Dear editor:

Thank you for both reviewers’ important and constructive remarks. They helped us to make corrections, additions, and improvements to the article, by which, we hope, the article will be suitable for publication in your journal. Below we relate to each reviewer’s remarks in their order of appearance.

Sincerely,

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**Response to Reviewer 1**

*1. Introduction*—the theoretical basis of the study is that classroom discourse plays a definitive role in teaching and that, therefore, its quality affects teaching quality. This theoretical foundation is presented in the Introduction and in the Literature Review.

 In the Introduction, we elaborated on the importance of the study and its implications for science teaching with references to appropriate sources (p. \_\_\_). We explained with emphasis that classroom discourse in science teaching may have a direct effect on conceptual understanding and the ability to enunciate arguments, draw conclusions, and solve problems. A fruitful and dialogic classroom discourse allows teachers to evaluate their students’ understanding continually, as they teach. Such a discourse may also play an important role in detecting misunderstandings and facilitating conceptual change. Analysis and recognition of discourse patterns are among the most sensitive means of evaluating a teaching method. The current study addresses several elements of classroom discourse—discourse patterns and how many, types of questions and how many, and who initiates the discourse or asks the questions. The study derives its importance from reflecting the picture and the analysis of classroom discourse in these respects, as manifested in five different classes. The main purpose of the study is to ask whether physics teachers share discourse patterns that may be associated with characteristics of their discipline, or whether each teacher has discourse patterns of his/her own. Many factors are involved in, and have an influence on, classroom discourse. Therefore, comparison of the characteristics of the discourse in different classes may help to detect meaningful elements that influence discourse quality and, in turn, learning quality. Teachers’ understanding of the discourse patterns as a reflection of the way they perceive their teaching is the key to the promotion of discourse patterns that will promote learning.

In view of the reviewer’s remark, we fine-tuned the goal of the study (p. \_\_\_).

*2. Methods*

1. Sampling— the schools that participated in the study are representative of Israel’s two most important education systems: the religious and the secular. Three of the school belong to the religious education system and are attended by girls only; the other two are secular and are attended by boys and girls together. Israel has additional education systems but the two sectors researched are the primary ones. We added this information to the Participants and Setting section (p. \_\_\_\_).
2. Selection of the lessons—we chose frontal lessons as opposed to laboratory or exercise lessons for the following reasons:
* Laboratory and exercise lessons are fundamentally different from frontal ones. In those contexts, students spent most of their time there working on their own, limiting the classroom discourse mainly to study groups. The purpose of our study is to analyze the whole-class discourse; therefore, the lessons chosen were those in which such a discourse is more predominant.
* The large majority of physics classes in Israel take place in a regular classroom setting and not a laboratory. Therefore, the investigation of these lessons holds greater importance.
* A technical consideration—since we wanted to compare different classes, we needed to have the same kinds of lessons in each class. It would have been very complicated to arrange both laboratory/exercise lessons and regular lessons in each class.

 We agree with the reviewer that a more meaningful discourse may occur after laboratory activity. As we noted in reference to limitations of the study, the analysis of classroom discourse only in frontal lessons fails to generate a full picture and does not reflect the characteristics of discourse in all physics lessons.

*3. Data analysis*

1. As we explained in the third paragraph of the Findings section (p. \_\_\_), “An episode was identified and counted when the dialogic or multi-participant discourse ended and the teacher continued to teach the topic at hand. The next episode related to a different topic or appeared after a lengthy spell in which only the teacher spoke.”

 That is to say, discourse episodes were differentiated from each other when the discourse in each episode concerned a change of topic. Episodes in the course of a lesson were usually separated by a teacher or a student talking about a new subtopic, or when much time passed—at least five minutes—with no discourse, as only the teacher talked and explained. As it happened, most discourse episodes in the classes differed from each other because they dealt with different subtopics after the teachers introduced them, since the teachers hardly ever spoke for five minutes uninterruptedly. An episode usually occurred after a teacher or student asked a question, followed by the development of a discourse—usually very brief—and the offering of an answer. If there were additional questions about, or related to, the same matter, they were included in the same episode and were counted as a single episode. If, however, the teacher began to explain a new aspect of the topic, asked questions about the new aspect, and a discourse evolved again, this discourse was counted as an additional episode.

 In view of the reviewer’s comment, we added this information to the analysis in the Findings section (third paragraph). A discourse analysis initiated by a student was identified and numbered exactly as a teacher-initiated episode was numbered. An episode was determined in accordance with its content and not in view of the number of students who took part in it. If three or five students participated in a discourse about the same question, the discourse episode was numbered as a single one. Almost every student-initiated discourse episode began with a question by the same student.

1. We agree with the reviewer that class size is one of the factors that may affect the classroom discourse. It does not necessarily follow, however, that there will be more discourse in a small class. In very crowded classes, students may feel less comfortable and may even be afraid to take part in the general discourse, whereas in smaller classes there could be a stronger sense of intimacy and students might feel more at ease to participate in, and even to initiate, a discourse. Thus, for example, we found the following in our study: Shem’s class, which had only eight students, nevertheless had especially lively discourse and many student-initiated questions. Apart from class size, many other factors may affect classroom discourse, such as classroom atmosphere, teacher–student relations, and the teacher’s experience and professional background, to name only a few. The current study examined the state of the classroom discourse in several classes that inevitably had dissimilar but also similar characteristics.

*4. Conclusion*

 The reviewer’s remark about the frequency of discourse episodes aims exactly at the conclusions of the study. Indeed, a high frequency of discourse episodes is indicative of superficial discourse. The large number of discourse episodes that we found in most classes implies that deep discourse did not develop. The lively and continual discourse does indicate student involvement and interest but also points to discourse superficiality. We expressed this point with greater emphasis in the Discussion section (p. \_\_\_, paragraph \_\_\_\_) and added Rowe (1974), who relates to the contribution of the wait-time between the teacher’s questions and the giving of an answer for the development of logical thinking, enhancement of students’ confidence, heightening of students’ involvement in the classroom discourse, and other aspects. Discourse quality was not directly examined in this study, but it was indirectly investigated by means of two parameters. The first is the duration of the discourse episode. One of the prime conditions for a deep discourse is its length. A lengthy discourse that is not very meaningful is definitely possible, but a discourse of only a few seconds is unlikely to be meaningful. The second parameter that may be indicative of the quality of classroom discourse, generally speaking, and that was investigated in this study, is the number of high-order-thinking questions (transformation questions) that were presented in class.

**Response to Reviewer 2**

1. *The importance of this type of investigation to further our understanding of teaching and learning in science:*

 The theoretical basis for this study rests on many studies that demonstrate the cruciality of the classroom discourse in science education, some of which are cited in the Literature Review. Research on whole-class discourse such as that in this study, with no intervention whatsoever, which has been less investigated, may yield an authentic picture of the discourse. Analysis of the discourse patterns, the types of questions, and the identity of the initiator of the questions and the discourse are parameters by which the classroom discourse may be characterized. Although there are additional parameters that affect the discourse, those examined here yield a rather reliable overall picture. Why is it important to research discourse patterns? Analysis and recognition of patterns of whole-class discourse are among the most sensitive instruments by which teaching methods and perceptions can be evaluated. An open and dialogic discourse pattern demonstrates a constructive approach, whereas a closed pattern with brief teacher feedback is indicative of the dominance and centrality of the teacher in the learning process. We fine-tuned these matters in the Introduction (p. \_\_\_).

1. *You have found differences among the five teachers in terms of types and frequencies of questions asked, but what can we learn from these differences in terms of teacher's views of teaching and learning science?*

The findings show that despite variance among the teachers, they teach in similar ways and use a similar approach in terms of learning and teaching science. All of them maintain continual discourse and student involvement by asking many questions, but they also lead short discourse episodes and do not encourage deep discussions. In other words, generally speaking, the physics teachers believe they need to challenge their students with questions all the time in order to get them more involved in the learning process and obtain immediate feedback from them. Thus, the teachers focus on getting immediate feedback from their students each and every minute of the lesson without developing a deep discourse that would verify meaningful understanding. This way of teaching is indicative of a perception of teaching that sees learning science as something that should be based on mastering knowledge and remembering facts.

Teachers who do not rush to answer questions, who make ample use of open feedback (e.g., following a student’s question by asking a leading question), and who give students time to think and respond, promote thinking, meaningful understanding, and the creative use of language, and encourage students to cope with challenges and lengthy inquiries. These points are emphasized in the Discussion (p. \_\_\_, paragraphs \_\_\_).

1. *What does answering the two research questions tell us about teaching and learning science?*

 As stated, analysis and recognition of discourse patterns are among the most sensitive means of evaluating a teaching method. The research questions address themselves to two important parameters: discourse patterns and types of questions, and who initiates them—the teacher or the students. When students initiate a discourse or ask questions, they indicate, above all, the extent of their involvement, their wish to know, and their interest. In classes where students initiate discourse, one may say that the classroom atmosphere is comfortable and open enough to make discourse possible. In addition, the types of questions that students ask, and the discourse patterns that they initiate, are suggestive of their level of understanding and their wish to enhance it.

1. *There is no analysis of the relation between questions asked and concepts explored.*

Indeed, in this study we did not analyze the types of questions in the context of the goals and the contentual sequence of the lesson. However, to obtain a variety of questions and discourse patterns that are directly affected by this stage of learning and the sequential organization of the lesson, we took care to analyze three or four successive lessons given by each teacher in each class. We insisted on successive lessons in which the first lesson was devoted to the introduction of a topic. Therefore, in a cluster of three or four successive lessons, one would expect to find questions of different types in accordance with the goals of the lesson. The first lesson raises more questions that look into understanding of the new concept; farther on, the lessons are devoted mainly to understanding and discussing meaning; here, the questions are at a higher level of thinking. In view of the reviewer’s remarks, we clarified this point in the first paragraph of the Findings section (p. \_\_\_) and in the Discussion (p. \_\_\_, paragraph \_\_\_).

1. *Why would you expect differences in discourse because the five classes were different?*

Classroom discourse is affected by various factors: the teachers’ perception of teaching, as the reviewer noted in h/her remark, but also by the topics of study, the teacher’s experience, his or her command of the scholastic material, the students’ characteristics, the teacher’s relations with the students, etc. In the classes that we researched, there were differences in topics of study, gender heterogeneity, students’ age, classroom atmosphere, and other matters. Therefore, we hypothesized that these differences, which may affect the classroom discourse, would lead to more salient differences in the discourse characteristics among the classes. In view of the reviewer’s remark, we added to the second paragraph of the Discussion a reference to Shodell (1995), who relates to factors that affect the questions asked in class.

1. *You pointed out that even though some teachers used more transformation questions these did not develop into dialogic discourse. What does that say about the types of discourses used in class? What does that say about the purposes of teacher-student interactions in these classes?*

When a closed, brief discourse ensues even after a high-order-thinking question is posed that could have stimulated a deep discourse, it may indicate that the teacher does not encourage thinking sufficiently and does not leave reasonable time for his/her students to think about and develop ideas in the classroom discourse. Teachers rush to provide answers even to complex questions and, by so doing, do not challenge the students to think. This way of teaching is indicative of a perception of teaching that sees learning science as something that should be based on mastering knowledge and remembering facts. Teachers who make ample use of open feedback, e.g., following a student’s question by asking a leading question, and who give students time to think and respond, promote thinking and more meaningful understanding.

We give this point greater emphasis in the Discussion (p. \_\_\_) and add a reference to Rowe (1974) in regard to the contribution of the wait-time between the teacher’s questions and the giving of an answer for the development of logical thinking. Finally, possible reasons for the low frequency of dialogic discourse that we encountered in the classes are analyzed in the Discussion (p. \_\_\_).

1. *More in-depth analysis of the relation between types of questions and discourses and the concepts being taught and the sequential organization of the lessons:*

Reference to the types of questions in the context of the topic, the goal, and the sequential organization of the lesson is meaningful and would undoubtedly add important aspects to our understanding of classroom dialogue. This, in fact, is a continuing study for which we are gathering additional data at the present writing. In it, we will analyze and compare discourse episodes among different lessons by the same teacher in which the lessons have different purposes—an introductory lesson and continuing lessons that elaborate and add depth, a laboratory lesson or an exercise class, and a summarizing lesson. This analysis will take the investigation of classroom discourse to an additional level. The current study, focusing on other characteristics that affect the discourse, yields a broader picture for understanding the discourse that takes place in physics lessons.