitive linguistics to certain problems of higher education in South Africa. It describes a research project which is being undertaken at the Peninsula Technikon to inquire into the nature of problems being experienced by many students currently entering higher education, the most serious of these being an inability to process text at appropriate levels of difficulty. The severely disadvantaged student is unable to interpret or to generate the kinds of text that are required. This is evidenced by an extremely widespread problem of plagiarism. The student is unable, through inadequate comprehension of texts, to extract and synthesise required information, which leads inevitably to plagiarism as a student coping strategy. Related problems arise in information seeking, in selection of relevant information and in critical assessment of information, particularly in problem-solving contexts.

2. Cognitive Issues

I would like to show briefly in this section how a range of variables and problems within the higher educational situation are found to be linked when considered from the point of view of underlying cognitive processes.

2.1 Language in the curriculum

The issue of the language of education is one that is difficult to resolve in African countries, where the indigenous languages have radically different histories of development from the colonial languages, and the conceptual resources of these languages are consequently varied. Thus learning a non-cognate second language (e.g. English) may entail the construction of new mental models or the alteration of existing ones, as opposed to merely learning new labels for existing models. Where semantic complexities of this kind exist, any task involving the translation of educational resources is also made more complex. In addition, the costs of translation on a scale that would enable the introduction of various indigenous languages of education tend to be prohibitive.

2.2 Culture

Culture is closely connected to language, at least within the theoretical perspective adopted here. It refers to those idealised cognitive models (Lakoff, 1987) that form one's world view and that are shared among members of a particular group, typically, although not necessarily, a group sharing a common language. These models, derived from shared experience (Johnson, 1987:xvi), are strongly constitutive of one's understanding of oneself and one's relations with others, and are schematic mental representations of typical situations, persons, actions and objects. They are formed through the processing of discourse (e.g. narrative) and are often described in the cognitive literature as 'frames' and 'scripts' (van Dijk and Kintsch, 1978; van Dijk, 1980).

The 'scientific world view' is particularly relevant here. The development of a scientific world view involves the construction of a set of mental models relating to patterns of causation, natural forces, methods of observing these, etc. Its development is a formative process, in that it involves the alteration of previously constructed models (derived perhaps from tradition or religion), and it constitutes a cultural shift for the individual.

2.3 Knowledge

My thesis here is that linguistic and cultural development are inseparable from the acquisition of encyclopaedic knowledge, and that essentially the same underlying cognitive structures are constitutive of language, culture and knowledge. It is necessary to introduce a brief discussion of text processing at this point. According to van Dijk and Kintsch (1978; 1983), in the course of processing text the subject assembles in episodic memory two main sorts of structures:

- A set of *textual functions* that together constitute the generic speech act or generic function that the text is performing. These functions may be represented mentally as a set of 'macropropositions', each of which is a synthesis of a particular section or episode of the text. The mental modelling of this text 'macrostructure' is facilitated by the activation of an already existing genre schema (or 'superstructure'), which would have been constructed in earlier instances of text processing, and which would render the typical functions of such a text immediately recognisable.

- A *situation model*: a mental structure that constitutes the referent of the text. The construction of the situation model in episodic memory requires the activation of already existing knowledge structures in semantic memory. These are the frames and scripts relating to persons, situations, objects, actions, etc., the activation and combination of which creates the possible world that is the referent of the text. Having been constructed from these previously existing resources, the situation model (or parts of it) may itself be incorporated into semantic memory through a process of learning, to be reactivated as a new knowledge resource in later instances of text processing.

Understanding concepts requires encyclopaedic knowledge of actual and possible worlds. For example, understanding the highly abstract term 'market', as used in economics, initially requires concrete knowledge of various types of markets in order to construct a more abstract model from these concrete instances. A cultural shift on the part of an individual involves knowledge change; it is a matter of understanding the communicative functions of previously unknown genres and being able to envision possible worlds that were previously impossible.

2.4 Transfer of knowledge and skills

Transfer involves the notion that there are generic skills and knowledges which the competent student will instinctively apply across the curriculum (Thesen, 1990). The problem is that the student who has to be taught these may have difficulty in transposing them from one context to another.

In terms of the perspective outlined above, the problem with academic literacy programmes is that they often attempt to address students' lack of generic knowledge and competence directly and explicitly, through the introduction of a metalanguage. Such a focus and strategy tends to dissociate the two cognitive processes that were described above, the modelling of text superstructure (textual functions) and modelling of the referent (situation model or possible world). Space does not allow me to explore this dissociation fully, but, briefly, the explanation involves a discussion of how certain levels of cognitive activity are 'overdetermined' by others. For instance, an interest in text content, which frequently is the driving force behind an active interpretation, will often disrupt the processing of the linear sequence of propositions making up the text, so that certain sections are ignored or skimmed, leading to an incomplete or idiosyncratic modelling of the text and its communicative functions. Such overdetermining of one sort of cognitive operation by another, including those cases where the interests and personal goals of the interpreter are strong determining forces, is entirely normal and consistent with the principles of 'processing from above' and 'processing from below' (van Dijk and Kintsch, 1983). Shifting the conscious focus of the student away from normal concerns with text content and personal interests, in favour of explicit attention to generic features, especially if this is the only strategy of literacy training, may well be a source of transfer problems.

3. The Model

It is suggested that a model of literacy should be testable, that it should have practical significance in terms of educational problems, and that it should be able to articulate at least the following four levels of text processing: (1) lexico-grammatical processes; (2) text genres and their functions; (3) encyclopaedic knowledge structures and inferencing activity; (4) intentional activity in processing and information seeking. In addition, it must ultimately be able to account for the impact of new technologies and media of communication upon these underlying processes. The workings of the model presented here are such that each of the four levels mentioned above can be 'overdetermined' by another, although many of the ways in which this happens are not clear at present. The following is an outline of the four levels and some of the ways in which they appear to affect one another.

Level (1): This is the level of 'linguistic competence', i.e. of knowledge of the grammar and lexicon of a particular language. The competence which is defined at this level pertains to the disambiguation of linguistic expressions and assigning context-free meanings. It is essentially a level of inductive operations, insofar as the reader relies on linguistic knowledge to build up, via synthesising operations, a set of (macro)propositions that constitute the content of the text. However, in order for these propositions to be assigned their functions within the discourse, knowledge of text genre and textual functions (or speech acts) is required, as defined in terms of level 2 below. Secondly, in order for these propositions to be interpreted to the extent that a 'possible world' (imaginary world or situation model) can be constructed, encyclopaedic knowledge is required, of the kind defined in terms of level 3 below. Incompetence in text processing at level 1 is typically that of the second or foreign language speaker of the language.

Level (2): This is the level of 'communicative competence', i.e. of knowledge of text genres, functions and speech acts, including institutional conventions and other rules of the communicative setting. It is at this level that the communicative intention (in Austin's sense) is defined. The competence defined at this level is essentially deductive in that 'top-down' processing occurs: a genre schema is activated and the (macro)propositions that make up the text (and which have been constructed "bottom-up') can be assigned their functions according to the conventions of the discourse. The intention of the author or sender of the message can only be recovered on the basis of this kind of generic knowledge, which is therefore an essential condition for achieving global text coherence. However, in order to augment this understanding of sender's intention, for example by positing and attributing motivational factors to the sender's communication, encyclopaedic or background knowledge is required, as defined in terms of level 3 below. Incompetence in text processing at level 2 is typically a cultural matter. It implies lack of familiarity with certain genres of communication, whether scientific reports, novels, polemical articles, etc.

Level (3): This is the level of encyclopaedic knowledge and of inferencing activity. If one divides the contents of semantic memory into dictionary and encyclopaedic knowledge, it seems clear that these correspond to different sorts of competence. Dictionary knowledge is a set of context-free meanings corresponding to lexical items, as defined in terms of level 1 above. It is perhaps adequate for achieving sentence level interpretations. Encyclopaedic knowledge, however, is required in order to construct the imaginary world that is the referent of the text. This is achieved by inferencing or 'abduction', an activity that gives content to the unstated assumptions that are an essential part of any text. The activation of knowledge schemas enables their assembly into the composite structure within episodic memory that has been referred to as the possible world or the situation model. Knowledge of this type is therefore essential for the text to achieve its global coherence and the author presupposes that the reader will possess it. Incompetence at level 3 arises from lack of exposure to the relevant knowledge-producing situations, either in ordinary life situations or in specialised knowledge contexts, such as education.

Level (4): This level refers to the interests, the intentions, the motivations and the active response of the reader or receiver. It has been referred to as the 'active control structure' or the 'central executive' within theories of memory. It determines or directs operations that occur at the other three levels in a 'top-down' manner. For example, if a particular instance of text processing is guided by clear information-seeking goals, then the processing of the linear text sequence may be interrupted or abandoned according to judgements that the required information is not to be found in the text. It also refers to the productive role of the reader in finding meanings that were not intended by the author. For example, a reader may have an interest in seeking flaws in a writer's argument, or, conversely, may support a writer's argument with information that was not available to the writer. This is not a competence that is incidental or non-essential. It is presupposed in information seeking. The reader who, for example, cannot scan a text to determine its fitness for his or her purposes is not fully literate. The competence defined at this level is clearly emergent from, and dependent upon, competence at the other three levels that have been described. A lack in competence at this level is clearly related to incompetence at the other three levels, but it also stems from a lack of clear personal goals in communication.

Regarding the impact of technologies and media of communication on these processes, this manifests itself as problems of media literacy and information literacy. Space does not allow for a full discussion of these complex notions here, but one possibility that will be pursued in the research project is that the impact of these technologies upon literacy is more quantitative than qualitative. In this view, media and information literacy are in a sense parasitic upon competence in the traditional speech and writing modes, and the impact of these technologies upon general literacy concerns mainly the volume of textual sources available (e.g. on the internet, on video, tape, CD, etc.) and the speed of textual transmission (e.g. e-mail). Clearly such a position would be contested by a whole generation of media theorists who are committed to such notions as 'media grammars' (Meyrowitz, 1998), and any arguments that are advanced will need to be well supported. But the converse position would need to show that the introduction of media and information technology leads to such qualitative innovations as modifications of the lexicon and grammar of the language and the emergence of new textual genres (as was the case in the historical transition from orality to literacy). This of course is not to deny that the quantitative changes are far-reaching. Indeed they place vastly increased pressure on literacy trainers and students alike, and they may ultimately bring about profound changes in social relations. But the position provisionally adopted in this research is that one should proceed with caution in extending the meaning of such terms as 'grammar' to qualitatively different phenomena (such as film techniques), when it may turn out to be the case that the most crucial determinants of media and information literacy are not some new 'grammars' at all, but linguistic and communicative competencies in the more familiar sense.

4. Hypotheses

The model that has been described above generates certain hypotheses, which include the following two groupings:

4.1 Meaning and knowledge

- Linguistic meaning is inseparable from encyclopaedic knowledge and inferencing activity.
- Conceptual understanding is similarly derived from knowledge of actual and possible worlds, as configured in semantic memory.
- Therefore certain transferable academic literacy skills cannot be taught in isolation from text content.
- Interest in text content is either an enabling condition or a powerful resource for the kinds of cognitive development that are foundational in the acquisition of academic literacy.

4.2 Genre and communication

- Effective communication requires the development of genre schemas, which are the cognitive representations of conventions, functions and typical structures of communicative events.
- In constructing genre schemas it is the intentional element that predominates.
- Genre schemas can only be constructed in semantic memory through processes of authentic dialogue, i.e. through mutual engagement of the intentions of senders and receivers.
- At the same time, new technologies of communication impact both qualitatively and quantitatively on the development of genres.
- Information and media literacies are dependent for their development upon authentic dialogue (or interaction) in appropriate technological settings. (This implies, inter alia, that they are not merely developed by familiarity with the technology alone.)

5. Empirical Aspects

The process of testing these far-reaching hypotheses would need to include the following empirical procedures:

- The development and design of literacy testing which is predicated upon the theoretical notions described above, together with appropriate statistical analyses. An especially important and difficult facet of this is benchmarking for comparison of educational outcomes with the linguistic and communicative requirements of society and industry.

- Action and ethnographic research, focusing on subjects' responses and experiences of communicative situations in higher education.
- Discourse analysis, in terms of data generated by observation of interaction among educational roleplayers and their interaction with textual materials in use.

6. Conclusion

The research project that has been under discussion in this paper seeks to characterise the cognitive aspects of literacy problems in higher education in South Africa today. It seems likely that the findings of this project will have a wide relevance and applicability. The present paper has avoided discussion of the socio-economic and historical determinants of literacy problems, but a comprehensive discussion of literacy would need to include these, particularly if a general theory of literacy is the overall aim. The research project that has been outlined here is intended to contribute to such a theory, through the development of a model of the underlying cognitive processes involved in text interpretation and generation, the development of which is regarded as being at the heart of the historical phenomenon known as literacy.

The literacy requirements of higher education and society in general are being heightened by technological innovations, which are rapidly increasing the volumes of text and information being transmitted and processed, as well as the speed of transmission. This quantitative change implies a need for faster and more efficient information and text processing abilities. The position adopted in this paper is that the terms media literacy and information literacy may simply mean that society must become more literate than it currently is. If this is so, it implies a crucial need to understand better the mental processes that have long been involved in text processing, firstly since the evolution of speech, and, secondly, since the invention of writing systems.

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