

SCIENCE TALK IN THE SECONDARY CLASSROOMS: ANALYSIS OF TEACHERS' FEEDBACK

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Abstract

Feedback, the third part of Initiation-Response-Feedback (IRF) structure in typical lesson discussion, is the most crucial part of teaching and science talk. Feedback constructs cognitive scaffolding as well as dialogical pattern of discussion in the classroom. Several studies analyzing teachers' feedback types and wait time of effect have been reported. Owing to its tremendous effect on teaching and learning, as stated by Chin (2007), a fine grained analysis has been felt. Video recorded data of fourteen science lessons in secondary level (Grade VI-X) of Bangladesh used as data source of this study. Data were analyzed with coded category. Through video analysis, the nine categories of teachers' feedback were emerged to students' correct and incorrect or no response. The prevalent nature of feedback was evaluative and corrective. All the generated categories were illustrated with example taken from the real lesson and tried to explain the effect of each type of feedback on lesson discussion. The results of the study are illustrated vignettes of the teachers' varieties of feedback and the role of the feedback at secondary science lessons, and would be helpful for teachers to think and frame their practices that make a science lesson into collaborative, dialogic and facilitative one.

Keywords: Secondary Classroom, Teachers' Feedback, Science lesson, Bangladesh

Introduction

Feedback is conceptualized as information provided by an agent that is teacher, peer, book, parent, self and experience (Hattie & Timperley, 2007). Feedback and instruction are inseparable (Kulhavy, 1977). Feedback is an essential construct for many theories of learning and instruction, and an understanding of the conditions for effective feedback should facilitate both

theoretical development and instructional practice (Bangert-Drowns et al., 2013). To take on feedback into instructional purpose, it needs to provide information specifically relating to the task or process of learning that fills gap between what is understood and what is aim to be understood (Sadler, 1989), and it can do this in various ways, for example, increased effort, motivation, or engagement (Hattie & Timperley, 2007). Alternatively, the gap may be reduced through a number of different cognitive processes, including restructuring understandings, confirming to students that they are correct or incorrect, indicating that more information is available or needed, pointing to directions students could pursue, and indicating alternative strategies to understand particular information (*ibid.* p. 82). A learner can confirm, add to, overwrite, tune, or restructure information in memory through feedback, whether that information is domain knowledge, meta-cognitive knowledge, beliefs about self and tasks, or cognitive tactics and strategies (Winne & Butler, 1994). A learning context is indispensable for feedback to be effective. It is the part of the teaching process and happens second-after a student has responded to initial instruction- when feedback is provided regarding some aspect/s of the student's task performance (Hattie & Timperley, 2007).

This study intended to reveal the nature and types of feedback in typical classroom context, given by the teacher to students' correct, incorrect or no responses of various science lessons at the secondary level of Bangladesh. Following question was tried to address through this research.

What sort of feedback do teachers make in various science lessons discussion to the student's correct, incorrect or no response type utterances?

Secondary Education System

Secondary education system in Bangladesh consists of 7 years duration with 3 sub-levels; Junior Secondary Education (Grade VI-VIII), Secondary Education (IX-X) and Higher Secondary Education. After finishing Grade X, students have to sit for a public examination and earn a Secondary School Certificate (SSC) degree and after finishing Grade XII, they earn a Higher Secondary Certificate (HSC) degree. At junior secondary level student must study science known as general science as a compulsory subject. At this stage there is no stream like science, arts or business studies. Stream wise segregation starts from grade nine. However, science is taught by the same teacher at Grade VI-X. Junior secondary and secondary science teachers are always together, while discipline wise teacher are found from Grade XI – Grade XII.

The role of Feedback in Teaching and Learning Process

The power of feedback has frequently been mentioned in articles about teaching and learning. It is, however, found that few studies have systematically investigated its meaning. Hattie and Timperley, (2007)

provides a conceptual analysis of feedback and reviews the evidence related to its impacts on learning and achievement. Their evidence shows that although feedback is among the major influences, the type of feedback and the way it is given can be differentially effective. A model of feedback is then proposed that identifies the particular properties and circumstances that make it effective, and some typically thorny issues are discussed, including the timing of feedback and the effectiveness of positive and negative feedback.

Another study on feedback conducted by Farquhar and Wesley (2012) about the type and timing of feedback within an intelligent console-operations tutor. They found that when immediate feedback is employed during the acquisition of console-operation skill, elaborative feedback yields greater accuracy of the skill over the use of corrective feedback. They assert that research in the use of feedback in education suggests that *corrective feedback*, or feedback that provides the correct answer is more effective than feedback that simply indicates an error. However, contrary to an information-processing theory of learning, these studies generally find no efficacy for feedback of a more elaborative nature such as the use of additional explanatory information.

In a social context, student constructs meaning and develops understanding when they learn science (Duit & Treagust, 1998). Through classroom discussion, much of this meaning-making occurs as a part of teacher talk and teacher-student interaction (Chin, 2007). In traditional classroom, recitation or triadic dialogue (Lemke, 1990) has been found to be pervasive. The format of this typical discussion consists of three moves—initiation (often via a teacher question), student response, and teacher evaluation and has commonly been referred to as “IRE” (Mehan, 1979, cited in Chin, 2007). Sometimes, it is also known as “IRF”—initiation, response, and follow up or feedback (Sinclair & Coulthard, 1975) as the third move may not necessarily be an explicit evaluation. Wells (1986), for instance, discussed the ways in which teacher may provide feedback by encouraging students to externalize ideas, generate hypothesis, and test them.

Chin (2007) identified four different types of feedback – (a) Affirmation-Direct-instruction, (b) Focusing and Zooming (c) Explicit correction-direct instruction, and (d) Constructive challenge- provided by the teachers in their teaching exchange. She stated that unlike feedback types (a) and (c), which did not encourage student input beyond the initial solicited answer, feedback types (b) and (d) further elicited students response, stimulated productive thinking, and extended lines of conceptual thought in students. Analysis of feedback given by the teachers in IRF sequence showed that this was typically in the form of a comment or statement followed by either another question, or further statements that expounded more scientific content (*ibid*, p. 1322). Therefore, the “F” part of the three-part exchange

could comprise a “comment-question” (C-Q) or “statement-question”(S-Q) couplet where the question part of the couplet may be regarded as overlapping with the initiation or “I” move of the next IRF sequence. However, if no question were asked, it took the form of a “comment-statement” (C-S) couplet. At times, feedback consisted of only comments(C) or statements(S).

Beccles and Ikeda (2011) reported science teachers’ responses to students’ incorrect answers during classroom discussion in Ghana. Generally, the science teachers either ignored or rejected students’ incorrect answers. Teachers also encouraged students, and engaged in actions such as using, finding out and judging students’ incorrect answers. They recommended that science teachers would engage in actions that encourage students and desist from making students feel shy and timidity in Ghanaian classroom atmosphere. Science teachers also need to: use incorrect answers to develop their lessons; create an environment in which every students feels accepted and important during discussion sessions; and factor students’ feelings and be sympathetic toward students’ incorrect answers in class(ibid, 2011).

Teacher need to make appropriate judgment about when, how and what level to provided appropriate feedback. Most common type feedback is praise usually given by repeating student’s initial contribution. However, it was cautioned by Flanders that:

“...praise without giving reason sometimes interrupts the train of thought of the pupil. Praise without explanation or when given inappropriately led that praise does not motivate. It may more often threaten rather than assure a person of his worth. It establishes the superiority of the praiser and praise may constrict creativity rather than free it...” (1970).

Ultimate goal of feedback is to evaluation which is accomplished by two ways: through verbalize student’s response publicly to the class by providing a comment, or teacher may not articulate this overtly but keep this evaluation silently to himself /herself, thus remain neutral in his or her response (Chin, 2006).

The evaluative feedback known as “*pedagogical interventions*” (Scott, 1998), has many drawbacks in student’s meaning-making learning as well as the participation in classroom dialogue. Scott in his research, differentiated forms of pedagogical intervention as degree of level of teacher control. *Elicitation of pupils’ contributions, Marking knowledge as significant and joint, Cued elicitation of pupil’s contribution*, treated as lowest level of teacher control, whereas, *Paraphrasing pupils’ contribution, Offering reconstructive recaps and Direct Lecturing*, were as at increasing level of teacher control. He asserted that anyone who has spent time in schools will recognize the forms of pedagogical interventions outlined

above. However, neutral or evaluation-free feedback has many advantages in developing conceptual understanding. For example, to develop a better inquiry atmosphere in a science class it has been suggested that it is better to avoid comments like ‘good boy’, ‘great answer’, and ‘well done’ (Goodrum, 2004). This approach encourages independent thought and inhibits the common classroom game called “guessing what teacher thinks’. In this game praise is bestowed on students who are successful in reading the teacher’s mind rather than thinking for themselves (Ibid., p.61).

The teachers’ actions, including the patterns of discourse they establish as well as the interventions (feedback) they employ, greatly influence discussions (Mortimer & Scott, 2003). A study investigating middle school science students’ responses to teacher prompts found that students were more likely to express diverse ideas and share their thinking in writings as opposed to whole class discursion (Furtak & Ruiz-Primo, 2008). The authors ascribed this difference to perception that teachers focus on assessing students’ answers as opposed to understanding their thinking during class discussions. This is due to teachers’ lack of awareness because they may not be aware of how they impede or constrain dialogue to limit the amount of students’ participation (Scott, 1998). In addition to that teachers may lack of skill needed to transition from the traditional IRE discussion in the classroom to one which is more dialogic (Driver et al., 2000). The type of questions teachers ask and the comments and feedback they incorporate into their classroom impact the nature of the science talk (van Zee & Minstrel, 1997b).

Researches on feedback mostly conducted in the West. Very few or almost no researches have been conducted in Asian countries. In the case of Bangladesh, this is the most basic one. As feedback has diversified effect on teaching and learning, this study will be exemplary evidence to the science teachers and educators and especially future science teachers. This study attempts a fine-grained analysis of the variety of teacher’s feedback to students’ correct, incorrect and no responses in various science classrooms in different science lesson discussions. I believe, it would be helpful for teacher interest on how could be a lesson becomes more dialogical in nature with the neutral feedback effect from the teacher.

Research design

An interpretative research (Strauss & Corbin, 1990) method was chosen to conduct this study. Identifying the themes or patterns is the main stance of interpretative research by looking at the meaning of the text. A text does not have a single ‘objective’ meaning, it has multiple meanings; the key activity in document research is interpretation rather than trying to discover “some kind of Holy Grail” (Wellington, 2000, p. 116). It focuses on the in-depth meanings of verbatim lesson transcripts generated from various

science lessons. This study is a part of the author's PhD research, which aims to investigate science teachers' belief and practices at the secondary schools. Data was collected from February and March 2012 and February and April 2013.

Setting and Data source

Data of this study was gathered through lesson observation via video taping. Fourteen science lessons from three different schools at Dhaka were purposively selected. All the lessons were observed by the researcher. The observed lessons covered a range of topics included in the science syllabus in secondary levels (Grade VI-X). These include motion; living organism and their environment; gas law; state of matter; symbol, formula and valences; work, power and energy; virus; human body; periodic table; plant classification; solution; animal kingdom; chemical reaction and equation; and structure of matter. The average class size was 42 students and average duration of the class was 30-35 minutes. As a consequence of large class size, time constraints to cover a prescribed national science curriculum, and accountability pressure on teachers for students to succeed on examinations, the teaching was implemented mostly via direct instruction in whole-class context. Table 1 shows demographic information of the teachers and grade wise lesson topics observed.

Because of manpower constraints and the availability of limited video camera for use in class, only classroom discussion in whole-class setting was recorded. The video camera was set up at the middle of the classroom and was directed at teacher and students. For the video documentation, a high definition (HD) video camera was used, which is sensitive to capture subtle knock of tone, therefore, no extra audio recorder was used. The video files of the recorded classroom talk were transcribed verbatim and ready for analysis.

Table 1. School wise demography of the Teachers, lesson topic and grade

School code	Teacher	Sex (M/F)	Years of Teaching experience	Subject taught*	In-service training**					Observed lesson topic	Grade level
					B.ED	SBC	TQI	CPD	OT		
A	T1	F	15	P	√	√	√			Motion	Nine
	T2	M	About 2	B	√					Living organisms and their environment	Eight
	T3	M	17	C	√	√	√	√	√	Gas law State of Matter	Nine
	T4	F	5	C	√					Symbol, Formula & Valences	Nine
	T5	M	9	P	√	√				Work, Power & Energy	Nine
	T6	F	14	B	√	√	√	√	√	Virus	Nine
B	T7	M	6	B	√	√				Human body	Nine
	T8	M	12	P	√	√	√			Periodic Table	Nine
	T9	M	10	B	√	√	√			Plant classification	Nine
	T10	M	11	C	√	√	√			Solution	Seven
C	T11	M	7	B	√	√				Animal kingdom	Seven
	T12	F	6	C	√					Chemical reaction & equation	Eight
	T13	M	8	C	√	√				Structure of Matter	Nine

*P, Physic; C, Chemistry; B, Biology ** B.Ed, Bachelor of Education, TQI, Teaching Quality Improvement; SBC, Subject Based Cluster, CPD, Continuous Professional Development; OT, 3 Month Overseas Training.

Data analysis

All the transcripts of video recordings were analyzed through coded category suggested by Chin (2006). Initial coding schemes for the teachers' feedbacks were developed following an iterative analysis of the transcripts. When teacher' feedback contains content related proposition this was coded as "statement" (S); on the other hand, a "comment" code as (C), is an evaluative or neutral utterance given by the teacher in response to a student's reply to his or her question. When there is comment with question or comment then it was expressed in couplet (C-S) or (C-Q). The intention was to distinguish those aspects of the teachers' science talk that elucidated second - after a student has responded to initial instruction. Each teacher's second contribution to class discussion was coded into one of nine categories: the first four categories were assigned for student's correct or partially correct answer, while the second five categories were represented students' incorrect or no response. Code(C-S)-teacher restate student's scientifically correct response and add more information with student initial contribution in an expository manner, Code(C-Q1) - teacher remains neutral to student correct response by a comment and then asking question, Code (Q1) -after having the correct response from the student, teacher pose a precise question for elaboration, in this case teacher remains neutral, Code (Q2)- teacher tries to take up a side via asking question, thus remain neutral in responding to student's reply, Code(S-Q)- in case of student's incorrect

response teacher made precise correction followed by further expounding of the normative ideas and ask question, Code (S)- in case of student's no response or incorrect response, teacher did not make any correction or not make any comment directly go further exposition to transmit normative ideas, Code(C- Q2)- in case of no response, teacher made an evaluative or neutral comment followed by restating the question, Code(Q3)- in case of incorrect response, teacher ask a completely different question in order to encourage student to think, and Code (Q4)- teacher give back student 's incorrect response to student via a question to clarify or self-checking. Table 2 shows an illustrative example of these code and categories along with example. Additional examples of all types of teachers' feedbacks are illustrated and discussed in the results sections.

Table 2. Coding method for teachers' feedback (F) in lesson discussion

Nature of student response	Code	Category	Description	Example
Correct answers/partial correct	C-S	Restate student response-add more information via exposition	Affirmation and reinforce response followed by further exposition and direction	Student: "Nucleic acid, T: Nucleic acid, it is one of the main components of micro organism. How many types?"
	C-Q1	Neutral comment-asking question	Accept response followed by question	T: yes, what is the reason behind your answer?
	Q1	Precise question for elaboration	Asking question to probe or extend conceptual thinking	Can you extend little bit more? What else? What next?
	Q2	Ask student to judge	Shifting authority for evaluating answer from teacher to all	Do you agree with S1 response?
Incorrect/no response	S-Q	Explicitly correction direction instruction	Precise correction followed by further expounding of the normative ideas and ask question	S: Cellulose T: it is protein, protein is the main component of virus body. What are other parts of it? T: do you know the name?
	S	No correction-Direct instruction	Further expounding the normative ideas without correction	S: no response T: Such aquatic..., ...are called hydrophytes.
	C-Q2	Restate the question along with comment	Evaluative or Neutral comment followed by restating of the question	Ha. I am asking you about its head shape? Is there any other shape? What do you think?
	Q3	Constructive challenge	challenge via another question	It is same as speed. Like: 13.89 m/s.but where the difference is?
	Q4	Responses give back to the student via question	Pose a question build on student's prior response	S: this is called osmosis T: Is this osmosis?

Researcher along with a rater (educational expert graduated from the graduate school for International Development and Cooperation, Hiroshima University, Japan) coded one lesson jointly to establish a common understanding of the coding regarding feedback. The two raters proceeded by coding all subsequent transcripts independently. Inter-rater reliability was calculated by percent agreement, which was 92%. All disagreements were

resolved through discussion. Finally the results were explained according to category with direct excerpt from the real lesson topics.

Results

Altogether 495 teachers’ feedback in different science lessons were found in various feedback categories. Table 3 summarizes the distribution and frequencies of the various types of teachers’ feedback.

Table 3 Frequencies of different types of Teacher feedback in various science lessons

Teacher(T)	Lesson topics	Types of Teacher feedback									Total no. of feedback
		Correct / partial correct response				incorrect /No response					
		Restate student response-add more information via exposition	Neutral comment-asking question	Recise question for elaboration	ask student to judge	Explicitly correction-instruction	Direct instruction	Restate the question along with comment	Constructive challenge	Responses give back to the student via question	
C-S	C-Q1	Q1	Q2	S-Q	S	C-Q2	Q3	Q4			
T1	Motion	18	8			8	4	1	2	4	45
T2	Living organism & their environment	17	4			9	6				36
T3	Gas law	9	23					4	2	3	41
T3	State of matter	7	16	4	4	2	0	4	2	1	40
T4	Symbol, Formula & Valences	15	10	1	1	8	4	2	2	1	44
T5	Work, power & energy	2	7			2	3		1		15
T6	Virus	12	10			3	8	1	1		35
T7	Human body	11	6			8	10		1		36
T8	Periodic Table	12	11			7	3	2		1	36
T9	Plants classification	11	5	2	2	10	2				32
T10	Solution	13	5			10	6	1			35
T11	Animal kingdom	18	4			8	7				37
T12	Chemical reaction & equation	9	3			9	4				25
T13	Structure of Matter	14	5	1	3	8	5	1	1		38
Total		172 (34.7%)	114 (23.0%)	8 (1.6%)	10 (2.0%)	97 (19.6%)	66 (13.3%)	16 (3.2%)	12 (2.4%)	10 (2.0%)	495

Types of Feedback to Students’ Correct or Partial Correct Responses

Among the science lessons analyzed, four types of feedbacks were found in the case of students’ correct/partial correct responses. The most common and predominant type of feedback is ‘*restating student correct answer along with adding more information via direct instruction*’ (C-S). This was (34.7%).The following excerpt illustrates an example where teacher restate student’s correct answer and then moved on to talk about further scientific information via direct instruction. This type of feedback has a transmitting function as well as authoritative nature as asserted by Chin (2006).

Teacher: How many molecules that scientist has discovered in nature and in chemical laboratory?

Student: one hundred and eighteen.

Teacher: 118 molecules. Scientist has discovered 118 molecules both in nature and in chemical laboratory. If we want to know about all 118 molecules individually, is it possible? It is not possible or quite tough for us to learn their characteristics separately. (*Taken from grade nine chemistry, chapter-Periodic table*)

The second prevalent type of feedback was found ‘*neutral comment-asking question*’ (C-Q1). Among the feedbacks this is (23.0%). In this case, teacher accepts student responses in a neutral manner, affirm the response with a comment such as, Yes, Okay, or sometimes restating student’s responses. This was followed by a question which built on student’s prior response. Through this type of feedback, teacher was tried to extend student’s thinking as well as involving student into prolonged discussion. Following excerpt is an illustration of this type of feedback.

Teacher: When Candle burns, what kinds of changes will you expect to occur? You (indicating one S) Tell.

Student 1: Chemical change (*Partial correct*)

Teacher: Yes! Chemical Change, What Else?

Student2: Physical change too.

Teacher: so chemical and physical change occur during candle burning. (*Taken from grade nine chemistry, chapter-State of Matter*)

The feedback type ‘*precise question for elaboration*’ (Q1) and ‘*ask student to judge*’ (Q2) were found less frequent (0.80%) and (1.2%) respectively of the lessons analyzed. Through precise question built on student previous response, teacher try to probe further student knowledge in conceptual level. The following excerpt illustrates *precise question* type feedback.

Teacher: what we write instead of Carbon dioxide?

Student: CO₂

Teacher: what does CO₂ have?

Student: Carbon, Oxygen

Teacher: Carbon, Oxygen, so we have carbon and oxygen in CO₂. (*Taken from grade eight general science, chapter-Chemical reaction and equation*)

Through feedback ‘*asking student to judge*’ teacher guides the entire class towards the scientific concept (Kawalkar & Vijapurkar, 2011a). Teacher remains neutral as well as shifting authority for evaluating answer from teacher to all students. Following excerpt, *taken from grade nine chemistry, chapter-State of matter*, is an illustration of the above type.

Teacher: Any one?

Student2: water.

Teacher: S1 and S2 said that it produces CO₂ and water, are these final? Do you agree with them?

Students: Yes sir

Teacher: so, water and Carbon dioxide.

Types of Feedback to Students' Incorrect or No Responses

By analyzing various science lessons in different grades in secondary level, five types of feedbacks were found in the case of students' incorrect/no responses. Among which, '*explicit correction-direction instruction*' (S-Q) was found predominate (19.6%). In this case, teacher overtly pointing out the student's mistake by saying 'no', 'your answer is wrong', that's not the right answer'. After point out the student's mistake, the teacher proceeded to give the correct answer and then carried on with telling them more scientific knowledge via clear exposition. After giving more content knowledge, teacher asked an instructional question. Following excerpt is an example of this type of feedback.

Teacher: Is there any difference between DNA and RNA?

Student: No Sir (incorrect answer)

Teacher: No no! There are differences. DNA is Double standard but RNA is Single standard not only that the sugar molecule of both nucleic acid is different. Nucleic acid is the main component of the virus by which it can infect other plants or animals and cause disease. There are many plants and animals diseases caused by virus. Plant diseases like tobacco mosaic disease, bean mosaic diseases, tomato vein cleaning disease, etc. Influenza, small fox, ham, etc, are some of the example of human diseases. Beside human being virus causes many diseases in animals. Cowpox, Ranked, Parrot fever, etc. There is no medicine for viral diseases. So we have to be very careful about virus. *How do viruses spread in the environment?* (Taken from grade nine, Biology, topic-virus).

In case of incorrect response, the second prevalent type of feedback was found '*direct instruction*' (S). Among the feedbacks this was (13.3%). The teacher's feedback was in the form direct instruction followed by a series of statements. Following excerpt is an illustration of the kind mentioned above taken from grade eight general sciences, chapter -*Living organism & their environment*.

Teacher: Like mesophytes, plants those grow in water they have a name? Do you know the name?

Student: no response

Teacher: Such aquatic plants grow abundantly in rivers, canals, lake, ditches, ponds, and other aquatic habitats. Plants which grow in water or place of having water are known as hydrophytes.

The feedback in the form of '*restate the question along with comment*' (C-Q2); '*constructive challenge*' (Q3); and '*response give back to*

the student via question' (Q4) did not have much or very negligible room in the case of incorrect or no response dimension in various science lessons studied. They were (3.2%), (2.4%) and (2.0%) respectively.

In the case of C-Q2 form of feedback, teacher kept neutral without articulating student's mistake explicitly. Instead, teacher restated or reformulated her question in the form of recast as a non threatening manner. This type of feedback ensure inquiry atmosphere and results normal classroom discussion (Goodrum, 2004).The following excerpt is an illustration of this kind of feedback taken from grade *nine chemistry, chapter-state of matter*.

Teacher: hum! What is called this phenomenon?

Student1: No response

Teacher: Ok! CuSO₄ mix with water, there is a scientific phenomenon. So what is called that phenomenon?

Student1: It is called... it is called...

Teacher: try

The feedback in the form of *constructive challenge*, teacher remained neutral but challenged student by posing another question in the case of incorrect student's response. The intension of asking this type of question is to force the student to reflect on and reconsider the answer made earlier (Chin, 2006). The following excerpt is an illustration of this kind of feedback taken from grade *nine chemistry, chapter- Symbol, Formula and valences*

Teacher: (ask the example of compound matter) you? Tell

Student: Aluminum, (*incorrect answer*)

Teacher: why do you call Aluminum is a compound matter?
What is the component of Aluminum?

Student: No response

Teacher: if aluminum is chemically analyzed, what do we get?

The feedback in the form of *response give back to the student via question*, known as "reflective toss" (van Zee & Minstrell, 1997a), in this case, teacher remained neutral followed by a question build on student's previous response, thereby throwing the responsibility to think back to student to judge the response made earlier. The purpose of this type of feedback is to move forward learner toward self-directing learning, one of the characteristics of effective learning (Griffin, 2006). The following excerpt is an illustration of this kind of feedback taken from grade *nine chemistry, chapter-state of matter*.

Student1: it is called

Teacher: try

Student2. It is called osmosis (*Scientifically incorrect answer*)

Teacher: Is this osmosis? Why did you think so?

Student2: no sir, this is called diffusion (*self- correction*)

Teacher: yes! This is called diffusion. You have seen that CuSO₄ has spread to the whole water. Some of you have shaken it. *What happened when you have shaken the tube?*

An effort was made through this study to make a comparison of feedback between a novice teacher with an experienced one. The results indicate that novice teacher was comfortable in giving more information as well as overt correction through direct instruction in both cases of correct or partial correct as well as incorrect or no students' responses. In contrast, experienced teacher remain neutral by accepting students correct response with neutral comments followed by a question. In the case of incorrect or no student response, he tried to restate the question, encourage student by constructively challenged question or reflective toss and offered explicitly evaluation occasionally. Table 4 shows a summary of the comparison. It is clearly evident that teaching experience and in-service trainings have influences on teachers' behavior.

Table 4. Comparison of feedback between experienced and novice teacher

Nature of response	Types feedback	*Experienced	**Novice teacher
Correct or partial correct response	Restate student response-add more information	7	17
	Neutral comment- asking question	16	4
	Precise question for elaboration	4	
	Ask student to judge	4	
Incorrect or No response	Explicitly correction– direction instruction	2	9
	Direct instruction	0	6
	Restate the question along with comment	4	
	Constructive challenge	2	
	Reponses give back to the student via question	1	
Total		40	36

*Male teacher, having 17 years of teaching experience, Chemistry was taught at graduate level, received B.Ed., TQI, SBC, CPD, & 3 Month OT, ** Male teacher, about 2 years(1 year and 11 months 10 days) of teaching experience, Biology was taught at graduate level, received B.Ed. training only.

Discussion and Implication

The analysis of feedback in various science lessons described that science teachers in secondary schools of Bangladesh were comfortable with giving precise information through direct instruction along with explicit correction in case of students' incorrect or no responses. The feedback given by the teachers were basically in the form of comment and further statements (i.e., C-S couplet) or statement along with an instructional question (i.e., S-Q

couplet). The pattern of feedback was evaluative and corrective. This kind of feedback breeds one-way communication which resembles to typical IRE structure. The findings of the study somehow corroborate with the findings of Chin (2006). She stated that the thrust of the teachers' utterances in the F-move consisted not just of an evaluative comment and further statements (i.e., C-S couplet) but rather comment or a further "productive" question, in the form of a C-Q couplet that took students forward in their thinking.

However, some features of inquiry classroom teacher also revealed as portrayed in the science lessons studied. Teachers tried to remain neutral in responding to students' correct or incorrect or no responses through the form of feedback 'comment-question' couplet or 'question alone'. Through this type of feedback teacher retained a long discussion, tried to draw out students' ideas with variety of questions. The purposes of the questions were calling for reasoning, asking for explanations, guesses, inference, encouraging wider response, driving towards the focal point, providing hints, asking for justification and so on (Kawalkar & Vijapurkar, 2011a).

Feedback, the third part of IRF structure in typical lesson discussion, is the most crucial part of teaching and science talk. It constructs cognitive scaffolding (Chin, 2006) as well as dialogical (Lemke, 1990) pattern of discourse in the classroom. Cognitive scaffolding engaged students in more cognitively active roles such as formulate hypothesis , predict outcomes, brainstorm ideas, generate explanations, make inferences and conclusions, as well as to self-evaluate and reflect on their own thinking (Chin, 2006). Research finding made an assertion that active discussion, for example, dialogical one, both between pupils and between pupils and teacher need to take account for effective or meaningful learning (McCormick & Leask, 2005).

Learning theorists, for example, Rogers(1969), Knowles(1978), Tough(1979) and Mezirow (1991), have all argued that effective learning is self-actualizing, self-directed, self-planned and self-transformative. Effective or meaningful learning (Entwistle, 1990) requires pupils to engage in an active reconstruction of information, to make new links and test old ones, to resolve contradictions and to identify underlying principles(McCormick & Leask, 2005). It happens best where social interaction, particularly between a learner and more knowledgeable (usually teacher) others, is encouraged. Teaching styles therefore need to take account of the need for discussion, both between pupils and between pupils and teacher (ibid. 2005 p. 279). The results of teachers' feedback in various lessons studied did not support meaningful or effective learning. The pattern of interaction was found as authoritative and maintained a typical IRF sequence.

The analysis of teachers' follow-up (F) in the classroom contributes to an understanding how the "F" part of the triadic dialogue can discourage

students' active involvement in construction of knowledge as well as limiting classroom discussion as a part of a teaching sequence. This notion of teaching as revealed through this study, "in the form of feedback", is completely opposite view of teaching as stated in the teacher education curriculum of Bangladesh. The teaching is stated as follows:

Teaching should *actively involve* the learners in the learning process through varieties of learning experiences, for example, Hands-on, *group/peer discussion*, investigation, practical work etc (MoE, 2006).

However, it is also found that whenever teacher's feedback in the form of C-Q couplet or Q alone, in both the cases of correct or incorrect students' responses evolve an elaborative sequence of interaction similar with the type IRFRF (Mortimer & Scott, 2003). They identify IRFRF chain, the elaborative feedback, where the teacher is followed by a further response from a student. This form is typical of discourse that supports a dialogic interaction. As a part of the feedback, the teacher could repeat a student's comment to encourage the student to continue, elaborate on the comment, or ask for elaboration. By establishing this pattern of discussion, the teacher is able to explore students' ideas (Mortimer & Scott, 2003).

Another important finding of the study is that teachers' feedback was found dependent on teaching experiences as well as in-services trainings. Experienced teacher in the study used the feedback to scaffold students' conceptual thinking. He used questions, as feedback, to elicit deeper thinking of the students and drive them toward self-directed learning rather than making explicit correction or giving more scientific ideas in responding to students' incorrect or no responses. This approach of teaching is called facilitation. Because facilitation emerge out of a particular philosophical framework that espouses the self-directed nature of learning (Gregory, 2006). By doing so teacher creates a learning environment within which learner can select and direct their own learning and development (ibid. 2006. p.99).

In Bangladesh, active involvement of the learners in the learning process through facilitation is the core of teaching science that allows learners into dialogical discussion. One of the hurdles can be assumed in adopting facilitative teaching practice has been that teachers have few operational models to understand what facilitation look like and what kind of teachers' behavior engaged students into dialogical discussion by which meaning making learning occur. In this study, an attempt was made to make an explicit example of facilitative approach of teaching with the experienced teacher. On the other hand, novice teacher's example of the study indicates traditional teacher-centered teaching. The author believes that these two examples of classroom teaching would help the teachers to think and frame

their practices that make a science lesson into collaborative and facilitative one.

Conclusion

Through video analysis of the various science lessons, the nine categories of teachers' feedback were found to students' correct and incorrect or no response. The prevalent nature of feedback was evaluative and corrective. The analysis of feedback in various science lessons illustrated that science teachers in secondary schools of Bangladesh were comfortable with giving precise information through direct instruction along with explicit correction in case of students' incorrect or no responses. The feedback given by the teachers were basically in the form of comment and further statements (i.e., C-S couplet) or statement along with an instructional question (i.e., S-Q couplet). This kind of feedback breeds one-way communication where the teachers are the knowledge purveyor and the students are the recipient of that knowledge conveyed by the teachers. On the other hand, feedback which scaffolds students' thinking and produces dialogical discussion was found infrequent among the lesson studied. These findings, therefore, would help science teachers to innovate the trend of science teaching in Bangladesh from traditional transmission of facts to a more interactive and facilitative one.

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