
Conceptions of teaching held by school science teachers in P.R. China: identification and cross-cultural comparisons

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This paper reports research into the conceptions of teaching of school physics teachers in Guangdong, China, utilizing both qualitative and quantitative approaches to research, which involved interviews of 18 teachers and a survey of 450 teachers, respectively. On the basis of analyses of both sets of data, five conceptions of teaching and two higher order orientations were identified and a multiple-level model was proposed.

Comparisons with previous Western studies suggested that, while most teaching conceptions might be universal, some distinctions could be found between those held by Chinese and Western teachers. Chinese teachers seemed to view students' exam performance as the most important indicator of good teaching and successful schooling while its parallel conception in the Western context focused more on the general institutional standard. Two other teaching conceptions commonly held by Chinese teachers seemed to combine classroom teaching with the cultivation of good learning attitudes and good conduct while their Western counterparts only focused on the facilitation of and interest in learning.

Background

Studies of children's ideas about the natural world around them have suggest that school science teaching needed to adjust its focus from transmitting knowledge to changing children's concepts about the natural world (Champagne, *et al.*, 1983; Driver, *et al.*, 1985, 1994; Osborne and Wittrock 1985). However, experiences in New Zealand and China showed that this change can not happen unless teachers realise the need for such changes and challenge traditional views about school science learning and teaching (Gao, 1989, 1992). Changing the Chinese teachers' conceptions of teaching is extremely important since the heavy emphasis on school examinations has become a major obstacle to improving the quality of Chinese education. As Liu Bin (1995) said: 'Changing the conceptions of teaching and schooling is now the key of improving students' quality' (p. 9). Such reasoning has led researchers in China and elsewhere to pay increasing attention in the past decade to teachers' perceptions and/or conceptions of teaching.

The term 'conception of teaching' is used in the literature to refer to the overall view of teachers of the process of teaching (Kember 1997). From a phenomenographic point of view, a teacher's conception of teaching acts as a framework through which that teacher views, interprets, and interacts, with his/her teaching environment (Marton 1981). A teacher's conception of teaching is also assumed to affect his/her adoption of teaching strategies, and this will, in turn,

influence the quality and outcome of student learning (Kember and Gow 1994, Trigwell *et al.* 1999).

Conceptions of teaching are viewed as different categories of teachers' ideas behind their descriptions of how they experience the teaching process (Pratt 1992). Based on this view, a substantial body of teaching conceptions has been identified by many researchers (Fox 1983, Biggs 1989, Dall'Alba 1990, Dunkin 1990, Martin and Balla 1990, Dunkin and Precian 1992, Martin and Ramsden 1992, Pratt 1992, Samuelowicz and Bain 1992, Gow and Kember 1993, Kember and Gow 1994, Prosser, *et al.* 1994, Trigwell, *et al.* 1994, Christensen *et al.* 1995). These teaching conceptions were arrayed in a linear sequence from the most student-centred extreme to the most teacher-centred extreme by most of the researchers (Gao 1999). After reviewing the above studies, Kember (1997) recognized five dimensions on which teachers constructed their conceptions of teaching: the essence of learning and teaching; the roles of student and teacher; the aims and expected outcome of teaching; the content of teaching; and the preferred styles and approaches to teaching. Teachers' views in each dimension were found to range from the most teacher central to the most student central. Further review of the descriptions of the conceptions identified by the above researchers showed that, in spite of the differences in the labels and descriptions of teaching conceptions made by different researchers, there was a high degree of commonality in the research findings. Kember (1997) re-conceptualized teaching conceptions in a multiple level model with two higher-level orientations and five lower-level conceptions. The 'teacher-centred/content-orientated' orientation covered the 'imparting information' and 'transmitting structured knowledge' conceptions. The 'student-centred/learning orientated' covered the 'facilitating understanding' and 'conceptual change/intellectual development' conceptions. The 'student teacher interaction/apprenticeship' conception acted as a bridge conception between the two opposite orientations.

Conceptions of teaching are assumed to be context dependent (Marton 1981). This implies that, while some aspects of teaching conceptions may be consistent across contexts, others will vary with differences in contexts, such as differences in the stage of schooling, major subject area, curriculum, evaluation system, social and cultural background, etc. Therefore it is meaningful to investigate and compare the teaching conceptions of teachers from different cultural and educational contexts and at different stages of schooling. While most such studies have been conducted in Western cultural contexts and at tertiary level, it would be value to explore the teaching conceptions of school teachers whose teaching environments and degree of freedom in making teaching decisions differ greatly from university lecturers. This is especially so in P.R. China, where the school system and the social and cultural context are so different from the West. For instance, classrooms in China are typically characterized by large class sizes, expository methods, and drilling for external exams.

Exploring the teaching conceptions

Given that qualitative interviews are beneficial for an in-depth understanding of teachers' ideas, a qualitative approach was adopted in the first phase of this research, which focused on exploring teachers' conceptions of teaching and constructing a model to describe the relationship between these conceptions. In the

second phase of this research, a questionnaire named School Physics Teachers' Conceptions of Teaching (SPTCT) was developed according to the qualitative findings in the first phase, it was used to assess teachers' conceptions of teaching among a large sample of teachers in order to discover the relations between teaching conceptions and student learning. Examination of the reliability and validity to the responses of the questionnaire was also conducted which provided evidence confirming the qualitative findings.

Qualitative data collection and analysis

Semi-structured interviews were conducted in March 1995. The interviewees were 18 teachers chosen from 40 volunteers to represent a range of characteristics such as gender, qualifications, teaching experience, and school band in Guangzhou, P.R. China. They taught senior school physics when the interviews were conducted.

Promoting interviewees' interest in the issues of research and eliciting their ideas are important for the success of an interview (Miller and Glassner 1997). In order to 'warm up' the teachers, the teaching routine under a normal class situation of every interviewee was videotaped about one week before the interview. The videotape was then sent to the interviewee. The interviewee was invited to explain the objectives and strategies of that class before formal interviewing took place. This encouraged the teachers to reflect about their teaching experience and prepare their views about teaching. It was also a new experience to most of the interviewees so they were all enthusiastic about participating.

To have a common understanding of the interview data between the interviewer and the interviewee, it is very important to limit bias (LeCompte and Pressle 1993). The video taped teaching episodes became a good way to understand the intended meaning of the teachers' descriptions. Teachers may use particular terms, for example, 'interacting with students', 'developing students' ability', etc., to describe or explain their videotaped teaching experience. On the other hand, if the interviewer is confused about the idea expressed, he/she can invite the teacher to relate his/her idea to the video. This provided a context to understand the teachers' terms. These video tapes were also used as an aid while re-coding the teachers' conceptual orientations of teaching.

The five commonly recognized dimensions proposed by Kember (1997) were used in this research for constructing the interview questions. Thirty-eight open-ended questions were constructed. These questions focused on two different aspects: the 'key questions' eliciting teachers' responses about their opinions and values relating to teaching; the 'practical questions' eliciting teachers' responses about their teaching experiences and behaviours.

Each interview lasted between 45 to 60 minutes. All interviews were audio-recorded. Transcriptions of the interview records and two circles of accuracy check were done soon after the interviews. Two experienced researchers in the Division of Teaching and Learning in Education Department of Guangzhou were invited to act as consultants in data analysis and constructing the questionnaire.

Analysis of the qualitative data had three stages. In stage A, the researcher and the two consultants read the interview transcripts and quoted the key words and phrases independently. Stage B focused on coding the teachers' ideas to explore possible regularities. Interview questions that were not able to elicit qualitative

Learning & Learner	Self-improvement	Establishing good attitude	Internal construction; Explorers, Capable, flexible and creative	Achieving exam requirements, Achievers, Competitive	Acquiring knowledge and skills; Passive receivers
Nature of Teaching	Facilitating and guiding good conduct	Promoting and fostering good attitude	Facilitating learning	Preparing for examinations; Drilling students	Delivering knowledge and skills
Role of Teacher	Role model of good conduct, friend of students	Model of good learner with good attitude	Guide, leader, and facilitator	Trainer and director	Deliverer and resource
Expected Outcomes	Qualified persons with good conduct	Active and independent in learning	Developing understanding and ability, knowing how to learn	High exam achievement	Accumulation of knowledge and skills
Teaching Content	Related materials, contained implicitly in teachers' behaviours	Contained implicitly in teachers' performance	Meets the needs of students and matches students' level	Conducted by the 'baton of exams'	Follows the textbook closely
Method of Teaching	Friendly and interactive, indirect manner	Interactive and interesting; indirect manner	A variety of methods, emphasises activities & interactions	Classroom drilling, Effective for preparing exams	One-way lecturing plus demonstration
	Conduct Guidance	Attitude Promotion	Ability Development	Exam Preparation	Knowledge Delivery
	Student-centred -----Teacher-centred				

Figure 1. Keywords and phrases in the 'mapping-plane'.

different responses were dropped and those elicited similar responses were combined into one question. Finally, 16 questions that provided useful information for identifying qualitatively different categories of teachers' descriptions were picked out and built a coding framework. All the quoted key words and phrases were then coded with those questions. Words and phrases with similar meaning were put together in a blank. Only one single word or phrase was then selected as the representative of that group. Stage C focused on identifying teachers' conceptions of teaching. Hypothetical dimensions were examined according to whether data related to each dimension showed qualitative variations and then were used to define teachers' conceptions of teaching. Since most researchers accepted the 'bipolar' nature of the dimensions (Kember 1997), a mapping-plane was thus developed. Those key words and phrases identified as of the same dimension arrayed in the same row. Words and phrases implying the most teacher-centred view located at the far-left side of the 'mapping-plane', the most student-centred words located at the far-right side, others were at different places in the middle in accordance. Those that were at the same distance from the left or right ends formed a column, which implied one category of teachers' ideas or, say, a conception of teaching. In this reported study, five columns emerged in the 'mapping-plane', which represented five teaching conceptions that were identified. Figure 1 gives the keywords and phrases in the 'mapping-plane'.

Finally, the researcher and the consultants had a meeting with all the interviewees reporting the process and findings of data analysis. All attendance agreed with the above coding and classifying.

Conceptions of teaching identified from the qualitative data

The five teaching conceptions identified from the above procedure were labelled as: *Knowledge Delivery* (KD), *Exam Preparation* (EP), *Ability Development* (AD), *Attitude Promotion* (AP) and *Conduct Guidance* (CG).

Knowledge delivery

The *Knowledge Delivery* conception is based on the view that learning is a process of acquiring or accumulating knowledge and skills and teaching is a process of delivering knowledge and skills. A student is viewed as a passive receiver or container of knowledge. A teacher is both a deliverer and a bank of knowledge and skills. As teacher J said:

The nature of teaching, or say, the role of a teacher, is to deliver knowledge as long as the methods and skills. . . . No matter how many things are involved in teaching process, it is still a delivery process.

(Teacher J, SIR, 4-1)¹

Exam preparation

The most important element of the *Exam Preparation* conception of teaching is students' achievement, especially in public examinations. As Teacher L said:

As a teacher, my main task in the classroom is to ensure that my students can get good marks in the matriculation examination, because this is the most important or even the only aspect by which the school authority assesses my teaching. As a result, the matriculation examination becomes the main focus of my teaching.

(Teacher L, SIR, 4-5)

Through this conception, teachers view learning and teaching from an exterior perspective in relation to students and teachers. Learning is a way to pass examinations and to attain required qualifications. Students are figures to be shaped according to the target of examinations. Teachers take the responsibility to ensure students to achieve the exam requirements. What is taught and the method of teaching are based on the content of and methods used in examinations.

In both the *Knowledge Delivery* and the *Exam Preparation* conceptions, the content of teaching is pre-determined by external factors. The related teaching strategy is one-way lecturing or drilling with exam-type items.

Ability development

The *Ability Development* conception aims at the development of students' abilities, as Teacher A said:

To develop students' abilities must be the most important aim of school physics teaching, the ability to explore physics knowledge by experiment and to apply the physics knowledge in daily life, . . . and the ability of analysing, thinking, . . . and experimenting. . . .

(Teacher A, SIR, 4-7)

From this conception, learning is a process of internal construction and development of students. They are at the centre of the teaching-learning process. A teacher is no more than a facilitator of student learning. Both teachers and students

are able to play a role in deciding the teaching content to make it closer to students, though the course syllabus and textbooks are still the basis of classroom teaching and learning. Varieties of teaching strategies and student-teacher interactions are encouraged. Classroom procedure is not simply one way, but rather two-way, interactions.

Attitude promotion

The *Attitude Promotion* conception is based on the view that learning skills and outcomes relate closely to learning attitudes. The products of learning are not only the accumulation of knowledge or development of academic abilities, but also changes in students' attitude to learning. For example, teacher I said:

I think if teachers can motivate their students and arouse their interest in the subject they teach, helping students to set up good habits and attitudes to learning, that's the most wonderful outcome you can expect.

(Teacher I, SIR, 6-18)

This conception emphasizes the inter-reactions between learning performance and attitude. It focuses on motivating students and developing good and 'correct' attitudes to learning. A good teacher is a model learner who models good attitude among students. Teaching 'content' is not explicit as knowledge in the discipline, but a kind of implicit 'message' contained in teachers' performance and in teacher-student interactions. Teaching proceeds through the interactions between teachers and students.

Conduct guidance

The *Conduct Guidance* conception emphasizes the implicit influences of classroom process on student behaviour. Learning is now a process of conduct cultivation, a way to arrive at self-perfection. As teacher H explained:

By attending school and classes, students learn not only subject matter and skills, but also how to interact and communicate with their peers, teachers, school authorities and parents. They learn how to be a person and how to behave well.

(Teacher H, SIR, 1-10)

Teaching aims at facilitating changes in students' conduct. Teaching includes novels, histories, and all kinds of materials implying good conduct and value. However, as in the *Attitude Promotion* conception, the most important teaching 'content' would be the implicit messages behind the teachers' performance and teacher-student interaction. Teaching proceeds in an indirect manner. A good teacher must be a good friend of students, and their conduct model. As teacher I claimed:

... However, teaching should involve far more than knowledge delivery. It should include educating and cultivating students. Help them to learn how to be a person. That's what we call 'Jiao Shu Yu Ren'.² This should be much more important than the other things. ...

(Teacher I, SIR, 4-13)

Relationships between different categories of teaching conceptions

Comparing the meaning of the above conceptions, it is able to see that students are in a passive position in both the *Knowledge Delivery* and *Exam Preparation* conceptions. In these two conceptions, teaching and learning are dominated by external factors: the course syllabus, the textbooks, and examinations. Classroom teaching learning proceeds from the content to teachers and then to students, through one-way lecturing and drilling and finally to the expected outcomes. What differentiates between these two conceptions are, (a) who determines the content of teaching, the course syllabus and textbooks, or examinations; and (b) what are the expected outcomes: knowledge acquirement or high achievement in examinations.

This suggested that it is reasonable to combine these two conceptions into a higher-order orientation. The core of this orientation is to mould students quantitatively and according to external demands and so is labelled a *Moulding* orientation. Students are viewed as passive acceptors and trainees. The teaching-learning process is mostly one-way. Figure 1 showed a model of the *Moulding* orientation. The dotted line from students to teachers in figure 2 meant that there are weak and limited interactions between students and teachers. Another dotted line from the achievements to examinations represented the feedback of examination results, which in terms would influence the examinations and the teaching-learning process.

Comparison of the meaning of *Ability Development*, *Attitude Promotion* and *Conduct Guidance* conceptions showed that under these three conceptions, students are in an active position. Teachers act as facilitators or role models for student learning and behaviour. Active interactions and activities are encouraged in a variety of ways. The content of teaching is not confined to the course syllabus, textbooks and examinations, it also includes daily life issues and methods of learning beyond knowledge and skills, as well as attitude and conduct reflected in teachers' performance and behaviours. All these three conceptions expect qualitative changes in students as the outcomes of teaching and learning. Examination of the relationships among the major teaching elements under these three conceptions shows that they share similar elements. Teaching content, teachers and students interact in multiple ways and form a complex system. These three conceptions differ in terms of (a) in the *Ability Development* conception, the teaching content relates to students' cognitive abilities. However, in the other two conceptions, teaching 'content' appears in an implicit form and relates to non-cognitive aspects; (b) the expected outcomes are different accordingly.

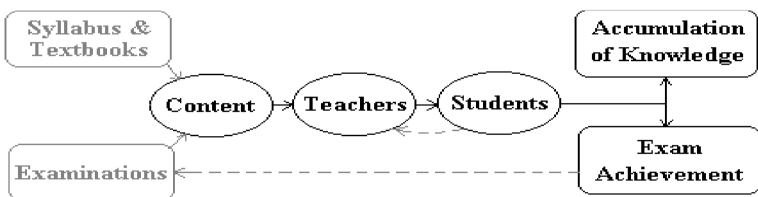


Figure 2. A model of the *Moulding* orientation of teaching.

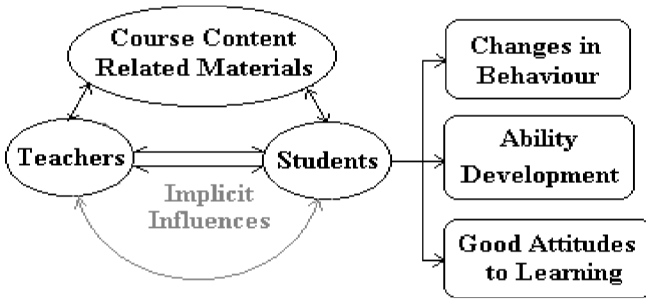


Figure 3. A model of the *Cultivating orientation of teaching*.

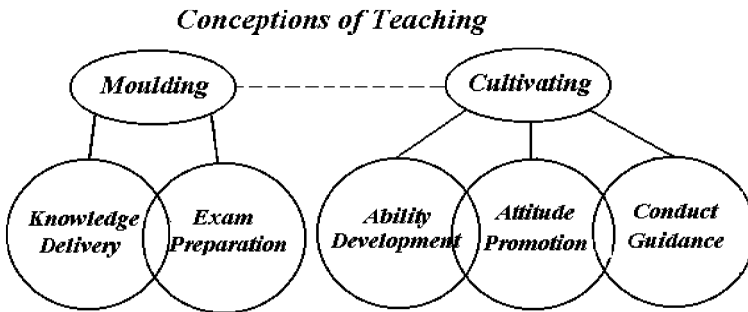


Figure 4. A general framework of the conceptions of teaching.

This also suggested that it is reasonable to define another higher-order orientation to cover the meaning of these three conceptions. The core of this higher-order orientation is the cultivation of students and so it is named as *Cultivating orientation*. Figure 3 showed the model of the *Cultivating orientation of teaching*.

A general framework (figure 4) can then be suggested for describing the categories of teaching conceptions and the relationship among these teaching conceptions. At the bottom level of this framework are the five first-order conceptions identified from the interview descriptions. The two higher-order orientations stand in the top of the upper level of the framework. The overlap between conceptions under the same higher-order orientation implies a strong relation between the first level conceptions, while a dotted line between the two higher-order orientations suggests a weak relationship.

Quantitative evidence of the conceptual model

The instrument

Based on the above qualitative findings, a questionnaire titled School Physics Teachers' Conceptions of Teaching (SPTCT) was developed to investigate Guangdong school physics teachers' conceptions of teaching. The 5-point Likert-type scale was used to collect responses of teachers to the items.

Items of the questionnaire were constructed to represent the main ideas of the key words related to different conceptions. These key words were extracted from

the qualitative data during the coding process. For example, two key points related to the exam preparation conception: (a) 'organized and systematic in learning' and (b) 'competitive and good in examination' were found from responses to the question 'what is the image of an excellent student in your mind'. Referring to the original statements made by the interviewees, an item was constructed: 'I like those students who are neat and competitive in learning'. The final version of the SPTCT included 37 items (see Appendix). Each item reflects one kind of teachers' opinions or ideas about teaching and learning, or asks teachers to give their views of a teaching method in practice. They were grouped in five lower order and two higher-order scales:

- Scale KD related to the *Knowledge Delivery* conception (8 items),
- Scale EP related to the *Exam Preparation* conception (10 items),
- Scale AD related to the *Ability Development* conception (7 items),
- Scale AP related to the *Attitude Promotion* conception (7 items),
- Scale CG related to the *Conduct Guidance* conception (5 items),
- Higher-order scale MO was the combination of scale KD and EP which related to the *Moulding* orientation to teaching,
- Higher-order scale CU was the combination of scale AD, AP and CG, which related to the *Cultivating* orientation to teaching.

Evaluating the instrument

The SPTCT was then distributed to 718 physics teachers in Guangdong with the help of the School Physics Teachers Association of Guangdong Province during the annual meeting of the association. Four hundred and fifty completed questionnaires were returned: a response rate of 63%.

Reliability. The internal-consistency coefficients (Cronbach α) were calculated as indicators of reliability of responses to the SPTCT scales. Alpha coefficients of the five first order scales KD, EP, AD, AP and CG were 0.74, 0.74, 0.65, 0.73 and 0.64 respectively, while those for the higher-order scales, MO and CU, alpha coefficients were both 0.83. According to Nunnally (1978), values of alpha coefficients above 0.70 can be considered as adequate for research purposes.

Within-construct validity. Confirmatory factor analysis was applied to test the within-construct validity of the SPTCT based on the conceptual model showed in figure 4. A 37-5 model (37 items to 5 scales) was tested at the item level and a 5-2 model (5 ordinary scales to 2 higher order scales) was tested at the scale level. The results (see table 1) showed that the GFI, AGFI, NFI and NNFI indices of both the 37-5 and the 5-2 models were all higher than the commonly accepted adequacy criterion value, 0.90. The root mean square residuals of these two models were 0.057 and 0.008 respectively. The first one was a bit higher while the later was much lower than the adequacy criterion value, 0.05. All these results implied that the fit of both the 37-5 (at item level) and the 5-2 (at scale level) models were acceptable.

Following the method used by Biggs (1992), the unidimensionality of the SPTCT scales was also examined by using confirmatory factor analysis to test the fit of the data to a one-factor model for each scale. The resulting goodness-

Table 1. Goodness-of-fit indices of the SPTCT responses (Sample: 450).

<i>Object for analysis</i>	<i>Level of analysis</i>	<i>Model</i>	<i>df</i>	<i>Chi²</i>	<i>RMR</i>	<i>GFI</i>	<i>AGFI</i>	<i>NFI</i>	<i>NNFI</i>
SPTCT	Item	37-5	591	1028.62	0.057	0.95	0.94	0.92	0.96
SPTCT	Scale	5-2	4	10.83	0.008	0.99	0.96	0.97	0.99
KD Scale	Item	8-1	20	25.34	0.040	0.99	0.98	0.98	0.99
EP Scale	Item	10-1	35	60.72	0.050	0.98	0.97	0.96	0.98
AD Scale	Item	7-1	14	17.27	0.037	0.99	0.98	0.97	0.99
AP Scale	Item	7-1	14	21.05	0.041	0.99	0.99	0.98	0.99
CG Scale	Item	5-1	5	34.44	0.053	0.98	0.93	0.92	0.87

Note: df = degree of freedom; Chi² = Chi-square;
RMR = root mean square residual; GFI = goodness-of-fit index;
AGFI = adjusted goodness-of-fit index; NFI = normed fit index;
NNFI = non-normed fit index or Tucker Lewis index (TLI).

of-fit indices are shown in the last five rows of table 1. The results indicated that the fit of all five unidimensional models was acceptable.

The above results suggested that responses to the SPTCT were reliable and valid while assessing school physics teachers' conceptions of teaching in Guangdong, China. Factor analysis showed that the five lower order conceptions were sufficiently distinct to form separate factors but also sufficiently related to form a hierarchy with the higher-level orientations. These results supported the model proposed on the basis of the qualitative analysis.

Comparison and discussion

Relations between the conceptions identified and previous relevant research

Parallels to the teaching conceptions and orientations identified in this study could be found in previous studies. *Knowledge Delivery* is the most widely identified conception of teaching in the literature, albeit known by different names. Examples include: 'presenter of information' (Christensen *et al.* 1995), 'presenting information' and 'transmitting information' (Dall'Alba 1990), 'transfer theory' (Fox 1983), 'knowledge transmission' (Gow and Kember 1993), 'presenting structured knowledge' (Larsson 1983), 'presenting information' (Martin and Balla 1990), 'engineering-delivering content' (Pratt 1992), 'transmitting concepts of the syllabus' and 'transmitting the teachers' knowledge' (Prosser *et al.* 1994), 'transmission of knowledge and attitudes to knowledge' (Samuelowicz and Bain 1992), etc.. Despite slight differences in the domain coverage or resource of knowledge, central to all these labels are the concepts that teaching is a process of transmission and that knowledge is something external to students that can be transmitted by teachers. Knowledge is determined by the course syllabus, stored in textbooks or teachers' brains, and is expected to accumulate in students through the delivery of teachers.

The *Exam Preparation* conception was similar to Biggs' (1990) 'organisational' conception that aimed at institutional responsibility for knowledge and standards. While Biggs' suggestion was based on theoretical study, Fox (1983) identified the comparable 'shaping theory' from responses of polytechnic teachers to his question

'what do you mean by teaching'. This 'theory' focuses on shaping students according to the institutional standard, such as producing a competent engineer or developing a capacity to handle equipment, and views students 'as raw material to be shaped, or moulded, or turned to a predetermined and often detailed specification' (p. 153). The idea that students are something to be shaped by teachers is the same in both 'shaping theory' and the *Exam Preparation* conception, although the former focuses on general institutional standards and the latter focuses primarily the demands of examinations.

A strong focus on examination is not only widely accepted by Guangdong school physics teachers, but also is shared by teachers of other subjects throughout China. This has become one important factor resulting in a weakness of the basic education system in China (Liu, B. 1995). This may be due to the effect of the educational evaluation system (Liu, W. 1996) and two powerful traditions in China (Gao 1998).

In China, public examinations was viewed as an effective method of selecting 'excellent' intellectuals since the so called *Ke Ju*,⁴ a national-run public examination for selecting government officers, started in China more than 1000 years ago. Every student had the opportunity to reach the top status in society and consequently became rich if he could succeed in the '*Ke Ju*'. As the ancient Chinese idioms went: 'although studying anonymously for ten years, once you are successful, you will become well-known in the world'. Young people, especially those that came from average or poor families, were taught by their parents and teachers to study diligently and consistently since 'there are golden houses in books and there are beautiful girls in books' (see Lee 1996).

Nowadays, schooling in China is still an important and effective way of raising one's social and economic status. Success in public examinations, particularly the national university entrance examination, means that one can expect a better career with security and high income after graduation from university. To many students from poor rural areas, tertiary education represents 'a distinctive line which decides whether they wear straw sandals or leather shoes later in their lives' as the saying goes. Parents are therefore very concerned about their children's performance in examinations. Most parents will reward their children if they get higher marks in examinations or punish them for poor school records (Zhao 1996). Student records in public examinations are treated as the most important indicator of the quality of schools by the community (Fu 1996). In Guangzhou, for example, there is a reward system which is dependent on how many students in a school succeed in the examinations and enrol in universities. If the performance of students is not as good as expected, their teachers, principals and the head of the local government education department are all punished. This causes great social pressure to push teachers towards this exam preparation direction.

A number previous researchers had conceptions parallel to '*Ability Development*' identified in this research: for example, 'facilitator of thinking and learning' (Christensen *et al.* 1995), 'developing the capacity to be expert' and 'exploring ways of understanding' (Dall'Alba 1990), 'encouraging activity and independence in learning' (Dunkin 1990), 'travelling theory' (Fox 1983), 'learning facilitation' (Gow and Kember 1993), 'to involve students in interpretative and strutting work' (Larsson 1983), 'relating teaching to learning' (Martin and Balla 1990), 'developmental - cultivating the intellect' (Pratt 1992), 'helping students develop conceptions' and 'helping students change conceptions' (Prosser *et al.*

1994), 'facilitating understanding', 'changing students' conceptions or understanding' and 'supporting student learning' (Samuelowicz and Bain 1992), etc.. When the word 'ability' was used by teachers in the interviews of this research, it was repeatedly accompanied by other terms such as 'ability to explore', 'ability of learning', 'ability to understand', 'ability to think', 'problem solving ability', etc.. Ability is viewed as something underlying knowledge and skills that relate closely to human intellect but which can not simply be picked up from teachers, rather, it has to be developed by students themselves during the process of learning or practising.

Some conceptions identified by other researchers in the literature shared ideas in common with the *Attitude Promotion* conception identified in this research. For example, Dunkin (1990) identified a conception of 'teaching as motivating learning', and Martin and Balla (1990) identified a conception viewing 'teaching as encouraging active learning'. These conceptions focused on motivating student learning by, for example, 'providing enough interesting material to maintain stimulation' (Dunkin 1990: 58). However, the *Attitude Promotion* conception does not limit itself to involving merely 'facilitation' of cognitive progressing, but views the establishment of good learning attitudes as one of the aims of teaching and learning. This is an important point that differentiates the present conception from Pratt's (1992) 'apprenticeship' conception. The later also encouraged teachers to demonstrate 'modelling ways of being' to their students, but its dominant elements were 'teacher and content' (p. 211) and it based upon a belief that 'a body of established wisdom and knowledge exists, in the form of expert practitioners, and is to be handed down from those who know, to those who don't know' (p. 212). The *Attitude Promotion* conception does not mean that teachers 'hand down' good attitudes to students, rather, it emphasises an implicit manner of helping students to set up good learning attitudes through active interaction and by creating a proper learning environment. The teachers' modelling effect is only one of many environmental factors which that facilitate students in fostering good learning attitudes.

However, very few conceptions that paralleled to some extent the *Conduct Guidance* conception identified in this research could be found in the literature. Among them, Pratt's (1992) 'nurturing' conception might be closest. Pratt defined nurturing as 'descriptive of a way of relating where genuine regard for the other person and a concern for the relationship bound the two together' (p. 214). He argued that nurturing was not 'reference to moral duty or obligation', instead, it 'has reference to relationship, caring, emotional support, and personal relationship' (p. 214). He sub-labelled this conception as 'facilitating personal agency'. The *Conduct Guidance* conception also shared some ideas with Fox's (1983) 'growing theory' in that they both 'place more emphasis on what is happening to the student as a person' (p. 158). While Fox's 'growing theory' referred to the intellectual aspects of a person, this conception referred to students' personal conduct.

Relating students' intellectual development to their moral and personal development, attending to the development of students' learning attitudes and personal conduct as an important aim of teaching, and expecting teachers to act as role models, all seemed to be aspects which made the teaching conceptions of Chinese teachers different from those within a Western cultural context. This might be another powerful legacy of Chinese educators. *Han Yu*, one of the

most widely recognized scholars and educators in the *Tang* Dynasty, summarized three different roles of a teacher in his book *Shi Shuo* (On Teachers):

What is a teacher? A teacher is the one who shows you the way of being human, teaches you knowledge and enlightens you when you are confused.

(Liu, Z. 1973: 754)

It was also believed that good conduct and learning attitudes could not be delivered easily, rather, they needed to be promoted through the influence of teachers. A good teacher should not only perform well in teaching and learning, but also perform well in other aspects of life, the so-called '*Wei Ren Shi Biao*'.⁵ According to this tradition, it is not surprising that no participants rejected the *Attitude Promotion* conception in the survey using the SPTCT.

The *Moulding* and *Cultivating* orientations were similar to the 'knowledge transmission' and the 'learning facilitation' orientation identified by Gow and Kember (1993). While the 'learning facilitation' conception related mainly to intellectual development, the *Cultivating* orientation identified in this research extended its domain from intellectual aspects to include the development of students' learning attitudes and their personal conduct.

From the above comparisons, it could be seen that in general, all teaching conceptions and orientations identified in this research reflected those identified in previous studies. However, the sharp focus on examinations, and the emphasis on relating teaching to developing good learning attitudes and good conduct, seemed to particularly characterize the teaching conceptions held by Guangdong school science teachers.

One point must be noted: when applying a conceptual framework which originated from another culture to analyse data collected in the Chinese context, some commonly used terms or ideas might have different meaning to Chinese teachers. For example, in relating to the 'teacher-centred' or 'student-centred' approaches to teaching, one of the teachers interviewed did not agree that a 'student-centred' approach always needed to relate to student activities, she argued that

... No matter what kind of method the teacher used, lecturing, demonstrating, discussing, or student experimenting, what is important is that students learn in an active way. If the teacher focuses on encouraging students, setting questions to challenge them, directing them to explore new knowledge, I don't think that means teacher-centred.

(Teacher I, SIR, 8-7)

In the videotaped teaching session a teacher spent 69% of his class time in one-way lecturing and demonstrating in front of the class, but he still believed that his teaching approach focused on facilitating student learning. He argued that:

What is important is to motivate students. If teachers can encourage students to be involved actively in exploring, if they can help students to understand what they are taught, no matter what kind of method they use, even though they lecture all the time, I think that is a good method...

(Teacher J, SIR 7-8)

According to Biggs (1998), the above understanding of 'teacher-centred' approach and 'facilitating student learning' were different to those commonly accepted by Western teachers. In this research, the conceptions identified were based on the actual understanding of teachers rather than the meaning of those words or terms

in the Chinese context or as used by a particular teacher. However, this might cause problems when asking teachers to respond to a questionnaire.

Multiple conceptions of teaching

Most of the teachers involved in this research seemed to respond positively to all categories of conceptions of teaching, which implied that most of them had more than one teaching conception and even espoused apparently conflicting conceptions. This was supported by the qualitative data collected from the interviews. A number of interviewees were found to base their answers to different interview questions on different or even conflicting beliefs and conceptions of teaching. For example, when responding to the question 'what is your personal belief about the nature of teaching', teacher J emphasized that teaching is a process '*to deliver knowledge as well as methods and skills*' (SIR, 4-1). Then, to the question 'what is the role of a teacher', he answered: '*teachers play an organising and leading/catalytic role in helping student learning*' (SIR, 8-5). The former reflected clearly a moulding orientation while the later implied a cultivating orientation.

However, this seems not only the characteristics of Guangdong school physics teachers, but also of teachers elsewhere. A number of previous studies (Argyris and Schon 1978, Larsson 1983, Marton and Saljo 1984, Bowden 1988, Pratt 1992) argued that a teacher might have more than one or even conflict conceptions of teaching. This research provided evidences to support the argument. In another study, Kember and Gow (1994) used a questionnaire to assess 170 university lecturers of 15 departments in two tertiary institutions in Hong Kong. The items were grouped into two higher-order scales: 'knowledge transmission' and 'learning facilitation'. They reported the departmental average for the 'learning facilitation' scale ranged from 4.2 to 4.7, implying that on average, the lecturers' attitude was between 'agree with reservations' and 'definitely agree'. The departmental average for the 'knowledge transmission' scale ranged from 3.4 to 4.0, implying that the lecturers' attitude was between neutral to 'agree with reservations'. This suggested that on average, university lecturers responded positively to both the 'knowledge transmission' and the 'learning facilitation' orientations. This, too, provided to support the argument that a teacher might have more than one conceptions of teaching.

As Bowden (1988) has described for Australian teachers, most of the Chinese teachers involved in this research did not realise that they had shifted their stance when they answered different questions during the interviews, or when they responded to the SPTCT. But they expressed no surprise when they heard about that. Their explanations for these conflicts fell into two groups. Some teachers explained that this was due to the big gap between the theoretical and the practical world: the '*ideal conceptions about what teaching should be*'⁶ reflected the theoretical world and the '*practical conceptions about what teaching really is*' reflected the real school environment. As a teacher said:

'I find it impossible to try (the action learning approach in my class). How can I teach so little? How can I cover the school syllabus if I introduce only six new concepts in two weeks? How can I help students to prepare for the examinations if I don't drill them in solving exam-type items? I know that the action learning approach is good for student development. It emphasizes the generation process of physics concepts and physics methods. But I have to emphasize the combination of physics and math-

ematics, calculation and solving-items. If I don't need to care about the performance of my students in public examinations, if I don't need to follow exactly the course syllabus and the textbooks, I think I will make a change.

(Teacher C, SIR, 16-2)

This supported the view of Argyris and Schon (1978) that teachers might have two sets of personal theories: an 'espoused theory' and a 'theory-in-use'. Another group of teachers argued that teaching is a complex system processing in multiple ways and directions, *'there are several parallel streams going down along the same slope, each stream defines one conception of teaching'*. For example, some teachers viewed the development of students' ability and the cultivation of good attitudes and good conduct as only one side of the picture. On the other side they felt that *'as a good teacher you need to be responsible to your students. You need to help your students to perform well in the examinations so they can have a bright future'*. (Teacher L, SIR 1-4). Therefore, preparing students for examinations was also emphasized by the same teachers.

This research did not focus on examining why teachers have more than one conception of teaching. However, from the above descriptions, we can see that teachers do have different models to support their conceptual framework about teaching. This might be an interesting issue for further study.

Conclusions and implications

This is the first study investigating science teachers' conceptions of teaching from both qualitative and quantitative aspects in China. It is also one of the first in a non-Western context and probably the first at secondary school level. Qualitative findings of this research may provide new insights to improve the present understanding of teachers' conceptions of teaching:

- (1) One teaching conception held by Chinese science teachers seems to view students' examination performance, especially public examinations, as the most important indicator of good teaching and successful schooling. This seemed to be one of the major distinctions between the teaching conceptions held by Chinese schoolteachers and those found from Western tertiary lecturers. Western studies at school level may well find a similar conception to this kind.
- (2) Two other teaching conceptions held by Chinese science teachers seem to combine classroom teaching with the cultivation of good learning attitudes and good conduct. These seemed to encompass both the Western 'facilitating learning' conception with the Chinese cultural focus on affective and moral development.
- (3) Given the above differences, however, parallels of the five teaching conceptions and two higher-level orientations identified in this research could all be found in previous studies, though most of those studies were conducted at the tertiary level within a Western context. This supports the argument that most teaching conceptions found in the Western culture would be universal, though some might emerge in one culture and not another (Prosser *et al.* 1994, Watkins 1997).
- (4) This research also provides quantitative evidence to support a multiple-level model for describing the relationship among the teaching concep-

tions and orientations. This relationship is important for distinguishing between conceptions and for the clarification of the meaning of each conception.

- (5) A number of previous studies have suggested that an individual teacher might hold multiple or even conflicting conceptions of teaching. This research provided both qualitative and quantitative evidence to support this idea. Furthermore, it described two different pictures of these teachers. In one picture, a teacher might strongly support two conflicting conceptions because he/she took both 'ideal' and 'practical' considerations into account. In another picture, teachers saw teaching as a complex system, which could not be described simply by only one conception of teaching and so held multiple conceptions of teaching.

Another contribution of this research for further investigation referred to the questionnaire developed in this research, the SPTCT. The SPTCT was carefully developed from the qualitative data collected in and the findings of the in-depth interviews and all items originate from the interview statements. Data collected by the SPTCT suggested a satisfactory reliability and validity for investigating science teachers' conceptions of teaching in Guangdong and probably in the most part of China.

The structure of the SPTCT, and the relationships among the SPTCT items and scales were supported by a series of scale and item level confirmatory factor analyses. Therefore, the SPTCT questionnaire may not only be suitable for quantitative assessment, but also may be an instrument for linking qualitative and quantitative approaches.

While previous questionnaires were developed at tertiary level and within the Western system, the SPTCT focused on secondary teachers within the Chinese context related to a particular secondary school subject. It may be used for the development of questionnaires for assessing schoolteachers' conceptions of teaching in other subject areas. It may also act as a starting point for developing similar instruments to be used in other places within the regions that have a strong Chinese cultural context, for example, Hong Kong, Taiwan and Singapore and may also be useful in future cross-cultural investigations of teaching conceptions.

This study does have possible limitations which can be explored in further research. It may be that the analysis relies too heavily on the assumption of a single 'teacher/content' v. 'student learning' dimension. While it was clear that such a dimension did underlie many of the interview responses perhaps other dimensions may have emerged with a more open-ended approach. The use of videos of classroom practice to focus the teachers' interviews may have limited the teachers' responses to that classroom context, rather than to any more general conceptions of teaching. Though the researcher tried to select the interviewees so as to represent a wider range of teachers, the use of a volunteer sample in the interviews limited its representativeness and may have affected the richness of data collected.

Notes

1. SIR means the Selections of Interview Records. The number 4-1 is a serial number of that quotation. Same as in the following.
2. Jiao Shu Yu Ren: A set phrase means teaching as well as cultivating good persons.

3. Xue Er You Ze Shi: A quotation of Zi Xia, one of the followers of Confucius. It means that when a scholar is able to cope beyond studies, he should take office in the government.
4. Ke Ju: The name of the national selection and examination system in ancient China, which began in 606 AC and stopped in 1898 AC.
5. Wei Ren Shi Biao: A term used to describe the role of a teacher. It means that a teacher should be a conduct model.
6. Quotations in this paragraph are taken from the oral record of the meeting.

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Appendix: Translations of the SPTCT items

1. Student learning means accepting knowledge from teachers.
2. Most of the workshops which I attend focus on strategies of promoting students' motivation.
3. I never miss any chance to demonstrate how to be a nice person.
4. Usually I will publish the results of student performance in tests to motivate student learning.

5. I like those students who know the knowledge learnt accurately and in detail.
6. Interaction with the outside world is the most important way of students learning, whether inside or outside the classroom.
7. I am very interested in sharing experiences with my colleagues on guiding conduct through teaching.
8. You should spend most of your class time in drilling students with exam-type items.
9. I would be very satisfied if my students could remember the details knowledge imparted in the physics textbooks.
10. Student learning means knowing how to mature gradually.
11. I like to exchange information and share experiences on public exams with my colleagues in meetings and in-service activities.
12. Delivering knowledge is the essence of teaching.
13. Students go to school to gain qualifications necessary for future studies or career.
14. Preparing a large amount of teaching materials is the most important factor for successful classroom teaching.
15. I expect my students to become more and more interested in learning through the physics course.
16. I prefer those students who are competitive and get good marks in exams.
17. I strongly agree with the simile that views a teacher as a bank of knowledge.
18. Organizing activities to change students' misconceptions is the key to good teaching.
19. Teaching means to develop students' behaviour.
20. My greatest concern is that all my students will get excellent marks in public exams.
21. Proficiency in physics is of prime importance to a physics teacher.
22. I often challenge students with questions focusing on their pre-conceptions before I start a new topic.
23. For a successful lesson, it is very important to make the students concentrate on their learning.
24. Knowing the teaching content thoroughly is the most important task in preparing a lesson.
25. A physics teacher should understand the fundamentals of students' attitudes.
26. A teacher should act as a model of learning to students by being diligent in learning and teaching.
27. Drilling students with well-designed exercises is the key to a successful lesson.
28. The theme of my preparation for a lesson is how to organize student activities.
29. To be able to promote correct learning attitudes in students is a very important prerequisite for a teacher.
30. A teacher should win the students' respect through his/her attitude to studying.
31. Teachers would be better not organizing classroom activities so they can spend most of the time for a better interpretation of knowledge.
32. The role of a physics teacher is very similar to a tourist guide who leads students in the way of learning.
33. I pay much of my attention on how to educate students with good conduct when preparing a lesson.
34. Teachers should know clearly about the objectives of their schools and the public examinations.
35. I try hard to create chances for students to ask questions during class.
36. I never miss any chance to encourage my students to learn actively.
37. I concentrate on how to ensure that students follow my teaching while preparing my lessons.