

TEACHER RESPONSE MODEL FOR THE MANAGEMENT OF STUDENT ANSWERS TO TEACHER QUESTIONS

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ABSTRACT: *This paper describes teacher responses to students' answers and proposes the use of Teacher Response Model (TRM) during classroom discussion. TRM requires teachers to recognize students' answers, commend students' efforts, and use students' answers to develop lessons. It also allows teachers to probe students' answers, and modify teacher responses to students' answers. Twelve teachers were purposefully selected from ten junior high schools (JHS) in two districts in 2009, and their lessons were observed. The teachers and 34 selected students were then interviewed on how teachers respond to students' answers. The data was thematically analyzed, and TRM was developed. The model was later applied in five JHS in 2012. One lesson in every school was observed before and after the intervention. Generally, the teachers who applied the model and 25 selected students interviewed after the intervention reported that the use of TRM promoted student thinking and understanding of teacher questions.*

KEYWORDS: Teacher responses, classroom discussion, students' answers, teacher questions

INTRODUCTION

It is an obvious fact that teachers should exhibit professional questioning practices, especially, towards the handling of students' answers. Students' answers could either be correct or incorrect. A teacher question could also elicit no responses from students during classroom discussion. A correct answer (CA) is a response that is generally true and accepted as the answer to the question. An incorrect answer (ICA) is a wrong response to a question or a response that is generally not true and unacceptable. It is also a deviation from what the question demands. No response is the condition when students do not raise their hands to respond to teacher questions or when a student called upon to respond to a teacher question does not talk.

The appropriate management of students' ICA and no responses potentially unveils student thinking during discussions. However, in most cases, a teacher's first response to students' answers is either an evaluation or a judgement. Studies on how teachers follow up on students' answers have been largely disregarded (Franke et al., 2009). Most studies on classroom discussion

have targeted areas such as cognitive processes (Dantonio & Paradise, 1988) and wait time (Altiere & Duell, 1991). The process of “teaching involves such a rapidly paced sequence of action and reaction that the teacher is hard pressed simply to keep up, let alone monitor his behavior at the same time” (Brophy & Good, 1974, p. 270), and teachers are generally not aware of their behavior in class (ibid.). Therefore, the purpose of this study was to investigate how junior high school science teachers respond to students’ CA or ICA and no responses, and to develop a model for managing students’ answers and no responses during classroom discussion..

Teacher Response Theory

This study is theoretically framed on the fact that students’ verbal participation in classroom discussion depends on how teachers respond to students’ answers. Responding appropriately to students’ answers in the classroom enhances the psycho-social environment surrounding discussion sessions, and sustains the interest and participation of students in discussion. It also uncovers students’ thought processes, conceptions, misconceptions, perceptions, and naive ideas. Teacher responses to students’ answers that facilitate productive learning is informed by teachers’ conception of students’ answers, and knowledge development by students themselves. The theory behind teachers’ conception of students’ answers are:

- (1) an answer from a child is his or her idea about something
- (2) an answer is the result of the interaction between students’ thinking and the surroundings
- (3) every answer is useful
- (4) an answer is either desirable/viable or undesirable/not viable
- (5) there is no incorrect answer; an incorrect answer is an answer in itself, and an answer to another question
- (6) incorrect answers are useful tools for developing lesson content

Furthermore, knowledge development by learners themselves is underpinned by the fact that students do not learn by means of direct instruction, but rather build their own knowledge through experience (Edelson, 2001; Gordon, 2008; Hassard, 2005). Knowledge cannot be directly imparted from one individual to another (Edelson, 2001; Von Secker & Lissitz, 1999), because the knowledge structures in everyone reflect his or her unique experiences (Edelson, 2001). It is actively constructed by the learner (Von Secker & Lissitz, 1999). Furthermore, “knowledge is attained when people come together to exchange ideas, articulate their problems together from their own perspectives, and construct meanings that make sense to them” (Gordon, 2008, p. 324). Students need to interact with objects and events through their senses and engage in verbal exchange of ideas. When this interaction results in an activity with a purpose effective learning, and for that matter, knowledge development takes place (Dewey, 1916).

Teacher Response Model

Teacher Response Model (TRM) is a facilitative approach by teachers to manage students’ CA and ICA and no responses during classroom discussion. This model involves five levels (Table 1). Levels 1, 2 and 3 require that science teachers recognize ICA, commend students’ efforts, and use ICA to develop lesson content. Level 4 allows teachers to strategically probe ICA, and level 5 calls for teachers to modify Teacher Response Behaviour (TRB) to ICA. Appropriate teacher responses toward students’ correct answers involve the first four levels of this model and science

teachers are required to use all the five levels in responding fittingly towards students' incorrect answers. However, TRB suitable towards students' no responses involve only level 5.

Table 1
Teacher Response Model

Level	Teacher Response Behavior	Correct Answer	Incorrect Answer	No Response
1	Recognize student response	✓	✓	X
2	Commend student response	✓	✓	X
3	Use student response	✓	✓	X
4	Probe student response	✓	✓	X
5	Modify teacher response	X	✓	✓

METHODOLOGY

Data Collection

This study involved collecting data in 2009 to develop Teacher Response Model and testing the model in 2012. Seventeen science teachers were selected through purposeful sampling from 15 junior high schools in two districts in Ghana. The schools were selected based on their comparable performance in the Basic Education Certificate Examination. The science teachers were made up of 13 males and four females. Their average age was 31 years. Ten possessed a 3-Year Post Secondary Teacher Training certificate, and six possessed a degree certificate in science education. The remaining one had a Bachelor of Agricultural Science degree. The students who were interviewed were 59, and drawn from the set of students who correctly or incorrectly answered questions and those who could not talk when called upon to respond to a question. The average age of the students was 15 years, and 44% and 56% were boys and girls respectively. Fifteen per cent and 85% of the students were in grades one and two of junior high school (JHS) respectively.

The science lessons of twelve teachers in 10 schools were first observed in camera in 2009. The video recording of the science lessons was entirely continuous without gaps. The teachers and 34 selected students were later interviewed. The interview sought for the views of science teachers and students on: how science teachers respond to students' correct or incorrect answers and no responses, and appropriate teacher response behaviour to students' incorrect answers or no responses in class. The data were analyzed and TRM was developed.

This model was then applied in 2012 in five schools. One science teacher from each of the schools taught two lessons each in camera. The first lesson was observed before the science teachers were introduced to TRM, and the second lesson was observed after the intervention. This process took three months. Two researchers and a videographer were involved in the data collection. In the first round of data collection, a JHS Grade 2 science lesson in each of the schools was observed with the consent of the science teacher and students. The average duration

of a lesson was 30 minutes. After the first round of the data collection, a workshop was organized for the science teachers and TRM was introduced to them. The teachers then applied the model for two months before the second round of data collection. The teachers and 25 selected students were later interviewed. The interview focused on TRB to ICA, and science teachers' views on TRM.

Data Analysis

Completely unedited video and verbatim transcripts of the science lessons were used for the analysis to preserve the content of the classroom verbal interactions captured. The stages in the analysis of the video were watching the unedited video recording of the science lessons, transcribing the verbal interaction, and marking all the discussion segments to clearly show the teacher's questions, students' responses, and teacher's responses to students' correct or incorrect answers and no responses. The verbal exchanges between the science teachers and students during the discussion sessions were then extracted to study how science teachers respond to students' responses (Figure 1).

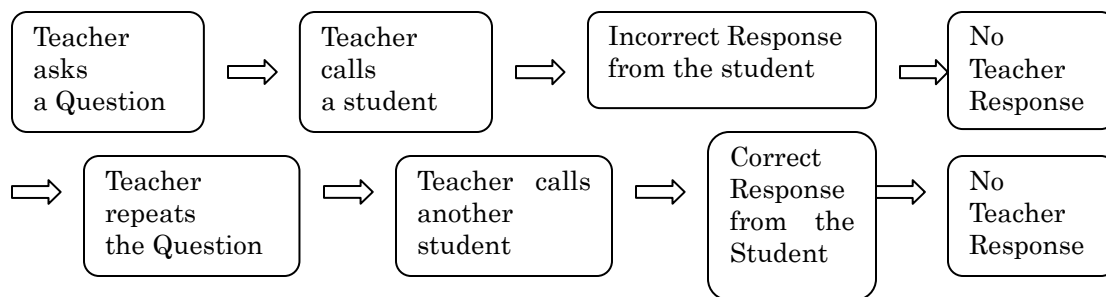


Figure 1: A teacher's response to an incorrect answer

Teacher responses to students' correct or incorrect answers and no responses from the video and the interview were thematically analyzed. The stages of the analysis were data immersion, initial coding, creating categories, and identifying themes (Green et al., 2007). The researcher and four raters repeatedly read through the teacher responses to students' responses extracted from the video, the interview, and contextual data to get immersed in them (ibid.). This was followed by coding, and related data were later put into categories using Table 2 as a guide. For instance, teacher response behavior to students' incorrect answers reported by science teachers themselves such as shaking the head and saying "no" were put under reject teacher response category (Table 2). Furthermore, no teacher response and telling a student to "sit down" were categorized as ignore teacher response behavior. Pattern coding was subsequently used to combine categories to look for themes (Appleton, 1995; Green et al., 2007; Miles & Huberman, 1994). Therefore, reject and ignore teacher response behaviors were unified under the theme shy-timidity which is the "state of being shy and timid and afraid to talk in class" (Beccles & Ikeda, 2012, p. 230). Similarly use and judge teacher response behaviors, and teacher responses that encouraged students were classified as self-learning and self-confidence respectively. Self-learning' is engaging in processes to discover correct answers to questions by students themselves, and self-confidence is the condition where students are able to freely and outwardly express their views, ideas and opinions easily in class (ibid., p. 234).

During the video analysis, the researcher and the raters scored at different times, and later discussed their results. Inter-and intra-observer agreement was ensured by first identifying agreements and disagreements, and then discussing the disagreements and agreements that occurred by chance until an agreement was reached.

Table 2**Guidelines for categorizing teacher responses to students' responses**

Category	Description	Guideline
Use	Using students' responses to develop the lesson	Linking students' responses to lesson content
Find out	Probing for information that will guide teaching strategy and help students to discover knowledge	Asking students whether they understood the lesson content or the question; asking students to give reasons for their responses; asking students to proof their responses
Judge	Probing responses to evaluate them	Asking students to evaluate the correctness or incorrectness of a response
Encourage	Actions that motivate students to respond to teacher questions	Use of verbal and non verbal rewards; recognition of students' answers and efforts; reformulation of teacher questions; providing hints/clues
Reject	Not accepting students' responses	Use of negative verbal cues(e.g. saying "No") and gestures(e.g. shaking the head); teacher getting angry; calling another person after an incorrect answer; interrupting incorrect answers
Ignore	Not passing comments on student responses or telling the student to sit down	No teacher responses to students' responses; calling another person after a no response from a student; Saying "Sit down"
Discomfort	Physical actions that do not make a student comfortable	Asking a student to keep standing during lessons; caning of students; sacking a student from class as a form of punishment

(Beccles & Ikeda, 2012)

RESULTS**Teacher response behaviors to students' correct or incorrect answers and no responses**

Most teachers in this study use encourage teacher response behaviour towards students' correct answers (Table 3). However, the same teachers usually require mere correct answers, and either reject or ignore incorrect answers (Table 3 and Appendix 1). Regarding teacher response behaviours to no responses the video revealed that the teachers mainly encouraged students (Table 3). However, whereas majority of the teachers reported the use of encourage response behaviour to students' no responses, the majority of the students reported that their teachers either rejected or

ignored their no responses and sometimes engaged in actions that were uncomfortable to the students (Table 3). The observed teacher response behaviors to students' no responses in camera are video recording of lessons taught by each teacher during the data collection, but the teacher response behaviors reported by the teachers and students are based on teachers' and students' experiences over many lessons. Therefore the pool judgement of the teachers and students will be considered over the single video evidence. However, since the students are the best stakeholders to describe how teachers respond to their no responses, the reported teacher response behavior by the students' will be trusted in this case.

Table 3

Teacher response to students' correct or incorrect answers and no responses in selected Junior high schools in Ghana

Teacher Response		Category of Response/ % (N)						
		Judge	Find out	Use	Encourage	Reject	Ignore/ Disregard	Discomfort
Towards correct Answer	Observed	2.8 (12)	0.5(2)	0	86.9(370)	0.5 (2)	9.4 (40)	0
	Reported by teachers	0	0	0	100.0 (17)	0	0	0
	Reported by Students	0	0	0	96.0 (48)	0	4.0 (2)	0
Towards incorrect Answer	Observed	3.7 (4)	1.9(2)	2.8(3)	25.2(27)	26.2(28)	40.2(43)	0
	Reported by teachers	0	5.0 (1)	10.0 (2)	50.0 (10)	25.0 (5)	10.0 (2)	0
	Reported by Students	0	0	0	35.9 (15)	43.6 (18)	18.0 (7)	2.6 (1)
Towards no response	Observed	0	2.5 (6)	0	71.7 (170)	5.5 (13)	19.4(46)	0.8 (2)
	Reported by teachers	0	0	0	61.5 (8)	0	23.1 (3)	15.4 (2)
	Reported by Students	0	5.0 (2)	0	37.5 (15)	25.0 (10)	15.0 (6)	17.5 (7)

Appropriate teacher response behaviors

Majority of the teachers and students reported that teachers need to encourage students when they either give incorrect answers or are not able to talk when called upon to respond to a question (Table 4). For example, the teachers reported that they need to make students understand why an answer is wrong and use incorrect answers to develop lessons (Appendix 2)

Table 4**Appropriate teacher response behavior in selected junior high schools**

Teacher Response		Category of Response/ %(N)						
		Judging	Finding out	Using	Encouraging	Rejecting	Ignoring/Disregarding	Discomforting
Towards incorrect	Reported by teachers	0	8.3 (2)	4.2 (1)	75.0 (18)	8.3 (2)	4.2 (1)	0
	Reported by Students	2.6 (1)	0	0	55.3 (21)	31.6 (12)	0	10.5 (4)
	Reported by head teachers	4.2 (1)	0	0	83.3 (20)	8.3 (2)	4.2 (1)	0
Towards no response	Reported by teachers	0	9.5 (2)	0	91.5 (19)	0	0	0
	Reported by Students	0	13.5 (5)	0	43.2 (16)	5.4 (2)	37.8 (14)	
	Reported by head teachers	0	30 (3)	0	60 (6)	10 (1)	0	0
Towards encouraging inactive students	Reported by teachers	0	0	0	100 (17)	0	0	0
	Reported by Students	0	8.6 (3)	0	82.9 (29)	0	0	8.6 (3)
	Reported by head teachers	0	6.3 (1)	0	93.7 (15)	0	0	0

Application of Teacher Response Model

Majority of the teacher response behavior (TRB) to students' ICA before the intervention reported by the science teachers (77.8%) and students (87.1%) were Other TRB (Table 5). Other TRB to ICA include reject, ignore, discomfort, teacher-anger, teacher-leaving class, and teacher answering teacher question response behaviors. Generally, the science teachers did not recognize, commend, use, and probe ICA, and modify their response behavior towards ICA.

Table 5

TRB to students' incorrect answers reported by participants before the intervention

Teacher Response Behavior	Incorrect Answer /% (N)	
	Teachers	Students
Recognize	11.1 (1)	0
Commend	0	0
Use	11.1 (1)	0
Probe	0	0
Modify	0	12.9 (4)
Other	77.8 (7)	87.1 (27)

Table 6**Views of science teachers on TRM after the intervention**

Teacher	Verbatim responses from science teachers
A	The workshop is very educative. It is helping to treat students' answers to questions with equity to avoid embarrassment in classroom. The teacher response model will help pupils to answer questions in class with boldness
B	In my opinion, the workshop has been successful because teachers were able to contribute freely and share their experiences in their teaching of science. The model of "Teacher Response" is a very welcoming way of encouraging students to partake in lessons and to love/like science as a subject.
C	This model is really a good approach to handle pupils responses since it enhances their involvement in class based on the fact that their wrong answers may be through the model channeled into right answers. I think the child will remember the correct answer always because he/she is involved in the refining process. This workshop has really added some skills of handling pupils questions in class
D	Appreciating learners wrong answers will help learners to contribute in class although the answer they gave for a particular question was wrong. Giving learners problem questions goes a long way to bring their minds on the sort of answers that the teacher wants as the answers that they may give is wrong.
E	This workshop was very interesting and the model used will also help in handling pupils answers to questions. This model used will encourage more pupils to participate in the lesson. I have also learnt about how to handle pupils answer to a question. The workshop is relevant in the sense that, it will help teachers to refrain from demoralizing pupils interest in some of the subjects deemed difficult to study. The teacher response model is an excellent idea but needs constant practice to master them (the levels).

Table 7

Effect of teacher response to students' incorrect answers reported by participants after the intervention

School	Verbatim responses from participants	
	Teacher response to the item "Do you think your treatment of students' incorrect answers led to the elaboration of the question/answer"	Student response to the item "Did your teacher's response to your incorrect answer help you to understand the question/answer"
A	When I asked a question on the particles of matter, the student gave an answer on the states of matter, that is solid, liquid and gas. Because of that I had to elaborate on the subject "matter", the particles and states. Afterwards the student was able to answer correctly.	The teacher will ask me to give more examples that may help me to understand the questions. She will explain the question well and give other examples, then will ask me to give the answer. If the answer is incorrect my teacher will correct me and go on to let me understand it better; if I am still wrong she then ask somebody else. She may write some examples on the board.
B	Yes, because some incorrect answers indicated that students had a little ideas about the question and needed more explanation. Some of the answers also give a clear indication that they did not understand the question in the first place.	The teacher will then repeat the question with some examples. Sometimes you can be caned but other times she will explain with some other examples to let you think about the question.
C	I asked a question on chemical energy and by the answers given me by pupils I realized that some pupils were fast in thinking due to my response given to the incorrect answers.	It helped me think about question and the answer; by rethinking about the question again. Yes, It helped me to understand the question. This is done by explaining the question to me.
D	This is because it can lead the teacher to probe more for the student to come out with right answer.	Yes, it helps me to understand the lesson; The reason is that if I give the wrong answer the teacher will call someone else to give the correct answer after which he tells me that that was what I should have said. It helped me understand the question. It was after the teacher told me to think about the question before I came out with the answer.
E	It helps other learners to bring out answers that are correct and also helped to explain issues for learners to understand better.	Yes, it does help me to understand the question. This is because he would explain the question to me again. Yes, it helps me to understand the question. This is because the teacher explains the question for me to think about it again.

However, after the intervention the science teachers were of the view that the use of TRM

promotes the teaching and learning of science (Table 6). They reported that science teachers who use the model will improve their questioning practices. Furthermore, the teachers reported that the use of the model helped them to elaborate on teacher questions (Table 7). This was corroborated by the students who also stated that the teachers' responses to their incorrect answers helped them to better understand teacher questions. For example, one student reported that "it helped me think about the question and the answer; by rethinking about the question again" (Table 7).

DISCUSSION

Students' incorrect answers and no responses are avenues for teachers to nurture student thinking during classroom discussion so teachers need to recognize, commend, use and probe them. This will make students feel accepted and raise their interest in lessons. However, teacher response behaviors that increase students' propensity to refrain from responding to teacher questions (e.g. reject and ignore TRB) will make students feel shy and become timid. This is because "ignoring an answer, being critical, sarcastic or dismissive will deter pupils from answering" (Amos, 2002, p. 12) because "the most frequent and prepotent reaction to an expectancy of failure is decreased involvement in the task and subsequent withdrawal" (Kagan, 1967, pp. 155-6). One probable cause for reject and ignore responses behaviours used by the teachers could be that teacher questions did not seek for student ideas but mainly checked students' knowledge so the teachers were disappointed when students could neither respond nor provide correct answers. Teacher questions need to elicit student ideas so that students will be encouraged to contribute their views during discussion.

Encouraging, judging, using and finding out teacher response behaviors positively reinforce student behavior in responding to teacher questions. These are very good and suitable for science teachers to practice in class. Encouraging teacher responses to students' answers strengthen students' self-confidence, and judging, using and finding out teacher response behaviors promote self-learning in students.

Self-confidence in students is a result of teacher actions like recognizing students' effort at attempting to answer questions, motivating students for their efforts, and using positive reinforcement. Science teachers need to verbally reward students' efforts, and always recognize and use both correct and incorrect answers from students. This act will make students feel accepted and understand why answers are either correct or incorrect, and gradually build their self-confidence. The teachers should respond to student answers in ways that promote their self confidence. The philosophy that every answer, viable or not, is useful should guide teachers in handling students' answers. Students' incorrect answers are still answers in themselves, so teachers need to make students understand why particular answers are not viable, and use them in developing the lesson. An incorrect answer may not be viable in one way or the other but viable in another context or situation so teachers need to probe them to unveil students' reasons behind them. This will help teachers to understand students' conceptions and perceptions about science content and their environment.

Furthermore, science teachers need to promote 'self-learning' among students in class. They have to teach them how to learn through meta-cognitive approaches. For instance they must teach

students strategies for answering questions in class. Besides, teacher questions should have a high content of meta-cognitive knowledge dimension and higher levels of cognitive processes. It is necessary for science teachers to promote 'self-learning' through probing students' answers and allowing students themselves to judge their answers to be either viable or not with reasons.

CONCLUSION

TRM breeds questioning practices that help teachers to follow up sufficiently on students' ICA and no responses, and also allows students to freely explore their answers. It makes teachers become more professional in managing students' answers and no responses. Hence science teachers need to engage in actions that support student learning such as recognize, commend, use, probe, and modify TRB. What teachers say and what is heard by students are frequently not the same so teachers need to use reinforcing language to manage students' answers and no responses.

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Teacher response to students' correct or incorrect answers and no responses

Teacher	Response		Category	Theme
	Towards correct answer	Towards incorrect answer	Towards no response	
Asks the class to judge the correctness of answers; asks student to proof answer	Questions whether the response is correct or wrong; says "are you sure"		Judge	Self-Learning
Seeks alternate correct answers	Asks for the reasons behind incorrect answer; jovially accepts incorrect answer and tries to explain the reason behind it	Asks students how they understand the question or whether students understand the meaning of particular English terms	Find out	
Explains correct answer with daily life experiences	Links answer to topic; uses answer to elaborate the question; repeats incorrect answer in a questioning way		Use	Self-confidence
Rewards learners verbally and non verbally	Gives hints; says: "not exactly"; "you have tried"; "that is not the answer, try again, try another idea; asks a simpler related question;	Reframes question; tells student to try to answer;	Encourage	
Not commending students who use their own words to construct a correct answer	Uses gestures like shaking the head; says "answer is wrong; says: "don't deviate the question"	Teacher says: No; sit down in an unfriendly voice;	Reject	Shy-Timidity
No teacher response	Provides correct answer; Asks the same question to those who can answer correctly; says "sit down"	No teacher response; calling another student;	Ignore	
	Caning of students	Tells student to keep standing	Discomfort	

Appendix 2

Appropriate teacher response to students incorrect answers and no response

Teacher Response		Category	Theme
Incorrect answer	No response		
Make students understand why an answer is wrong; Teacher should ask the student whether he/she understands or not;	During the lesson you ignore the child and later call her/him after the lesson to find the problem; look for the causes or reasons; the teacher should: ask the student whether he/she knows the answer or not, ask whether the student understands or not, and further ask the part that the student does not understand explain that part again, ask me why.	Find out	Self-learning
Use incorrect answers as useful tools for developing the lesson		Use	
Teachers should: be friendly towards students, create a friendly atmosphere, not shut the person down, not use negative verbal cues, use verbal cues like not exactly, guide the student to the correct answer, appreciate every answer given in the class, correct students, gives students hints; teachers need to say “try again”, “keep on learning”, “not exactly what you think, think about it, another idea”; the teacher should: call the student privately and teach him/her because maybe the person does not know, or go through the lesson again.	Teachers should: give them probing questions with gestures and sketches, ask the student to write the answer in a book, be friendly and patient, repeat the question, try to explain it further, explain the lesson content again, then ask the question again, reframes the question, urge the student to try his or her best, always keep on asking them questions so that when they go home they will make research and be able to give answers to questions, give them more chances as this will enable them to prepare before coming to class, make them feel that they are part of the lesson, discourage those students who laugh/mock at students who do not respond to questions, advice them to learn at home, teach me to understand, wait for the person to think about it and come out with an answer	Encourage	Self-confidence