



A Framework for Teacher Verbal Feedback: Lessons from Chinese Mathematics Classrooms

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Teacher verbal feedback plays an important role in classroom teaching. Different types of feedback can have different effect on students' learning. Praise and blame feedback could provide positive and negative results for learners. The gap was left in considering teachers' attitudes in providing verbal feedback to students. Due to feedback which may culture dependently, the types of teachers' verbal feedback were studied based on analysis of 24 teachers from 4 regions (Shenyang, Beijing, Hangzhou and Chongqing) in junior secondary mathematics classrooms of China. A coding scheme on the attitudes of teacher verbal feedback was developed which included three categories: "Negative", "Neutral" and "Positive (Encourage in gesture & Encourage in action)". Feedback frequency and duration were documented and showed that teachers hold neutral attitudes mostly. Teaching method (student-centered or teacher-centered) and school policy were the most apparent factors presented by this study which can have effect on teacher's verbal feedback.

Keywords: teacher verbal feedback, attitude, Chinese mathematics education, classroom communication

INTRODUCTION

Communication has been paid attention in various contexts (Alrø & Skovsmose, 2004). Just as in mathematics classrooms, certain types of communication, such as dialogue and discourse, can be found easily in classroom teaching. As the teacher, if he/she did not realize the importance of classroom communication, it could be a problem for them in his/her teaching (Van Zoest & Enyart, 1998). Compared to other aspects, the effectiveness of classroom communication between the teacher

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and students was focused more in various studies, because it is important for nurturing students' mathematical potential (Baroody, 1993). It also influences mathematical-knowledge construction, reasoning, self-confidence, and social-skills acquisition (Lappan & Schram, 1989). Hence, researchers and practitioners need to pay attention to teacher-student communication occurring in mathematics classrooms on both how teachers raise questions and how they respond to students' answers.

In classroom communication, questioning is one of the most common strategies used by teachers during their classroom instructional practices and has been investigated in a large number of studies (Carlsen, 1991; Chin, 2007; Franke et al., 2009; Herbal-Eisenmann & Breyfogle, 2005; Martino & Maher, 1999; Nicol, 1998; Vacc, 1993). Less emphasis should be made on the questions teachers ask, but more on the manner in which teachers react to pupils' responses in order to "open" classroom interaction (Smith & Higgins, 2006). Teacher-verbal feedback is considered as a significant instructional behavior which can have considerable effect on students learning (Ryan, 1982; Zahorik, 1968). The focus of this study is to look into teacher verbal feedback.

Chinese context, as another factor is considered in this study. Chinese students outperformed their Western counterparts in recent international mathematical assessments, such as TIMSS and PISA which has drawn attention from outside (Cai & Nie, 2007; Lapointe, Mead, & Phillips, 1989; Leung, 2010; OECD, 2014; Tang, Peng, Cheng, Kuang, & Song, 2013). However, due to teacher-centered instruction (e.g. whole classroom teaching and excessive classroom exercise) frequently adopted in these mathematics classrooms which may not favorable for learning, the *East Asian learner paradox* has been discussed by researchers (Mok, 2006). A teacher-dominated lesson may not means bad for learning and a student-centered lesson may not always be positive (Mok, 2006). Other thing was that innovative teaching and learning have been advocated from the beginning of this century (Huang & Li, 2009). One of the major point was that the role of teacher was required to change from "demonstration" to "communication" (Ministry of Education, 2001). To have a communicative classroom, teacher questioning was a frequent strategy in bring interaction between the teacher and students which was the most communicate ways in Chinese mathematics classroom (Cao, 2011) rather than feedback. Based on analysis of Chinese literature on classroom discourse, it was found that the teacher play a leading role during teacher-student interaction and the role of the teacher was extremely important in studying Chinese mathematics lessons (Mok, Yang, & Zhu, 2014). It was very recently to study mathematics classroom communication in mainland China and most centered on teacher questioning while very little on feedback to students' ideas and thought (Liu, 2013). In addition to the culture has been one of the most important factors in explaining students' mathematical achievement (Leung, 2008), feedback has also influence on students' achievement (Ryan, 1982; Shute, 2008; Zahorik, 1968). Furthermore, feedback was culturally dependent has found (Kluger & DeNisi, 1996; Markus & Kitayama, 1991). This research aims to study teacher verbal feedback within Chinese context.

State of the literature

- Teacher questioning has been focused too much.
- Teacher formal feedback has also been studied for a long time.
- Classroom communication has been a hot topic in Western countries with a long history.

Contribution of this paper to the literature

- Teacher verbal feedback is the focus of this study.
- A framework for teacher verbal was developed and applied.
- This study was conducted in four major cities of China.

THEORETICAL CONSIDERATION

Teacher verbal feedback is one kinds of the behavior of the teacher in classroom communication. Considering that, the teacher role in classroom communication was discussed to show the importance of feedback for teachers. Then the theoretical framework for this study was proposed based on the analysis of existing literature on feedback.

The role of teacher in classroom communication

Classroom communication typically follows a three-part exchange beginning with a teacher initiation, followed by a student response, and then the teachers' response (Cazden, 2001). In this pattern, teachers, as the master of the class, usually hold a belief that their role is just to transmit knowledge to students. This should be abandoned because teachers play a crucial role in shaping the discourse in their classrooms through the signals they send to their students about what is valued about mathematical knowledge as well as ways of thinking and knowing about mathematics (Ball, 1991). Students' role in classroom instruction should be paid more attention and teachers need to be sensitive to student learning (McClain & Cobb, 2001; Yackel & Cobb, 1996),

If teachers want to know students' learning, they should encourage students to develop explanations, make predictions, debate alternative approaches to problems and clarify or justify their assertions (Brophy & Good, 1986). To ensure these activities achieve, a discourse environment needs to be created. However, creating and maintaining discourse environments is complex endeavor for teachers (Sherin, 2002), because it is not only to encourage students to discuss their ideas and converse with each other but also ensure that these discussions are mathematically productive for teachers.

In a discourse environment, it is not the students who can learn, but the teacher learns as well (Fennema et al., 1996; Hufferd-Ackles, Fuson, & Sherin, 2004; Schifter, 1998). Students sharing and explaining their ideas seems to be a key factor in their learning (Sherin, 2002). Novel students' ideas prompt teachers to rethink their understandings of mathematics and the pedagogical strategies that they use in teaching such ideas (Sherin, 1996). If teachers encouraged students to communicate their solutions and conjectures to their classmates (NCTM, 1991), students could consolidate their mathematical understanding, improve their communication skills, and enrich their repertoire of problems solving strategies (NCTM, 2000).

However, "simply engaging students more actively in classroom discourse is not a panacea for improving mathematical achievement" (Truxaw, 2009, p. 18). This depends on the function of the discourse; either univocal or dialogic in nature (Olson, Knott, & Currie, 2009). Teachers play a crucial role in determining the function of classroom discourse, especially how they make feedback to students.

The theoretical framework for this study

Research on feedback intervention dates back 100 years ago. The effects of feedback interventions (FIs) on performance has been examined and reported from a historical perspective (Kluger & DeNisi, 1996). Kluger and DeNisi reviewed extensive literature which was traced to Thorndike's classic research 100 years ago, did a meta-analysis on experimental findings and formed a preliminary feedback intervention theory (FIT). The findings included FI effects on learning, FI-induced affect, and FI effects on task-motivation process, task-learning process and meta-task process. Based on these, two major conclusions were summarized. One was FIs seemed change the locus of learner's attention to task-motivation or task processing learning. The other was that FI effects were moderated by the characteristics of tasks,

such as complex task performance benefitted from FIs much less than simple tasks and the novel task performance could be weakened if the performance was evaluated in the early stages. The FIT provided feedback moderators including praise, written or verbal feedback, task novelty and complexity.

Shute did a review focused on formative feedback which was also in a historical perspective (Shute, 2008). In this review, formative feedback was defined as “information communicated to the learner that is intended to modify his or her thinking or behavior for the purpose of improving learning” (Shute, 2008, p. 154). Task-level feedback was focused in this review, because task-level feedback could provide more specific and timely information to students’ responses and consider students’ current understanding and ability, especially in their cognitive understanding. Through literature review, Shute found that the gap between students’ current level of performance and desired level could be indicated; cognitive load of students could be reduced effectively; and useful information for correcting inappropriate student’s responses could be provided by informative feedback. However, if formative feedback did not provide specifically, students may view it meaningless, disappointed or both. Some specific aspects were summarized in this review, for example, features of formative feedback included verification and elaboration; the complexity and length of feedback; negative effects of feedback complexity; motivation and goal-directed feedback; and the timing of feedback (delayed feedback and immediate feedback). Also, the variables, such as the ability levels of students, response certitude, goal orientation and normative feedback were included.

Despite the lavish feedback research many conflicting findings can be found, consistent pattern can not be generalized (Shute, 2008). The agreements were that the type of feedback given can be differentially effective and there was no best type for all learners and learning outcomes (Hattie & Timperley, 2007; Shute, 2008). Although the first review focused on FIs while the second formative feedback, feedback was related to tasks including task motivation and learning process. Verbal feedback was seen a moderator in FIT and a kind of formative feedback, but it was not found any study on verbal feedback in the two reports. If feedback undertook the responsibility to provide information to students, it may be through affective processes to achieve this goal (Hattie & Timperley, 2007). The effects of FI-induced affect were discussed in by Kluger and DeNisi. FI with positive (negative) sign could produce positive (negative) mood and then had effect on cognitive performance. Actually, teacher’s immediacy verbal behavior has been linked to student learning (Christophel, 1990). Nearly half items in evaluating teacher’s verbal immediacy behavior were on teacher questioning and feedback, such as “Praises students’ work, actions or comments” and “Criticizes or points out faults in students’ work, actions or comments” (Gorham, 1988). Praise and criticizes are all related to attitude. Since teacher’s verbal feedback has not been focused, the attitude of teacher’s verbal feedback was considered to outline. In addition, the quality classroom discourse at the secondary school level needs to be focused more (Walshaw & Anthony, 2008). The feedback functions within a wider variety of learning domains recommended to be examined (Mory, 2004). The more important is to consider the feedback in different instructional contexts and to learners (Shute, 2008). The difficulty was to document the frequency of feedback in classroom (Hattie & Timperley, 2007). Combined these considerations, this study aims to outline the attitude of teacher’s verbal feedback in mathematics classrooms in junior secondary school level and try to analyze it in the views of frequency and duration.

To study the characteristics of mathematics classroom dialogue in Chinese primary schools, Li and Ni offered the three aspects: teacher’s reaction to student’s ideas; the authority of classroom dialogue and the types of teacher questioning to depict general teachers and expert teachers’ classroom dialogue (Q. Li & Ni, 2007).

The scheme of teacher's reaction which aimed examine whether teachers encourage students to share their ideas or not in classroom teaching. The coding scheme included four categories: a) ignore or give up student' idea; b) accept but not apply student' idea in his/her teaching; c) repeat student's idea to accept; d) investigate and apply student's idea in his/her teaching (Q. Li & Ni, 2007, p. 37). The codes of teacher's reaction mainly considered the attitude of teacher to student's idea which was as one of the third important characteristics in depicting Chinese mathematics classroom dialogue.

However, the types of attitude have not been leveled and categorized clearly, especially for the last type. This was testified in actual classroom observation. For example, the teacher sometimes asked students to provide explanation for their answers or ideas to help students clarify and learn which could be categorized into the fourth type but difficult to determine the attitude. Moreover, some teachers seemed to like pose many more questions than others which seemed indicated the frequency and duration of teacher's verbal feedback different. Based on the consideration, teacher's verbal feedback has not been focused much, the attitude as one of important characteristics of mathematics classroom dialogue but did not categorized well and the frequency and duration of verbal feedback were sometimes various. Hence, to know about the teacher's verbal feedback in Chinese mathematics classroom in secondary school level, this study aims to address questions as followed: what are the main attitudes of teacher verbal feedback in Chinese mathematics classrooms? How about the frequency and duration of each type? Studying teacher verbal feedback not only make outsider know more about Chinese mathematics teaching but also can shed a light on Chinese mathematics educational research in classroom communication.

RESEARCH METHOD

Definition

An instructional question was usually raised by the teacher, followed by students' responses; reply and subsequently teacher's feedback (Wells, 1986). In this case, verbal feedback was defined as to describe the communication given to inform individual student of the accuracy of a response to the teacher's questions.

Data collection

To expand and refine the framework mentioned in section 2.3, 24 video lessons (14, 9,1 of grade 7, 8, 9 respectively) of 24 teachers (9 male & 15 female) were collected from 4 urban major cities (Shenyang, Beijing, Hangzhou & Chongqing, located respectively in the Northeastern, Northern, Southeastern and Midwestern parts of China) in mainland China. Considering the discrepancy among different school levels (good, general & low) in teachers and students, two teachers of each level were recruited. Eventually, 13 algebra lessons, 10 lessons geometry lessons, and 1 Statistics lesson were analyzed.

Coding scheme developed and coded

The review of formative feedback (Shute, 2008) focused in the task-level, because task-level feedback could provide more specific and timely information to students' responses and consider students' current understanding and ability, especially in their cognitive understanding. If formative feedback did not provide specifically, students may view it meaningless, disappointed or both. Amount of literature can be found in this review, but it can not be found the attitudes of teacher's verbal feedback which may have effect on students' learning. Praise and blame feedback could provide positive and negative reinforcement for learners (Mory, 2004).

Moreover, teacher’s reaction to students’ answers or ideas has been one of the third important characteristics in depicting Chinese mathematics classroom dialogue. (Q. Li & Ni, 2007). The coding scheme included four categories: a) ignore or give up student’ idea; b) accept but not apply student’ idea in his/her teaching; c) repeat student’s idea to accept; d) investigate and apply student’s idea in his/her teaching (Q. Li & Ni, 2007, p. 37). This scheme did not explain very well. It seemed to have a hierarchy in teacher’s attitudes, but it was difficult to distinguish the second and the third. Besides, the code scheme was applied to expert and non-expert teachers in primary school level.

In actual classroom observation, there were other findings. For example, if the teacher encouraged the student to make an explanation for his/her wrong answers and did not accept it finally, this can be classified into the kind of (a) or (d). It seemed that teacher’s attitudes can be affected by the correctness of answers.

Based on the aforementioned work, the first author tried to develop a code scheme in task-level. In the code scheme developing, 1 professor and 3 doctoral students, were invited as consultants. The professor and one of the doctoral students have years of teaching experience in secondary school to make sure theoretical and practical advices provided. To make the code reliability, at least one example (video episode) for each code was presented to consultants (See the examples in section 3.4). All the consultants and the first two authors agreed completely, and then the first author started to code the 24 video lessons. The final scheme used in this study can be seen in the following (See table 1).

Table 1. Attitudes of teacher’s verbal feedback

Attitude	Negative	Neutral	Encourage in gesture	Encourage in action
Wrong	The answer is wrong and the teacher criticizes the answer.	The answer is wrong, and the teacher ignores it and then let other students to answer or explain it or by the teacher herself/himself.		
Part correct and fully correct	The answer or idea is correct but not the teacher anticipated.	The teacher satisfies with the correct answer but no substantial suggestions are provided.	The student’s answer is not totally correct, the teacher still find the merit of this idea, and encourages and guides the student to refine the answer.	The teacher applies students’ correct answers and good ideas in the actual teaching;

Examples illustrating the codes

Video episodes were transcript as examples to explain the code scheme. All the episodes from the 24 teachers were labeled in anonymous with region plus order, such as the first teacher from BJ named BJ01 and so on.

Negative

Student’s answer was correct, but it was not the teacher anticipated. The teacher didn’t accept it with a negative attitude.

Episode sample (HZ05)

Background: The teacher asked students to solve the following problem:

$$-a^7x^4y^3 \div (-\frac{4}{3}ax^4y^3),$$

several minutes later, the teacher showed one of student’s exercise book to whole class through the projector. The student’s answer as shown in following:

$$\begin{aligned}
 & -a^7 x^4 y^3 \div \left(-\frac{4}{3} ax^4 y^3\right) \\
 & = \left[-1 \div \left(-\frac{4}{3}\right)\right] (a^7 x^4 y^3 \div a \div x^4 \div y^2) \\
 & = \frac{3}{4} a^6 y
 \end{aligned}$$

The teacher drew a check and then explained the solving procedures step by step.

1Teacher: The step that the first coefficient divides the second coefficient ($= [-1 \div (-\frac{4}{3})]$) is ok, but the next step is this, $(a^7 x^4 y^3 \div a \div x^4 \div y^2)$, Right?

I don't think so. The next step should like this— $(a^7 \div a)(x^4 \div x^4)(y^3 \div y^2)$.

(The teacher showed the perfect step which she required students should have completed.)

Neutral

a) Students' answers were completely wrong or partially correct, teachers didn't accept these answers directly. This type is frequently seen in mathematics classrooms.

Episode sample 1 (BJ01)

Background: The teacher asked students to recall the concepts which are relation to data collection and sorting which they have learnt in primary school.

1Teacher: What are the methods of data sorting?

2Student: Data classification.

3Teacher: Classification is a kind of strategy rather than a method.

Neutral: b) The idea of student is incorrect, but the teacher still asks the student to explain or show their thinking on the answer. Eventually, the answer was not accepted eventually.

Episode example (SY01):

Task: 【Think hard, you will make success】 There is a ripe persimmons tree. Supposing one persimmon will down from the tree. Which one of the following figures (See in Figure 1) can describe the changing of the persimmon' velocity before it falling down the ground?

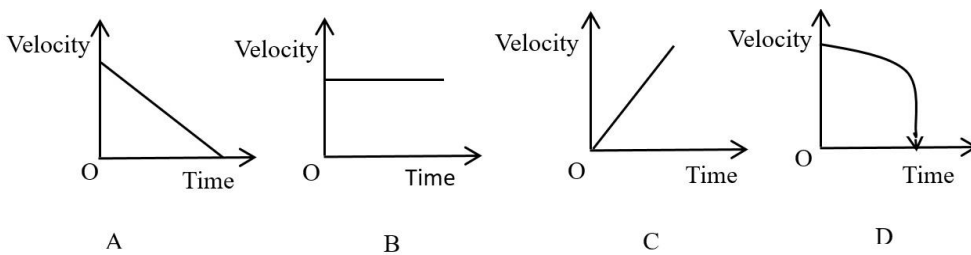


Figure 1. The task presented in the PowerPoint

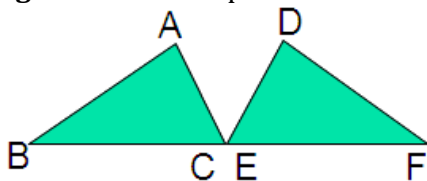


Figure 2. The graphs in the problem

At first, the teacher posed the question of corresponding vertexes to whole class

Background: After showing the task to the whole class with the PowerPoint, the teacher let students think for one minute and then asked them to discuss it in group.

1T: Who can tell me the answer? Not only should you tell me your choice, but also explain why you choose this one. Cai (*One student*), can you tell me your choice?

2 Cai: I think my choice is A. (*The students spoke his answer hesitantly. His answer was so obviously wrong that once he spoke out his choice, the other students laughed and whispered in different opinions.*)

3T: Could you explain why your chose A as your answer? (*Although the answer is incorrect, the teacher still asked the students give his reason.*)

4. Cai: Because the height of the tree, oh..., is a constant value, the apple fall down (*The other classmates laughed because Cai said apple rather than persimmon*). Oh..., the distance between the persimmon falling and ground become smaller and smaller until there is no distance, so my choice is A.

5T: Can you understand the explanation?

6 Class: Yeah.

7T: Who can tell Cai that his explanation is right or wrong? If his explanation is wrong, please give your own explanation.

(*No one respond to the teacher, so the teacher waited for a moment.*)

8T: Cai said the persimmon is on the tree, so the height is a constant value, and then the persimmon falls down. The height would not exist finally, so his choice is A.

(*The teacher designated a girl to explain why Cai's choice was not right.*)

9G: I think this the problem solving without considering the height, because when we look at the coordinate, we would find that the axes represent velocity and time separately which has no relation with the height. So I think A is not the right answer.

10 T: That's right. When you watch the figure, you should pay more attention to what the axes represent. (*The teacher explained again about the axes' representation*) Which is the right answer on earth?

11 Class: C.

12T: Who else can explain that? (*The teacher asked students explain why choose C as the final answer.*)

(*After three students' explanation, the teacher refined the explanation and then moved on the next problem.*)

Neutral: c) When the students' answers were correct, teachers habitual say "good", "Very good".

Episode example (CQ02)

Background: The teacher interpreted the definition of congruent triangles and corresponding vertexes, corresponding sides and corresponding angles firstly. And then the teacher required students to find out all the corresponding vertexes, sides and angles existed in the two graphs (see figure 2).

1 T: Next, I will ask you to answer what the corresponding sides are? (*The teacher designated one student.*)

2 S: AB and DF; BC and EF; and AC and DE.

3 T: Good. Sit down.

4 T (*Continued*): I want to add one point. When you look for the corresponding vertexes, sides and the after angles, the order of the three groups (*which mean the three pairs of corresponding vertexes*) is independent for each other. Ok, let's look at the corresponding angles (*indicated the student gives the answer*).

5 S: $\angle A$ and $\angle D$, $\angle B$ and $\angle F$, and $\angle C$ and $\angle E$.

6 T: Ok, sit down. His performance is good?

7 Class: Good.

Analysis: We can easily find that teachers usually say “Good” to students’ performance, if there is no fatal mistake of students’ answers, the teacher would like to say “Good”. However, this not illustrates the teacher has a moved emotion. This is just a habit speaking.

b) Students’ answers are satisfied with teachers, but there is no suggestion about these answers which are provided by teachers.

Encourage in gesture

a) When students answering questions with lack of confidence, teachers still encourage students to explain their ideas.

Episode example (BJ03):

Background: The formula ($m(a + b + c) = ma + mb + mc$) has been written on the chalkboard and the teacher want students to explain it with language.

1T: Who can depict the formula in word language? It’s ok even your answer is not right. (*There is no one hand raised up.*) Ok, I will seek someone to explain it.

(*Speak out a name*)

2S: You explain it with word language.

3S: oh,,, that is,,, should be,...(*The student hesitate to say.*)

4T: You can say what you think. (*The teacher encouraged him with a gentle voice.*)

5S: That is,,,the monomial multiply each term of the polynomial monomial separately.

6T: How about he said just now? It’s very good? Right? (*The teachers always spoke in an encourage tone.*)

(*The student sat down with a happy smile*)

7T: That is using the monomial multiply each term of the polynomial monomial separately, and then..? (*The teacher still asked the student who just answered the question*)

8S (*Stand up*): Then add them up.

9T: Yes, after multiplication and then adding them up.

Encourage in action

a) The student shows his/her solution on the chalkboard.

b) Even if the student’ s idea/thought was not totally correct or not the teacher anticipated, the teacher still tried to find the merit of this idea, encouraged and guided the student and other students collectively to refine or learn the answer (or idea).

Episode example (which is abstracted from BJ T 03):

Background: The main task for students is to learn monomial multiplied by polynomial. After the teacher explained the formula ($m(a + b + c) = ma + mb + mc$) and then demonstrated the example 1 in the chalkboard. She hoped the students could do example 2 by themselves according to the steps shown by example 1 and she also asked one student to do the example in the chalkboard and other students do it in their exercise books.

$$\text{Example 1 } 2a^2(3a^2 - 5b)$$

$$\text{Solve: } = 2a^2 \cdot 3a^2 + 2a^2 \cdot (-5b)$$

$$= 6a^4 - 10a^2b$$

The teacher walked around and emphasized the normalization of problem solving again and again when students did the exercise. After the student finished in the chalkboard, the teacher started to comment on the his solution (Example 2):

$$\text{Example 2 } \left(\frac{2}{3}ab^2 - 2ab\right) \cdot \frac{1}{2}ab$$

$$\begin{aligned} \text{The solution} &= \frac{2}{3}ab^2 \cdot \frac{1}{2}ab - 2ab \cdot \frac{1}{2}ab \\ &= \frac{1}{3}a^2b^3 - a^2b^2 \end{aligned}$$

When the teacher saw this $= \frac{2}{3}ab^2 \cdot \frac{1}{2}ab - 2ab \cdot \frac{1}{2}ab$, she said the following:

1T: The student wrote like this, I think it's also ok. (*The teacher had hoped students write like this*): $= \frac{2}{3}ab^2 \cdot \frac{1}{2}ab + (-2ab) \cdot \frac{1}{2}ab$

(Then, the teacher explained the student's solution again.)

2 T: This kind of solution is much better than I gave actually. I wrote like this (*figure out the $2a^2 \cdot (-5b)$*), which is to make you understand carefully. If you could write like the student's, you should do it. The student performed a better solution for us.

(Although the student didn't do the exercise according to step by step shown by the teacher, her solution was praised by the teacher. What's more, the teacher thought her idea was much better.)

The presentation of the above examples to illustrate the codes can be used in analyzing teacher's attitude of verbal feedback.

Coding Unit

To know the frequency and duration of teacher verbal feedback, a coding unit should be determined. In this case, after teacher questioning, the student was designated to answer the question as the beginning, and teacher's feedback completion as the termination. If teacher have follow-ups, the final feedback would be as the end. The follow-ups are for the same student's answers. The final attitude of feedback can be known from these follow-ups.

STATISTICAL RESULTS & EXTREME CASES

To have an overview of the 24 teachers' verbal feedback, frequency and duration of teacher were provided in Figures 3 & 4. The frequency means the times of teachers offered verbal feedback to individual students. The duration means the percentage of each type in one lesson.

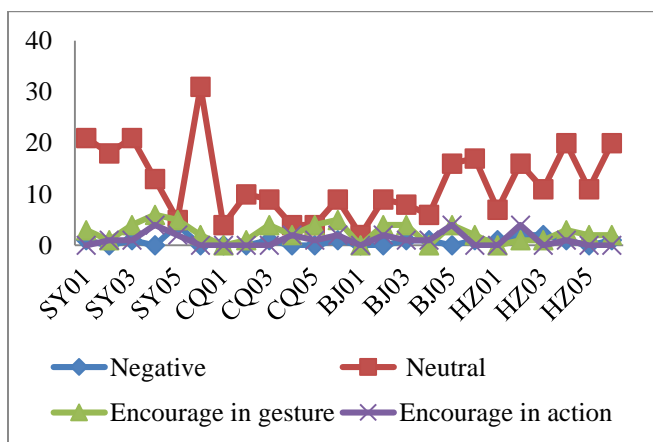


Figure 3. The frequency of per teacher

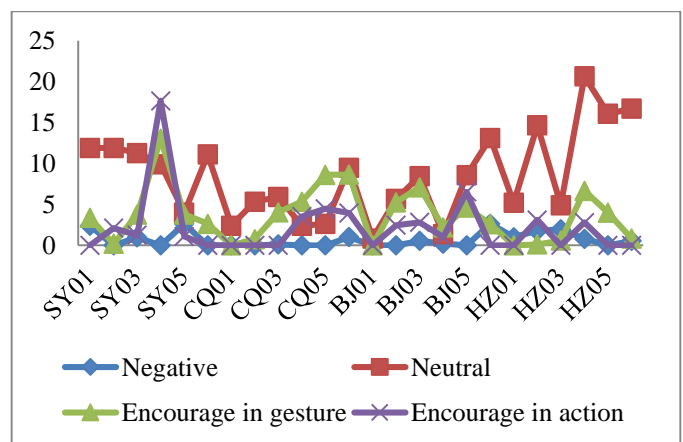


Figure 4. The duration of per teacher

The frequency and extreme cases

Except for the teachers of SY05 and CQ05, the most type was “Neutral” attitude for other teachers. For most teachers, the “Negative” attitude was adopted few. There was a large gap between the “Neutral” attitude and other three attitudes in frequency for most the 24 teachers. It seemed that the frequency of teachers from Shenyang was much higher than teachers from Chongqing. About the two kinds of encourage attitude, the discrepancy was not apparently. Although this study is not a comparative study, it is still found that there were apparent differences between the four regions, especially in SY and CQ. The total frequencies of each of the four regions were 144 (SY), 103(HZ), 83 (BJ) and 63 (CQ) respectively and the corresponding average years of teaching experience were 15.5(SY), 14.9(HZ), 10.7(BJ) and 10.7(CQ).

In addition, there were some extreme cases can be found from figure 3. The frequency of the teacher SY06 was the highest (total 33 times including 31 “Neutral” and 2 “Encourage in gesture”) while the teacher of BJ01 was least (2 times, both were “Neutral”). The lesson of SY 06 was a geometry lesson of “Triangles in Changing” and the teacher had 15-year of teaching experience when the lesson tapped in a general school. During this lesson, the teacher seemed like to pose questions to designate students to answer and then she provided feedback. The teacher of BJ01 taught the lesson of “Plane Rectangular Coordinate System” and had 17-year of teaching experience in a major school. At the beginning of the lesson, the teacher required students put aside their textbooks and listen carefully during the whole lesson, because she would teach with the help of projector (See Figure 5). The results were that almost teaching content was show in the projector and the teacher explained it step by step.

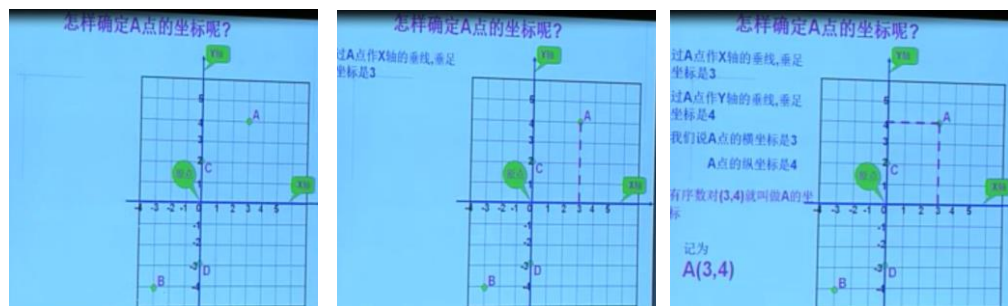


Figure 5. Task and its solution

The duration and extreme cases

About the duration, the most type of attitude still was “Neutral” for half of the teachers. “Negative” was almost the least. For many teachers, there was a big gap between the most attitude of “Neutral” and other three types, such as SY01, SY02, SY03, SY04, SY06, BJ06, HZ02, HZ04 and HZ06. For some teachers, the gap between “Neutral” attitude and “Encourage with gesture” was very small or no existing, for instance SY04, SY05, CQ06, BJ01, BJ02, BJ03, BJ04, and BJ05. Both the two kinds of encourage attitude seemed have risen.

There was another extreme case, SY04, the durations of “Encourage in gesture” and “Encourage in action” were higher than “Neutral” attitude’s duration. Actually, the lesson was a review lesson of triangle and thus the exercises were prepared and given by the teacher from the beginning to then end. Specially, this lesson was taught in group which was differently from other lessons. Each group included four students were required to accomplish each task cooperatively and then explained their solutions in front of the class with the help of projector (See picture 6&7). During



Figure 6. Group discussion



Figure 7. Group explanation

or after their explanation, the teacher gave questions or feedback. Every one of the group had to explain at least one part of the solution/idea. The teacher, SY04, was a teacher with 12-year of teaching experience in a major school.

CONCLUSION AND DISCUSSION

Through the coding scheme, the main types of mathematics teachers' attitude of verbal feedback within Chinese context were: "Negative", "Neutral attitude", "Encourage in gesture", and "Encourage in action". Considering the 24 lessons covered algebra, geometry and statistical content; ranged grade 7,8 and 9; included new and review lessons; taught by female and male teachers; and recorded in low, general and good school levels, this scheme could be applied in analyzing teachers' attitude of their verbal feedback in secondary school level in China. Moreover, this framework can be referred and revised by others via conducting studies in other contexts, such as senior secondary school.

Besides the framework provided by this study, the study indicated that the way of teaching was a factor in affecting teachers' verbal feedback. Two extreme cases were shown in section 4, BJ01 & SY04. Projector played an important role in their teaching. Both the two teachers did not use the textbooks and just hand out learning plan to students. The teacher of BJ01 used the projector to present her teaching content including definition, notes, tasks and solutions. For example, one task was given by the teacher through the classroom projector, and then the procedures of the solution were explained by the teacher and shown in the projector one by one (See the picture 3).

However, the teacher of SY04 left the projector to students to let them explain their solutions and she provided feedback immediately. The first teacher adopted group teaching and the second teacher applied the Chinese traditional model "teacher delivery" for the projector using that she said at the beginning of the lesson. Even the projector played an important role in the two lessons, the frequency of feedback and attitudes were very different. The first teacher adopted a student-centered approach while the second teacher had a teacher-centered method. Thus, the teaching method was another factor in explain the difference among teachers.

Moreover, in SY, when the teachers were interviewed about whether the school leaders could have effect on their teaching. Most of the teachers mentioned that teachers were required to obey the rule of "student-centered" instruction. In details, teachers should not spend much more time on demonstrating while should pay much attention to students' learning. For example, a policy named "35+10" was enacted in some schools in SY which required the teacher to spend 10 minutes in demonstrating and the other 35 minutes should be left for students. The duration of one lesson

usually is 45 minutes or 40 minutes for primary and secondary schools in China. Besides, in observing the videotaped lessons, the teachers not only had teaching plan (lesson plan) for themselves, but also prepared a learning plan, which was similar with lesson plan but included questions designed for students. At the beginning of the class, every student would receive one copy of learning plan. Then, the teacher would start to teach the content according to the learning plan with questioning which made students have more chance to show their ideas. Through the discussion, school policy, may be the deep factor which caused the difference between BJ01 & SY04.

Overall, according to the statistical results, the most frequency and duration was the type of "Neutral" attitude while the least was "Negative" for most teachers. This indicated that teachers usually hold neutral or encourage attitudes to students' answers no matter their answers right or wrong. For Chinese mathematics teachers, they more focus on students' thinking through questions prepared well before the class through teachers' prediction of students' thinking and learning (Cai & Wang, 2010). This is not only the characteristic of Chinese mathematics teaching, but also for Japan. Teachers need not to prepare questions, but also need to think the possible solutions students may use (Shimizu, 2009). Before the class, teachers of Chinese and Japanese usually have a long lesson preparation. One of the crucial aspects in lesson planning is anticipating students' responses to the problem (Y. Li, 2008; Shimizu, 2009). Through students' responses, teachers can evaluate whether students have attained he/she planned in the lesson. Moreover, if students could be given the chance to show their thinking, especially when they provide a wrong or not completely correct answer, the teacher can correct students' wrong answers through their explanation to help students to learn. Since teachers in East Asian mathematics classrooms focus on students' thinking rather than the correctness of their responses, it cannot difficult to understand teachers hold neutral and encourage attitudes at most time. In such contexts, it can be concluded that teacher's attitude are culturally dependent. Carefully feedback provided by teachers produced good achievements for students.

However, although most of the teachers hold neutral and encourage attitudes to students' responses, it seems that there was no way to avoid paying the price for participation by sacrificing some control over content (Emanuelsson & Sahlström, 2008). The first author interviewed more than 10 teachers about their feedback to students' answers in teaching. They said they were facing a dilemma situation. On the one hand, they would like to encourage and investigate students' ideas, conjectures and innovative solutions in their teaching. On the other hand, they could not do that freely for the limited time of one lesson. For example, students, who were in grade 9, had many kinds of proofs when a geometry task was shown to them. However, teachers admitted that they could not consider every student's proof method carefully in a 40 minutes lesson. This is a big issue for future study.

LIMITATIONS

However, during the investigation, limitations were still inevitable. The code scheme was developed for teachers' verbal feedback in junior secondary school level and in urban cities. It may not be suitable for mathematics teachers in senior secondary schools and in rural areas. Additionally, the relationship between teacher verbal feedback and students' mathematics achievements did not consider in this study. If feedback was combined with instruction effectively, it would be a power tool in enhancing students' learning (Hattie & Timperley, 2007). Through the investigating the relationship, the effective types of verbal feedback may be found and then could apply in improve students' learning. The relationship between teacher verbal feedback and their student's mathematics achievement can be established in the future study. It is a very important and interesting research topic.

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