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An inquiry into "expert" chemistry teaching at the pre-university level
in Singapore schools

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**An Inquiry into "Expert" Chemistry Teaching at the
Pre-University Level in Singapore Schools**

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Introduction

All experienced teachers can teach. But the difference lies in their instructional effectiveness. The expert teachers produce superior teaching; a form of teaching which extends beyond mere application of techniques of effective teaching. What are the decisions and plans made by these teachers that produce this superior teaching? How do they go about their decision making and planning? How do they assess the situations in the classroom? What are the characteristics of these expert teachers? These are important research questions.

A working "model" of an expert teacher can be derived from research done on expert teachers (Berliner, 1986; Brandt, 1986; cf. Penick, Yager and Bonnstetter, 1986). It has been established that the best practitioners have strong content, pedagogic and curricular knowledge (Shulman, 1986). They act upon insight derived from the "wisdom of practice" (Shulman, 1987). They use efficient routines to allow for effective instruction and classroom management (Leinhart, Weidman and Hammond, 1987).

Based on this "model", an inquiry into "expert" chemistry teaching at the pre-university level in Singapore schools was made. Chemistry teaching was chosen for the study because, firstly, it is within the teaching experience and content specialization of the researchers. Secondly, local research into

expert teaching is relatively new (cf. Chen, Ng and Yeo, 1989). Also, there are relatively few studies done on the more specific area of chemistry expert teaching at pre-university level. Some notable research has been done in Australia (eg. Garnett and Tobin, 1988) which supports the findings outlined in the prior paragraph.

This exploratory study investigated four experienced and effective teachers in chemistry at pre-university level. Its objective was to inquire into the characteristics of "expert" chemistry teaching in the light of the working "model" outlined. A combination of clinical and naturalistic inquiry methods was used to collect the necessary data for this study.

Method

Selection of Teachers

The researchers elicited the help of a selector who, until recently was a Specialist Inspector (Science) from the Ministry of Education, in the identification of four pre-university chemistry teachers for the study. The selector was asked to recommend those teachers which satisfy the following criteria. They must be experienced teachers who have been known for their good teaching record and for producing consistently good results. They must be knowledgeable in chemistry and have good attitudes towards the teaching profession.

Of the four chosen, the selector had taught in the same school with two of them and hence had first hand knowledge of the kind of teachers they were. As for the other two whom she selected, her knowledge of their work came from mutual professional acquaintances.

Method of Study

Each of the four teachers was observed in a clinical teaching laboratory situation and a routine classroom teaching session.

For the clinical teaching session, they were asked to teach an introductory lesson in organic chemistry. The topic was taken from the General Certificate of Education "Advanced" level chemistry syllabus (University of Cambridge Local Examinations Syndicate, 1990). It read as follows :

The shapes of ethane, ethene and benzene molecules explained in terms of hybrid orbitals.

The teachers were given 45 minutes to prepare a lesson (lecture and/or tutorial) for a group of 4 - 5 students who were unknown to them. They were provided with stationery, transparencies, vanguard sheets, the relevant textbooks and models for them to use if they so desired. They were told that completing the topic in the stipulated time was not the top priority but to ensure that the students attained, at least a level of understanding required by the syllabus.

The clinical teaching session was video-taped. Structured interviews were conducted with them immediately after the session. A week later, they were asked to view the video tape of

their teaching. After which, structured interviews were again conducted with them. The purpose of these interviews was to inquire into their knowledge base, classroom behaviour and decision making skills.

For the classroom teaching session, the researchers went down to the teachers' respective junior colleges to observe a routine lesson given by them. These sessions were audio-taped. Similarly, structured interviews were conducted after the session.

In order to ensure greater credibility of the data collected, the technique of triangulation (Lincoln and Guba, 1985) was adopted. Therefore, structured interviews were also conducted with the following people:

1. two of their colleagues (peers),
2. an immediate superior (head of department/principal),
3. four to five students in the clinical teaching session and
4. four students in the routine classroom teaching session.

For the four students in the classroom teaching session, the respective teachers were asked to submit a list of names of the students in the class beforehand. They were told to divide them into three groups: academically good, average and weak students. The researchers randomly selected one student each from the academically good and weak categories and two students from the academically average category. All interviews conducted for this study were audio-taped.

RESULTS

Limitations of the study

This study is an exploratory one and suffers from several limitations. They are :

1. Small sample size of only four teachers in a population of about one hundred pre-university chemistry teachers.
2. Low frequency of sampling as only one clinical teaching session and one classroom teaching session were observed. Thus, allowance should be made for the Hawthorne effect of the teachers' and students' responses during the lessons.
3. Selection of teachers was restricted by the extent of contact, knowledge and experience of the selector. The best practitioners may not have been selected.

These limitations arose because the researchers wanted to minimize disruptions to normal classroom teaching. Another reason stemmed from the time-consuming nature of the research. Hence caution should be exercised in the interpretation of the findings and in the generalization to other populations and settings.

Data collected

On analysis of the data collected, only one teacher, Mrs TS Wong (a pseudonym) appeared to approximate to the model of an "expert" teacher. She was found to be strong in content and pedagogic knowledge, was people-oriented, a good communicator and organiser. She also displayed good decision making and was dedicated to the subject and students. As for the other three teachers identified, although they were effective teachers, there were inconsistencies in the area of pedagogic skills as compared

with those of the "expert" teacher. Hence, for the scope of this paper, the researchers will only attempt to discuss in detail the findings pertaining to Mrs TS Wong. The remainder of this section will be discussed under the following subheadings :

Background information

Planning (what, how and why was the lesson planned as such)

Teaching (observations of how the clinical and classroom lessons were taught)

Expectations, attitudes and beliefs (of the teacher)

Background information

Mrs TS Wong has taught chemistry at the pre-university level for 13 years. She graduated with a Bachelor of Science (Honours) degree in Chemistry from the then University of Singapore. She also obtained a Diploma in Education from the Institute of Education, Singapore. She is a member of the Singapore National Institute of Chemistry. Her 13 years of teaching experience has been in the same junior college. She has not held any other job besides teaching. She is presently the Senior Subject Teacher for chemistry in her junior college.

Planning

From observations made of Mrs TS Wong during the planning of the clinical teaching session, it was noted that she spent most of her time writing out a skeletal framework of the lesson on transparencies. Mrs Wong had left blanks in this framework which she filled in as the lesson progressed. She also included some blank transparencies in her teaching material. But she had

no written lesson plan. Her explanation for her action was :

"In my transparencies I also plan that if they are not familiar with certain concepts then I will try to elaborate, and so on. That is why I need some spare transparencies."

This action of hers seem to indicate that she is a flexible and adaptable teacher.

Mrs Wong also used part of the time preparing suitable teaching models and skimming through the textbooks to locate a particular definition. She mentioned later on during the interview that she actually could not find an appropriate definition for the required term. Hence she coined her own. This shows that she is very well versed with her content knowledge.

Besides these planning activities, she also spent time thinking through other aspects of the lesson. During the interview she said :

"I tried to envision what type of students I will be meeting and what kind of difficulty they may have concerning the topic, their background knowledge. Then I also decided on how I can approach this topic whether lecture style or tutorial. So I think I decided to make it into a combination since it is only 4 or 5 students. So that is why I also planned to ask certain questions."

Linked with these thoughts, she also cited the main considerations that she had when she planned any lesson :

"The important thing in my mind is that I want to see whether the students can understand this I mean their understanding is most important. I mean no doubt that we have to meet the examination requirements and things like that, but we also feel that there's no point rushing through. We will try to make this topic in such a way that the students can understand. Sometimes to simplify the whole thing. So I think understanding is important."

This could explain why she did not try to teach the whole topic in the given 45 minutes. In her own words :

"I feel that if I pushed through, I will definitely have to take more than 45 minutes. And if I tried to put it in 45 minutes, I don't think they will understand. So instead of, say, achieving nothing, at least I achieved two-thirds."

For the classroom teaching session, Mrs Wong conducted a tutorial lesson. When questioned about her planning procedure for the tutorial, she had this to say :

"For tutorial the planning has to a bit more flexible because we cannot anticipate actually what the students will ask. Actually this tutorial is not the start of a new tutorial. They already had one where we had already gone through a few questions. At the end of the last tutorial, some students asked certain questions on Dalton's Law. So I anticipated that they would ask this, so I try to think of ways to show how this law is related to their experience. So that's one part of the planning. The other part of the planning is getting them to do the tutorial. I try to anticipate what kind of mistakes they would make and try and correct the mistakes. The actual planning don't have to do any transparencies or anything. If I feel that they need models, then I just make sure that I bring my models along If I were a new teacher, I would have gone through all the questions, worked out all the answers. But now, look at my book. There are no answers because I roughly already know what kind of answers they will give. So what I do is to look at the answers and correct them if they are right or wrong."

However, in the case of a lecture, it entails much more planning :

"Lecture we usually plan way beforehand. At the beginning of the year we will plan out the work scheme who will give the lectures. So the person giving the lecture will be given the topic very early Normally we prepare transparencies. If it is a new topic, we will read up first, get all the materials, think of which is the best way to present the topic. If we can get slides or filmstrips or even videos, we will contact the IML (*Instructional Materials Library*) and try to incorporate materials into our lecture."

Besides content preparation, she again emphasised that the students are uppermost in her mind when she is planning for her lesson. Hence she will have to be flexible in her planning and make the necessary adjustments as the lesson progresses :

"Have to make allowances (depending on the class). In fact this class (that was observed) is not an exceptionally good class. So I go slowly There is another class I have it is the top class so I can go faster with them But then for that type of class I have to give them more. They will finish the tutorial faster I give them work to do or I bring out from the ten-year series questions (past examination questions) to let them try. The better classes you have to stretch them. We try with the better classes to push them a little more they will attain a higher level."

Hence, it can be concluded that in the planning stage in both the clinical and classroom teaching sessions, Mrs Wong's main concern was the students and whatever content or materials she selected revolved around the students' understanding.

Teaching

Several characteristics of her teaching in both the clinical and classroom sessions were identified. Mrs Wong taught in a confident and sure manner. It was evident that she knew her subject well and was keenly aware of the requirements of the syllabus. The following excerpts from interviews with her colleagues and students substantiate this fact :

Teacher PA : She has very good knowledge of chemistry. Whenever we have some things to argue about, she is usually able to come up with her comments and to check up further if necessary I think she reads widely in chemistry regarding facts, we will refer to her for comments

Teacher HC : She is very knowledgeable in her subject, particularly in physical chemistry. She does refer to other books besides the standard text.

Student CA : She really can teach She not only can teach about whatever is in the syllabus, she really knows her subject. That is why she can teach so well and so clearly.

Student MB : She was very knowledgeable. She was not a textbook teacher. There are some teachers who are textbook teachers. In other words, they don't really read up

beforehand or they aren't very familiar with the stuff or the jargon and they have got the textbook and they narrate it out to you.

Mrs Wong delivered the content of both lessons observed systematically and in an organised fashion, characterised by clear and thorough explanations. Her colleagues and students agree unanimously on this point :

Teacher PA : She is organised in her lecture. Normally she has section headings outline of what she is going to do. Then she goes on. As she teaches she will come back and tell them (*the students*) that this topic is finished and so on.

Teacher HC : She is a very systematic teacher. She has very good organisation of her teaching material.

Student CC : She tries to explain beyond the syllabus. She would really want her students to understand a certain topic, a certain question. So what she does is to go beyond what we are supposed to know.

Student MB : She showed great clarity in thought. A very systematic presentation.

When it came to asking questions, Mrs Wong was able to direct appropriate questions and respond to students' questions with ease and confidence. At the same time she exercised control over the students' questions and does not get carried away in answering students' queries. In the interview when she was asked if she would plan her lessons to the last detail, she replied :

"I always allow for spontaneity because if the students ask questions and so on. But I try not to deviate too far. Sometimes the students can ask you things that will require a lot more explanation. Usually if that is the case, I will tell them to meet me after the lesson and see me and I will explain in more detail."

Her student had also this to say about her openness to questions :

Student MB : Although she didn't specifically ask questions periodically, she did not discourage us from asking her questions, interrupting her She did not show any chagrin or disdain to our interjections.

Her overriding concern for her students' understanding of her lessons, whether they be lectures, tutorials or laboratory sessions, showed up very clearly again during the sessions observed. She was able to understand and assess accurately her students' ability and knowledge level and so, could select the appropriate content and strategies required for the lessons observed. She also tried to simplify concepts and use suitable analogies to help her students better understand difficult and abstract concepts. Furthermore, the pacing of her lessons matched her students' ability and the time available. The following excerpts taken from the interviews with her illustrate these student-oriented characteristics of hers :

"I have been teaching for so long. So I roughly know where students will find difficulty in. So before they can even I mean (say so), I can sense it that if this is the topic, so probably I will elaborate more and go slower and give more examples. But I think this comes from experience can anticipate problem areas. I think a young teacher will probably have to learn with a few batches of students. The other thing is maybe the speed at which we go. Maybe we are older or what, I somehow go a bit slower. I find that the young cadet (trainee teacher) tend to go very fast. Either they are nervous or they feel they must finish in the time slot. So we have to tell them to go a bit slower and make sure they (the students) understand the basic concepts. No point rushing. I always tell them 'slow down ! Make sure the basic concepts sink in, then the rest will be quite easy to build on.'"

"(The teacher) must show concern for the students. They have to think of the welfare of her students that means if the students don't understand or if the students are not paying attention, they must find out why. I think sometimes just call them up to talk to them, you'll learn a lot. Rather than say this student is hopeless You can help them a lot."

"(An effective chemistry teacher must) be able to bring a difficult concept down to the students' level. We have some teachers who are very good in the subject area but they just can't communicate. They just can't tell the concept to the students in simple language that the student can understand."

"I use analogies quite often in my lessons. I find that teaching them with analogies quite effective but every time I have to tell them (*the students*) don't quote the example or else they would answer questions with the analogies instead of using scientific theories."

Further proof of this characteristic of hers was given by her colleagues and students :

Teacher PA : I think the students like them (*her lectures*). She is able to do it at a consistent pace that is comfortable for the students. They benefit from her lessons. She is not nervous. She is confident and she is able to put across her content She is very open not inhibited, so she is able to illustrate whatever she wants to explain.

Teacher PB : She has got quite good illustrations quite imaginative, to the point, quite apt for the situation very practical.

Student CB : She is able to simplify things to the point that we can understand everything concisely and that is important in science because some of the concepts are hard to understand She gives a lot of analogies which makes the concepts easier to grasp. If you use analogies in real life situations and you apply it to science then we can understand better She relates to students very well She has had the experience of dealing with students a lot. So she knows how we work, how we 'tick' She understands our problems. She is able to give her best to her students in terms of knowledge, in terms of experience.

Student CD : I think her lectures are good. She goes at a comfortable pace.

Student MA : She was quite humourous She knows how to use analogies to make us understand Actually she is a good teacher, honestly.

The selector, who had taught with Mrs Wong in the same school for no less than five years, also remembered that she was "very skillful in terms of using analogies and even communicating with students through wit and humour and drama."

A distinctive feature was noted in Mrs Wong's classroom teaching session. It was a tutorial lesson where questions based on an earlier lecture were discussed. The feature noted was that

Mrs Wong would read the tutorial question first. Then she would build up an understanding of the key concepts involved in the question based on her students' responses to her questions. After which, the complete solution would be presented. Based on our experiences as supervisors of student teachers, this was in direct contrast to what a student teacher would typically have done in a tutorial. He/she would normally go into the complete presentation of the solution without first reading the question. When Mrs Wong was asked why she found it necessary to read the question first before attempting to solve the problem, she confessed that she did not know why. After thinking for a while, she said :

"Sometimes when I go to the class it may be the first time I have seen it (*the question*) that year. In a way I thought maybe just to tell myself this is the question. Actually it never occurred to me why I should read the question first For them (*the students*) it might be their first time too I feel that by reading the question, the students will be following me they are all looking at that question this is the problem we are discussing. What I find is that if I don't read the question, some of the students will be turning around to each other they won't be directed at the question."

When probed further as to when she began this practice of reading the questions, she added :

"I only did this only much later. I remember as a trainee teacher or even as a new teacher, I also followed the trainee's way (*of going into the solution of the problem without first reading the question*)."

Hence there are some unique teaching skills that are acquired through experience.

From the observations of Mrs Wong's clinical and classroom teaching, it could be concluded that she is strong in content, pedagogic and curricular knowledge. She is able to assess her

students' needs accurately and tailor her lessons accordingly. Her communication and organisation skills are good.

Attitudes, expectations and beliefs

It has been found that Mrs Wong plans and instructs well. From the interviews with her, it could be inferred that her motivation comes from her sincere love for the job. She also finds teaching a challenging career. It was her first choice of career and she views it as a life-long profession. The following interview excerpt illustrates her sentiments :

"Yes, teaching was my first choice. Even up till now I still enjoy teaching. At first I thought after ten years, probably I will find it very dull, but every time you have a different batch of students and after some time the syllabus would change. When the syllabus changes, it means a lot of work for us. So we have to read up and so on. So it sort of keeps us on our toes. You don't really teach the same thing throughout. Also teaching is more challenging, in the sense that now they have the 'S' paper and the Chemistry Olympiad even though the students are trained by NUS (National University of Singapore), if they have problems, they still come back to us. So we really have to keep up to date with our work. So it's not really a stagnant thing. Generally, I also like to relate to young people so I find it very interesting. The only thing I am afraid is they want to promote you they will take you out of teaching, and that is one thing we never like. Like some people, the Heads of Department they do very little teaching where I am concerned, I am not interested. I would like to be a teacher."

"I still love teaching. I find it very stimulating. I am so happy to see students' faces lighted up when they understand what you are talking about."

Besides her love for the profession, Mrs Wong was also very interested in her subject (chemistry) and hence she was eager to impart the knowledge to her students. She said that she enjoyed reading articles related to chemistry, for example, on polymers and their new uses, and environmental issues. Then she would try

to relate these current issues and technological advances to what she was teaching if it was relevant. She also tried to introduce her students to the scientific process approach of looking at things. This was what she shared with the interviewer:

"Science is important in our society. I do relate, for example, the ozone thing, even things like the nuclear explosion, I do bring it to the students' attention. But I also tell them that science does not have all the answers. Some students have the idea that chemistry is very wishy washy. They come to you with a question out of the blue, 'how come this one is a gas, this is a solid' without the data. Then after that they come back to you and say 'no, it's the other way round' I find that they don't understand that every time a reaction takes place, there are a lot of factors and some of them contradict each other and it's only the one that dominates, then it'll go that way. So I have to keep telling the students that it is not so simple as this rule and that rule. You have to see how many factors there are, which one is the predominant one, then the reaction takes place. So I think you have to let them understand that. I always have to tell them that after you observe certain things happening, then you postulate and try to reason why it happened. It is different from physics where a rule is a rule. I always tell them that chemistry is not like that that chemistry is the real science where practical is ahead of theory. In fact some of my students take science as a religion !"

One of her students said this in support of the above, showing that Mrs Wong had indeed imparted her beliefs to them :

Student CC : She said that chemistry is not a religion that it is actually a theoretical subject. These theories which the scientists/chemists have come up with may not be true. She has made us aware of that. So I think she has given us greater understanding towards chemistry so that we will not accept blindly what is taught in chemistry and to be more critical about it.

Mrs Wong comes across as a caring, understanding and concerned teacher. She has good rapport with her students and they find it easy to approach her regarding their problems in

both their studies and private life. This is what one of her colleagues, her students and the selector had to say :

Teacher PA : She is friendly. She is caring. She is not the type who will just keep her distance away from them (her students). She is able to interact with them well.

Student CB : You don't really feel scared to approach her. She won't judge you whether you are stupid or not There is always a time to work and a time to play - so I guess we have this understanding with her. When it is work, we do the work. When it is time to play then we relax a bit.

Student CC : She doesn't impose certain rules on us If we are too tired she does consider our point of view. So she lets us 'doze off' but we are not supposed to make noise or disturb the rest while she is teaching. Sometimes she lets us have early breaks because she feels that the students have a problem (i.e. tired). She is a very good teacher she can teach. She is very caring, very understanding. She knows her students well and tries to know the feelings of her students.

Selector: I have observed her giving personal attention - tuition - to students even way past working time way past 5 pm I have seen how she would never turn away students and she would never give up on explaining things to students.

Besides her students, her colleagues also show her much respect. The selector could still recall that Mrs Wong was "unselfish in sharing her skills how in the process she sharpened her own skills as well as her colleagues'....". At present, as the Senior Subject Teacher in chemistry, she has to vet her colleagues' teaching materials, approve their practical schedule and assign duties for marking and setting of questions for examinations. They accept her professional judgements willingly and rate her a "very capable, efficient and fair Senior Subject teacher one of the best chemistry teachers in the college".

Summary of Findings

From the findings, it is evident that Mrs TS Wong considers teaching for understanding a very important priority (Garnett and Tobin, 1988). Although she is keenly aware of her primary responsibility of preparing her students for the national examinations in chemistry, she remains adamant that it should not be at the expense of understanding the subject. In Singapore, paper qualifications and achieving excellent grades are of paramount concern to our students, teachers and parents. Consequently, the completion of the syllabus may be achieved at the expense of understanding in the subject taught. Often, it is not easy to balance teaching for understanding and teaching to complete the syllabus. Mrs Wong seems to be able to draw this balance in which the students are brought to a better understanding of the subject as well as being adequately prepared for the examinations.

Although Mrs Wong has her own expectations of each new group of students she meets, she maintains a flexible predisposition towards them. Perhaps, by her willingness to discover and identify each group's peculiarities as they manifest themselves, she is able to realise her goal of teaching for understanding. When confronted with new students in the microteaching session, she did not attempt to prepare a detailed lesson content but only a skeletal framework which allowed her to teach according to the entry knowledge of these students. In tutorials, she dealt with students' questions and difficulties as they arose. She made allowances for different classes and students taught. She went at different pace for different classes and sets of students. In

her assessment of her students' abilities and entry knowledge, she is strongly guided by the "wisdom of practice" (Shulman, 1987).

Mrs Wong's ability to teach for understanding is effected by her strong content and curricular knowledge, sound knowledge of pedagogical principles and of the psychology of learners as well as good communication skills (Shulman, 1987; cf. Chen, Ng and Yeo, 1989). Her commitment to and love for science and chemistry in particular (Penick, Yager and Bonnstetter, 1986; Shakhashiri, 1986) also contribute to her goal of teaching for understanding.

Mrs Wong displays her strong content knowledge by the confidence and ease with which she explains and teaches the concepts in chemistry and by her candid responses to students' queries and comments. In the microteaching session, when she failed to find a suitable definition she wanted from the texts provided, she formulated her own. Her peers and her superior thought highly of her knowledge of chemistry. Her students were equally impressed with her content knowledge.

Mrs Wong is knowledgeable in curriculum matters. She is aware of the requirements of the syllabus; what is relevant, important and current in the syllabus. She is also aware of the various texts and teaching media and materials at her disposal. She keeps up-to-date on the current happenings in chemistry which are of general interest and relevance to the syllabus.

Another contributing factor to Mrs Wong's effective teaching is her pedagogical intelligence (Rubin, 1989). In her instructional moves, she is able to choose appropriate

illustrations and make liberal use of analogies in her teaching. She is keenly aware of the need to simplify difficult concepts and topics for her students. She systematically develops from simple and fundamental concepts to more complex and abstract ones at an appropriate pace of teaching.

Being aware of the psychology of the learner, Mrs Wong is sensitive to the needs and abilities of her students. She shows much care and concern for their general welfare and learning. She is able to motivate them to learn and attempts to anticipate their learning difficulties. For example, when the students are tired, she gives them a break. Though firm in the way she deals with them, she knows when to relax her control over them.

As a good communicator, Mrs Wong is able to present the lessons in a systematic manner. Her clear teaching and explanations are accompanied by effective media and materials. She asks appropriate and relevant questions.

Having a deep sense of commitment to chemistry and to the teaching profession, Mrs Wong is able to communicate her love of the subject to her students. She impresses upon them the nature and relevance of scientific principles to their daily lives. This aspect of her came across very strongly from the interviews with her students.

Expert teachers make use of certain routines to teach effectively and efficiently (Leinhart, Weidman and Hammond, 1987). In the case of Mrs Wong, she adopts the routine of first reading the tutorial question she will be discussing in order to help her students to focus on the question. Interestingly, she admitted to being unaware of such a routine. Apparently, this

routine may be derived from the wisdom of practice as described by Shulman (1987). This suggests that there may be other useful established routines that she may be unaware of (cf. Berliner, 1986).

Conclusion

The findings from this exploratory study support those established in the literature on expert teachers. The chemistry teacher reported for this study approximated closely to the outlined model of an expert teacher. She was found to be strong in content and pedagogic knowledge, was people-oriented, a good communicator and organiser. She also showed good decision making and dedication to the subject and to her students. In particular, these patterns of behaviours appear to be consistent to those identified in previous studies on "expert" economics and English literature teachers done by Chen, Ng and Yeo (1989) at the Institute of Education.

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