Teacher-Pupil Interaction During Science Lessons in Two Western Samoan Primary Schools

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Science education throughout the world is facing changes in teaching methods similar to those which began in the 1960s. However, still the most favoured method of teaching science is the inquiry-generating-discovery approach. In Western Samoa, moves in this direction began in the early 1970s resulting in new science curricula which are now being reviewed and revised.

Despite these revisions, there is concern by local educators that the high attrition rates of tertiary students taking science-oriented courses, and the general lack of interest in such courses, could be due to the non-development of scientific attitudes and behaviour (inquiry-type) in students at earlier levels. This concern prompted the author to investigate science education in Western Samoa.

This article is a report of that study and it includes comments on the future directions of science education in Western Samoa — these may apply to other South Pacific countries too. It is suggested that there is a conflict between Samoan culture and the favoured science teaching approach, i.e. inquiry-generating-discovery approach; and that interaction in the classes studied was influenced by some teacher-pupil relationships which had developed out of the continuous association between each class and its teacher. It is suggested therefore that the outcome of the science lessons was the result of an aggregation of factors and not merely the result of the interactions during the lessons.

Science education in Western Samoa — an overview

In 1984-85, the senior secondary school science syllabus was determined mainly by the New Zealand School Certificate and New Zealand University Entrance examinations, but science in the primary and junior secondary schools followed a locally developed curriculum which was

more relevant to local needs.

Armed with a book of lessons for the year, the primary school teachers have much to help them in their teaching of science. For each level from Standard 1 to Form 2, there is a book of lessons that have been developed by a team of local educators: practising teachers, Curriculum Unit staff, school inspectors, and lecturers from the Primary Teachers' College. These books are available to teachers throughout the country though it is understood that they are not supposed to be the sole resource in the teaching of science. The books for Standards 1 to 4 contain 30 lessons each, Form 1 has 59 lessons, and Form 2 has 56.

The lessons are activity-based, in Samoan for the standards and English for the forms. It must be noted however, that of all the books seen in 1985, there was only one that was published after 1979, that for Standard 4.

Prior to the formulation of the national aims and objectives of education in 1979, the primary science curriculum was based on the Papua New Guinea Three Phase Primary Science curriculum materials. The aims and objectives proposed a time allocation for each subject in the timetable. For science at the middle primary level it was 10%.

Since 1979, revision of the science materials has been continuing with a view to making the teaching guides conform more closely to the stated aims and objectives. In 1983, the revised book of lessons for Standard 4 was published by the Science Subcommittee, Department of Education. In these materials, there is an effort to teach science by the discovery approach and a tendency to emphasize the acquisition of skills, especially laboratory techniques, which receive more attention than those for use in environmental inquiry.

In addition to the ongoing revision, in 1985 a project was undertaken by a team led by Mr Dick Bishop, then a Fellow in the Institute of Education, of the University of the South Pacific. Other team members were Education Department subject organisers, practising teachers, school inspectors, and Teachers' College lecturers. This project tried a new approach: that of teaching composite classes (combined classes of two different levels taught by one teacher) and, of relevance to this study, integrating science with other subjects. Also under investigation was the possibility of science being integrated across class levels. The team reviewed materials in use to

determine which could be reorganised and improved to "give a more valid educational experience" (Bishop, 1985). According to Bishop, the materials in use at the time were attempting "too much, too early" and presenting science concepts rather "clinically". The method used was "more fitted to laboratory techniques than to exploring the environment". In my view, this makes science rather remote and detached from the children's everyday experiences and, as a result, school science does not have much meaning for them.

Bishop's project team attempted to overcome this relevancy problem by using an environmental approach. For example, in teaching the concept of *heat transfer,* they used the idea of cooking food (which integrates science with the social science aspects of nutrition and health) in contrast to the existing materials which teach heat transfer with the usual experiment using wax and metal.

It can be said that primary school science in Western Samoa is dynamic, and that it uses the inquiry or discovery method, as it is practised elsewhere in the world.

The Study

Specific aim

It was surmised that the lack of development of inquiry behaviour occurred in the earlier levels of science instruction so primary school would be the best place to research the problem. This study aimed to examine teacher-pupil interactions during science lessons in two primary schools in Western Samoa in order to explore the reasons for any differences observed between the urban and rural classes studied and to propose hypotheses which could be the subject of further research. Interactions were studied on the basis of whether they were conducive to the development of inquiry or conforming attitudes in pupils.

Methodology

The study used middle primary school science lessons at the Standard 4

level, and it was carried out in two parts — the main study and the substudy.

Fieldwork for the main study was done in 1984. The analysis of data obtained from this fieldwork showed differences between the two schools which might have been due to the influence of the teachers. Thus the substudy was carried out to control the teacher variable.

The main study

1. Of the two primary schools used, the urban one was selected by the author, and the rural one was selected on the advice of the Development of Education.
2. Standard 4 classes were used because students at the level sit a national examination; therefore the curriculum materials used should be uniform throughout the country.
3. A series of lessons on one topic was observed and tape-recorded. The topic to be used was determined as follows: each teacher was requested to carry on with the next topic in the science programme. This would give an 'original' classroom interaction in that the class would be tackling a topic they had not studied together previously. The urban class topic was "Air"; and the rural class topic was "Mixtures".
4. Before and after each lesson, the teachers were interviewed about their expectations of the lessons.
5. Six pupils were interviewed after each lesson on their views of the lesson. Of the 6 pupils, 2 were high achievers, 2 average, and 2 below average. In addition, the 6 pupils discussed the lessons and other aspects of class life without the presence of the author or the teacher. Several such discussions took place and were tape-recorded.
6. The audiotape recordings were transcribed. Those of the lesson proceedings were analysed quantitatively and qualitatively. The instrument used in the quantitative analysis was a refined version of Flanders' Interaction Analysis Categories (FIAC).

The FIAC was refined by the writer with the following criteria in mind:

1. Each teacher/pupil talk was to be classified into one of three categories.
2. The categories were to be named Q, C, N, so that 'Q' was talk that

fostered inquiry behaviour, where inquiry meant questioning and critical,
'C' was talk that fostered conforming behaviour,
'N' was talk that was neutral — neither A nor B.

3. Classification of the interaction was of a subjective nature. That is, the transcript of each science lesson was treated to a subjective assessment by the author.

Thus, each teacher or pupil statement was assessed and coded as either Q-type, C-type, or N-type. Each category was given a further classificatory number (subnumary), in a manner similar to the original classification by Flanders. Illustrations of FIAC and the refined version are presented in Appendices A and B.

Using the instrument, tallies of instances of the three types of talk were recorded in tally tables.

In addition to the transcriptions of the lessons, interviews and group sessions, data for qualitative analysis included information on the socioeconomic background of the pupils and teachers, institutional organisation and classroom organisation (e.g. timetable and seating plan).

Results and interpretations

1. The main study

(a) *Quantitative analysis*
Summaries of the tally tables are given below.

(i) *All statements made by teachers and pupils*

Table 1.
Teacher statements

	Urban	%	Rural	%
'Q' type statements	162	40	45	9
'C' type statements	241	60	483	91
Total	403	100	528	100

Thus, in the urban school, 40% of the teacher statements were 'Q' type, significantly more than in the rural school where only 9% of the statements were 'Q' type. ($p < 0.001$), $\chi^2 = 132.6$.

Note : χ^2 was worked out as follows:

For a 2x2 table

$$\begin{array}{ccc} a & b & R_1 \\ c & d & R_2 \\ S_1 & S_2 & N \end{array} \qquad \chi^2 = \frac{(ad - bc)^2 N}{R_1 R_2 S_1 S_2}$$

and for the above table, a=162, b=45, c=241, d=483, N=931

Table 2.
Pupil statements

	Urban	%	Rural	%
'Q' type statements	80	47	50	14
'C' type statements	91	53	314	86
Total	171	100	364	100

Thus, in the urban school, 47% of pupil statements were 'Q' type, significantly more than the 14% in the rural school. ($p < 0.001$)

(ii) *Direct teacher-pupil interaction*

Tallying the teacher statement against the pupil response gave the following results.

Table 3.
The urban school

	Teacher 'Q' type	Teacher 'C' type	Total
Pupil 'Q'	81 (46%)	6 (3%)	87 (49%)
Pupil 'C'	0	89 (51%)	89 (51%)
Total	81	95	176 (100%)

Table 4.
The rural school

	Teacher 'Q' type	Teacher 'C' type	Total
Pupil 'Q'	29 (8%)	16 (5%)	45 (13%)
Pupil 'C'	11 (3%)	298 (84%)	309 (87%)
Total	40	314	354 (100%)

Overall, 'Q' type statements were used more frequently in the urban school.

In both the urban and rural schools, the overwhelming tendency was for the pupil response ('Q' or 'C') to be the same as the teacher statement i.e. 97% of the time in the urban school and 92% of the time in the rural. However, there was a small number of occasions when the pupil response was *different* from the teacher statement. On these occasions, there were more 'C' type pupil statements made in the rural class than in the urban class. Further, when the teacher made a 'Q' type statement, she/he was more likely to get a 'C' type response in the rural school (3%) than in the urban school (0%). ($\chi^2 = 21.3$, $p<0.01$) On the other hand, a 'C' statement by the teacher would most likely get a 'C' response in *both* the urban (94%) and in the rural (95%) school. ($p<0.10$)

Finally, the incidence of a 'C' type teacher statement drawing a 'C' type pupil statement was much lower in the urban school than in the rural school. (89/182 in the urban school, 297/354 in the rural school)

(b) *Qualitative analysis*
For this, the data used were:
(i) the science lessons
(ii) the interviews of both teachers and pupils
(iii) the group sessions of the selected pupils
(iv) other factors such as socioeconomic status of pupils, social relations in the classes, timetables, and seating arrangements.

From this data, the following observations were made.

1. In the rural school, the teacher's questions were directed more to the class/group in general and not to individual pupils. The urban

teacher directed questions more to individually named pupils.

2. Group work was more evident in the rural school.
3. Experimental activities were effected differently. In the rural class they were group activities, while in the urban class they were teacher demonstrations.
4. Urban pupils sat at their desks most of the time, including during experiments, (to get a clearer view of demonstrations they stood up), only going to the floor during storytelling time. Rural pupils, on the other hand, congregated at the front during experiments, crowding around the teacher or group leader. Pupils sat on the floor when there was a discussion of the experiments.

   The choice of seating at the desks was left to the pupils in the urban class and settled by the teacher in the rural class. The seating plan in the urban class was modular while that of the rural class was traditional. [According to Hurt et al. (1978, 98), teacher-pupil interaction is most intense in the central area at the front position of the traditional classroom and scattered in the modular classroom.]
5. Urban lessons were conducted mostly in English while the rural ones were predominantly in Samoan.
6. Report writing in the rural class was on a set pattern and the final report was copied from the combined effort recorded on the blackboard. That of the urban class was left to the individual after a class discussion; there was also more time allowed for completion of the report in this class.
7. Pupil-pupil interaction was more open in the urban class whereas in the rural class it was restricted to whispers behind the teacher's back during experiments. Both teachers allowed pupil-pupil talk during discussion time.
8. Both teachers claimed that they were aware of pupils' attention straying the moment it happened.
9. Advance planning appeared limited in the rural class due to the institutional limitation of withholding the curriculum materials until the week before.
10. Both teachers agreed on the advantage of learning by doing and discovery, and encouraged such types of activities though teacher A (urban class) set her activities for homework mostly. All pupils agreed that experiments were useful for learning but they preferred that the teacher demonstrate them first.
11. Both teachers encouraged questioning but teacher A usually answered the questions at the end of the lesson. The urban pupils

voiced opinions while the rural ones made statements which confirmed what the teacher had told them.

12. Each group of 6 pupils identified some parts of lessons that were "boring", "unclear", or "interesting". During their unsupervised discussions they made candid remarks about their teacher, other pupils and each other.
13. A survey of the socioeconomic status of the pupils revealed that:
    (a) the families of urban pupils generally were better educated and of a higher income bracket;
    (b) urban families generally had househelpers; the rural ones often *provided* the househelpers;
    (c) urban pupils had more access to the public library and other educational resources than rural pupils.
14. The rural timetable was observed quite rigidly because of the compulsory radio session and the school inspector's regular visits. The urban class timetable was less rigidly observed since there were no such limitations.

One cannot generalise from the results obtained in just two schools. However, the findings suggest some points which could be investigated further:

1. Institutional demands and limitations on the teacher.
2. The way in which science lessons are conducted.
3. Pupils' opinions of their science lessons.
4. The differences in writing reports of science activities.
5. The differences in pupils of different ethnic backgrounds.
6. Socioeconomic status of pupils.
7. Pupils' reactions and responses.
8. Pupils' perceptions of classroom activities.

2. The substudy — controlling the teacher variables

This part of the study was carried out to eliminate the possibility of the final outcome being due to differences between the two participating teachers. The same methodology as the main study was used, but the teachers exchanged classes. In addition, teacher A took a second class, the lowest Standard 4 in the urban school — the ability level of the pupils of the latter was similar to that of the rural class. Since this was done a year later, a close check on the type of pupils in the 1985 classes was made; it was

found that the type of pupil (socioeconomic status, age, girl: boy ratio) had remained practically the same. In some instances siblings were observed. The science topics were the same as in the main study. That is, teacher A taught "Air" while teacher B taught "Mixtures".

Results of the substudy are set out in the following tables.

Table 5.
Direct teacher-pupil verbal interaction in the rural Standard 4

	Teacher 'Q' talk	Teacher 'C' talk	Teacher 'Q' & 'C' talk
Pupil 'Q' talk	15 (22%)	9 (13%)	1 (1%)
Pupil 'C' talk	0 (0)	39 (58%)	3 (4%)

Table 6.
Direct teacher-pupil verbal interaction in Standard 4A1 (urban)

	Teacher 'Q' talk	Teacher 'C' talk	Teacher 'Q' & 'C' talk
Pupil 'Q' talk	36 (21%)	8 (5%)	4 (2%)
Pupil 'C' talk	5 (3%)	114 (67%)	3 (2%)

Table 7.
Direct teacher-pupil interaction in Standard 4B3 (urban)

	Teacher 'Q' talk	Teacher 'C' talk	Teacher 'Q' & 'C' talk
Pupil 'Q' talk	16 (11%)	0 (0)	1 (0 006%)
Pupil 'C' talk	13 (9%)	110 (76%)	5 (0. 03%)

Table 8.
All teacher talk (urban & rural)

	'Q' type	'C' type	Total
Teacher B with 4A1	22 (25%)	66 (75%)	88 (100%)
Teacher A with 4B3	62 (25%)	182 (75%)	244 (100%)
Teacher A with rural	63 (27%)	170 (73%)	233 (100%)

Table 9.
All pupil talk (urban & rural)

	'Q' type	'C' type	Total
urban 4A1	25 (40%)	38 (60%)	63 (100%)
urban 4B3	42 (26%)	120 (74%)	162 (100%)
rural Std 4	12 (9%)	124 (91%)	136 (100%)

3. Comparison of results from the main study and the substudy

Quantitative and qualitative results of both studies were compared and the following points were found to be either the same or nearly so.

(a) *Quantitative*

1. Both teachers made more 'C' type statements than 'Q' type statements.
2. The proportion of pupil 'Q' type statements was much less than 'C' type statements.
3. Direct interaction in the urban classes showed inquiry-type behaviour and in the rural classes it showed conforming-type behaviour.

(b) *Qualitative*

1. In the rural school, the only 'Q' type talk was direct pupil responses and only in response to a teacher 'Q' type statement.
2. It was only in the urban classes that 'Q' type pupil statements were made to both 'Q' and 'C' type teacher statements.

3. Pupil-pupil interactions were freer and more pronounced in the urban classes while those in the rural classes were more subdued and furtive.
4. There was a marked difference in pupil reaction to an 'accident' (when water was spilled dramatically). The urban class reaction was far more boisterous and spontaneous; that of the rural class was extraordinarily subdued.
5. Despite teacher encouragement, fewer questions were asked by the rural class. However, this was due partly to a lack of understanding; some pupils later admitted this.
6. Although the 1985 rural class had apparently been taught the topic before, their 'Q' count was still lower than that of the 1985 urban classes.
7. Both teachers claimed that they had to modify their teaching to suit the classes they took in 1985. When Teacher B took the urban class (1985), the pupils displayed what appeared to be an increased inquiry reaction, and he had to accommodate this by giving them additional activities. Further, he did not carry out his routine for report-writing as he had for the rural class. Teacher A stated that she had to slow down the rate of discussion, use Samoan language, make many more leading statements, and guide the report writing. Thus, it seems that the differences in the two teachers did not influence whether the classroom interaction was inquiry-type or conforming-type.

Although the pupils were not the same in the two years, they were of the same *type* and therefore much of their behaviour was assumed to be the same. From the analysis, we can see that there was a tendency for the urban class to be more confident. This implies more independent thinking on the part of the urban pupils than the rural pupils. This was despite the determined efforts of teacher B to give his pupils a lot of opportunities for discovery learning with his activity-based lessons. Both rural and urban pupils, though declaring their enjoyment of such lessons, professed to understanding more if the teacher had a guiding hand. Research bears this out (Van Rennes, 1978).

One very interesting point was that the lessons in the urban class, with less pupil activity, became more inquiry-oriented. The rural class experiments with more lab-type activities did not appear to foster the expected scientific behaviour. It is suggested that some subtle teacher-pupil relationships were operating to affect classroom interaction. In particular, the author

observed that the control of the rural class by Teacher B followed the typical style of the traditional Samoan singing group — that is, seated in a circular pattern on the floor with the conductor at the centre-front. It appeared that this was *not* a deliberate strategy. Thus, perhaps the more formal activities restricted conceptual development to merely confirmation of former concepts. This could be investigated further.

4. Interaction analysis

Classroom interaction analysis has become a dominant area in educational research and Flanders' Interaction Analysis Categories, which consider the affective classroom climate, is a major contribution to useful analysis.

In this study, a modification of FIAC was used to investigate a certain aspect of this affective classroom climate, i.e. was the classroom climate different between the urban and the rural schools, and was the difference related to inquiry/conforming behaviour? Interaction, arising out of both verbal and non-verbal communication, was observed in the two schools. An attempt was made to relate the classroom interaction during science lessons and the consequent classroom climate, to the eventual pupil attitudes. In addition, an effort to reach the pupils' thoughts as closely as possible was effected by the interviews with the 6 representative pupils individually, as a group with the author, and as a group on their own. From the results, it has been established that the classroom climate was significantly different between the two schools. Further, that the classroom interaction in the urban school was conducive to inquiry-type behaviour whilst that of the rural school tended to foster a conforming-type behaviour.

It must be pointed out that speculations raised in this study are just that — speculations — and the testing of these is beyond the scope of this research. Many variables were difficult to control due to the limitations already mentioned.

Implications for Science Education in Western Samoa

This study was intended to obtain some insight into the attitudes Samoan pupils were developing as a result of classroom interaction during science

lessons: in particular, whether these attitudes were productive of scientifically-oriented thinking, i.e. questioning and critical (inquiry-type) thinking or whether they were merely conforming. Further, was the classroom interaction heuristic or expository?

From the findings of the present study, the following two hypotheses are proposed for further investigation:

1. "that teacher-pupil interaction in an *urban* Samoan school differs significantly from that in a *rural* Samoan school"
2. "that in an *urban* Samoan school, classroom interaction in science lessons tends to foster questioning-critical attitudes on the part of the pupils, whereas in a *rural* Samoan school, an attitude of unquestioning acceptance tends to be fostered in science lessons"

It is hoped that this preliminary investigation will provoke a wider and fuller study of science education in Western Samoa and thence be extended to the South Pacific region.

Conclusion and comments

It must be emphasised that because of the limitations under which the study was carried out, the conclusions can only be tentative.

1. *Time allocation for science*

   There is a need to examine the discrepancy between the official departmental time allocation (at least 2.5 hours) and the actual time allotted in both schools studied (one hour). Should the stated allocation be adhered to, more time for science experiments would be available.

2. *Institutional limitations*

   Practices such as withholding curriculum materials, scheduling compulsory broadcast sessions, school-wide sports periods and school-wide music periods need to be minimised in order to allow more flexibility for class science activities.

3. *Curriculum materials*

   Existing curriculum materials are highly structured and tend to limit both teacher and pupil creativity. Materials should be made more flexible by permitting more creative pupil activities e.g. projects, and should be adjusted to suit the pupil developmental level and lifestyle. In addition, further scientific background knowledge for the teacher should be provided to encourage extension activities and increase

teacher confidence in science teaching (Dobey and Schafer, 1984).

4. *The teachers*

   Admissions by the teachers of their lack of scientific knowledge and their using experimental activities for "proving-the-point" rather than for "discovering", show that these factors can affect their style of teaching and most likely reduce their inquiry teaching style. Thus there is a need for workshops to be held to promote and upgrade the inquiry/discovery teaching of teachers, and increase their scientific knowledge.

5. *Cultural values*

   Samoan culture calls for children to be respectful of their elders and those in authority. This is likely to limit the critical-questioning development of a pupil who will curb such urges in a desire to be respectful and not to question the teacher. It would then be taken as a conforming attitude. The use of English during lessons could decrease a pupil's identity with the Samoan culture and put him/her in a European frame of mind, leading to increased critical-questioning attitudes such as those seen in the urban school. The use of Samoan language would do the reverse.

   Further, the traditional Samoan parental attitude to schoolwork does not encourage the pursuit of independent/inquiry learning as the pupil is restricted once she/he is at home. This attitude is that schoolwork should be done in school-time and home-time is family-chore-time. This is compounded in the rural situation by the demands on the children to participate in income earning. In the urban situation, nuclear families are becoming the norm and paid househelpers are responsible for the home chores, thus releasing the child for extra activities, and so opportunities for independent/inquiry learning are plentiful. Relevancy to the home environment, and the cultural acceptance of science concepts and their applications should also be considered.

It is therefore suggested that the teaching of primary science take these culturally-related factors into account, and teachers be made aware of the effect of these on classroom interaction.

Summary

This study has revealed the need for more information on science

education in Western Samoa if serious consideration is to be given to its improvement.

In particular, three important points that arose out of this study could be investigated further. The first is the opposing aspects of the inquiry or discovery methods in science and *Samoan culture.* That is, the questioning critical attitude of the former and the unquestioning conforming attitude of the latter. This may well be one of the main reasons for the high attrition rate of Samoan students in tertiary science.

Another aspect highlighted by the study is the plight of the *teachers* — i.e. their need for more knowledge of science content and process, for more time (both to teach the subject and to prepare for the teaching), and their lack of resources. It is unfortunate that time constraints limited the study to only two schools but it would be a worthwhile follow-up study to investigate more schools in a similar manner. This could provide a sound basis for future directions for science education in the country.

Thirdly, the *curriculum materials* being used are too content-centred. It is suggested that these be changed to a process-oriented curriculum using teaching materials and specimens that are more relevant to the local situation. In this way, positive attitudes towards science would have the best chance to develop.

The limitations of this study make any conclusions tentative but at least it can be said that some start has been made to identify possible drawbacks, and thence to suggest ways of improving science education in Western Samoa. In particular, I wish to point out the conflict between cultural values and expected science attitudes, the need for immediate teacher in-service courses aimed at changing negative teacher attitudes, and further revision of curriculum materials.

From a start made at the primary level, it is suggested that a similar consideration of curriculum needs at the secondary level is necessary for appropriate changes to be made in the secondary science curriculum. Such changes would better prepare the students for further studies in science. It is urged that the current revision of national curricula be carried out with these points in mind.

Implications for Science Education in the South Pacific

"At present, science instruction in Island primary schools shows the following characteristics: teacher centred, content oriented, theoretical and pedantic" (Mason, 1982).

This strong statement of Mason's should be used as a lever to prise the lid off the complacency in our region and investigate how much it holds true. The study that has recently been completed for Western Samoa appears to bear out Mason's belief. To what extent is it true for the South Pacific? If it is the norm, how and what can we change for the betterment of science education in the region?

Results of this study have prompted suggestions for the improvement of both primary and secondary science education in Western Samoa. It is also suggested that the findings of this study be compared with similar studies to be carried out in other countries of the South Pacific. However, the methodology used could be improved to reduce time and costs involved. Suggested changes are:

1. Use the instrument directly on the tapes and avoid the time-consuming transcribing process.
2. Tapes could be made by teachers or student teachers on section from teacher's college or other training institutes.
3. Tapes could be recycled.
4. Other data could be requested from the schools and education departments/ministries using a form letter.
5. Teachers could be coopted to take part, thereby achieving the beneficial side effect of furthering the teachers' appreciation of positive classroom interaction.

Pursuit of these suggestions would perhaps give the South Pacific a more successful approach to science education.

Interviews

As part of the research, several interviews were carried out. The following is a list of the interviewees.

Mr. Dick Bishop, Fellow, Institute of Education, The University of the South Pacific, 1985.

Afioga Galumalemana Netina Schmidt, Deputy Director of Education, Western Samoa, 1984.

Mr. Fuata'i Simanu, Subject Organiser for Science, Department of Education, Western Samoa, 1984.

Mrs. Lisi Va'ai, Chairman, PSC, past Assistant Director of Education-Primary Schools, past headteacher.

Mr. Vasa Faamoe Samu, Lecturer in Science, Primary Teachers' College, Western Samoa (past subject organiser for science), 1984.

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Appendix A: Flanders' Interaction Analysis Categories* (FIAC)

Teacher Talk	Response	1.	*Accepts feeling.* Accepts and clarifies an attitude on the feeling tone of a pupil in a nonthreatening manner. Feelings may be positive or negative. Predicting and recalling feelings are included.
		2.	*Praises or encourages.* Praises or encourages pupil action or behaviour. Jokes that release tension, but not at the expense of another individual; nodding head, or saying "um hm?" or "go on" are included.
		3.	*Accepts or uses ideas of pupils.* Clarifying building or developing ideas suggested by a pupil. Teacher extensions of pupils ideas are included but as the teacher brings more of his own ideas into play, shift to category five.
		4.	*Asks questions.* Asking a question about content or procedure, based on teacher ideas with the intent that a pupil will answer.
	Initiation	5.	*Lecturing.* Giving facts or opinions about content or procedures; expressing his own ideas, giving his own explanation, or citing an authority other than a pupil.
		6.	*Giving directions.* Directions, commands, or orders to which a pupil is expected to comply.
		7.	*Criticizing or justifying authority.* Statements intended to change pupil behaviour from non-acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing; extreme self-reference.
Pupil Talk	Response	8.	*Pupil-talk - response.* Talk by pupils in response to teacher. Teacher initiates the contact or solicits pupil statement or structures the situation. Freedom to express own ideas is limited.
	Initiation	9.	*Pupil-talk - initiation.* Talk by pupils which they initiate. Expressing own ideas; initiating a new topic; freedom to develop opinions and a line of thought, like asking thoughtful questions; going beyond the existing structure.
Silence		10.	*Silence or confusion.* Pauses, short periods of silence and periods of confusion in which communication cannot be understood by the observer.

* There is *no* scale implied by these numbers. Each number is classificatory: it designates a particular kind of communication event. To write these numbers down during observation is to enumerate, not to judge a position on a scale.

Flanders, N., *Analysing Teaching Behaviour*, p. 34

Appendix B: The Refined Version

Table 1.

Categories that foster inquiry behaviour

teacher talk	T - praises and encourages	- by complimenting unexpected answers	- 2_1A
	T - praises and encourages	- imagination, creativity, originality and resourcefulness	- 2_2A
	T - accepts/uses pupil's ideas/pupil's divergent thinking	- by complimenting information seeking questions.	- 3_1A
	T - "	- redirecting pupil's questions to class	- 3_2A
	T - "	- clarifying/building/developing pupil's questions	- 3_3A
	T - asks open questions	- about content expecting pupil to think for answer	- 4_1A
	T - asks open questions	- soliciting answers from pupil's experience	- 4_2A
	T - gives directions	- on pupil's actions, encouraging self inquiry	- 6_1A
	T - "	- giving opportunities for pupil's response in the initiative	- 6_2A
	T - "	- prodding pupil's initiative	- 6_3A
	T - criticising (in the context of opportunity for pupil initiative)	- lack of originality/imagination	- 7_1A
	T - "	- misbehaviour/inattentiveness eg. "It looks as if I will have to separate you back to your usual positions.... you're not paying attention"	- 7_2A
	T - "	- attitude eg. "... you are not helping one another, you are playing...",	- 7_3A
	T - "	- lack of effort, does not try, gives up easily.	- 7_4A
	T - "	- failure, can't answer, low score, failure to think before responding eg. "You said it smells like a jar... you'll get a dong on the head for, smelling like a jar!"	- 7_5A

Table 1 continued

pupil talk	P - response	- to teacher's questions, expressing own thoughts	- 8A
	P - initiative	- expressing own ideas and opinions	- 9_1A
	P - "	- expressing observations	- 9_2A
	P - "	- asking thoughtful (open) type questions:	
		a. with reference to outside sources	- 9_3A
		b. expressing own interpretation	- 9_4A
	P - "	- introducing new topic of discussion	- 9_6A
	P - "	- volunteering information from own investigations:	
		a. personal experience	- 9_7A
		b. reading material read	- 9_8A
	P - "	- giving directions to other pupils	- 9_9A

Table 2.
Categories that are neutral

teacher talk	T - accepts feeling	- accepts pupil feeling/attitude, predicting/recalling feelings	- 1C
	T - praises/encourages	- jokes, but not at expense of pupil	- 2C
pupil talk	P - response,	- eg. negative noises	- 3C
		Periods of silence/pauses	- 4C

Table 3.
Categories that foster conforming behaviour

teacher talk	T - response, praises/ encourages	- acknowleges correct answer	- 2_1B
	T - response, "	- good compliant behaviour	- 2_2B
	T - response, "	- neatness, careful work	- 2_3B
	T - response, accepts/uses pupil's ideas	- compliments pupil's questions that are extensions of teacher's views/ questions for explanation	- 3_1B
	T - response, "	- answers pupils questions	- 3_2B
	T - asks questions (closed)	- re pupil's attention	- 4_1B
	T - "	- asks about content, geared to affirmative answer/expected response from pupil	- 4_2B
	T - "	- seeking confirmation re statement teacher made	- 4_3B
	T - "	- solicits pupils for answer from pupils in-class experience	- 4_4B
	T - lecturing	- giving facts in lengthy discourse	- 5_2B
	T - "	- giving own views/ideas	- 5_2B
	T - "	- giving own explanations	- 5_3B
	T - "	- giving examples from own experience	- 5_4B
	T - giving directions	- on seating arrangement	- 6_1B
	T - "	- gushy build up introducing activity	- 6_2B
	T - "	- on behaviour/actions complying with teacher's expectations	- 6_3B
	T - "	- mentions information/skills pupils will learn	- 6_4B
	T - "	- without giving opportunity for pupil to take the initiative	- 6_5B
	T - "	- bribes for good work	- 6_6B
	T - "	- warns/reminds re test	- 6_7B
	T - criticising/justifying authority	- threatens punishment for poor attention/work	- 7_1B
	T - "	- bawling someone out	- 7_2B
	T - "	- extreme self-reference	- 7_3B
	T - "	- criticises pupil's ideas	- 7_4B
pupil talk	P - response	- direct response to teacher solicitation	- 8_1B
	P- "	- response limited to teacher's question structure	- 8_2B
	P - "	- confirming teacher statement	- 8_3B
	P - initiation	- asking for directions/clarification	- 9B