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ABSTRACT

Classroom dialogue is an important influence on students' learning, making the structure and content of dialogue important research variables. An analysis of two sample classroom dialogues using the Thematic and Structural Analysis (TSA) Technique shows a positive correlation between the quality of dialogue structure and the level of student achievement. The TSA Technique overcomes the inadequacies of earlier methods of analyzing classroom language by (1) studying dialogue rather than teacher monologue: (2) eliminating the need for specifically prepared transcripts; and (3) accounting for the context of words, an element left out of other computerized analyses. The steps in using TSA Technique are: (1) divide the dialogue into cycles; (2) select substantive words; (4) produce a correlation matrix; (5) factor analyze the matrix; (6) cross-correlate the factor scores with a lag of 1; and (7) draw diagrams of both the distribution and relationship of themes across cycles and among the themes themselves. (Six tables of data and 4 figures are included; 101 references are attached.) (MHC)

A PROCEDURE FOR ANALYSING CLASSROOM DIALOGUE

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Abstract

The importance of dialogue in classrooms and the neglect of dialogue structure as a significant research variable are highlighted. Techniques for analysing classroom dialogue are reviewed. These are limited in that they are relatively unsophisticated frequency counts, focus on a limited range of types of interactions, analyse teacher dialogue only and/or disregard the context of the utterances. A tec..nique that overcomes these inadequacies, the Thematic and Structural Analysis (TSA) Technique, is described. The technique has been used previously in the analysis of text material to investigate the emergence and recession of themes by the analysis of the distribution of substantive words across paragraphs. In the case of dialogue, paragraphs are replaced by Bellack cycles and implicit language is made explicit. The application of the Technique to a sample of classroom dialogue is discussed along with possible future uses of the technique.

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A PROCEDURE FOR ANALYSING CLASSROOM DIALOGUE

John A. Clarke

Introduction

Few classroom activities can be carried out without the use of language. Observation of what goes on in schools reveals that classroom activities are carried out in large part by means of verbal interaction between students and teachers (e.g. Brophy and Evertson, 1974; Flanders, 1970; Meihls and Streeck, 1978; Root and Scott, 1975; Ward and Tikunoff, 1975). Typically, teaching involves the use of dialogue where the teacher controls the direction and duration of subject-matter discussion while maintaining a necessary degree of attention and order (Westbury; 1973). Moreover, it seems reasonable to hypothesize that the patterns of language that the teacher uses influence the development of thought patterns in the pupils (Belme and Gray; 1979). Indeed, students in teacher-less discussion groups, compared to either formal classes or teacher-led groups, are less able to sustain discussion in a logical, critical and open way or to collate and organize material from individual contributions effectively (Michell and Peel; 1977).

The verbal activities involved in teaching and learning are reciprocal affairs involving both teachers and students. For example, Dillon's (1982, 1983) studies reveal that, in teacher-student dialogue analysed on the basis of Bellack's six categories of utterances (Bellack, Kliebard, Hyman and Smith; 1966) student utterances follow precisely the same temporal pattern as teacher utterances though systematically briefer i.e. short or long teacher questions or statements lead to correspondingly short or long student responses or statements. In a similar vein, the Klinzing, Klinzing-Eurich and Tisher (1985) study demonstrates that training teachers to significantly increase the proportion of higher cognitive process questions leads to a corresponding increase in the level of pupil responses. This modelling effect is also demonstrated by Swift (1982), Gooding and Swift (1982) and Corindia (1982). A study by Bennett (1973) indicates consistent significant differences in the interaction patterns of classrooms using the "advance organizer" and "enquiry" strategies, while Russell's (1983) interesting analysis shows the potential that teacher directed questioning has for distorting students' understanding of the nature of science.

Classroom dialogue obviously influences the learning outcomes of students. The focus in this paper is on its content and structure and the measurement of those characteristics.

Content and Structure in Classroom Dialogue

"The structure of classroom verbal communication is a fundamental variable in the understanding of the teaching process" (Anderson;

1974: 219). This notion has support irrespective of whether the approach to teaching is inductive (e.g. Bruner; 1966), deductive (e.g. Ausubel; 1978) or eclectic (Babikian, 1971; Browne and Anderson, 1974; Cazden, 1986; Clark, Gage, Marx, Peterson, Stayrook and Winnie, 1979; Francis, 1975; Russell, 1983; Wilhite, 1983). All of these studies have shown the structure of dialogue to be an important variable influencing student achievement and attitudes towards the teacher and/or subject-matter. The Browne and Anderson (1974) study is particularly interesting as far as the subtle influence of structure is concerned. Students were exposed to theoretically different levels of structuring and their achievement was found to be directly related to the degree of structure. However, they were not able to detect any difference in the degree of structure.

Research on vagueness provides indirect support for the importance of structuring in classroom dialogue. Numerous studies, mainly by Smith and his coworkers, have reported negative relationship between the use of vagueness terms and student achievement and satisfaction (Hiller, Fisher and Kaess, 1969; Land, 1981; Land and Smith, 1979; Murray, 1983; Smith, 1977; Smith and Bramblett, 1981; Smith and Edmonds, 1978; Smith and Land, 1980). Similar to the Browne and Anderson (1974) study, the Smith and Bramblett (1981) study also detected that students were not aware of the subtle differences in vagueness exhibited by the teachers, but their achievement scores reflected significantly the influence of that variable. Smith has also carried out other research marginally related to vagueness in the sense that it examines potentially confusing "noise" in classroom dialogue. Building on earlier work by Kounin and others (Kounin, 1970; Kounin and Doyle, 1975; Kounin and Gump, 1974), Smith, Smith and Staples (1982) found that "transitions" - announcements irrelevant to the lesson or verbal statements left uncompleted - significantly affect achievement.

Measurement of Content and Structure of Dialogue

Despite the significance of these studies, analyses of classroom language have devoted little attention to the structure of knowledge communicated, or to the effect of different kinds of content structure on the acquisition of knowledge (Galton; 1978, 1979; Simon and Boyer, 1975). Even in their thorough analysis of classroom language, Bellack et al (1966) restrict their categorizing of structure to "pedagogical moves" which have the function of "...setting the context for subsequent behaviour by either launching or halting-excluding interaction between students and teachers" (p. 4). The focus is more on the frequency and periodic occurrence of pedagogical moves than on content. Peel and his students (Michell, 1976; Michell and Peel, 1977; Peel, 1966, 1973, 1975a, 1975b, 1976; Young, 1981) have developed and explored a methodology for analysing the intellectual content of teacher and student discourse by identifying "describer" and "explainer" categories. The developers of the system, although believing it to have "...considerable potential", feel that they are "...only (at) a beginning and there is scope for further research" (Michell and Peel; 1977: 264).

Johnson (1975) reviews six "classical" procedures for measuring the content and/or structure of verbal materials (associational frequency, word frequency, word asscciations, associative communality, cloze procedure and semantic differential) all of which he found inadequate. He concludes that "...the development of alternative methods of measuring meaning and meaningfulness ...warrants research priority" (p. 439). Some newer attempts have been made to analyse classroom dialogue with both content and structural aspects in mind. These are considered next.

Anderson's "kinetic structure theory" (Anderson, 1966a, 1966b, 1969a, 1969b, 1970, 1971, 1972, 1974) is perhaps the most widely used approach to analysing both the content and structure of dialogue. The theory is presented extensively elsewhere (Anderson; 1969a, 1971) but, in brief, is based on the principle of proactive facilitation. The assumption is that connected thought is facilitated "...by the presence of linking words, representing linking ideas, between consecutive verbal statements" (Anderson; 1974: 220). When there are linking words between two consecutive verbal statements in extended discourse "...acquisition of one statement of a pair will facilitate acquisition of the second statement" (ibid).

Kinetic structure theory has been used to show that teachers from different disciplines produce different amounts of structure in lessons e.g. Anderson (1972) (chemistry, biology), Sharp (1972) (physics) and Muehlke (1973) (biology). A number of studies using prepared transcripts have also established a direct relation between the amount of kinetic structure and student learning (Anderson, 1966a; Anderson and Lee, 1975; Browne and Anderson,1974; Ferraro, Lee and Anderson, 1977; Lamb, Davis, Leflore, Hall, Griffin and Holmes, 1979; Lu, 1978; Mathis and Shrum, 1977; Simmons, 1977, 1980; Smith and Sanders, 1981; Trindade, 1972) and satisfaction with classroom experiences (Anderson, 1972; Butterworth, 1974; Smith and Sanders, 1981).

The major problem with kinetic structure theory is its focus on and preoccupation with teacher talk. Teacher monologue was used initially because

> ...when one is first building a theory-based analytical system, it is wise to test it on the simplest examplar of the phenomena to be observed and then proceed to more complex examplars when the system has been adequately tested and refined (Anderson; 1974: 228).

Although the aspirations of those who developed and evaluated the system is to extend it to dialogue (Anderson; 1974; Neujahr, 1974), such development has not occurred with research still focusing on the teacher monologue or lecture. All contemporary theories of communication (e.g. Barnlund, 1970; Wenburg and Wilmot, 1973) emphasize the reciprocal nature of language. In implementing this reciprocity principle, Bellack et al (1966) insist that "...studying the (verbal) activities of teachers in the classroom without at the same time analysing the (verbal)

actions of students would give a distorted and incomplete view of the teaching process" (p. 2).

A further problem relates to the practical application of the technique. All of the research cited above involves specifically prepared transcripts. These take "...an inordinate amount of time... (such that) we feel that the small, albiet statistically significant, increases in student achievement aren't worth the effort" (Lamb et al; 1979: 226-227). Attempts to get practising teachers to increase the structure of their lessons using this technique have been unsuccessful. Such research has led to the conclusions that "...discovering effective methods for training teachers to ...(use the kinetic structure in) their lectures is an important area for further research" (Lamb et al; 1979: 227) and "...unless a more time-efficient method ...is found, application of Anderson's theory... should be limited to preparation of written and audiotaped material" (Lamb and Davis; 1979: 209).

Another approach to analysing both the content and structure of dialogue is by means of some form of computerized analysis. Such an approach is not new. Reviews by Stone, Dunphy, Smith and Ogilvie (1966), Newman and DiSalvo (1980) and the ten contributors to the Annenberg School Conference in 1967 (see Gerbner, Holsti, Krippendorff, Paisley and Stone; 1969) indicate that this approach developed quite extensively in the sixties. One of the major programs that emerged from that period is The General Enquirer (Goldhamer, 1969; Stone et al, 1966). Drass (1980) contends that data analysis consists of an interpretive phase and a mechanical phase. The General Enquirer actually performs interpretive work by applying a predetermined conceptual framework ("vocabulary") to raw data and assigning it to theoretical categories on the basis of this conceptual framework. This approach does not allow the researcher to take into account the effect that context has on the meaning of words.

One computerized approach that overcomes the inadequacies of Anderson's attempts and takes into account the context of words in dialogue is the Thematic and Structural Analysis (TSA) Technique (Carss; 1973). It not only analyses the dialogue at a level of sophistication similar to kinetic structure theory but also incorporates the student contribution to the dialogue. Further, since the co-occurrence of words is a fundamental aspect of the analysis, the context of the words is accounted for.

The Thematic and Structural Analysis (TSA) Technique

The TSA Technique (Carss; 1973) was originally developed as a methodology to provide a sophisticated analysis of text material. The original procedure is detailed elsewhere (Carss, 1973; Clarke, 1974a). However the procedure used here includes some as yet unpublished refinements of the original procedure and is detailed below. With text, the technique analyses the relationship and distribution of themes, or word clusters, across paragraphs. With dialogue, it analyses the relationship and distribution of themes across Bellack cycles (Bellack et al; 1966).

Step 1. Divide the dialogue into cycles. There is usually no problem with this part of the procedure. In dialogue, Bellack cycles are formed by definition.

Step 2. Select words that have substantive meaning. Words that are only present to ensure the smooth flow of the dialogue such as conjunctions, definite and indefinite articles, are ignored as are punctuation marks. Words that only differ in their tense, voice or number are regarded as the same and written as the "root" words e.g. "measure", "measured", "am measuring", "will be measuring" etc. are all considered as "measure(v)". Words that have the same spelling but are different parts of speech are identified separately e.g. "measure(n)" and "measure(v)".[1] Words that "stand for" other words are changed to that word. For example in "Place a mouse into a beaker. Look carefully at it", "it" becomes "mouse".

Step 3. Find the frequency distribution of the substantive words within the total dialogue and within each cycle. This can be done manually but such an approach is very tedious and prone to error. Here, a program COUNT (Mavor; 1985) was used. Once the frequency count is available, a decision is usually made to ignore for further analysis all words that fall below a particular frequency of occurrence. Often, the "cut-off" frequency suggests itself due to a natural break in the distribution. At other times, the limit imposed by the space requirements of further computer analysis determines just how many words can be considered.

Step 4. Produce a correlation matrix suitable for further analysis. A correlation matrix of the word frequencies in each cycle is produced. Any standard correlation procedure is appropriate. In this study, the CORR program in SYSTAT (Wilkinson; 1986: Chap 12) was used. The procedure identifies the degree of co-occurrence of words throughout the dialogue. Some words tend to correlate at a reasonable if somewhat low level with many other words across most cycles. Experience has shown that these words tend to reduce the possibility of producing more clearly defined themes in subsequent analysis i.e. they produce "noise" or "interference". To overcome this problem in this study, a new element has been introduced into the TSA Technique. By raising the values in the correlation matrix to the fifth power and summing the rows[2] (i.e. Σr_{ij}^5), those rows (i.e. words) that have consistently low correlations can be identified because they will have small Σr_{ij}^5 values. By appropriate deletions of these rows and corresponding columns from the original correlation matrix, a modified matrix containing a reduced number of significantly correlated words can be produced. The "cleaner" matrix can then be further analysed. Alternatively, the words thus identified can be ignored in Step 5.

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[1] "n" for "noun", "v" for "verb"

[2] A simple FORTRAN program, "POWER", has been written to do this.

Step 5. Factor analyse the modified matrix or selected words. Any standard factor analysis procedure is applicable. In this study, the FACTOR program in SYSTAT (Wilkinson; 1986: Chap 14) with a principal components analysis followed by a varimax rotation is utilized. The "factors" produced are clusters of co-occurring words that represent themes while the factor scores indicate the amount of each theme present in each cycle. The decision that a theme is substantially present in a cycle is somewhat arbitrary. At this stage of the development of the TSA Technique, there are no definite guidelines as to what is an appropriate threshold value for the factor scores (Carss; 1973: 111). However, experience has shown that somewhere in the range |Ø.6| to |1.Ø| is appropriate (Carss, 1973; Clarke, 1974a; Cox, 1975). Here, the value used is |Ø.6|.

Step 6. Cross-correlate the factor scores with a lag of 1. This identifies the themes that are significantly cross correlated. Such a significance indicates that themes tend to follow each other in the dialogue. According to Rogosa (198Ø) "...Cross-lagged correlation is the most popular procedure in many areas of psychological and educational research for identifying causal effect" (p. 245). Further, it is widely recommended for such an activity. See, for example Calsyn (1976), Calsyn and Kenny (1977), Clarke-Stewart (1973), Crano (1974; 1977), Humphreys and Stubbs (1977) and Kenny (1975). Here, the CORR program in SYSTAT (Wilkinson; 1986: Chap 12) with one set of factor scores in each pair modified to produce a lag of 1 was used.

Step 7. Draw diagrams of both the distribution and relationship of the themes across cycles and amongst the themes themselves. The first representation shows how themes emerge, recede and relate to each other throughout the dialogue. The second summarizes the dialogue, indicating the "essence" or basic ideas discussed.

Preparation of the Dialogue for Analysis

In preparing the dialogue for analysis, it is necessary to replace words like "it" with the word it represented e.g. "oxygen". In making such changes, an attempt is being made to take into account an important feature of the content and structure of dialogue viz. its implicit component. This process of "reconstruction" has been considered and developed by Loflin, Guyette, Barron and Marlin (1972) who, along with others e.g. Hays (1969), argue that "...traditional techniques of content analysis have failed to take into consideration certain types of implicit information in verbal behaviour" (Loflin et al; 1972: 1Ø1).

Traditional content analysis has operated on the assumption that all information communicated through language is overt (Berelson,

1954; Holsti, 1968; Kaplan, 1943; Lasswell, 1941). Loflin et al (1972) reject this assumption on the basis that "...much information in a communication event is inferable from overt verbal structures" (p. 102).[3] In other words

> ...if individuals who interpret messages must supply information which is not overtly available, then this implicit information must be included to obtain frequency counts which accurately reflect the semantic preoccupations of the verbal interaction (ibid).

Working from this standpoint, Loflin et al (1972) categorized the information present in a communicative event into three types: explicit, grammatically implicit and contextually implicit. Using detailed reconstruction procedures (Loflin and Barron; 1970) they found substantive differences between the amount of implicit information in black and white classrooms and at different grade levels. They conclude that "...content analyses of classroom discourse generate distorted views of the concerns of participants unless reconstruction of the discourse is carried out" (Loflin et al; 1972: 102).

Using the procedures developed by Loflin and his associates (Loflin and Barron; 1970), classroom dialogue can be reconstructed prior to being submitted to the TSA Technique. For example:

Original Dialogue

> T: Now, if your mice need cleaning out, clean them out, weigh them quickly, and it will be the same procedure as yesterday. Once you have finished bring them back out here please. Don't touch the mice until you have washed your hands. Right? Don't touch them until you have washed your hands.

Reconstructed Dialogue

> TI:[4] Now, students, if your mice cage needs cleaning out, clean the mice cages out, weigh the mice quickly, and, today, it will be the same procedure as yesterday's procedure. Once you students have finished cleaning out the mice cages and weighing the mice, bring the mice and mice cages back out to the front of the class please. You students are not to touch the mice until you students have washed your hands. Do you students understand that? You students are not to touch the mice until you students have washed your hands.

When Step 2 of the TSA Technique - Select words with substantive meaning - is applied to this example, it becomes:

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[3] Emphasis is Loflin et al's

[4] "TI" means "teacher initiated" dialogue.

TI STUDENT YOUR MOUSE(A)[5] CAGE NEED CLEAN(V) CLEAN(V) MOUSE(A) CAGE WEIGH MOUSE(N) QUICK TODAY IS SAME PROCEDURE YESTERDAY PROCEDURE YOU STUDENT FINISH(V) CLEAN(V) MOUSE(A) CAGE WEIGH MOUSE(N) BRING MOUSE(N) MOUSE(A) CAGE FRONT CLASS PLEASE YOU STUDENT NOT TOUCH(V) MOUSE(N) YOU STUDENT WASH HAND YOU STUDENT UNDERSTAND YOU STUDENT NOT TOUCH(V) MOUSE(N) YOU STUDENT WASH HAND

The overall procedure then is:

Original dialogue "paragraphed" into Bellack cycles	⟶	Original dialogue reconstructed using Loflin's techniques	⟶	Reconstructed dialogue prepared for TSA Technique by the selection of substantive words only	⟶	Analysis by the TSA Technique using Bellack cycles as paragraph equivalents

An Example of Dialogue Analysis

Two examples of dialogue are analyzed here. The dialogue comes from two different Year 8 science classes under two different teachers studying the same curriculum unit, "Mice and Men" (ASEP 108; 1973). They are part of a larger study of four classrooms studying two different curriculum units in a large metropolitan secondary school in Brisbane (Clarke; in process). The dialogue from a sequence of three lessons covering basically the same content is analyzed in each case.[6]

The Analysis of Class 1 Dialogue

The dialogue was divided into 110 Bellack cycles. 44 words with frequency of occurrence >15 were selected for further analysis. This was reduced to 21 words by the POWER procedure. These 21 words and their frequency of occurrence (F) are shown in Table 1.

[5] "A" for adjective.

[6] Details of the students and teachers in the sample are not particularly relevant to the discussion so are not included here. They are however available elsewhere (Clarke; in process) or on request from the author.

TABLE 1 SOMEWHERE HERE

The principal components analysis identified 8 interpretable principal components which accounted for 38.7% of the variance. These themes are summarized in Table 2.

TABLE 2 SOMEWHERE HERE

Reference to the transcripts is necessary to understand Theme 5. During Lesson 2, the teacher spends a lot of time distributing sheets of blank paper to students at their benches. On these, they are to indicate which of the activities in the unit they had finished and to place the completed sheet on the front bench. Significant cross correlations of the themes are shown in Table 3.

TABLE 3 SOMEWHERE HERE

The overall structure of the Class 1 dialogue is shown in Figure 2 and its "essential" structure is shown in Figure 3.

FIGURES 2 AND 3 SOMEWHERE HERE

Table 2 and Figures 2 and 3 summarize the content and structure of the Class 1 dialogue. The theme that dominates the total structure is Theme 8. It is evident in all three lessons and indicates that the teacher is doing most of the talking. Since this talk often involves students, Theme 8 is accompanied throughout but to a lesser extent by Theme 4. The other theme that occurs consistently throughout the whole structure is Theme 7 which refers to the mice cages. Obtaining the mice in their cages is a necessary prerequisite to the students undertaking activities involving the mice. Within Lesson 1, Themes 1 and 3, the prescriptions for how students are to act during and after handling the mice are the major ideas. Lesson 2 is dominated by the distribution of the activities checklist (Themes 5 and 6). The recording of the outcomes of the activities (Theme 2) is also an important part of this lesson. Themes 5 and 6 continue on to some extent into Lesson 3 but despite this, the lesson lacks any unique theme. The last lesson is concerned with the general activities involving the use of the mouse cages and cleaning up afterwards. The "essential" structure shown in Figure 3 indicates no major coherence or logical progression of themes. Apart from the strong relationship between Themes 5 and 6, as indicated by

significance at the Ø.Ø5 level, all other themes tend to be independent of each other.

In summary, Class 1 is a classroom where there is quite a lot of talking. Most of it is done by the teacher however and little of it relates directly to the tasks the students have to perform. The talking deals with what students should or should not be doing, but the activities focussed on (e.g. washing hands) are peripheral to the type of activities that the students should be engaging in viz. investigating the behaviour of mice and comparing it to human behaviour. This focus on student "dos and dont's" combined with the lack of focus on science content means that the lessons are essentially the same. This no doubt contributes to the lack of any logical sequencing both within a lesson and over a number of lessons.

Analysis of Class 2 Dialogue

The dialogue was divided into 123 Bellack cycles. 56 words with frequency of occurrence >15 were selected for further analysis. The POWER procedure was applied to these words, reducing them to 31 words. These remaining words and their frequency of occurrence (F) are shown in Table 4.

TABLE 4 SOMEWHERE HERE

The principal components analysis identified 9 interpretable principal components which accounted for 73.8% of the variance. These themes are shown in Table 5.

TABLE 5 SOMEWHERE HERE

All themes can be named by inspection although one of them needs confirmation from the transcripts. They confirm that Theme 2 is about the warm-blooded characteristic of mammals. Significant cross correlations of the themes are shown in Table 6.

TABLE 6 SOMEWHERE HERE

The overall structure of the Class 2 dialogue is shown in Figure 4 and its "essential" structure is shown in Figure 5.

FIGURES 4 AND 5 SOMEWHERE HERE

Table 5 and Figures 4 and 5 summarize the content and structure of the Class 2 dialogue. The total structure is dominated by the Themes 1, 7 and 3 - teacher-student discussion on mammals. Related ideas in Themes 8, 5 and to a lesser extent, 4 emerge and recede along with the dominant structure. The major theme of teacher-student question-answer interaction, Theme 1, provides a cohering umbrella under which the content is developed. The characteristics and types of mammals (Themes 7, 3, 8 and 5) and a comparison of them with reptiles (Theme 4) is the content being dealt with. Activities (Theme 2) using equipment (Theme 6) also occur. In Lessons 1 and 2, activities involving mice sometimes in their cages occur while in Lesson 3, the emphasis is on discussion rather than student activity.

In Lesson 1, during a discussion on the characteristics of mammals (Themes 1, 7 and 3), there is reference to reptiles and primitive mammals (Themes 4 and 8) and the introduction of the notion of warm bloodedness (Theme 5). This continues in Lesson 2 but with a reduction in emphasis on the cold-blooded characteristic (Theme 4) and a corresponding increase in emphasis on the warm-blooded characteristic (Theme 5). In Lesson 3, there is less whole class dialogue than in the previous two lessons as indicated by the fewer number of cycles. In that lesson, the 1-7-3 structure strengthens throughout the lesson and assists, in the final few cycles, in drawing together most of the main ideas dealt with throughout all three lessons. This is shown by the presence of Themes 1, 2, 3, 5, 6 and 7 in cycles 120 to 123. The essential structure reflects some coherence among themes with the sequencing of Themes 1, 7 and 3 and strong coherence within themes with six themes relating to each other. All cross-correlations are significant at the Ø.Ø5 level indicating that, as themes emerge, they are given the opportunity to continue and to develop.

In summary, Class 2 is one where there is a lot of teacher-student discussion and where the discussion, compared to Class 1, is focussed strongly on science content. The normal sequence of events is that an idea is introduced, mainly by the teacher, discussed for some time and then used to lead logically on to the next idea (e.g. cold blooded --> warm blooded) and/or a student activity. Specific aspects of the discussion are continually being related to a more general conceptual framework (characteristics of mammals) in the form of the classic Ausubelian subsumption model.

A Comparison of the Two Dialogue Structures.

The Class 1 dialogue reflects what could be described as a "Sergeant Major" model dominated by teacher-talk. This talk prescribes and proscribes student behaviour and is only marginally related to science activities. On the other hand, the dialogue in Class 2 is "Ausubelian" in nature with new specific information subsumed into existing general information in a systematic way under teacher direction.

The dialogues analyzed here are in fact the "best" (Class 2) and

"worst" (Class 1) of all four classes studying "Mice and Men" in the larger study (Clarke; in process). The rank ordering of the quality of the dialogue is based on a number of theoretical criteria such as the percentage of variance explained by the themes, the number of themes, the number of significant cross-correlations, the overlap between the dialogue themes and the corresponding text themes etc. Theoretically, the dialogue structures are different. They also look different, so the theoretical differences have face validity. Based on the descriptions of the classrooms derived from the structural analysis, it would be possible to predict, again theoretically, that the learning and achievement would be better in Class 2. However, do these differences emerge in practice?

In a multiple regression analysis with achievement as the dependent variable and the quality of the dialogue and an extensive range of other personal and environmental characteristics[7] as independent variables, the structure of the dialogue emerged as the most influential variable. It accounted for nearly two-thirds of the explained variance and there was a positive relationship between the quality of the dialogue structure and the level of student achievement (Clarke; in process). In other words, as well as a theoretical difference, there was an actual effect in the classroom. The theoretical analysis of the content and structure of the dialogue was able to predict a practical difference in the classroom.

Conclusion

The TSA Technique has been shown to be eminently suitable as a procedure for analyzing dialogue. This, added to its already proven ability to analyze written materials, makes it a powerful procedure that can be applied to any sequential organized arrangement of information. With written materials, it has been used not only to describe structure but also to prescribe where and how deficits in the structure can be overcome (Clarke, 1973a, 1973b, 1973c). It has been used in this study to describe structure in dialogue. The next logical step is to attempt to use it to prescribe how deficits in structure of dialogue can be overcome.

A fruitful line of research to follow would be the production of "ideal structures" or "templates" of lessons or series of lessons based on particular models of teaching (e.g. inductive, deductive, transactional, etc.). Such "templates" would facilitate the production of actual lessons and also provide a reference point against which actual lessons could be compared. Such comparisons would not only allow specific deficiencies to be highlighted but also indicate how these deficiencies could be remedied.

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[7] Conceptual Level, Locus of Control, Piagetian Level, General and Specific Scholastic Aptitudes, Cognitive Structure prior to Instruction, Quality of the Classroom Dialogue and Perceptions of the Psychosocial Characteristics of the Learning Environment

Some time ago, Carss (1973) suggested a number of uses for the TSA Technique. Two of the suggestions have been explored: the analysis of textbooks and curricula (Clarke, 1973a, 1974a; Cox, 1975) and the analysis of dialogue which is the focus of this study. The other suggestions which have yet to be researched are

- information storage and retrieval. Here, an "essential structure" of a particular subject area, being made up of keywords from abstracts of articles or books in this area, would show a network of related ideas. Hence, instead of a catalogue, an interested reader would have a "map" of the subject area.

- Cloze-type reading tests. Instead of removing words at random, those associated with a given theme could be systematically deleted.

The TSA Technique could also be further developed in itself by experimentation at each step. For example, can the r procedure be improved upon? What would be the effect of different rotations after the factor analysis? What is the optimal factor score cut-off value? What would be the effect of a lag of 2 instead of 1 in the cross- correlation step? And so on. The TSA Technique has evolved over the years. There is room yet for further development.

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Word	F	Word	F	Word	F
because	15	hand	28	sheet	55
bench	47	I	131	student	417
book	17	mother	28	teacher	158
cage	32	mouse(adj)	45	wash	16
classroom	26	mouse(n)	110	you	324
eat	16	paper	20	young	29
front	19	record(adj)	18		

Table 1 Word Frequencies for Class 1 Dialogue

Theme	% Var	Words in Theme(Loadings)	
1. Reason for students not to handle mice pups	9.1	young(.96) eat(.97) mother(.92)	mouse(n)(.92) because(.64)
2. Student workbook	4.8	book(.98)	record(adj)(.97)
3. Cleaning up after handling mice	4.3	wash(.95)	hand(.95)
4. Reference to student	4.3	you(.92)	student(.92)
5. Distribution of an activities checklist	4.1	sheet(.96) bench(.91)	paper(.90)
6. Area of the classroom	4.1	classroom(.92)	front(.90)
7. Apparatus for housing the mice	4.0	cage(.93)	mouse(adj)(.88)
8. Reference to teacher	4.0	teacher(.89)	I(.88)

Table 2 A Summary of Themes in Class 1 Dialogue

Theme	r	
1-1	Ø.71	(**)
2-2	Ø.24	(*)
5-6	Ø.37	(**)
8-8	Ø.21	(*)

** Significant at the Ø.Ø1 level

* Significant at the Ø.Ø5 level

Table 3 Significant Cross-Correlations of Themes in the Class 1 Dialogue

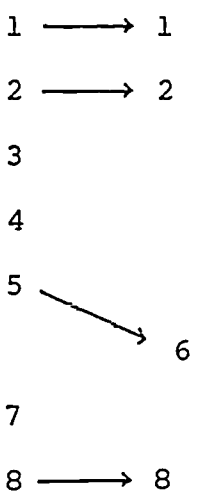


Figure 3 The "Essential" Structure of the Themes in Class 1 Dialogue

Word	F	Word	F	Word	F
answer(n)	61	hair	15	SR	71
answer(v)	36	human	26	student	279
blue-tongue	21	lizard	18	teacher	95
body	15	marsupial	47	temperature	95
cage	22	mean	20	TQ	94
characteristic	48	mouse(adj)	21	TR	75
container	17	mouse(n)	123	type	31
correct	50	primitive	17	up	15
dog-fight	15	put	27	way	15
go	16	question	46	warmblooded	23
				you	208

Table 4 Word Frequencies for Class 2 Dialogue

Theme	% Var	Words in Theme(Loadings)	
1. Teacher-student question-answer interaction	15.1	answer(n)(.84) answer(v)(.84) question(.82) correct(.77)	SR(.79) TR(.74) TQ(.65)
2. Characteristics of mammals - 1	11.3	body(.87) go(.86) temperature(.77)	human(.86) up(.72)
3. Activity: mice fighting	10.6	put(.88) mouse(n)(.77) container(.77)	fight(v)(.72) way(.65)
4. Example of a cold-blooded animal	6.8	lizard(.98) blue-tongue(.97)	
5. The meaning of warm-blooded	6.8	mean(.90) warm-blooded(.89)	
6. Apparatus for housing the mice	6.5	mouse(adj)(.90)	cage(.87)
7. Characteristics of mammals - 2	6.5	hair(.92) characteristic(.90)	
8. Type of mammal	5.9	primitive(.92) marsupial(.47)	type(.89)
9. Reference to student	5.7	you(.92)	student(.92)

Table 5 A Summary of Themes in Class 2 Dialogue

Theme	r		Theme	r	
1-1	Ø.49	(**)	5-5	Ø.27	(**)
1-7	Ø.27	(**)	6-6	Ø.45	(**)
2-2	Ø.32	(**)	7-3	Ø.29	(**)
3-3	Ø.25	(**)	9-9	Ø.41	(**)
4-4	Ø.45	(**)			

** Significant at the Ø.Ø1 level

* Significant at the Ø.Ø5 level

Table 6 Significant Cross-Correlations of Th mes in the Class 2 Dialogue

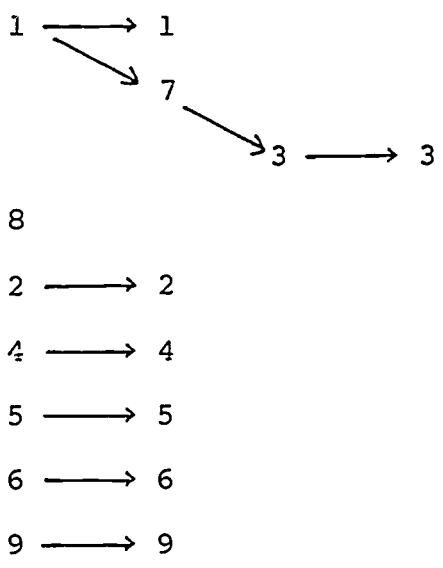


Figure 5 The "Essential" Structure of the Themes in Class 2 Dialogue

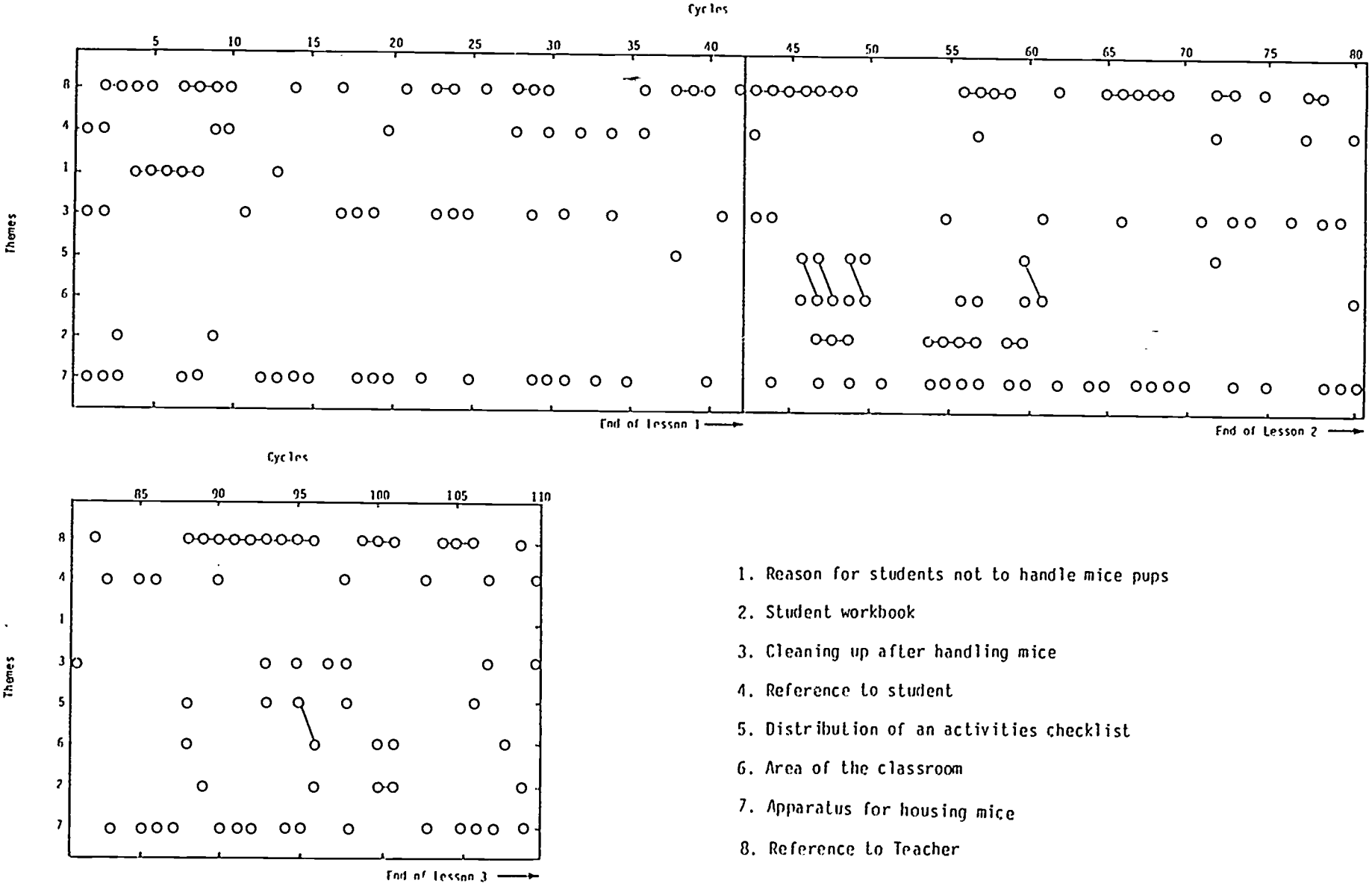
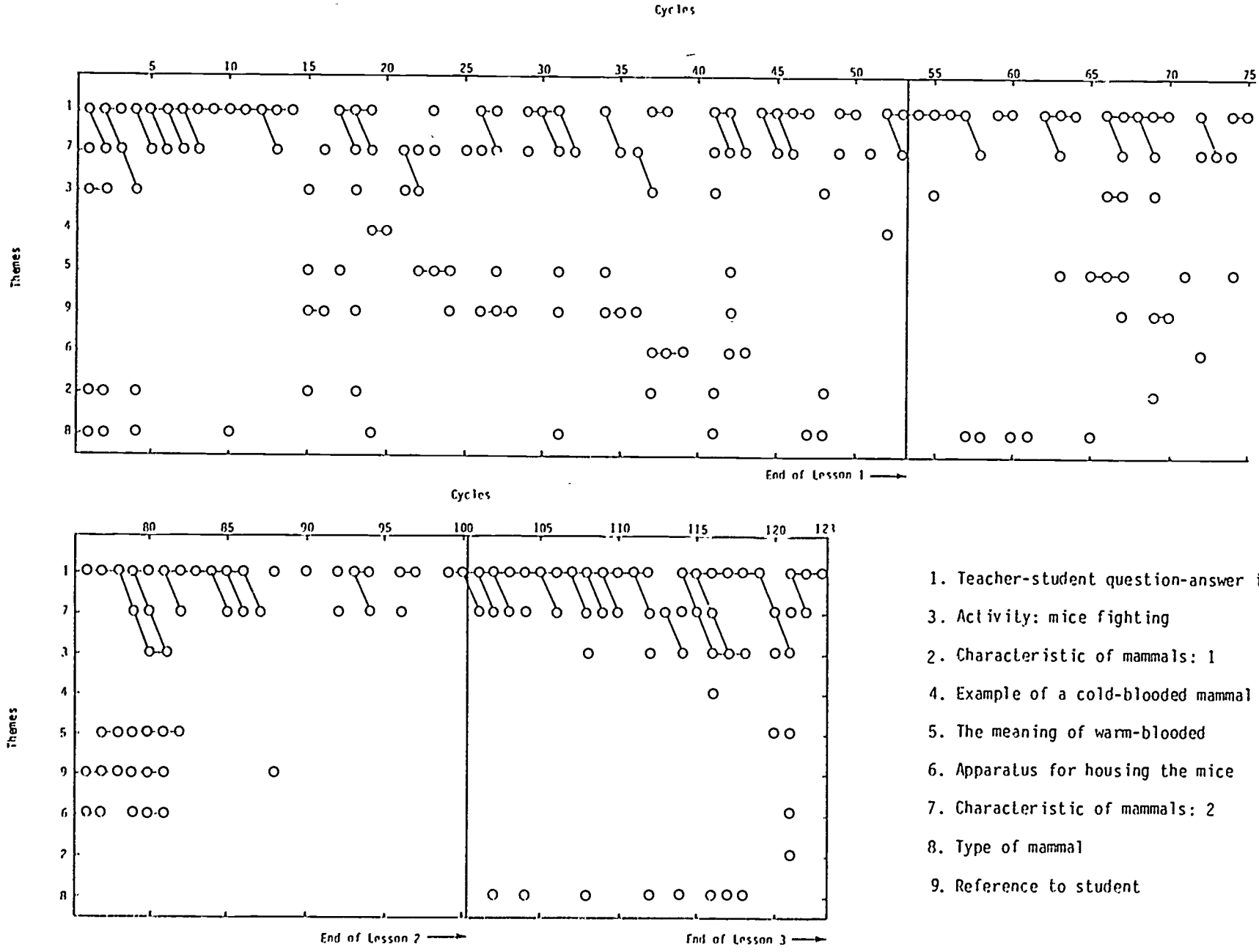


Figure 2 The Structure of the Class 1 Dialogue

1. Reason for students not to handle mice pups
2. Student workbook
3. Cleaning up after handling mice
4. Reference to student
5. Distribution of an activities checklist
6. Area of the classroom
7. Apparatus for housing mice
8. Reference to Teacher



1. Teacher-student question-answer interaction
3. Activity: mice fighting
2. Characteristic of mammals: 1
4. Example of a cold-blooded mammal
5. The meaning of warm-blooded
6. Apparatus for housing the mice
7. Characteristic of mammals: 2
8. Type of mammal
9. Reference to student

Figure 4 The Structure of the Class 2 Dialogue