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ABSTRACT

This paper evaluates the effects of using the NUDIST (Non-numerical, Unstructured Data Indexing, Searching and Theorising) computer program to organize coded, qualitative data. The use of the software is discussed within the context of the study for which it was used: an Australian study that aimed to develop a theoretical understanding of the challenge that students who fail to learn pose for neophyte teachers' images of effectiveness. The potential for interacting with the data during the process of creating and collapsing categories into more over-arching theoretical constructs is considered as it relates to NUDIST's procedural and structural influence on eventual analytical outcomes. Topics covered in the paper include: (1) the aims and processes of qualitative analysis; (2) the computer as a tool in qualitative analysis; (3) NUDIST in qualitative analysis; and (4) examples of using NUDIST to theorize in the self-image study. A description of NUDIST and a description of the study for which it was used are appended. (Contains 14 references.) (KRN)

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DENUDED DATA!

Grounded Theory using the NUDIST Computer Analysis Program:

In researching the challenge to teacher self-effficacy posed by students with learning disabilities in Australian education

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TITLE: Denuded Data! Grounded theory using the NUDIST computer analysis program: In researching the challenge to teacher self-efficacy posed by students with learning disabilities in Australian education.

ABSTRACT: This paper evaluates the effects of using the NUDIST (Non-numerical, Unstructured Data Indexing, Searching and Theorising) computer program to organise coded, qualitative data (Richards & Richards, 1991A). Further, the potential for interacting with and interrogating the data during the processes of creating and collapsing categories into more over-arching theoretical constructs is considered, in respect of the program's procedural and structural influence on eventual analytical outcomes. In this Australian study (Burroughs-Lange, 1992), data analysis for which NUDIST was employed aimed to develop a theoretical understanding of the challenge which students, whom teachers teach but who fail to learn, pose to neophyte teachers' newly-formed images of effectiveness.

INTRODUCTION: It is a fundamental tenet of qualitative research that the validity of one's scholarly efforts can be established to a considerable extent by the way one moved from the source evidence to the conclusions, (Atkinson, 1990). The use that is made of organisational systems (manual or technological) and the means of recording the progress of data and its transformations as it journeys through that system is likely to be influential on the structure and substance of its final form. The aims and processes of qualitative analysis must remain paramount in any discussion of the potential and limitations of using a tool such as the computer to reach research goals. NUDIST has characteristics of 'code and retrieve' programs which support the analytic process. In employing NUDIST's tree structure to organise data concerning student teachers' reflections on their self-efficacy and attitude towards exceptional learners, its features which facilitate theorising are also evaluated and exemplified.

The aims and processes of Qualitative Analysis

The data which the qualitative researcher collects and generates are mostly words. According to Erickson (1986):

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> "One basic task of data analysis is to generate assertions, largely through induction. This is done by searching the data corpus - reviewing the full set of field notes, interview notes or audio-tapes, site documents, and audio-visual recordings. Another basic task is to establish an evidentiary warrant for the assertions one wishes to make. This is done by reviewing the data corpus repeatedly to test the validity of the assertions that were generated, seeking disconfirming evidence as well as confirming evidence." (p.146)

If one accepts this perspective on qualitative data analysis, then the various assertions contained in the field data need to be understood and organised into a coherent explanation of the situation being studied. This task can be facilitated if the assertions in the field data are used by the analyst to define specific concepts. The concepts can then be related to each other to render an explanation of the situation.

An initial step in modelling a concept, therefore is "to identify and cull assertions from the data" (Padilla 1991: 265). But the conceptual foundations for describing a situation are not provided explicitly. There is no clearly articulated body of information that the qualitative analyst encounters in the field. The analyst abstracts concepts from the data in order to develop well articulated information about the situation under study.

> "Assessment of concept models involves a critical reconstruction of the model based on careful reflection and study of it and in the light of additional empirical evidence that is brought to bear on the model. Hence, the model becomes an a priori framework guiding the collection and analysis of new qualitative data about the situation in question."
>
> Padilla 1991: 272/3

In our study the end result of the analytic endeavour was to be a grounded theory that explained the major action in the situation under study. According to Corbin (1986) this should consist of "categories that are dense with concepts and saturated to the point that a range of variation can be accounted for, verified by hypothesis testing, and integrated, that is, woven together" (p.101). The informative stages of a qualitative

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study are built on the dialectic between intense detail and the unifying view which enable ways of seeing (Habermas, 1971) to emerge.

The case for using the computer's ability to handle large quantities of textual material has already been convincingly made (Tesch, 1990). The researcher who wishes to use the computer to reduce tedious tasks is faced with the dilemma of keeping in check the urge to assemble neat and tidy coded segments and allow Agar's (1991) dialectic process to explore uncertainties and unresolved ambiguities.

The computer as a tool in qualitative analysis

> "The computer is probably the best general purpose tool that can enhance the use of the human brain as a research instrument in qualitative analysis. In particular, the computer can be used to carry out effectively the various mechanical aspects of qualitative analysis."
>
> Padilla (1991)

Qualitative analysis is not simply extracting sections of text from one context and to recontextualising them into an account of some situation. The danger is that qualitative data analysis may be inappropriately seen as this simple mechanical procedure (Pfaffenberger, 1988).

Yet qualitative analysis has to be inductive, holistic, interpretative, tentative, emic, conditional, contingent, casuistic, and dependent on the human brain as an instrument (Agar, 1986; Glaser & Strauss, 1967; Miles and Huberman, 1984; Lincoln & Guba, 1985; Spradley, 1979). Qualitative researchers fear that employing computers may reinforce the mechanistic aspects at the expense of operating more theoretically in the research environment. The effectiveness of qualitative analysis does indeed depend upon the ability of the human brain to "make sense" of what is going on in the world. But 'making sense' for the analyst using a software tool also includes understanding and controlling its structural influences rather than allowing the program's nature to overide the natural setting.

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Whilst Padilla (1991) talks of the computer as offsetting the human brain's limitations in discerning complicated patterns in data, in keeping track of large amounts of information, in quickly retrieving some small piece of information and in remembering many things at once, Agar (1991) talks of a need to be in the middle of his computer and be able to scan all around its information at once. More than merely scrolling the screen, having a split screen or windows superimposed, he needs a classroom with blackboards on several walls.

> "I start writing things on the boards, erasing and writing again...I'll often stand in the middle of the room and turn slowly around, looking at boards, then go to another board and write something else ... What's important is the larger space that I can visualise all at once ...The large simultaneously accessible visual space is critical for me in shaping the macro frame for an ethnography into focus."
> (Agar 1991:192)

However, Agar (1983) in his early writings, attributed to the use of microcomputers in ethnographic research as making possible "in a rough way" the fulfilment of the "Popperian dream of repeatedly trying to prove myself wrong" (p.185).

Getting to the underlying theory absorbs more of researchers' interest, intellect and creative energies than marking up textual units and moving them around. Particularly in the early stages of framework setting, this can involve a focus on fine detail in a small number of cases rather than looking for commonalities across many and might not therefore tax the brain's capacities too greatly. "For that you need a little bit of data and a lot of right brain" (Agar 1991: 194)

Despite the reluctance of some qualitative researchers to use computers in their work, increasingly the computer is proving to be a valuable tool for qualitative analysis. Concept modelling and grounded theory work is greatly facilitated by using computers to record and carry out further identification of assertions and concepts. Without the use of a computer, this task is mechanically tedious and time consuming and delays the critical theorising proce ses which need to begin early and continue throughout the life of the research. In looking for software to support our research endeavours we

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are aiming to establish "synergistic relationship between the abilities of the human brain and the capabilities of the computer so that the particular strengths of each processor can be used advantageously in a reinforcing manner." Fielding and Lee (1991).

Employing the NUDIST program in this study ensured that the mechanics of the field research did not draw attention away from the analytic processes; that new data were easily integrated and re-coding accommodated with great flexibility. The program allowed the data to be 'played with' in a truly interactive mode which greatly enhanced the generating and testing of theorising possibilities.

NUDIST in Qualitative Analysis

All qualitative analysis software allows for sections of text to be labelled and retrieved according to that label. To be effective these codes need to be applied systematically. As the individual and groups of codes become larger and richer, the researchers have to keep track of these outcomes. This is even more difficult when the coding system changes, collapses and expands during the process of the analysis and continuing data collection cycles. Data already processed needs to be relabelled in line with the movement through concepts towards theory. "So grounded theory produces, as theory emerges, an imploding collection of codes, and an expanding system of cumulative memos about the data. Whereas the code-and-retrieve approach produces a coding framework that grows as new categories are invented" (Richards & Richards, 1991b:47). NUDIST by using these processes enables the researcher to remain truer to the aims of qualitative enquiry that is often possible using manual or other computer coding systems.

Recontextualising data into a new category is always a danger in that it loses its links with the original data, its holistic meaning. Computers tend to distance the researcher from "messy" data of the original transcripts. NUDIST provides, for every retrieval, a paragraph of header information (like a facesheet) about the document itself and sub-headers to identify speakers or give context information as well as other indexing

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already allocated to that retrieved section. Back in the index system memos about the node can be browsed or any number of text sections which came before or after the coded section in the original document may be retrieved. NUDIST stores information in tree-structured indexes, which become the repository for references to documents and the researchers thinking about them. (See Appendix 1 for a description of the NUDIST program features).

NUDIST may be accused of mixing its metaphors in the use of a tree structure as well as using "siblings" and "children" in its functional instructions. But the "family tree" analogy works well where a relationship exists between its members. Whether that relationship is strong or weak, neglected or actively supported, imbalanced or reciprocated can only be determined by reference to its members.

In NUDIST each branching point is called a "node" and the whole configuration is termed the "index system". Memos can be recorded in the comment field at a node and may be added to or deleted at any time. When a node is moved, or combined, the memo also goes with it. (Dated and labelled with the node whence it originated). Memos can be treated like text, as data documents and indexed (labelled) at a node (code, category).

The index tree is a representation of the researchers' analytical scheme. Like memos it grows in depth and integration as the theory grows and allows an overview of the theory to be produced at any point. The index scheme can be rearranged, added to, and subtracted from, allowing the data to be manipulated in a way that is impossible when relying solely on memoing (Corbin, 1986; p.117) or a room full of chalkboards (Agar, 1991:192)

The tree data organisational system works like a taxonomy, where the children of the node represent more closely differentiated aspects of the parent concept. It represents a semantic net where lower branches are a kind of, a part of a member of a group, a case of the level above, hierarchically expressed. One problem of this is identified by

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Richards and Richards (1991b) themselves in that some concepts can be specialisation of several parent concepts and would require a place on each of these trees.

The links in the tree structure are not named as in some concept mapping models or similar relational explanations. Nodes (branching points) on the trees can hold indexing references to data (on or off line) and NUDIST works at this textual level as a sophisticated 'code and retrieve' system. Nodes can represent concepts so making the trees into theoretical representation which, when understood taxonomically, means that higher nodes automatically represent meaningful groupings of the textual data at lower level nodes. This provides the means for retrieving textual references to generic concepts. Tools in NUDIST for searching and reorganising, for browsing and changing the index system make for very sensitive and flexible support for theorising processes (whilst also memo recording these activities in an audit trail). For example, running a command file enables a (potentially limitless) series of "if"-"then" connections to be searched for and tested. Because the program enables rapid and safe interrogation and revision of all the conceptual structures expressed in the index files and the actual text located there, as well as recording of comments at any node, theorising becomes a key focus for the researcher from very early in the study's time scale.

The pressure in qualitative work (as in quantitative) for parsimony of categories in simple structures is removed. Tree-structuring no longer has to be done in a very "bonsai fashion". NUDIST encourages indexing "as rich as the data deserves" (Richards & Richards 1991b:51). Theoretically "innocent" index categories can be assigned and then used to locate instances of an emerging pattern, rather than labels which initially assert that an emerging idea is occurring in the data here. Discovery of unexpected patterns is not thereby pre-empted, and genuine testing of relationships is possible.

When a question is answered by the computer search in an interesting way, asking further questions takes only seconds, hence more questions <u>are</u> asked when NUDIST is

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in use. These 'flights of fancy' can be grounded in the data, since at any stage, text can be attached to the conceptual structure or relationship being explored. Exploration and theory development are achieved through the interplay of the original text with the conceptual structure used for and created by its exploration. (Richards & Richards, 1991: 45).

Theorising with NUDIST in our study

We hoped to 'discover' theories from our data that were formerly unrecognised or that challenged or supported existing understanding of the phenomena. Of course, all stages in analysis are somewhat theoretical. Identifying 'in vivo' categories is theorising about what is significant. Whenever the same label is given to another piece of text then a theory about the ways in which they are similar is emerging and confirming, expanding or re-framing the definition of that category. Bringing together text from different sources under a category label enables new theories about their meaning to be suggested. Testing out of tentative explanations is necessary before these insights can take on the status of a theory. This testing out involves searching the data again looking for support or challenge to this new idea or possible explanation. (Strauss, 1985). Negative case analysis and constant comparison often also involves re-fracturing the data.

For example, in our study categorising data under the pathway "self evaluation/practicum context/exceptional students" brought together many students' accounts of the ways they evaluated themselves when responding to the presence of and demands of exceptional children in their practicum classrooms. We wanted to 're-fracture' this category to look at students who had exhibited a low or high self-image in terms of their effectiveness. In other words, if they already felt inadequate as a teacher did working with difficult or slow children make them feel even more so? Equally if they began by feeling capable as a teacher did their experience with these exceptional students allow them to preserve or even enhance feelings of effectiveness in the teacher role? Were there accounts of experience with exceptional students that reversed the direction of the self-evaluations? Studying results of these new

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configurations suggests possible relationships with other categories (both conceptual and factual) as the 'nascent' theories grow in data-based strength and conceptual skeletal structure. Theory construction and theory testing began very early in the research process and was continuous. The NUDIST program allowed the process of coding to be integrated with the processes of discovery and exploration whilst still managing the emerging categories and constantly updating prior categories to reflect the current state of theorising and meaning making. The program enabled theory testing to be part of theory construction, not a final stage of verification.

The software uses coding therefore not merely for textual retrieval, but also to hold the growing analysis and explanation system. The analytic exploratory material becomes more data for the next level of foraging, understanding and theorising, i.e. system closure.

As Padilla (1991) claimed "an important step in concept modelling is to identify and cull relevant assertions from the data" (p265). These assertions can be straightforward or complex.

> "Some of them went to remedial each week...(description of type of organisational support strategy for LD children). I thought that was good but in a sense that made them separate from the other kids because everyone knew where they were going and it tended to make their learning problems more evident to everyone else." (R* 418-420)

R* reveals an understanding of the complex effects of this organisational pattern of support.

So a conceptual model of 'support' now has elements of 'location', 'effects of labelling', 'effects of support strategy on slow learner', 'on other children' in class and 'on the teacher'. Using constant comparisons and negative case analysis strategies (Strauss & Corbin, 1990), these assertions about the extraction pattern of support were further grounded in the textual data of the speaker R and others in the research context.

* Letters indicate student teacher identifier. Numbers indicate lines (text units) in transcript or field notes.

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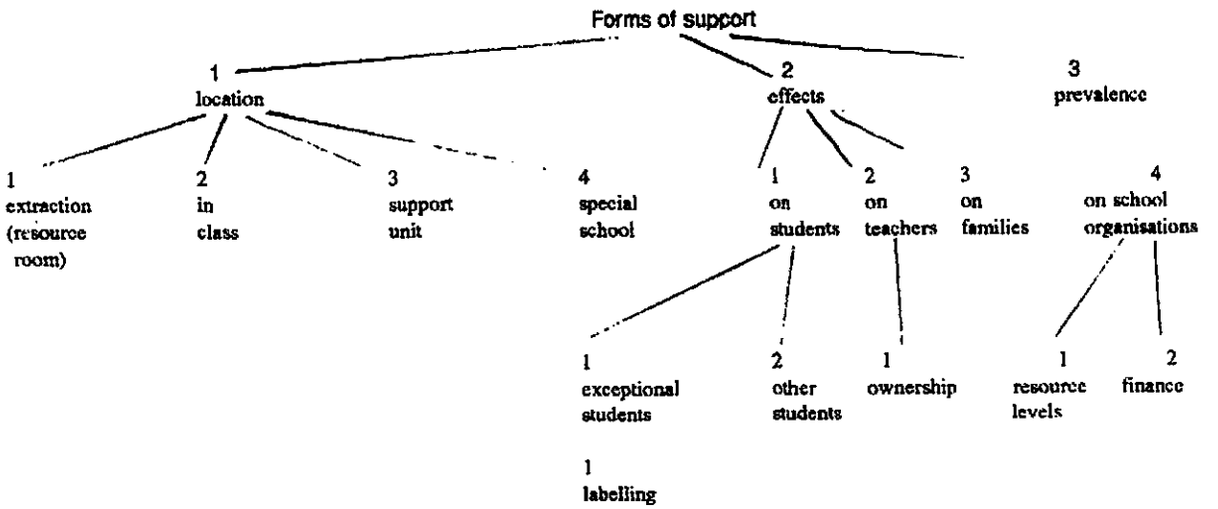
Table 1



The support model 'extraction' then had codes and text which were relevant to its understanding at the locations (node addresses). 6.1.1, 6.2.1.1, 6.2.2.1, 6.3 etc. In fact it was possible to search other categories that might be linked to the 'extraction' model of support, e.g. motivation, self-esteem trees. So it was possible to move from open coding, fracturing the data for axial coding and regrouping the data around some new unifying theme (Glaser & Strauss 1967). NUDIST makes this a simple procedure by doing a search of text which was coded 'extraction' AND any of the 'effects', 'prevalence' etc. sub-trees of nodes.

The results of this search formed a new top level category with the history of the former locations of all the elements that were searched and brought together maintained by NUDIST as a dated audit trail of concept development. Hence steps were often retraced or reversed if necessary. It was in line with the research aims to try and establish whether viewing 'extraction' positively, ambivalently or negatively, from the teacher's, exceptional child's or other children's perspective or even awareness of this complexity related to locus of control (LOC) or to self efficacy (SE) values. Coding each respondent's answers to the question on the LOC and teacher SE measures allowed further searches to be conducted within NUDIST. Relationships were explored between students' feelings about their teacher self-efficacy (e.g. high

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score), their sense of control in this situation (e.g. internal LOC) and their perceptions of 'extraction' models of learning support. We hypothesised that students who were confident in their own effectiveness, who also felt able to control and influence the teaching situation would view negatively the loss of 'ownership' of the problem in extraction negatively. This proved to be the case. However, students with mid to high scores in self-efficacy, had confidence in their own teaching abilities but those with external LOC were also aware of the adverse effects of labelling that 'extraction' patterns emphasised. Yet they still supported the practice for its benefits to the teacher who 'got a break' and couldn't be expected to cope alone.

Seeking ways to understand apparent anomalies leads to a deeper understanding of the phenomena. NUDIST allows limitless hypotheses to be very quickly tested and equally quickly discarded if unfruitful without endangering or rearranging insightful analysis already in place. For example, trying out possible relationships between teacher focussed aspect of the teaching situation and characteristics of the extraction model of support used the matrix facility of NUDIST. We came to understand (and were able to ground this understanding in the data from the NUDIST searches) that for a student teacher with low self-esteem, external indicators of effectiveness (in SHR's case it was noise levels), take on more prominence especially as her internal locus of control urged her to do something about it. Yet she ethically felt prevented from stopping the sound of the braillers and of the support staff talking to the students. 'Extraction' then emerges as one answer to her dilemma and periodically reduces her stress levels.

Performing the same matrix search for a student with an external LOC but midway in the measure of teacher self-efficacy, showed that when in a situation where no external help was available and encouraged by the other children's acceptance, she was able to cope with a difficult student given to outbursts of uncontrollable range. "And they were saying 'Miss, Miss, Sam's having one of his things' and I said 'OK, OK everyone, just continue on and I'll just take Sam over here and that's OK'. I can't remember what I said I was just trying to calm him down because he was just

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heaving". (R 325-327) Having nowhere to send the difficult student meant that teacher self-efficacy effects came to the fore. So that particularly in students where SE and LOC results seem to be somewhat paradoxical, which personal characteristic the student relies on in a particular situation is partly determined by that context. Hence the extraction context may be influencing teachers to rely on their 'weaker' characteristics rather than provide situations to build on their stronger resourcefulness.

Further analysis showed that some student teachers saw integration of exceptional learners as a dichotomy of either the regular or the exceptional children being disadvantaged e.g. (J 288-291, SR 532-534, SL 412-416). We wanted to know how the student teachers would evaluate an 'extraction' model of support and did it relate to their SE and/or LOC reported characteristics? Searches (taking only minutes) allowed all these multiple codes to be 'tested' for possible relationships and relevant text retrieved on each and any examples found. (For substantive write up of the study see Burroughs-Lange & Lange, 1993).

In another example of "theoretical play" we began by focussing on data where many student teachers had mentioned their need for "parental help". We wondered was there a relationship between identified need for parental help and the students reported LOC and teacher SE levels? The parental help category cut across the range from internal to external LOC but only cross-referenced with mid to lower teacher SE levels. Did the way students saw the parents' role differ whether they tended towards an internal or external LOC? The answer was "yes" and NUDIST retrieved text to illustrate these differences. Differences in student teachers' confidence (teacher SE) did not follow the expected pattern, but student teachers' past experiences with exceptional students in practicum and other settings was linked to their views of the parents' role - a connection we had not pursued until the results from the earlier questions had suggested it.

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Conclusion

There is a reported fear that computer approaches could drive qualitative researchers towards behaving more like quantitative researchers, and NUDIST might seem to encourage this. For example NUDIST automatically displays percentages when retrieving text. These refer to what percentage of text units for that document and all documents were coded at that node. This can be deceptive for if ysoftware our text unit is a line, it relies heavily on accuracy at the clerical level, i.e. the typist not putting in any extra spaces and beginning a meaning unit/sentence on a new line each time (very difficult in transcripts as people do not talk in sentences, unfortunately!) Hence these statistics need to be viewed only as a very rough guide to the amount of attention the respondents gave to a topic.

Hostility to computer approaches divides qualitative researchers into sceptics and enthusiasts. To see QA computer software as offering relief from tedious and less than efficient clerical tasks is to undervalue the relationship. NUDIST opens up the potential for the intuitions and clashes of human insight of the right brain (Agar, 1991) to be evaluated for 'trustworthiness' by being able systematically to retrieve the data which supports powerful understandings of the phenomena. In our experience of this study, and of two other current projects (Burroughs-Lange & Lange, 1992; Lange & Burroughs-Lange, 1992) the use of the NUDIST software supported the claims that:

- the mechanics of field research are less likely to get in the way of analytic processes;
- the researchers' mental and creative energies were more directed towards analytic concerns;
- new data were easily integrated with already coded material;
- theoretical 'play' was often productive, always easily accomplished and was without risk to important outcomes if it proved to be a "blind alley";
- an audit trail of the analytic progress was always available through NUDIST at any stage of the research process;

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- answers to pre-existing questions and emerging theories were always grounded in the data with NUDIST providing rapid retrieval of textual evidence;
- NUDIST supported the generation and testing of grounded theory about the phenomena.

Our difficulty in moving into the NUDIST environment related to issues of linearity in the tree structure and a felt need for graphical representations of concepts emerging from the data. Renata Tesch (1990) recognised the need for being able to use the computer to graphically depict relationships among categories that go beyond hierarchical trees, 'perhaps even three-dimensional models and maps' (p301). Padilla (1991) suggests that

> "The complementary use of various pieces of software (e.g. NUDIST, word processor, a drawing program) produces a completely integrated computing environment for qualitative data analysis and presentation of findings". (272)

Nudist support for the data gathering, analysing, and reporting of results can all be carried out in a non linear way which is consistent with the way that qualitative research is conducted. NUDIST provides the researcher with the means to 'relive' the inductive process that gave rise to the conceptual model. Reliving of the research process can result in new insights about the phenomena or the methods that were used to study it. NUDIST's housekeeping records also enhance the trustworthiness and transferability of the research results. (Padilla 1991).

We can even see how NUDIST could address Michael Agar's problem with the 'room full of chalkboards' for his theorising (simultaneous visual access in the form of printouts maybe). There must be a point where Agar has to take the outcome of his search for understanding away with him and record it somewhere. When the boards are wiped clean, who then can act as an auditor? When he presents his theories, how much effort is involved in locating textual data to enable the reader to make

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judgements about his claims of explaining the phenomena?

NUDIST, when compared with other QA software, does seem to be a somewhat hybrid system. But it seems to bring together the desirable features of many of these programs along with some features unique to NUDIST.

Our early fears about being 'forced' into "tree-thinking" for our conceptual models and their inter-relatedness proved unfounded. Becoming comfortable with the program (our self-efficacy improved!) enabled us to use the index system creatively as coat-hangers for patterns and directions of relationships which were generated from the data and never lost their sensitivity to that study context. More importantly, NUDIST enabled us to test out emerging theories and to be able to express them with more data-based confidence than ever before. We are moving into a second-phase of our study with groups of experienced and effective teachers, still focussing on the effects of interactions with difficult, disabled or slow learners. NUDIST has given elegant and accessible descriptions and theoretical level structures for the student teachers' study which can be readily integrated with the second phase or evaluated discretely as appropriate.

NUDIST has the potential for changing the researcher's tasks and focus in ways that bring them practically and epistemologically closer to the professed aims of qualitative enquiry.

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The NUDIST Program

(Non-numerical Unstructured Data Indexing Searching and Theorising)

NUDIST has a unique design, building separate document and indexing (coding) data bases. This means that NUDIST will index and explore the indexing of any unstructured text, so it can accept offline field notes, books, manuscripts, tapes, music, scores, highly formatted print outs from spreadsheets or databases, graphs, etc. If your documents are not typed on, you simply nominate units to divide the document into, and index them. They can be pages, paragraphs, rows of a table, sections of photographs etc. Retrievals give the same information about indexing data - but not, of course, the option to display the content of offline documents.

Using text data, the program allows the researcher to label numbered "text units" with codes (called "indexing" in NUDIST). There are no restrictions on the number of times a rich passage of text can be indexed, and no restrictions on the number of indexing categories you can use. The indexing data base can be of any level of complexity - from the flat lists of codes necessary for most code-and-retrieve programs, to tree-structured indexes that are highly organised. Thus indexing concepts can be organised and managed as theoretical systems. Tree-structured indexing allows you to give any indexing category any number of sub-categories, give them sub-categories, and so on.

To recognise the importance of tree-structuring, the categories in the indexing system are called nodes. The indexing system is itself available for inspection and exploration - not just the indexed documents. The researcher can see what documents each node indexes, what other index categories cross-refer with this one, and read her/his own comments about the node. Then s/he can shift (hypermedia-like) across to the documents that this node indexes, and look at the text referenced there in context.

New indexing nodes are structured out of old using any combination of a set of 14 operators, which fall into five groups:

(1) Boolean operators (e.g., the intersect of text units in one node with text units in another).

(2) Non-Boolean operators (e.g., text coded with just one of a set of nodes).

(3) Relational operators (e.g., text coded with one node that occurs inside coding with another, or near it, within some number of text units, or following it).

(4) Operators that exclude or restrict to documents indexed by a node - allowing searchers to draw on information about the file or other parts of it.

(5) Operators exploiting tree structured indexing - the collect operation allowing gathering of data indexed at any set of subcategories; and the facility to build matrices that "cross-tabulate" subcategories.

Retrievals are returned to the indexing system as new index categories. Having built the new node to hold the results of a retrieval, the researcher can explore the relationships with any other indexing node.

NUDIST combines exploration of indexing information with searches for words or patterns occurring in the text. When a text search is completed its results can be recorded as a node in the indexing system, as well.

By containing and organising the user's emerging concepts and theories, not just the original "empirical" codings of the documentary data, and by allowing new categories to emerge as the results of the researcher's exploration of the data, the indexing system has become concept-based, and expresses the user's taxonomy of concepts.

NUDIST will run on a Macintosh Plus or better, it needs at least two megabytes of free main memory. NUDIST for 386, 386SX and 486 DOS machines running under Microsoft Windows 3.0 is now available.

Multi-platform Release 2.3 for macintoshes, PC's, Unix and VAX/VMS systems has uniform scroll-mode user interface across all computer systems. Stand-alone, network and site licences available from:
NUDIST Project, La Trobe University, Bundoora, VIC 3083, Victoria, AUSTRALIA.

The authors have no connection with the marketing of this program.

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Appendix Two

The research study:

A population of 350 University undergraduate students in the final year of their Elementary Teacher Education program were given a questionnaire made up of 2 attitude scales relating to locus of control (LOC) and teacher self-efficacy (SE). According to the results from the scales the students were grouped in a 3x3 matrix of Internal-Mixed-External locus of control on one axis and High-Medium-Low level of teacher self-efficacy. A sample of students from each cell were interviewed with the interviewers being unaware of the student teacher's questionnaire results. The open-ended interviews focused on the student teachers' feelings about their effectiveness in general and in recounting particular experiences of teaching difficult, slow learning or disabled students. The interviewers probed their attributions for student failure and their reflections on school organisational and curricular strategies. Initial analysis of the transcripts and field notes was undertaken without reference to questionnaire scores. The NUDIST program was used to record coded text segments (1 line) and the attitude scale information was entered towards the later theorising stage of the analytic research process. The facilities of the NUDIST program were used to interrogate the data and test hypotheses, beginning from the time that the 3rd interview had been entered. The index system was changed and developed in response to new data and the result of questioning/theorising activity. Emerging ideas were included in the focus of later interviews. The full report of the study outcomes are in the final stages of preparation. (May 1993).

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