Probing Children's Understanding Of Science Concepts Via Interviews

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Abstract

Many teachers usually employ paper and pencil tests to assess their pupils' knowledge and understanding of science concepts. However, if the test questions are mostly of the recall type, then the assessment becomes very limited and may not be able to determine "true" understanding. One powerful method that can be used by teachers is the interview. This paper will discuss how interviews should be conducted with children, the kinds of data that can be acquired from the interviews, and how to analyse and interpret them. If properly executed, interviews can be a very powerful method to determine not only the children's alternative conceptions but to assess whether learning has actually been meaningful. Implications for teaching will also be discussed.

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Introduction

The constructivist approach to learning perceives students as learners who are responsible for their own learning by constructing meanings based on their own prior knowledge. Learning is thus an active process. However, "active" in this sense refers to the mental rather than the physical domain. This is because a child who is physically active conducting experiments and science activities does not necessarily mean that learning has occurred. How do we know then whether a child has learned anything since we cannot see what is in his/her mind? A teacher will not know whether a child has learned what is taught unless he/she evaluates the learning outcomes.

Many teachers evaluate learning outcomes by administering tests. These tests are usually in the form of paper and pencil and may include multiple-choice, true-false, fill in the blanks, and open-ended questions. If these tests include many recall type of questions, a teacher cannot say for sure that the students have understood the lessons well even if they managed to obtain high scores in the tests.

One method that could seriously be considered by teachers to probe students' understanding about science concepts is by interviewing the students. White and Gunstone (1992) proposed the "Interviews about Concepts" method, which is a conversation between two or more people, whereby the interviewer tries to elicit as much information or knowledge that a person has about any concept, and for that information to be analysed to yield measures or impressions of the person's understanding.

White and Gunstone (1992) used this method with university students to test their understanding of electricity and eucalypts. I have used this method with nine and ten-year-old pupils in Sheffield, U.K. and Malaysia to test the children's understanding of light (Abdullah, 1998). I have also used this method with course participants at RECSAM on various science concepts. The course participants include primary and secondary science teachers, and teacher educators from the 10 ASEAN countries. The course participants have also tried this method with school children in Penang.

Understanding a Concept

When a person understands a concept, it means that he/she has some knowledge or information about it in his/her memory (White and Gunstone, 1992). To know how that knowledge or information is stored in the memory, it is important to identify the types of elements in the memory or cognitive structure. Gagne and White (1978, p.188) define memory structure as "the contents of memory that result from learning, and the organizations that these contents are postulated to have". White (1985, p.51) defines cognitive structure as "the knowledge someone possesses and the manner in which it is arranged".

Gagne and White (1978) identified four elements in the memory structure, namely propositions, images, episodes and intellectual skills. White and Gunstone (1992) added three more elements, namely, strings, motor skills and cognitive strategies. According to White (1979, 1988), the information that people have is actually verbal knowledge that consists of facts and beliefs which are stored as ***propositions***. Information is stored in long-term memory in the form of interconnected propositions (Gagne and White, 1978).

Images are "mental pictures" but they are not only limited to visual imagery although it is the most pervasive kind (Gagne and White, 1978). ***Episodes*** represent events directly experienced by the learner and can be specifically recalled by the learner (Gagne and White, 1978). It can also be a recollection of events that one experiences either directly as the chief actor or as a passive observer (White, 1979). ***Intellectual skills*** refer to the learned memory structures that underlie the identification of concepts and the application of rules (Gagne and White, 1978). The difference between propositions and intellectual skills is that the former are single facts whilst the latter are rules that direct behaviour so that people can perform classes of tasks (White, 1985).

Strings are fixed in form, such as the recitation of a scientific law or the multiplication tables, proverbs, mnemonics and poems (White and Gunstone, 1992). Propositions differ from strings in that the former can be paraphrased (White, 1988). ***Motor skills*** are the ability to perform physical tasks. ***Cognitive strategies*** are broad skills used in thinking and learning for example, focusing on a task, deducing and inducing and reflecting (White and Gunstone, 1992).

White and Gunstone (1992) define a person's understanding of a concept as the set of propositions, strings, images, episodes, and intellectual and motor skills that the person associates with that concept. When the set becomes richer with more elements and there is a greater degree of interlinking between elements, understanding becomes greater. However, it is not easy to specify which particular element is more essential to understanding. Does a person with more propositions understand a particular concept better than one who has more episodes? To be able to do that, we need to look at the dimensions of the memory structures; and White (1985) has proposed nine dimensions, namely, extent of knowledge, precision, internal consistency, accord with reality or generally accepted truth, variety of types of element, variety of topics, shape, ratio of internal to external associations, and availability of knowledge.

White and Gunstone (1992) used interviews to measure their respondents' understanding of concepts and scored them on eight dimensions, namely extent of knowledge, accord with authority, precision, internal consistency, variety of types of elements, externality, shape and availability. I used White and Gunstone's model of understanding as a starting point in my interviews with primary school children and focused on three dimensions only, namely, extent of knowledge, precision or accuracy, and internal consistency. The precision or accuracy dimension is a combination of the accord with authority and precision dimensions made in White and Gunstone's model of understanding. I found that these three dimensions were sufficient to inform about the children's understanding and whether their learning was scientifically meaningful (Abdullah, 1998).

A pupil with a lot of propositions, images and episodes would have a greater **extent of knowledge** than one who has lesser of these elements. However, a pupil with a greater extent of knowledge does not necessarily mean that his/her knowledge is **accurate** or **precise**. An accurate statement is one that is in accord with the relevant authority, that is, the science curriculum knowledge for a particular age level. A precise statement is one that is not vague and can be understood clearly by another person. When a pupil makes a lot of contradicting statements, it shows a lack in **internal consistency** and means that he/she is not able to reflect on and integrate his/her knowledge.

Conducting the "Interviews about Concepts" Method

The interviews could be conducted before the teacher introduces a particular topic (pre-interview) and after completing the lessons on the topic (post-interview). One reason for conducting pre-interviews is to find out whether the pupils have any alternative conceptions about the concepts; and the post-interviews to find out whether they still retained their alternative conceptions after the lessons. When properly conducted, interviews can reveal a lot of information about the pupils' understanding or lack of understanding of the science concepts.

It is not possible for a teacher to conduct interviews with all the pupils. Pupils could be selected randomly or by purposive sampling. In purposive sampling, the teacher could select three pupils from one class that is, the above-average, average and below-average children according to their science achievement tests. Taking the Malaysian classroom scenario, in order to not disrupt the science lessons, it would be proper to conduct the interviews out of the school hours and volunteers are needed (and maybe parental permission) since the pupils have to come earlier or stay back after school hours for the interview sessions.

When conducting the interviews, an audio recorder to record the conversation is an important requirement so as not to lose any information. Interviewing is an art and there are rules to be followed, but following rules alone does not guarantee that a person can become a good interviewer. Good interviewing skills can be acquired through practice and it takes a lot of practice to get it right, that is, to be able to ask relevant questions and follow-up questions as the pupils respond. For effective interviewing, some pointers that need to be considered by the interviewer are listed below.

i) Interviewers must be thoroughly familiar with the topic to be able to respond with appropriate follow-up questions to the pupils' responses (Novak and Gowin, 1984).

ii) Do not treat the interviews as "Socratic teaching", that is, asking questions that will steer pupils towards new understanding (Novak and Gowin, 1984). For example, when a pupil gives a wrong answer, there is a tendency for the teacher to ask him/her questions that leads to the answer. The teacher should instead rephrase the question but care should be taken so that the teacher does not give an "answer" in the process of rewording it (Hopkins, 1985).

iii) Effective interviewing depends on effective probing (Goetz and Le Compte, 1984). Probe the pupils instead of giving those prompts that will help them get the answer.

iv) An interviewer should appropriately wait up to 10 or 15 seconds for a response from the pupil. However, the "wait-time" should not be as long as a minute or two because a pupil would freeze up if stared at for too long. If you do not get a response after about 10 seconds, it could mean that the pupil have not understood your question or may not know the answer. The interviewer can then rephrase the question or move on to a new topic (Novak and Gowin, 1984).

v) Instead of keeping quiet, a pupil may give an "I don't know" or "I forgot" answer. The interviewer should try to rephrase the question or ask the pupils to think back on any activity that he/she had carried out in the class related to the question (Abdullah, 1998).

vi) The interviewer needs to find a suitable room which is quiet and without any distractions to conduct the interviews.

vii) The interviewer should refrain from dominating the discussions with the pupil and from expressing their opinions.

viii) The interview atmosphere should be relaxed and do not try to hurry the interviewees. The pupils should be allowed to talk as much as they want to about the concept and the interviewer should only end the session when the pupils have nothing else to add. The length of an interview depends partly on the age of the child and partly on the purpose of the interview, but generally does not last more than fifteen to thirty minutes (Novak and Gowin, 1984). My pre-interviews with 9 to 10 year old pupils lasted between ten and fifteen minutes and the post-interviews between fifteen and twenty-five minutes (Abdullah, 1998).

In the "Interviews about Concepts' method, the interviewer can ask three main questions to elicit three types of knowledge, namely, propositions, images and episodes. For instance, if the concept is "light", the interviewer can ask these three main questions below:

i) What can you tell me about light?
ii) What comes to your mind when I mention the word "light" (or any other concept related to light such as reflection)?
ii) What experiences have you had with light (or any other concept related to light such as shadows)?

The three questions do not have to be asked in the order as above but anytime during the interview depending on the pupils' responses. It would be a good idea for the interviewer to make verbatim transcripts of the interviews and then reword them into statement sets immediately lest they be forgotten. The statement sets are to be written according to the three types of knowledge elicited during the interview and only information that could tell something about the pupils' scientific ideas need be included in the statement sets. If a pupil states a fact, idea, belief or opinion about the concept, that will be categorized as a proposition. A statement with many examples should be considered as more than one proposition. For example, if a pupil states that the sun, fire and stars are sources of light, it should be reworded as three propositions and not one.

A statement is considered as an image when a pupil states whatever image he/she visualizes in his/her mind in response to a word given by the interviewer. However, images do not have to be limited to visual imagery only but can also include the other four senses. A statement is considered as an episode when a pupil is asked to state any experience he/she has related to the concept. This could include experiments and activities they had carried out in school.

Analysing the Interviews

The reworded statement sets can be analysed by scoring them on three dimensions of understanding mentioned above. A pupil's **extent of knowledge** is obtained by counting the number of propositions, images and episodes in his/her reworded statement sets. A high extent score indicates a greater breadth of knowledge as compared to a low extent score. The score is subjective in the sense that there are no minimum or maximum marks. It depends on how much the pupils are willing to tell the interviewer. Since the score does not take into account whether the statements given are right or wrong, a higher extent score is therefore not sufficient to guarantee better understanding.

Further descriptors of understanding have to be considered and this brings us to the second dimension, namely, the accuracy or precision of the propositions. The **precision score** can be calculated by the number of accurate and precise propositions divided by the total number of propositions multiplied by a hundred. The third dimension is the consistency of the statements made. When contradictory statements are expressed, they indicate a failure to reflect on and integrate knowledge. For example, a pupil may say that photosynthesis only occurs during the day and that respiration occurs at night and in another instance he/she says that plants respire at all times. The statements made about respiration could be marked as two contradictory statements. The **internal consistency** is calculated as an index equal to (1 – number of contradicting propositions/ total number of propositions) x 100. If a pupil does not have any contradicting statement, his/her internal consistency index is 100.

In calculating both the precision and internal consistency index, only the propositions have been included whilst images and episodes are excluded. The reason for this is that it is not possible to verify these statements because the pupils themselves are the ones having the images and the experience. For example, a pupil can state correctly the seven colours of the rainbow and that would be categorized as propositions and marked as accurate. In another instance, the same pupil could say that he/she has seen the rainbow and mentioned pink as one of the seven colours. It is difficult to dispute what a child has observed and only fair to give him/her the credit. This is the main reason why images and episodes are excluded from the calculation of the precision score and internal consistency index (Abdullah, 1998).

An example of how an interview has been analysed is given below. The interview was conducted with a 9 year old girl, whom we shall call Mary, in a school in Sheffield. Two interviews were actually conducted with Mary, that is, the pre-interview at the start of the lesson and the post-interview two months later. This girl was considered as below-average by her teacher and it was really difficult to get her to talk during the pre-interview. However, during the post-interview, when she had known the interviewer for quite some time, she was no longer inhibited.
(I = interviewer, M = Mary)

I: OK Mary, I want to find out what you know about certain things. The topic we will discuss today is light. What comes to your mind when I mention the word light?

M: The sun, traffic lights.

I: Anything else?

M: Bus lights.

I: OK, have you heard of the word energy, Mary?

M: (Nods)

I: Do you think light is a form of energy?

M: Yes.

I: Do you think we can change the light energy to another form of energy?

M: Yes.

I: How?

M: We need light switches.

I: Why do we need them?

M: When we switch on the light, light comes.

I: What makes the light come out?

M: Electricity.

I: Very clever. OK do you think light travels?

M: Light travels in a straight line.

I: How do you know that?

M: Mrs J told us.

I: Have you seen light travel in a straight line before?

M: No.

I: Can you see light travel?

M. No.

I: No?

M: Cos we can see all wobbly lines.

I: All wobbly lines? If you shine a torch, does the light go in a straight line or does it go wobbly?

M: Straight line.

I: OK can you tell me how we are able to see?

M: Err...

I: Why are we able to see things? What does the light do?

M: Help us find things.

I: Help you find things. Does the light enter your eyes so that you are able to see things or is there light already in your eyes?

M: Light in your eyes.

I: There's light in your eyes?

M: Yes.

I: Does the light go out of your eyes?

M: Never.

I: Why?

M: Cos it's not dark.

I: It's not dark? OK now it's bright in this room. How are you able to see this microphone?

M: The light comes from the window.

I: How does the light reach your eyes?

M: It doesn't.

I: How are you able to see then? Can you see the table?

M: Yes.

I: OK does the light hit the table?

M: It hits the table and forms a shadow.

I: Can you tell me why we see different coloured things?

M: Because the light goes on it.

I: Have you seen a rainbow before?

M: Lots.

I: What are the rainbow colours?

M: Red and yellow and pink and green and orange, purple and blue.

I: How do you think the rainbow forms?

M: By the rain and the sun.

I: What does the sun do?

M: It makes plants grow when it rains.

I: What does the sun do to make rainbows?

M: It shines on the sky.

I: Has it got anything to do with the rain?

M: No.

I: No? When do you usually get rainbows?

M: Only when it's hot.

I: When it's hot? Don't you need the rain to make rainbows?

M: No.

I: Oh you don't need the rain, it's just the sun, right?

M: The sun.

I: OK anything else you want to talk on light?

M: No.

I: Any experiences you had with light?

M: No.

I: OK Mary, thank you very much.

The reworded statement sets from the above transcripts are given below:

<u>Propositions</u>

1. Light is a form of energy.
2. Light can be changed to another form of energy.
3. You can change light to another form of energy with the light switches.
4. The lights in the room come from electricity.
5. Light travels in a straight line.
6. We cannot see light travel.
7. We cannot see light travel straight because we see all wobbly lines.
8. If you shine a torch, the light goes straight.
9. Light helps us find things.
10. There is light in our eyes.
11. We can see because of the light in our eyes.
12. The light does not go out of your eyes because it is not dark.
13. The light from the windows does not reach your eyes.
14. The light hits the table and forms a shadow.
15. We see different coloured things because the light goes on it.
16. The rainbow colours are red, yellow, pink, green, orange, purple and blue.
17. The rainbow is formed by the rain and sun.
18. The sun makes plants grow when it rains.
19. The sun shines on the sky and forms the rainbow.
20. The rain has nothing to do with the formation of rainbows.
21. You get rainbows only when it is hot.

Images

22. I think of the sun when I think of light.

23. I think of the traffic lights when I think of light.

24. I think of the bus lights when I think of light.

Mary has 21 propositions and 3 images but no episodes. This gives her an extent score of 24. Statements 3, 7, 10, 11, 12, 13, 15, 16, 19, 20, and 21 are either inaccurate or not precise which gives her a precision score of 10/21 x 100 = 48%. Statements 7 and 8 contradict each other because she says that we see light travelling in 'wobbly' lines but when you shine a torch, light travels straight. Statements 17 and 20 also contradict each other. At first she said that rainbows are formed by rain and sun but later she contradicted herself by saying that rain does not play a part. This gives her an internal consistency index of (1 - 4/21) x 100 = 81%.

Statement 3 is marked as inaccurate because Mary thinks that light can be changed to a different form of energy using the light switches. She does not really believe that light travels in straight lines because she "sees them as wobbly lines", but since her teacher tells her so, she will say that light travels straight because that is what she thinks you want to hear. Mary also believes that there is light in our eyes and light from outside does not reach our eyes to enable us to see. Statement 15 is marked wrong because she could not explain how we are able to see coloured objects. Mary could only give five rainbow colours correctly, therefore statement 16 has to be marked as incorrect (Abdullah, 1998).

For the post-interview, Mary managed to increase all her scores, that is, 59 for extent, 61% for precision and 91% for consistency. However, since her precision score is still comparatively low, her understanding of light could be said to be still relatively poor. She still maintained a number of alternative conceptions even after going through the lessons and the activities. There was no apparent cognitive restructuring on her part. For instance, she still maintained her belief that light does not travel straight although she would tell you otherwise because that was she thought you wanted to hear. When she was asked why she thought light travelled straight, she said her teacher told her so. However, when asked whether she had seen light travelling straight, she said that she had seen it "up in the sky, it goes around, it goes round that tree, round like a rainbow".

Interpreting the Scores

White and Gunstone (1992) state that concept understanding is not dichotomous but a continuum. It means that there is no such thing as understanding a concept or not understanding it. Everyone understands to some degree a concept they know of, and the understanding can stretch from a little to a lot. From the extent of knowledge, precision and internal consistency index scores, how does a teacher know whether the child has fully understood the concepts? Would a score of 100% for both precision and consistency be taken to indicate, in an operational sense, a "full" understanding of the concepts that was declared?

If a pupil scored 80% and above in a science achievement test, it would certainly be graded as an "A" and the pupil would be considered to have understood the lessons well. However, in interviews, a score of 80% for precision means that the pupil still has some inaccurate and imprecise concepts. Therefore, that pupil has yet to reach the status of "full" understanding. A 100% score for both precision and consistency is therefore needed before we can say that a pupil has fully understood the concepts. This may initially appear unrealistic and unfair, but since the scores are calculated from statements the pupils themselves made freely, and not from some tests with limited questions, whatever the pupils say should be scientifically correct and non-contradictory to be judged as scientifically meaningful. However, it does not mean that her/his understanding is as fully developed as a scientist's level of understanding. We need to consider his/her extent score too.

If a pupil obtains a relatively low extent score, for example 20 but has precision and consistency scores of 100%, how should we regard her/his knowledge and understanding? Such a pupil would need to extend their breadth of knowledge further before we can say that her/his knowledge and understanding is exceptional, especially if her/his peers also obtained precision and consistency scores of 100% with much higher extent scores. A pupil can also score 100% for consistency but if the precision score is low, it implies that most of the statements made are inaccurate and the pupil is consistently wrong about them.

If we are to compare pre- and post interview scores, an increase in all three scores would indicate an increase in knowledge and understanding; and the higher the scores, the better the understanding. However, the pupils' extent scores may decrease for the post-interviews, which does not mean that they have lesser knowledge after the lessons? It could be that they may not have wanted to repeat the same experiences or facts twice to the interviewer and therefore had less propositions and episodic statements, as shown in my interviews with Malaysian children (Abdullah, 1998). Malaysian children too tend to remain quiet and would not give an answer they are not sure of unlike British children who would not hesitate to give you an answer even if it is wrong.

An increase in extent score with a decrease in precision score indicates that the pupils may have retained their preconceptions or formed misconceptions after being taught the topic. They are also unable to explain the 'hows' and 'whys' of phenomena. They may be able to state whatever new terms the teacher has introduced but they cannot adequately explain them. A decrease in both precision and consistency scores suggests, as Piaget termed it, disequilibration. From a constructivist's viewpoint, students learn by interpreting new information in ways which make sense to them in terms of their existing knowledge. If the students are to accept the teacher's interpretation of the phenomena, they may have to change their minds, which may require restructuring of their existing conceptions and the children may not have accommodated the new experiences to their knowledge systems as yet during the post-interviews. Another explanation for this could be that the pupils may have learned their new facts by rote and could recall words or phrases used by the teacher without understanding their meanings or the principles behind them (Abdullah, 1998)

Implications for Teaching

Teachers' perceptions of their pupils' capability in science are usually based on the pupils' results in the achievement tests. However, if teachers conduct interviews, they may discover that there are vast differences in the pupils' knowledge and understanding even though they have been grouped in the same category. For example, in my interview with Year 5 pupils (10 years old) in two schools in Selangor, (Abdullah, 1998) the pupils whom the teachers had categorized as above-average had shown vast differences in their understanding. Of the five pupils who were perceived as above-average by their teachers, only one showed full understanding of the topic with increases in all three scores and 100% for both precision and consistency; three had yet to understand the concepts fully; and one showed confusion and disequilibration. There was also a pupil whose teacher had categorized him as below-average but it turned out that his scores were comparably better than other pupils who were perceived as average by the teacher.

Even though the findings from the interviews above are not conclusive due to the limited number of samples, it does give us an insight of how teachers' perceptions of their pupils' capability in science based only on their academic achievements will not be able to help them plan their lessons for effective learning. Teachers need to be aware of individual differences between their children. Postlethwaite (1993) suggests five broad categories of differences between children, namely educational differences, psychological differences, physical differences, social differences, and socio-economic & cultural differences. The first two have a direct bearing on pupils' learning and highly relevant to the teacher's tasks, and will be described here.

Educational differences are described as differences in what the pupils already know and understand and able to do in the face of new learning experiences. If we look at the constructivist's view of learning, then differences in existing knowledge, understanding and skill must affect how effectively pupils learn new materials. Psychological differences include quantitative differences amongst pupils in their general cognitive characteristics such as intelligence, specific intelligence such as visual-spatial or mathematical abilities, personality, motivation and attitudes, Piagetian stage of development, preferred learning styles as well as other psychological characteristics. Teachers can therefore group the pupils in their science classes based on their educational or psychological differences and plan their lessons accordingly.

Teachers can also use the interview scores to group pupils according to their category of understanding or scientific capability instead of grouping them randomly, as is usually done. Pupils with increased scores in all three dimensions in the post-interviews may have different levels of understanding. A pupil with a high extent and 100% scores for both precision and consistency can be grouped with pupils with lower scores to enable the skilled ones to help their less capable peers. In reviewing Vygotsky's works on social constructivism, Bruner (1985, p.25) is convinced that "social transaction is the fundamental vehicle of education" and learning involves "entry into a culture via induction by more skilled members". The skilled members could refer to the teacher or more capable peers. A more capable peer can form a "scaffolding" for a weaker pupil and guide him/her until the latter can internalize the process himself/herself (Edwards and Mercer, 1987). This has to be made clear to the pupils involved. The teacher can help by giving the weaker ones in the group a wider range of learning experiences and the more capable ones could benefit if they are given more reference materials to widen their knowledge. More investigative work and other enrichment activities could be given to these better pupils too.

Teachers should also take heed of another category of pupils, that is, the confused and disequilibrated ones. These are the pupils whose extent scores have increased but their precision and consistency scores have decreased in the post-interview. These pupils seemed to show that the more they learned, they more confused they became. They were able to extent their knowledge and used terms and phrases used by the teacher through successful rote learning. However, when probed further, they were not very sure of the meanings of the terms and phrases they used and in what context those terms are to be used. They might not have been able to process the statements given by their teacher or link them to their prior knowledge to be able to give meaning to it. In cases like this, teachers need to find out these pupils' prior knowledge so that they can identify their alternative conceptions, if any, and address them at once. Discussions with these pupils should include the "hows" and "whys" of phenomena too.

Teachers too need to vary their assessment techniques to differentiate between, on the one hand, pupils who can answer test questions because they had learned by rote and, on the other hand, pupils whose science learning has been meaningful, with the result that their understanding is deeper.

Summary

The use of the one-to-one or clinical interviews has made it possible to assess the pupil's knowledge and the degree of their understanding, as well as to determine whether their learning has been meaningful or largely by rote. Even though the method can reveal a lot of information on children's learning, teachers may be reluctant to employ this method due to time constraint. The emphasis on examination results in many schools too has turned the process of teaching and learning into drill and practice.

However, if teachers are interested to find out whether their pupils have learned the science concepts meaningfully, then they should try this method. A teacher can start by practicing the three questions to elicit propositions, images and episodes with the class. Once the teacher has developed the skills of probing for information from the pupils, he/she can ask the pupils to volunteer for an interview session. If a teacher finds that it is difficult to do the interviews himself/herself, he/she can team up with other science teachers to use the method as an action research project.

Interviewing is not a difficult skill to acquire and its' benefits can far exceed its setbacks.

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Open Session : Paper 1

Title	:	**Probing Children's Understanding of Science Concepts via Interviews**
Presenter	:	Dr. Azian T.S. Abdullah, SEAMEO-RECAM
Date & Time	:	13 August 2003 (Wednesday), 2.00 pm –2.45 pm

1. Content of the Paper

1.1 Learning is an active process because students are responsible for their own learning, constructing meaning based on their own prior knowledge. A child is directly involved in the learning process, actively participating during experiments and science activities but this does not necessarily mean that learning has taken place. Evaluation is thus necessary to obtain information on what the child has learned.

1.2 Teachers usually evaluate learning outcomes by administering tests usually in the form of paper and pencil tests. Another method that can be considered by teachers is through interviewing the students to probe understanding of the science concepts.

1.3 Interviews can be conducted before a particular topic is introduced and after completing the lessons on the topic. Conducting pre-interviews is to find out whether the pupils have any alternative conceptions about the concepts and the post-interviews to find out whether they still retained their alternative conceptions about the lesson.