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Dealing with Students' Undesired Responses to Teachers' Oral Questions in Chemistry Classrooms: Exploring Effective Feedback Practices

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Abstract

The study explores chemistry teachers' ways of dealing with students' responses to teachers' verbally posed questions, responses that teachers regard as either undesired or incorrect. Actual teaching situations of three chemistry teachers were recorded, transcribed and interpretively analyzed. Semi-structured interviews with these teachers were also conducted to bring forth the teachers' inherent perceptions about their practice in relation to what was observed of the teachers in the actual practice. The study reveals up to eight different ways in which teachers react to students' responses that they (teachers) deem incorrect or undesired. These teachers' reactions/actions or behavior are discussed with respect to how they affect students' progressive learning. From the findings, an interactive-authoritative communicative approach is still dominant in science/chemistry classrooms. There is the need for in-service science/chemistry teachers to be supported in how to effectively use their classroom powers to support students' productive engagement with scientific matter.

Keywords: *Chemistry teacher oral questions, Students' undesired responses, Effective feedback practices;*

1. Introduction

Research into teachers' classroom practices over several years has underscored the potential of teachers' oral questions in enhancing students' science learning [1]. To understand the important role of teachers' oral questions, one must characterize the context in which such questions occur [2]. This is so because teachers' oral questions are conceptualized as mutual constructions between the teacher and his/her students, and occur in teaching contexts that are continuously modified by both teacher and students [3]. Consequently, the nature of interactions between teacher and students influence the kind of benefits that come with the teachers' classroom use of oral questions [3, 4]. For example, teachers can pose oral questions during chemistry teaching, to which students can respond with single acceptable scientific views or with varied arguments. The teacher has a role to guide and maintain a productive exchange between him/herself and the students. Through these questions and answer interactions, that involve exchange of information and guided discussions, students have the opportunity to bring out their views/conceptions, receive feedback, adjust their wrong science conceptions, and hence learning [5-8].

Not all students' responses to a teacher's oral questions align with the acceptable scientific views. Quite often students come up with views that deviate substantially from the acceptable forms of scientific knowledge or from the teacher's pre-specified answers. Teachers react in different ways when responding to students' varied/undesired or incorrect answers to teachers' questions. Some may want to trigger students' thinking and further students' making of reflections. This may necessitate teachers providing additional information to initial questions [5] and using prompts such as follow-up questions on clues that teachers notice in students' thoughts or feelings [4, 9, 10]. Some teachers might also decide to adjust their questioning to accommodate students' contributions and thinking [4]. Recent research on teachers' questioning practices however still indicates that the dominant nature of practice is such that teachers despite inviting responses from their students, they discount students' ideas in pursuit of pre-specified scientific views [4]. As such, students' varied views have little room for discussion. In this study, we explore how chemistry teachers react in questioning situations whereby the questioner considers students' responses to the posed oral questions incorrect or undesired. The aim is to underscore the kind of feedback practices effective in chemistry classrooms.

2. Data sources and analysis

Three chemistry teachers from different schools in Iringa Municipality in Tanzania were observed in actual teaching situations. These actual teaching situations were followed with a semi-structured interview with each one of the three teachers. Both the video-recorded actual teaching situations and the audio-recorded interviews were transcribed for analysis. All the three participants were qualified chemistry teachers with at least six years of teaching experience.

We drew on Gadamer's views regarding the interpretation of written text (behavior -verbal or non-verbal) [11], to analyze and develop an understanding of the different teachers' actions or behavior (verbal/non-verbal) in questioning situations that involved students' undesired/incorrect responses to teachers' questions. According to Gadamer, a person seeking to interpret a written text (verbal or transcribed) goes with preconceived ideas into the process of interpretation. It is through our prejudices that he calls "fore-structure" that an interpreter begins to understand. Having an awareness of our prejudices enables us to take account of them in the effort to hear what the text or the told stories say to us. In the process, we have to remain open for what the other person or text may tell us. We accept participants' stories as their individual realities, how they make sense of the world. Then we start to construct our own understanding of the participants' stories [12].

We thus read teachers' transcribed accounts (both from actual teaching and from interviews), and started to develop interpretations of what the different teachers' actions implied. The process involved first characterizing the context of the teacher's question, thereby analyzing the discourse resulting a teacher's question as well as the subsequent teacher and students' turns [2, 3, 9]. This made it possible to identify and characterize the various forms of actions, responses or behaviors (both verbal and non-verbal) performed by each one of the three participant teachers as they responded to their students in certain teaching situations involving undesired/incorrect students' responses.

3. Results and discussion

There were altogether 16 questioning and answer incidents (that's, seven, five, and four questions for teachers 1, 2 and 3 respectively), where the teachers deemed students' answers/responses to their questions as incorrect/undesired. In characterizing the teachers' questions, we particularly focused on three question categories, facts-requiring, algorithmic, and conceptual question [13]. We also followed up the teachers' management (structural and procedural) questions aimed at either keeping classroom activities running or as follow-up questions/reflective tosses [2, 10]. Thus, 12/16 of the teachers' questions were facts requiring, conceptualized as questions with pre-specified answers. During these 16 questioning situations, the teachers, each reacted to his/her students' response in different ways in particular situations. Altogether, we identified and characterized eight kinds of teachers' actions, behavior or responses. These actions/behavior/responses, summarized in figure 1, could be classified based on whether they are characteristic of an interactive-authoritative communicative approach or whether they bend towards a dialogic form of classroom communicative approach [14-16]. Majority teachers' courses of actions were cutting across for all three teachers. There were only two actions unique to single teachers including, embarrassing students (teacher 1), and referring students to textbook material in a pseudo act (teacher 2).

The teachers' actions categorized under the authoritative classroom communicative approach depicted the teachers as exercising their enormous classroom powers during the teaching, and limiting students' responses to only those directions desired by the teacher. There was very limited (almost no) space for students varied views and the teachers simply rejected or ignored those students with views different from the pre-specified acceptable forms of scientific knowledge. The students could thereafter be seen assuming a passive role, and remaining silent for the rest of the lesson. On the other hand, in questioning situations where the teachers attempted to accommodate and followed up students' varied views (tending towards dialogic communicative approach), there was more talk and elaborated arguments from students. Students could be seen increasingly willing to contribute to the exchange that is taking place, as the teacher attempted to throw back probing questions to students.

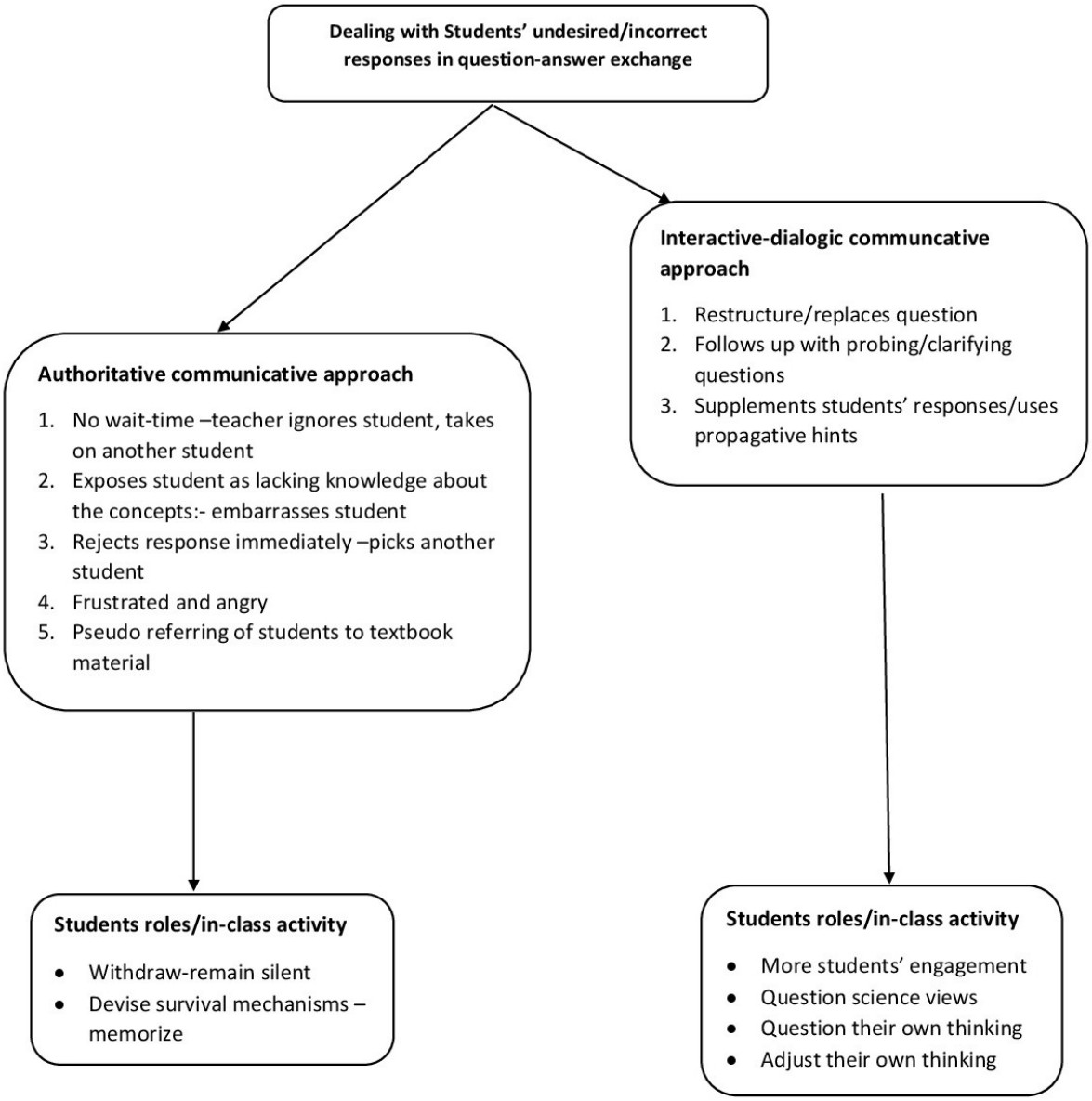

Figure 1: Teachers' actions/behavior in response to students' undesired responses and the possible effects on students' in-class activity

Our analysis reveals that the teachers dominated most of the talk. There were very few instances, where the teachers in our study considered students' varied views. The teachers seemed to lack knowledge about how to deal with students' views that do not align with the pre-established scientific facts. This challenge unfolds at a time when the chemistry school curricula in Tanzania emphasizes constructivist teaching approaches [17]. A successful constructivist teaching approach in chemistry classrooms implies that teachers are able to use their classroom powers to provide opportunities to students to contribute to their own learning [18]. Nevertheless, the teachers in our study instead used their classroom powers to guard themselves from classroom insecurities such as, to avoid situations where students could question the teachers' chemistry content knowledge. The teachers are afraid of being exposed as lacking on any of the teaching aspects (chemistry content, experimental procedures etc.). Thus, they only use questions to evaluate students' masterly of prior concepts, and to manage the classroom in a structured way. This is why from our findings; the teachers mainly used fact-based questions, which are useful but not sufficient for engaging students' in productive learning. With this kind of practice, achieving the objectives pertaining a competence- based approach to teaching as

outlined in the Tanzania science teaching curricula [17], could still be far without first paying attention to these teachers' teaching related challenges and training needs. These preliminary findings from our study thus highlight the important role teacher education in Tanzania has to play, if the teachers are to adopt and implement inquiry-based forms of teaching. Important to note also is that, the teachers are to some extent (though very limited) able to provide some degrees of freedom to their students. The teachers restructuring/replacing questions during teaching, to accommodate varied views, as well as supplementing students' responses, and calling for more elaborated explanations (figure 1) portray this fact. This is a sign into the sought direction of practice and it can be a starting point for profession-development (PD) intervention programs for in-service teachers.

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