

Epistemic Analysis

A TOOL FOR ASCERTAINING EPISTEMIC CHARACTERISTICS OF TEACHER-PUPIL DIALOGUE

CHRISTINE PERROTT

In relatively recent times there has been an increase of interest shown by educators in the area of what has been variously called 'critical thinking', 'good reasoning', 'creative thinking', 'rational thinking', and 'thinking skills'. There is a growing body of literature which indicates this, see for example Ennis (1985); McPeck (1990a); Siegel (1988a); Girle (1991); Mackenzie (1991); Henderson (1990); Norris (1985); Schlecht (1989); Dauer (1989). Independently of this growth of interest, there has been in existence since the 1970s a movement called Philosophy for Children. This emerged in New Jersey, U.S.A., where the Institute for the Advancement of Philosophy for Children was established by Matthew Lipman in 1974. Advocates and practitioners of his program, with its booklets and teacher manuals, can be found also in U.K., Australia, and European countries. In Australia the movement has been taken up by, in particular, Dr. Laurance Splitter who now heads a Centre of Philosophy for Children located at the premises of the Australian Council of Education Research (ACER) in Melbourne.

Both of these 'movements', that is the teaching of thinking, and Philosophy for Children, have

felt the need to evaluate the classroom programs they have implemented. They wish to ascertain the success or otherwise of their efforts. The current evaluation techniques used with the Philosophy for Children program test individual participants on measuring instruments like the New Jersey Test of Reasoning Skills or relevant traditional psychological tests. Where evaluations have been undertaken for 'thinking courses' the same type of methodology is applied, that is a post test, sometimes combined with a pre test, given to individual participants after the 'intervention'. There has been another form of analysis for evaluating Philosophy for Children proposed by O'Loughlin (1991). This involves content analysis of taped discourse in terms of the epistemological position of the individual participants by analysing each participant's talk. One participant, for example, might be shown as relying on anecdotes and would therefore be put in the epistemological category of Subjective. Another might attend to and deal with the arguments of others and would then be categorised as taking the Constructed Knowing epistemological position.

Although these types of evaluation can be useful they cannot show how the participants are interacting in a session or series of sessions. Another shortcoming of post test assessments is

that they do not consider the actual contents pursued in a session or series of sessions. Any found improvements in participants' thinking could very well be the outcome of interventions other than the sessions in question. The analysis of interactive talk as an event can provide such details as the interactive talk behaviour taking place and can take account of the talk contents. These are surely of crucial import in evaluating sessions which purport to utilise and enhance participants' thinking. Through examining spoken discourse which has taken place in a session one has at least a more direct way of assessing the quality of thinking being engaged in than is possible through post session tests of participants. One of the criticisms of Lipman's Philosophy for Children is that "there is simply the unwritten hope that dialogue will be used effectively" (Girle, 1983:142). An appropriate method of analysing dialogue could answer the question of to what extent the dialogue is "effective" in light of certain goals or a particular framework.

I thus became interested in this question of whether it would be possible to analyse the talk in classroom sessions for the nature of the thinking evidenced therein. I was also interested in the related question of whether sessions that are particularly arranged to enhance participants' thinking are different in crucial ways to other classroom sessions. I had been collecting classroom transcripts for some years amongst which were a number of transcripts of sessions based on the Lipman Philosophy for Children program. I also had collected a large number of transcripts of after-school philosophy sessions with children, sessions held in my home city of Armidale, N.S.W., and not directly based on the Lipman program. I decided to use some of these transcripts and attempt the development of an analysis technique which reveals the nature of the thinking in a session.

This paper outlines the development of an analysis technique to answer the first question in particular. This analysis and its refinement has potential for use not only in school classrooms but also in other education arenas such as tertiary level seminars.

DEVELOPING THE ANALYSIS

Prior to my interest in the above two questions, which began in 1990, I had undertaken

analysis of classroom discourse to ascertain the beliefs of teachers about learning and knowledge (Perrott, 1985). I followed this work with the development of guidelines for teachers on how to create constructive learning environments through attending to the way the talk in the classroom evolves and is allowed to evolve (Perrott, 1988). This latter work in particular indicated how relatively small but important differences in the nature of the talk in a classroom can enhance the quality of the talk in which the pupils engage, with a potential concomitant improvement in the quality of pupil thought. Given that this is the key aim of programs like Philosophy for Children, I thought it would be of interest to examine those transcripts in my possession which were from sessions which had the express aim of letting and helping the children think in a particular way, e.g., rationally; with judgement; creatively; about 'deep' questions, etc. I therefore began with comparing regular classroom session transcripts to transcripts I had from sessions in which children were engaged in philosophy (whether of the Lipman variety or not).

I did find some differences of importance as well as of interest, (for details readers are referred to Perrott, 1990). These included the stance of the teacher vis-a-vis the pupils (e.g., teacher not regularly interspersing a comment after each pupil response to indicate correctness or agreement) and the type of the contents addressed. The philosophy sessions, for example, included topics such as what is the difference between instinct and intelligence; how does language relate to meaning.

I was, however, not satisfied by being able to identify differences between the regular classroom sessions and the 'thinking goals' sessions as this still did not reveal the characteristics of the dialogue which might indicate the type of thinking taking place in the session. I wanted to develop a method of analysis which would ascertain directly and specifically the nature, quality, content, and form of the talk, in order to discover the epistemic characteristics of the dialogue.

I knew from my previous work in analysis of classroom dialogue (see above) that the nature of the relationships between participants that are indicated in the talk have epistemological significance. Analysis can show participants' relationship or attitude to knowledge in that knowledge might be seen as an outside 'given' to be ab-

sorbed or transmitted, or on the other hand as constructed by persons, allowed to be queried, not 'true' for all time. Analysis of a classroom dialogue can also show the participants' stance in the session in relation to the known and the unknown. One participant might speak as the 'expert: to the 'inexpert' who accepts the stance. On the other hand, the talk can show if participants are relating to each other as equal enquirers, by either self placement or other placement. It was clear that epistemic analysis of classroom talk would need to examine the interaction in a session for these features because of their relevance to the nature of the thinking taking place therein. I decided to call these dialogue features **the epistemic stance and positioning of the participants** and this became the first analysis focus that I identified as appropriate to an adequate epistemic analysis of classroom talk.

Although important, the positioning of participants does not fully take account of those characteristics of the talk which indicate whether there is opportunity for, encouragement of and occurrence within the talk of such things as being involved in judgement, clarification and in the giving of reasons or evidence, digging out and/or questioning assumptions of self and others, probing and challenging, making speculative and imaginative comment, taking risks and speaking out for oneself, becoming aware of oneself as a thinker, listening and building on the talk of others, developing an opinion or commitment, and being willing to change or correct this opinion in light of talk during the session. There is also the question of whether the talk proceeds towards some form of settlement or resolution, and of whether the group is acting, or developing towards acting, as a "community of inquiry", an important stated goal of the Lipman program. However, all of these above mentioned features are noted as important goals of dialogue in the literature of the Philosophy for Children program because they are seen as features which indicate quality of thinking or the encouragement of same. (see Lipman and Sharp, 1978 :(ix), 129; Lipman, Sharp and Oscanyan, 1980: 7, 26, 105, 108, 112 ; Splitter, 1991: 35)

Not only the advocates of Philosophy for Children have identified features like the above as indicating quality of thought in a dialogue. When speaking of 'critical thinking' Richard Paul speaks of the necessary pedagogy for its occurrence as being one which helps students: to ar-

rive at judgement using their own reasoning; to note claims, evidence, conclusions, questions at issue, assumptions, implications, consequences, concepts, interpretations, points of view, which he calls "the elements of thought". (Paul, 1990:270) Similar features are noted by O'Loughlin (1991) as indicating quality of thought. In her proposed analysis system the epistemological category with the lowest quality of thought includes "paradox unrecognised ... critical dimension absent" whereas the second highest category includes "systematic doubting ... collaborative thinking ... asking good questions" and the top category has "attending to the arguments of others and dealing positively with these". (O'Loughlin, 1991:117-118.) Although the analysis I developed eschews the use of a category system with its problems of establishing "fit" of talk to specified categories, the features identified by O'Loughlin, Paul, and in the Philosophy for Children literature provided starting criteria for the second analytical focus seen as important to an adequate epistemic analysis of classroom dialogue. I termed this focus **the epistemic tenor of the dialogue**. It was expected that this focus would to some degree interplay with the epistemic stance of participants evidenced in a dialogue (the focus noted above) but it was seen as important in its own right.

Neither of the above foci take sufficient account of the epistemic content and character of the utterances that make up a dialogue being examined. The content is particularly relevant for indicating what a dialogue is about (e.g., is it about matters of fact? beliefs? "deep" problems or issues?). Also, the character of an utterance and how it is treated by participants can show whether it is, for example, an assertion, challenge, explanation, reason, withdrawal, inference, judgement, definition, question, etc. I decided to call this analysis focus the **epistemic character and contents of the utterance**.

APPLICATION OF THE FORMULATED EPISTEMIC ANALYSIS

After establishing the three above mentioned foci as the key indicators to look for in a dialogue when undertaking an epistemic analysis I began applying them to relevant transcripts in my possession. I found that it was possible to move through a transcript noting specific features of it

regarding the identified foci. I intend to illustrate the outcomes of this in this paper, and as this is done the criteria for the three foci will become clearer than was possible to explain in the brief descriptions above.

I have chosen to use here two extracts from transcripts taken during the after-school sessions mentioned above. The main reason for choosing these particular samples is that the application of the developed epistemic analysis to them shows contrasts which highlight the usefulness of this technique in revealing the character of thinking taking place during an interactive session. In addition each dialogue used here involves pupils aged 7 to 9 years in small group session with the same teacher and similar contents (and probably similar teaching objectives). In undertaking the epistemic analysis I found it indicated important differences between the two sessions with regard to the three analysis foci of Stance, Tenor, and Contents, differences that served to explain the contrasting "success" of the two sessions. (The talk and thought in one session had, prior to close analysis, appeared to be superior to the other.) This article will illustrate this by concentrating on an extract from each of the dialogues that covers similar content, a section which I have called **The Archimedes Section**.

I will refer to the two different sessions as **Anna et al.** and **Francisco et al.** and will discuss their analysis in that order, referring to the relevant sections of the extract, the transcript of which will be provided first. This analysis commentary will take each transcript in turn under the three headings Epistemic Stance and Positioning; Epistemic Tenor; and Epistemic Character and Contents of Utterances. Each contribution to the talk is numbered, and when I refer to contributions I provide the relevant number in brackets, (1).

The "Anna et al." Archimedes Section
THE TRANSCRIPT

- 1-t. Now I've got a different sort of problem here out of Julius Sumner Miller's book. I don't know if you've heard this one before, but you can think about it anyway.
- 2-p. Yes.
- 3-t. Suppose you wanted to measure half a cup of butter, half a cup of hard solid butter without melting it, how would

- 4-p. you measure half a cup of margarine?
- 5-t. How much there is or how...
Half a cup. Not how heavy, not half a kilo or anything. Half a cup of butter, he wants half a cup of butter. How do you do it?
- 6-p. Mmm.
- 7-p. Squash it?
- 8-p. No. Umm
- 9-p. Cut it in slices?
- 10-p. Yes!
- 11-p. You could take...
- 12-t. I suppose you could do that, but there's a way of doing it that Professor Sumner Miller said that's better than that.
- 13-ps. (No responses.)
- 14-t. Do you give up? (waits)
- 15-p. Yes.
- 16-t. It involves starting off with some water in a cup.
- 17-p. Uhuh.
- 18-t. (waits)
- 19-p. Can I guess?
- 20-t. Yes.
- 21-p. Could you ask us that about the thing you had for those other people? Before?
- 22-t. What was that?
- 23-p. How you had it for my sister last term? I forget that—I've got to think of it, that crocodile one ...
- 24-t. Oh yes. There was one we had in a book. Was that the one in the book we had about what to do when something happens? Is that it? How to do certain things?
- 25-p. Yeah. When a crocodile ...
- 26-t. Yes, but how do you escape from a crocodile?
- 27-p. I know.
- 28-t. Yes?
- 29-p. You go (illustrates with hand) 'cause he's longer than you.
- 30-p. What? What do you do?
- 31-t. You run in zig-zags because it takes time for the crocodile to turn.
- 32-p. How do you get away from 'em?
- 33-t. Yes. If a crocodile's after you how do you get away?
- 34-p. From what?
- 35-p. Yes
- 36-p. 'Cause it takes them a while to run
- 37-t. On land, you're trying to get away.
- 38-p. On land?

- 39-t. Yes.
- 40-p. Oh yeah.
- 41-t. But it's better not to get into that situation at all because crocodiles can go very quickly.
- 42-p. We won't be.
- 43-p. Wouldn't it be the same to go straight?
- 44-p. Of course not!
- 45-t. Why Mark?
- 46-p. Because you'd take about the same time as, as the crocodile.
- 47-p. Yeah well if you were really, really, really slow.
- 48-t. The point is that it's easier for you to turn and zig-zag than it is for the crocodile.
- 49-p. I don't know what everyone's talking about.
- 50-p. Well if you're slow and the crocodile's after you
- 51-ps. (giggles)
- 52-p. You don't go straight.
- 53-t. Well the, what it says, what the professor says about the butter is: fill your measuring cup half full of water, right?
- 54-p. Uhuh.
- 55-t. Then push the solid butter until the water level rises to the top of the cup (waits) right?
- 56-ps. Mmm.
- 57-t. Because you're then filling up the other half of the cup.
- 58-p. I know why the stuff rises. Because um the butter's heavier.
- 59-p. If you push the butter down into the cup
- 60-t. This is a variation of what Archimedes did. Have you ever heard of Archimedes?
- 61-p. Yes.
- 62-t. Tell me about Archimedes.
- 63-p. No, I don't know but
- 64-p. I've heard of him.
- 65-t. Well look, what it depends on is this. Supposing there was a bath quite full of water
- 66-p. Oh yes! We've got a book about that.
- 67-t. Yes?
- 68-p. Oh yes.
- 69-t. He's in his bath
- 70-p. He measures the water and he gets in, and all these animals get in
- 71-p. Oh yeah
- 72-p. And the water always overflows
- 73-p. And he's always the one mopping it up.
- 74-t. That's the story book about it, but there was a real Archimedes who lived in Greece lots and lots and lots of years ago.
- 75-p. Yep.
- 76-t. And he noticed that when he got into the bath, if the bath was full when he got in, it, the bath would overflow. How much water overflowed when he got into the bath?
- 77-p. As much, just as much as he
- 78-p. Just as himself
- 79-p. As much as he weighed.
- 80-t. Is it as much as he weighed?
- 81-p. As much as would fill up himself.
- 82-t. That's right; as much space as he took up. And he was interested in that because he was trying to work out a problem of finding out whether the king's crown was pure gold, without melting it down.
- 83-p. Mmm!
- 84-t. Because if you melt it down it wouldn't be any good any more. When he did this in the bath then he realised that if you have a container of water and you put the crown in, the amount of water that'd come out would be equal to the volume of the crown. And then you could measure the weight of that much gold because different metals have different weights.
- 85-p. Oh.
- 86-p. Oh yes.
- 87-p. That size of gold would have
- 88-t. So, this about the butter is the same thing as about what Archimedes did.
- 89-p. But how could he get the crown?
- 90-p. I can't understand
- 91-t. You didn't understand the question is that it?
- 92-p. No.
- 93-t. What did you say Anna?
- 94-p. How did he get the crown?
- 95-p. How did he get the crown? (sic)
- 96-t. Well they had the crown there and they were all trying to work out how to find out if it was pure gold or not. He had the crown and he wanted to find out what it was made of ...
- 97-p. What if it was something the same weight as gold?
- 98-t. Well as far as I know there isn't anything exactly the same weight as gold.
- 99-p. Gold's very heavy isn't it?

- 100-t. Yes, it's quite heavy. (long pause)
 101-p. They'd have to find out what carat it was
 102-ps. (giggles)
 103-t. That's so. What does it mean when you say so many carats gold?
 104-p. HOW pure it is. Twenty four carat gold is pure.
 105-p. It has all carrots in it! (laughs)
 106-ps. (giggles)
 107-p. No carrots at all it's real?
 108-p. You get carrots and carrots...
 109-t. It's spelt a different way, Kess, it's "c-a-r-a-t" I think, carats of gold and the other is "c"
 110-p. It's spelt differently, but I mean
 111-t. Do you know how to spell the other carrots that grow in the garden?
 112-p. Yes.
 113-t. How do you spell them?
 114-p. Um. "c-a-r"
 115-p. A double "r".
 116-p. "T-e"
 117-p. "r-r-o-t"
 118-t. Yes, Double "r-o-t."

EPISTEMIC STANCE AND POSITIONING OF PARTICIPANTS IN ANNA ET AL.'S ARCHIMEDES SECTION

Epistemic Stance refers to way the participants are either positioning themselves or are positioned by others in relation to what is known and unknown, and to each other as knowledge givers and seekers.

The teacher sets the group a puzzle and takes care to explain clearly what the question means, and doesn't mean (1 & 3). However, before the pupils have made many suggestions the teacher places herself as the holder of the best answer: "there's a way of doing it that Professor Sumner Miller said that's better than that" (10), and the pupils withdraw from further offers. The initial pupil offers, however, are given in an 'is this right' format: "Cut it in slices?" (9), with the pupils positioning themselves as stabbing for the right answer. At contribution (19) one even asks "Can I guess?" as if seeing this as not quite acceptable. There is no evidence of the pupils positioning themselves as problem solvers, yet the teacher does seem to want to have them work it

out themselves, giving clues before providing an answer, and waiting for pupil input (see 12 & 18).

That the pupils place themselves as seekers of "the right answer", the unknowing ones finding out from the knowing one(s) is evidenced in the next section of the dialogue where a pupil requests that the teacher ask a question to which the pupil at least knows the "right answer" (21-51). This is the crocodile problem (joke?) which his sister has told him was mentioned in one of her philosophy sessions. He has decided not to accept the stance of problem solver and introduces a question for which he has the answer.

During this section the teacher becomes positioned as a type of expert, the Explainer: "The point is that it's easier for you to turn and zig-zag than it is for the crocodile" (46).

During the interchange in this segment there is evidence that not all pupils are tuned in (e.g. "How do you get away from them?" (32), meaning crocodiles, just after it has been explained). At the end of the crocodile exchange one pupil says: "I don't know what everyone's talking about" (49). Pupil understanding and 'thinking along' is also lacking when the pupil says at (58): "I know why the stuff rises. Because ...um... the butter's heavier" just after the teacher's explanation of the displacement solution (53, 55 & 57).

The teacher is placed, and places herself, in the stance of instructor or informer despite earlier attempts to encourage the pupils to seek or guess answers for themselves. (These attempts are more evident in the part of the lesson not analysed here, but after the crocodile talk the teacher does ask the children to tell her about Archimedes, but in the end has to do so herself) The time taken with the teacher's explanations increases as she tells them about Archimedes being a Greek (74); about his experience in the bath (76); and why Archimedes was interested in what happened in the bath (86 & 84 & 96). Whilst doing so she tells them that this is the same point as with measuring a cup of solid butter (88) but the pupils are not 'with her' and one asks about how Archimedes got the crown (94). The pupils position themselves as the unknowing ones. In the way they ask questions of the teacher they show that they want to obtain information from the one they consider expert or in possession of the information, rather than puzzle it out for themselves.

Not long after this the teacher falls into a com-

mon classroom instruction role of the checker of knowledge when she asks a pupil "how to spell the other carrots that grow in the garden" (111).

The Epistemic Stance of Anna et al.'s Archimedes Section can be described as largely that of instructor to those wanting to be the instructed, the expert to those who are content to play ignorant, with the 'right answer' forever lurking in the background, whether it be from a Professor, a book, or from the teacher. The stance of the pupils does not approach that of problem solvers, despite the efforts of the teacher who finds herself more and more positioned as the provider of information.

EPISTEMIC TENOR OF THE DISCOURSE IN ANNA ET AL.'S ARCHIMEDES SECTION

Epistemic Tenor involves those characteristics of the talk which indicate the types of involvement by participants, for example, whether there is use of judgement, giving of reasons, or the questioning of the contributions of self and others.

The Epistemic Tenor of the Archimedes Section of Anna et al. is established largely by the fact that the session is one where the pupils either:

1. Avoid engagement with the presented problem:

p. Could you ask us about the thing you had for those other people? (21)

and

p. How did he get the crown? (94)

or

2. Attend to the problem in a cursory manner:

t. ...How do you do it?

p. Mmm.

p. Squash it?

p. No. Umm

p. Cut it in slices?

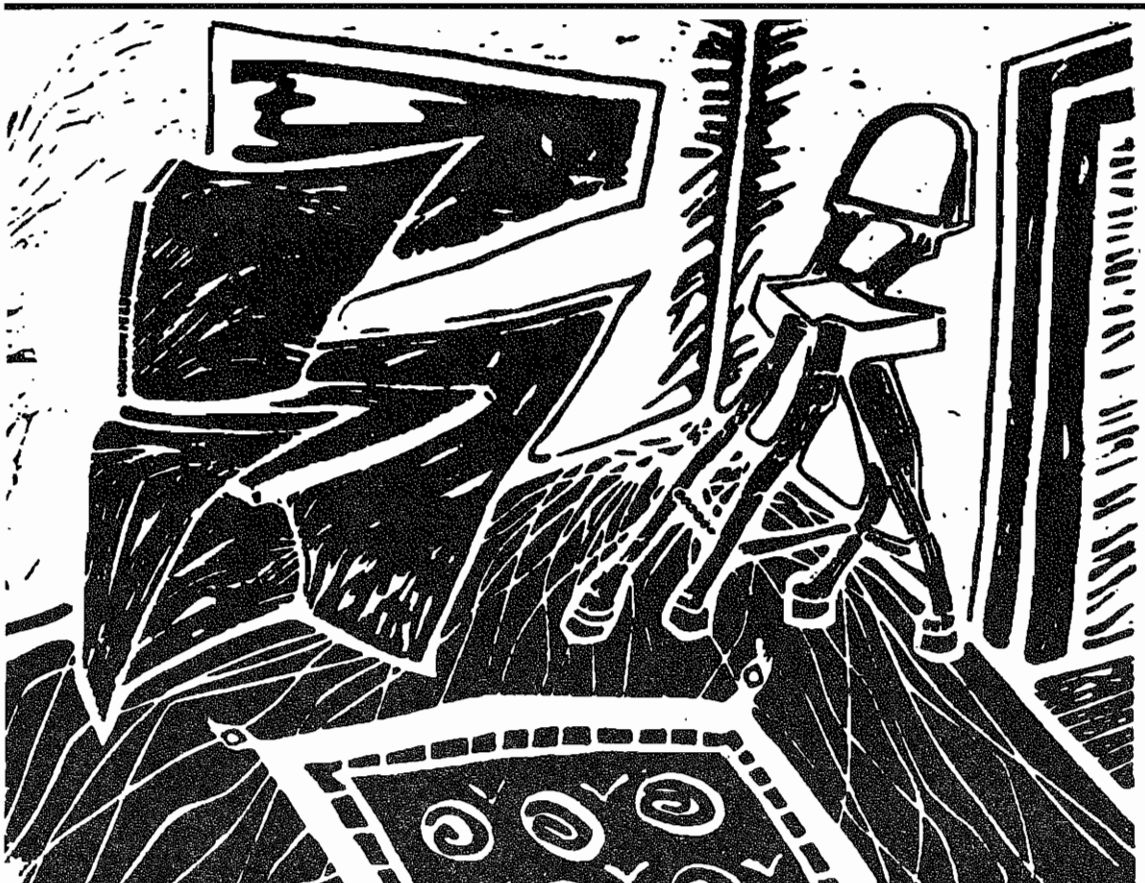
p. Yes! (5-10)

3. Show little interest in or understanding of the solution. At times they do not even seem aware that the answer has been presented:

t. So this about the butter is the same thing as about what Archimedes did.

p. But how could he get the crown?

p. I can't understand. (88-90)



There are, however, times of pupil attentiveness and sensible questioning:

- p. What if it was something the same weight as gold?
- t. Well as far as I know there isn't anything exactly the same weight as gold (97-98).

The general dialogue format of: question from the teacher > response(s) (sometimes) from pupil(s) > "proper" answer from teacher results in relatively little talk engagement of the pupils and very little pupil to pupil interaction. Pupils tend to respond directly to the teacher and ask questions directly of the teacher. They do not hypothesise or speculate together. This might be because of the teacher asking questions in a way which does not invite the hazarding of guesses: t....how would you measure half a cup of margarine? (1). It might also be the outcome of the teacher referring at the start to Millers' book, and thereby setting a scene of the need to find out the authoritative answer.

Yet it appears also to have something to do with the pupils and their covert, and sometimes overt, non-engagement. This pushes the teacher into doing such things as stepping in to give the answer before the pupils can examine each other's input:

- t. Supposing there was a bath full of water
- p. Oh yes! We've got a book about that.
- t. Yes?
- p. Oh yes.
- t. He's in his bath
- p. He measures the water and he gets in, and all these animals get in
- p. Oh yeah.
- p. And the water always overflows.
- p. And he's always the one mopping it up.
- t. That's the story about it, but there was a real Archimedes, etc. (65 to 74)

This has the outcome of relatively low pupil input in both quantity and quality and much explanatory talk from the teacher. The Epistemic Tenor is not one of probing, speculation, evidence giving, etc., but is at the level of straight information provision and acceptance among the participants.

EPISTEMIC CHARACTER AND CONTENTS OF UTTERANCES IN ANNA ET AL.'S ARCHIMEDES SECTION

The Epistemic Character and Contents of Utterances of a dialogue refers to what the talk being examined is about, for example whether it is about matters of fact, and to the character or types of utterances being used, whether for example an utterance is an assertion, a reason, a request for evidence etc.

In Anna et al.'s Archimedes Section the pupil utterances are relatively short, in many cases one or two words, and consist largely of direct responses in answer to teacher questioning or of questions directed at the teacher:

- p. How did he get the crown? (93)
- and
- p. From what? (34)

The contents of the utterances are almost entirely reactive to whatever contents the teacher has introduced. Where this is not the case the contents are unrelated to the topic to hand and involve, for example, requests to look at a different "problem". (Elsewhere in the lesson, i.e., in the non- Archimedes parts, a pupil comments on what time it is, and another at a different stage asks whether there is a heater in the room, both in the middle of current topic discussion.) An exception to the reactive nature of the pupils' input is the pupil-introduced example of the crocodile problem, but even this results in reactive responses.

The contents introduced by the teacher are problems or "puzzles" about what is commonly called 'the physical/natural world' and the one about measuring solid butter without melting it is an example representative of the whole lesson. For the entire session there were no contents concerned with "deep" problems or non-empirical issues.

There are no utterances concerned with asking for or giving reasons for assertions, or with examining assumptions and implications or with providing supporting evidence. (This is in fact true of the whole lesson.) The teacher talks more as the dialogue progresses and her utterances become more explanatory in nature.

The Epistemic Character and Contents of Utterances in Anna et al.'s Archimedes Section evidence little thoughtfulness, lack of engagement with solving problems, and no pupil-pupil chal-

allenges, questioning of assumptions or the asking and providing of reasons.

**The Archimedes Section of "Francisco et al."
THE TRANSCRIPT**

- 1-t. Well I'll give you a different kind of problem now. Supposing you want to measure out half a cup of hard solid butter without melting it? How can you measure half a cup of hard solid butter without melting it?
- 2-p. To make sure it's half a cup? You've got a lump of hard solid butter?
- 3-t. Yes, that's right. It's got to be just half a cup.
- 4-p. Oh I think I know! Um
- 5-p. I know!
- 6-t. Shall we let Peter have a go first?
- 7-p. Please!
- 8-t. If he can't do it we'll try Francisco.
- 9-p. Right. A quick guess. You get some cold water and put the butter into it and see how much the water rises?
- 10-t. What were you going to say Francisco?
- 11-p. Um measure it with a tape measure or something.
- 12-ps. (Giggles)
- 13-p. A tape measure?
- 14-p. Well you could kind of shape it into the cup
- 15-p. It's solid
- 16-p. You could, you could cut it, cut them into little tiny cubes, that's sort of a bit like water, but it's not melted and then you could, it'd just go up.
- 17-p. But that's like wanting a bucket of milk and put the carton in there.
- 18-p. (inaudible)
- 19-p. No you don't 'cause it's solid
- 20-p. I mean how can you melt milk?
- 21-p. I'm saying if it's in the carton.
- 22-p. You just cut the carton up into bits?
- 23-p. No you want to keep the carton.
- 24-p. You say here's your half, here's your
- 25-p. No. Just putting cubes into a cup, you're not going to get the right shape or anything, it's gunna stay.
- 26-p. But then you could measure
- 27-p. No but you could
- 28-p. But then you know how many millilitres in half cup and then the little cubes, you could cut them into centremetre square cubes
- 29-t. Alright you can have a say.
- 30-p. Carve it into the right shape the bowl is and then see how much, and, or, you know
- 31-p. What is it?
- 32-p. You know, a cup
- 33-p. Oh yeah, a cup! Well anyway, cut it up.
- 34-t. You're all right.
- 35-p. And cut it up and everything into the right shape. What do you think?
- 36-p. Weigh it and see, just try and work out how much it would weigh
- 37-p. Why can't you melt it anyway?
- 38-t. Well that's part of the problem.
- 39-p. Why, why
- 40-t. That's the puzzle.
- 41-p. Why can't, why don't they just be a bit lazy and just melt it?
- 42-t. Because the puzzle is to do it without melting it. It wouldn't be a puzzle then.
- 43-p. Say you're in the middle of Antarctica?
- 44-p. Light a fire.
- 45-p. Umm. Is you, you put it in the water and see how much the water rises, the right one?
- 46-t. Yes. You're right — Archimedes principle, yes. I'll read out what it says in the back of the book. Fill your measuring cup half full of water and push the solid butter until the water level rises to the top of the cup. You've got half a cup anyway and then you push the butter in and the water goes right up to the top so you know then that the butter's filled up the half cup.
- 47-p. Uhuh!
- 48-t. Now you mentioned Archimedes a while back. Could you tell us about Archimedes?
- 49-p. Oh! Oh! I know!
- 50-p. He was made famous for that method. He was a Greek myth, he wasn't, uh, he was Greek.
- 51-p. He said "Bingo!" or something.
- 52-t. Let him speak.
- 53-p. He was an ancient Greek and he always devised little ways and plans but some of them didn't work. He was kinda like Leonardo. Some of them didn't work like a mirror on top of a cliff to reflect the sun to destroy burning ships.

- 54-p. He was a Greek philosopher.
 55-t. Yes?
 56-p. And he, oh yeah! One day there was this, the king came up with this crown had some, and he's given this crown to be melted into shape or something? But he's scared that the guy who gave it to him put a little silver in, um, and had cheated him. So Archimedes found out by placing it in the water to see how much it rises.
 57-p. I know. I thought, I thought he did it in the bath and um he yelled out "Bingo" or something, what did he say?
 58-t. Eureka!
 59-p. Eureka!
 60-p. How could he do that? I mean Eureka wasn't even invented till
 61-p. Eureka's a Greek word.
 62-p. He just ran out and said.
 63-p. Oh no! you're right, could've said Eureka.
 64-p. It's Greek.
 65-p. He was in the bath and then he ran outside and he yelled out "Eureka".
 66-t. That was
 67-p. Maybe
 68-p. Because when he saw
 69-p. Oh, that's right, that's right, that's right! That's how he got — he was really stumped for, um checking the crown, so when he had a bath the solution hit him when he saw the water rise up as he went in.
 70-t. What did he realise? When he got in the bath?
 71-p. Um he realised that um, his weight um his mass um, it was taking up the space, so where could the water go?
 72-t. That's right.
 73-p. It had to go upwards.
 74-p. Displacement.
 75-t. Go on Peter. What were you saying about displacement?
 76-p. Well it's just, well it's obvious. If you stick something in, something's got to go!
 77-t. That's right.
 78-p. Unless you're more solid than water.
 79-p. Yes, but um imagine imagine if you had, if nothing was, if no one had told you or anything before, it'd be quite hard to work out. If no
 80-p. Yeah
 81-p. One had told you. It seems quite simple

- but that's why, that's how we know, that's because we know. If they, they didn't know it so it's just, they thought it pretty hard, that
 82-p. It's always the simplest things which um as soon as it's been invented or whatever, everyone says " Oh! Aha! that was simple, that wasn't such a great invention, but if, it's always the simplest things which turn out to be the best. I mean, like it took about 3,000 years for the wheel to be invented.
 83-p. Yeah!
 84-p. Well, longer than that, three
 85-p. But that's quite complicated when you come to think of it. One could be re-used all the time. Um, besides it's re-used and, um, I mean it's, someone long ago discovered that the line of cemetery, and that was
 86-ps. (giggles)
 87-p. Cemetery!
 88-t. Symmetry, the line of symmetry.
 89-p. Yeah
 90-t. Go on Francisco.
 91-p. I've done it.

EPISTEMIC STANCE AND POSITIONING OF PARTICIPANTS IN FRANCISCO ET AL.'S ARCHIMEDES SECTION

Epistemic Stance refers to way the participants' are either positioning themselves or are positioned by others in relation to what is known and unknown, and to each other as knowledge givers and seekers.

Relatively slight differences in this dialogue from **Anna et al.** are apparent. As slight as these differences are on the surface they have the outcome of the participants taking almost opposite Epistemic Stances in the two different sessions, despite the similarity of the teacher's objectives and of the size of the group and its members' ages.

Pupils position themselves as able to: **1) challenge**, e.g., when the pupil challenges with: "It's solid" (15) when a suggestion is made about squashing the butter into a cup; **2) call for evidence for answers**, e.g., "I mean how can you melt milk?" (20); and even **3) challenge each**

other, e.g., "But that's like wanting a bucket of milk and putting the carton in there" (17); and the teacher "Why can't you melt it anyway?" (37); and also 4) **explain a point with reasons and evidence**, e.g., "No. Just putting cubes into a cup, you're not going to get the right shape or anything. It's gunna stay." (24); and 5) **query assumptions**, as does the pupil who suggests that something is not necessarily "obvious" when first thought of (78). There is not the need for the teacher to intervene so much as in *Anna et al.* to "lead" the pupils towards the answer, because they eagerly do so themselves from the beginning of the Section.

A pupil does position the teacher as the "expert", as is so common in *Anna et al.*, when he asks: "Is you, you put in the water and see how much the right one?" (45). The teacher again provides the information from the authority of the book (and Professor Sumner Miller) (45), but almost immediately afterwards places the pupil in the stance of experts by asking them to be the information givers: "Now you mentioned Archimedes a while back. Could you tell us about Archimedes?" (48), and thereafter emerges the story of Archimedes. The teacher intervenes only when asked, as in the case of whether Archimedes used the word "Eureka": "How could he do that? I mean Eureka wasn't even invented till..." (60). (This pupil was probably thinking of the Australian place of the same name where took place a well known [to Australians] historic event.)

Pupils talk with each other more than with or to the teacher. The teacher in this Archimedes Section is positioned as the facilitator and 'keeper of the peace'. The pupils become eager speculators and hypothesisers, interacting with each other. They vary their responses from mere assertions to posing their own problems: "Yes but um imagine, imagine if you had, if nothing was, if no one had told you or anything before, it'd be quite hard to work out." (79)

The pupils are positioned or position themselves as collaborators in seeking answers. They collaborate mostly with each other; the teacher is positioned somewhat to the side as a type of arbitrator. It is clear that they pay attention to the assertions, claims, etc., of others and are prepared to challenge and question as equal participants.

The Epistemic Stance and Positioning of participants in the *Francisco et al.* Archimedes Sec-

tion is as joint seekers and questioners of knowledge, with the teacher seldom in the instructor and expert stance. This contrasts with *Anna et al.*'s Archimedes Section.

EPISTEMIC TENOR OF THE DISCOURSE IN FRANCISCO ET AL.'S ARCHIMEDES SECTION

Epistemic Tenor refers to whether there is expression and talk which indicates such things as a critical dimension, collaboration in seeking answers, attentiveness to the talk of others and relevant contribution to development of a conclusion or agreed position.

The epistemic tenor of this session is speculative and hypothetical with ideas from participants open to questioning from, and questioned by, the group. As soon as they are presented with the puzzle the pupils are cooperative and eager to contribute: "p. Oh I think I know! Um" "p. I know!" (4&5) whilst also being attentive to the responses of others and contributory to them. This latter characteristic is evidenced in the section about putting a carton into a bucket of milk (17-28).

The Epistemic Tenor is developmental towards a shared conclusion with interactive talk building towards it. The conclusions are not merely provided by the teacher as in *Anna et al.* This is especially the case in the discussion about the discovery of new things and ideas. There is also a willingness on the part of participants to shift from their initial positions as they listen to input from others. This happens, for example, when the assertion "it's obvious" (76) results in a discussion at the end of which it is agreed that it is quite clever to come up first with new ideas and inventions which to us today seem simple and "obvious".

The teacher is able to intervene little, and is not required to provide explanations and solutions as in *Anna et al.* The participants do not "go along" with what is put forth to them, but attentively and critically question the input of others.

The Epistemic Tenor of *Francisco et al.* contrasts to that of *Anna et al.* in that the talk is thoughtful, responsive to each other, works towards an agreed position and involves speculation combined with relevant questioning of contributions.

EPISTEMIC CHARACTER AND CONTENTS OF UTTERANCES OF FRANCISCO ET AL.'S ARCHIMEDES SECTION

The Epistemic Character and Contents of the Utterances in a dialogue refers to the nature of topics that make up what the dialogue is about (contents) and to the types of utterances occurring therein, (e.g. challenges; assertions; reasons).

There is a noticeable difference in the Epistemic Character of Utterances in this transcript to those occurring in **Anna et al.** If epistemic quality of talk is seen to rest to some extent on utterance characteristics such as the giving of reasons and the provision of evidence then this transcript demonstrates a qualitative difference to **Anna et al.** There is an example in **Francisco et al.** of a challenge being made and then being pursued in such a way that a new and "deeper" issue is introduced into the conversation:

- p. Yes, but um imagine imagine if you had, if nothing was, if no one had told you or anything before, it'd be quite hard to work it out. If no... (79).

Pupils use phrases which indicate they are engaged in inquiry, and hypothesising, for example: "How could he do that?" (60) and "Maybe..." (67), and also in judgement: "Oh no! You're right, could've said "Eureka" (63). The teacher's utterances are very much shorter than in **Anna et al.**, and the reverse situation occurs here with the pupil's individual contributions becoming longer and longer instead of the teacher's.

The Contents of the Utterances at the start involve a topic on a physical world problem as in **Anna et al.** and pupil contributions are at first reactive to what the teacher introduces. They are of the puzzle variety also. However, quite early in the section the pupils begin reacting to each other and there is a shift in the nature of the contents when we reach the section about whether it is "obvious" to the first people who think of a new idea or invention. The contents develop proactively more than reactively.

The characteristics and contents of the utterances are noticeable different to those found on **Anna et al.** despite the similar starting place with regard to content, and involve types of utterances not represented at all in **Anna et al.**

DISCUSSION

Application of the proposed epistemic analysis with its three foci of Epistemic Stance, Epistemic Tenor, and Nature of Contents of Utterances has in the above example been able to identify epistemic qualities and characteristics in the classroom dialogue taking place in a small section of a particular session.

If the assumption is accepted that talk is one of the most direct ways of ascertaining and thereby assessing the thought processes (or "elements") individuals are using, then it can be claimed that in the case of the two sessions analysed in this paper there is a difference in their epistemic nature. If we assume that the talk, and thus the thought, which involves, for example, making judgements, hypothesising, cooperating with participants in interactive talk towards a shared conclusion, and which has contents that go beyond mere information demonstration is of a better quality, then the Epistemic Analysis illustrated in this paper allows us to say that **Francisco et al.** involves better talk, and thus better thought by participants than does **Anna et al.** In the latter for example, the Epistemic Stance includes that of instructor-teller to the in-expert in the case of teacher *vis-a-vis* the pupils; the Tenor is one of lack of participant engagement in talking together about presented problems, and of forcing the teacher to provide the answer; while the Contents involve only matters of fact. On the other hand, in such talk as hypothesising and, in **Francisco et al.**, the Epistemic Stance includes a relationship between participants as equal enquirers and a stance towards knowledge which indicates that it is possible to question information put forward and that there needs to be provision of evidence for its acceptance; the Tenor is one of excited, collaborative involvement whilst the Contents go beyond matters of fact and include discussion of suggestions that cannot be settled by appeal to "known" matters of fact.

CONCLUSION

In this paper is outlined an analysis technique which looks specifically at the epistemic features of two brief sections from two pupil-teacher dialogues. The paper demonstrates that this analysis technique can show important characteristics of talk which can assist in making judgements

about that talk's epistemic nature and even its epistemic quality.

The importance of this is seen to be the fact that it offers a new approach to evaluating the quality and worthwhileness in the classroom of talk and discussion of a certain type on particular topics. The method of post session assessment and measurement of individuals taking part, or of those who have taken part, in certain dialogues (e.g. philosophy for children session) to ascertain their reasoning or the improvement in their thinking does not address the fundamental, and what I believe to be the primary question of the nature and characteristics of the dialogues *per se*. In particular it cannot show the talk taking place within the session, and to do so offers a direct indication of what is occurring therein. Talk can be a better indicator of thought taking place in a session than can post session assessments of participants.

Attempts to ascertain the nature of the thought through analysis of talk have tended to use category or typology systems by which sections or single utterances of a dialogue are classified according to a predetermined schema in order to determine one or each individual's epistemic position. It is often difficult to get "fit" between what occurs in natural dialogues and a category system, and a picture of the dialogue as a whole is usually lost in the process. I feel that it is this latter information which is not only of more use to practitioners, but is also going to tell us more about the quality of participants' thinking. It can also suggest ways of improving the quality of participants' talk with the aim of improving their thinking because such analyses concentrate directly on what happens in the session and can therefore provide pointers for how a teacher might go about making improvements.

The theoretical and practical implications of such an analysis technique thus have potential in research and for practising teachers. With regard to research it offers a tool for analysis of discourse from the point of view of the nature of its epistemic characteristics and quality. It could also provide insights into the quality of thought demonstrated by individuals either during a particular interaction sequence or over time in a number of such transactions. For the practising teacher there are many ways such an analysis technique could be utilized. Classroom interactions could be analysed in the light of their objectives, in particular in the light of learning process

objectives.

Often what seems like a successful lesson is shown to be less than we wanted when the actual dialogue and its quality is examined on, for example, audio or video tape. With epistemic analysis this could be even more precisely indicated, thereby providing valuable information for the teacher. So much of our assessment and evaluation has had to rely on written and other concrete products of the learners (e.g. test answers; models; drawings). The above outlined form of analysis offers a way to use analysis of the **process** to help in our evaluations and reflections. With so much emphasis these days on the form and quality of pupils' thinking and learning we need a tool like this to assist in establishing just exactly what we are achieving in this area with our pupils.

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Address correspondence to:

Christine Perrott
Dept. of Social, Cultural
and Curriculum Studies
The University of New England
Armidale, 2351 New South Wales
Australia