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Pre-Service Teachers' Use of Dynamic Discourse Variables During Classroom Teaching

Sibel Kaya, PhD*
School of Education, Kocaeli University, 41380 Izmit/Kocaeli, Turkey

Asli Elgun Ceviz
School of Education, Istanbul University, 34452 Beyazıt/Fatih-Istanbul, Turkey

Abstract
The aim of this study is to examine the nature of questioning in primary classrooms taught by teacher candidates. The participants were 39 teacher candidates enrolled in the Department of Primary Education at a large university in Western Turkey as well as 3rd and 4th-grade students in four schools located in the area. Each teacher candidate has taught a course she or he selected from Mathematics, Science, Turkish or Social Sciences subjects for about 35-40 minutes and these courses have been recorded by a video camera. Classroom discourse has been transcribed into MS Word file. Questions of teachers and students and evaluation of student answers have been analyzed by the researcher using discourse analysis techniques. Descriptive statistics on number and types of questions and types and frequency of evaluation was determined using SPSS 18. It has been observed that while teacher candidates used numerous low-level questions in the classroom, they did not use high-level questions and task-related questions sufficiently. This may be due to not utilizing activities frequently or time management issues. It has been found that teacher candidates use significantly more lower-level evaluations in classrooms. Higher order teacher and student questions were observed in Science more compared to other subjects. This may stem from the fact that science classes cater to the curiosity of students and are directly related to their daily life. Findings indicate that teacher candidates are open to development in asking higher-level questions, high-level evaluation and promoting students to ask higher level questions. It is recommended to emphasize the importance of question and evaluation types, high-level questions and evaluations and student questions during teaching courses in education programs.
Keywords: Question types, evaluation types, classroom discourse, IRE

1. Introduction

Classroom discourse refers to the mechanism of teacher-student interaction in classrooms (Nystrand, Wu, Gamoran, Zeiser, & Long, 2003). Nystrand and colleagues (2003) state that the flow and quality of classroom discourse give us clues about what student learn and how they learn it. Classroom discourse can be classified as monologic and dialogic (Scott, 1998). In monologic discourse, teacher transmits knowledge with minimal participation from students. Teacher questions tend to be factual that requires only one word or phrase. When teacher opens the ground for knowledge construction and discussion, classroom discourse tends to be dialogic. The teacher encourages students to ask questions and freely express their ideas. This interactive communication positively influences student understanding (Nystrand et al., 2003). Mercer and Howe (2012) highlight that when students' ideas are incorporated into lesson through dialogic discourse, students feel more valued and more motivated towards the lesson. For a more dialogic discourse, teachers need to know how classroom discourse shapes student learning.

Nystrand and colleagues (2003) indicate that high-level questions, high-level evaluation, and especially, student questions all constitute a dialogic form of communication. They describe these elements as dynamic variables in unfolding the classroom discourse. These variables give clues about the quality of instructional discourse and student engagement in a classroom. They comprise the elements of student-centred, constructivist approach as active student participation is essential for a dynamic discourse. Even though the significance of dynamic variables in classrooms is emphasized, research shows that 85% of the class time is devoted to monologic elements, namely, lecture, recitation and seatwork (Nystrand, 1997; Nystrand & Gamoran, 1991). Teacher questions are a frequent form of classroom interaction; therefore, they reveal rich information about classroom discourse (Chin, 2007). Research shows that a large majority of questions in a classroom are asked by teachers (Graesser & Person, 1994; Erdogan & Campbell, 2008; Kaya, 2014; Kaya, Kablan, & Rice, 2014; Reinsvold & Cochran, 2012).

1.1 Teacher Questions

In whole class teaching environments, classroom discussion usually starts with a teacher question (Nassaji & Wells, 2000). Previous studies show that questions in classrooms are overwhelmingly asked by teachers (Graesser & Person, 1994; Erdogan & Campbell, 2008; Kaya, 2014; Kaya, et al., 2014; Reinsvold & Cochran, 2012). Teacher questions not only provide guidance for student learning but also encourage students to use

language as a thinking tool (Mercer & Howe, 2012). According to Yip (2004), teachers ask questions for various purposes, such as to identify students' bias and misconceptions, to resolve conflicts, to bridge new concepts with previous learning and experiences, to encourage using new knowledge in different contexts.

Researchers used different terms in classifying teacher questions. Nystrand and Gamoran (1991) classified them as "authentic", quasi-authentic", and "inauthentic". Nassaji and Wells (2000) classified them as "known information" and "negotiatory" questions. Finally, Graesser and Person (1994) defined them as "short-answer" and "long-answer" questions. The current study used Erdogan and Campbell's (2008) classification of "open-ended", "closed-ended", and "task-oriented" questions.

Closed-ended questions tend to seek recall information and require a single word or phrase. These questions are not cognitively demanding and each question is usually answered by a single student. For example, when teacher asks "Do solids have definite shape?", students are expected to say "Yes" or "No". Lemke (1990) claims that these type of questions limit students' learning and thinking deeper about the topic. On the other hand, open-ended questions require several sentences to answer and they encourage students to think deeper about the subject matter. In general, several students are given chance to answer the question. These questions can also reveal students' misconceptions. Task-oriented questions are usually asked to clarify a task and help students complete the activities (Erdoğan & Campbell, 2008; Reinsvold & Cochran, 2011).

To raise the level of student interest and interactions in the classroom, teachers are advised to ask more open-ended questions. These questions help students construct their knowledge, encourage them to critically think about the subject matter (Scott, Mortimer, & Aguiar, 2006; van Zee & Minstrell 1997) and be aware of multiple viewpoints (Lemke, 1990).

1.2 Student Questions

What makes classroom discourse truly interactive and discussion-like is the student questions. Students usually ask questions to get additional information or clarification of ideas. Student questions can be wonderful opportunities to open the ground for discussion (Nystrand et al., 2003). Unfortunately, research shows that a very small percentage of questions in a classroom are asked by students (Graesser & Parson, 1994; Nystrand et al., 2003). Student questions serve different purposes in classrooms. These questions might give clues about students' comprehension of the topic (Chin & Osborne, 2008) and reveal their misconceptions (Etkina, 2000; Etkina & Harper, 2002). Since student questions uncover what they know and do not know on the topic, they can be used as evaluation tools (Chin & Osborne, 2008). Furthermore, student questions might affect the flow of the lesson (Chin & Brown, 2002; Etkina & Harper, 2002). The teacher can integrate a student question into the next classroom activity and this would be highly motivating (Chin & Osborne, 2008).

One of the main purposes of student-centered, constructivist learning is to improve students' questioning skills (Chin & Osborne, 2008). Chin and Brown (2002) state that when students ask questions, they utilize their process skills, such as hypothesis, prediction, and inference that help them construct knowledge. Asking questions also improves students' problem-solving, reasoning and critical thinking skills (Zoller, Tsaparlis, Fatsow, & Lubezky, 1997). Student questions make instruction more dialogic, interactional and engaging.

Despite the emphasis on student questions, studies report that only a small percentage of questions are asked by students in classrooms (Graesser & Person, 1994; Kaya et al., 2014). Teachers' preference of didactic and teacher-centred approaches (Chin & Osborne, 2008) and their concerns related to time and classroom management (Jofili, Geraldo, & Watts, 1999) may cause a lack of student questions in classrooms.

Research shows students do not ask questions spontaneously; they need to be stimulated and encouraged (Chin & Brown, 2002). First of all, students need explicit training in how to ask questions (Chin & Osborne 2008; King 1994; Marbach-Ad & Sokolove, 2000). Informing students about the types and forms of questions helps them develop more thought provoking questions (Chin & Kayalvizhi, 2002; King, 1994). Students need to know the difference between a fact-based, low-level question and an open-ended high-level question (Chin & Osborne, 2008). Another important strategy could be group discussions. During group discussions, knowledge is constructed socially (Chin & Brown, 2002). Since individual knowledge is limited, peer questioning is shown to be more effective than self-questioning (King, 1994). Through peer questioning, students stimulate each other and brainstorm ideas (Chin & Brown, 2002).

1.3 Initiation-Response-Evaluation (IRE)

A common pattern of teacher-student interaction in classrooms is Initiation-Response-Evaluation (IRE) (Mehan, 1979). Lemke (1990) describes this three-part exchange as "triadic dialogue". The first move in IRE pattern is "Initiation". In whole class instruction, usually teacher questions initiate the cycle (Nystrand et al., 2003). The type and quality of teacher questions influence how students construct knowledge and direct their thinking (Chin, 2007). In traditional classrooms, teacher questions aim to reveal what students know. In general, these are short-answer, lower order questions. In classrooms where constructive learning is aimed, however, questions help

students construct their knowledge and evaluate themselves (Chin, 2006).

The second part of IRE is "Response". For the better construction of knowledge and understanding, frequent and extended student responses should be encouraged (Myhill, 2006). For extended responses teachers are advised to ask open-ended, higher order questions (Kaya et al., 2014; Myhill, 2006). Another way of increasing student response is providing students with the necessary wait time. The wait-time defined as "the pause following any teacher utterance and preceding any student utterance" (Tobin, 1987, p. 90). Research has shown that at least 3 seconds or more are considered optimal for students to formulate a well-thought out response (Stahl, 1994; Tobin, 1986). Wilen (2004) indicates if students are not given enough time to comprehend the question, connect the ideas and formulate their response, they may get frustrated.

The third part of the IRE model is "Evaluation". This part is very critical in terms of clarifying ideas and providing accurate information (Newman, Griffin, & Cole, 1989). Furthermore, evaluation determines what to do next Sometimes, the teacher poses a new question during evaluation and chains might start (van Zee & Minstrell, 1997). If a teacher simply accepts student response by saying "Good", "Yes" or repeats student response without further participation from students, this would be a "low-level evaluation". If teacher comments on, exemplifies, expands students' ideas or asks a follow-up question, this would be described as "high-level evaluation" (Nystrand et al., 2003). The type of evaluation could be related to lesson goals and objectives; however, high-level evaluation helps to balance power dynamics within the classroom and provides a dialogic discourse (Wells, 1999).

Detailing student responses and producing new ideas is only possible with student participation and student participation can be provided through high-level evaluation. Otherwise, the IRE model would be highly teacher-centered (Mortimer & Machado, 2000). Even though the discourse starts with a lower order question, by requesting further explanations teachers can make high-level evaluation; thus, encourage student engagement (Nassaji & Wells, 2000). Haneda (2005) states that IRE cannot be labeled as 'good' or 'bad'. How teachers implement it makes it more important in promoting active student participation. For an effective IRE model, teachers need to use open-ended questions with high cognitive demand, so that students can use their reasoning and critical thinking skills (Chin, 2007).

According to Neal (2008), there are several factors that affect how IRE is used in classrooms, such as the type and source of questions, number of responses, and the type of evaluation. If questions are only asked by teachers and these questions seek for known information the discourse tends to be asymmetrical under teacher control. Asking high-level questions, making high-level evaluations and allowing student questions provide a more dialogic discourse. Whereas, asking lower order questions, making low-level evaluations and ignoring student questions and comments cause a monologic discourse (Nystrand et al., 2003). Monologic discourse is more likely to put students in a passive state and tends to be uninteresting.

Examining how pre-service teachers use questions and evaluations in classrooms might help them to develop consciousness about classroom interactions and improve their questioning skills when they start their teaching career. Findings of this study might shed light on how pre-service teachers transfer their learning in teacher education program into the field and to what extent they can ignite dialogic discourse recommended by constructivist teaching approach.

2. Method

The current study aimed to analyze classroom talk during 3rd and 4th-grade primary lessons through sociocultural discourse analysis. In sociocultural discourse, qualitative data is often supported by quantitative data in order to examine content and function of spoken language (Mercer, 2010). The current study used observational data regarding teacher and student questioning in primary classrooms. Types of teacher questions, student questions, teacher evaluation and uptake were identified and/or quantified. The use of this methodology in educational research has been validated previously on theoretical and pragmatic grounds (Gee & Green, 1998).

2.1 Participants

The participants were 39 teacher candidates enrolled in The Department of Primary Education at a large university in Western Turkey as well as 3rd and 4th-grade students in four schools located in the area. They were 9 male and 30 were female teacher candidates with an average age of 22.

2.2 Data Collection and Analysis

Data were collected during the spring semester of 2015-2016 from four local public schools where pre-service teachers were having their student teaching experience. Each teacher candidate has taught a course she or he selected from Mathematics, Science, Turkish or Social Sciences subjects for 40 minutes and these courses have been recorded with a video camera by the researcher. Classroom discourse has been transcribed into MS Word file. Questions of teachers and students and evaluation of student answers have been analyzed by the researcher using discourse analysis techniques. Descriptive statistics on number and types of questions and types and

frequency of evaluation was determined using SPSS 18.

Teacher questions and teacher evaluations were classified as low-level, high-level and task related. When classifying questions and evaluations, previous research on classroom discourse was used as guidelines (Erdogan & Campbell, 2008; Graesser & Person, 1994; Nystrand et al., 2003). Accordingly, information seeking recall questions that require short answers were coded as *low-level* questions; open-ended questions that required several sentences and students' reasoning were coded as *high-level* questions. Finally, the questions that were asked to clarify directions as students interacted with classroom activities were coded as *task-related* questions (see Table 1).

Table 1. Examples of teacher questions

High-Level Question	Low-Level Question	Task-Related Question
• "What do you think would happen to this plant in a couple of days?" [Referring to the plant which was covered with a plastic bag] • "We cannot see the electricity but we can feel it. How?" • "What do you think Bora will do with these materials?"	• "Are trees living or non-living?" • "How do we measure temperature?" • "What is the shape of the earth?" • "Which layers of the earth can we see? • "How many types of fractions are there?"	• "Did everybody come up with a character name?" • "Did you finish classifying your rocks?" • "Which ingredient will you add next? • "How many grams did yours weigh?" • Did everybody finish drawing the shapes?"

Some How- and Why- questions can be low-level, such as "Why are plants living things?" since it is a factual question that does not require deeper thinking.

The teacher's certification of the student response such as 'Good' or 'Yes', or repeating the student's answer, is considered as a low-level of evaluation. However, the teacher's incorporation of the student response in the form of an elaboration or a follow-up question is considered to be high-level of evaluation (Nystrand & Gamoran, 1991).

Examples:

High-level Evaluation:

T: "Do plants move?"

S: "Yes they do."

T: "They do, you say. I do not see them walking around, how do they move?"

Low-level Evaluation:

T: "How do fish breathe under water?"

S: "They have gills."

T: "Ok, good."

Randomly selected videos were coded by two researchers separately. The agreement on the question types was 0.82 and the agreement on the evaluation types was 0.77 as computed by Cohen's Kappa. The disagreements were resolved through discussion. The frequencies and percentages of questions, evaluations and uptake were reported descriptively.

3. Results

In 39 classrooms taught by pre-service teachers, a total of 616 teacher questions were coded. Teachers asked as many as 43 questions during a lesson. Students asked a total of 36 questions in 39 classrooms which means, approximately one student question was observed in each classroom. These questions were mostly related to the task. For example, one student seeks help on drawing geometric shapes by asking: "How am I going to draw this triangle?" Or, they seek clarification about concepts such as: "Are barysphere and the core same thing?" The highest number of student questions observed in a lesson was six.

Table 2. Teacher and student questions

	Teacher Questions	Student Questions
N	39	39
Mean	15.79	0.92
Min	4	0
Max	43	6
Total	616	36
%	94	6

Of the 616 teacher questions, 65% of them were low-level, 24% of them were high-level and 11% were task-related questions (see Table 3). During a 40-min lesson, on average, teachers asked 10 low-level questions, 4 high-level questions, and 2 task-related questions.

Table 3. Teacher questions

	Low-Level Questions	High-Level Questions	Task-Related Questions
N	39	39	39
Mean	10.26	3.74	1.79
Min	0	0	0
Max	27	14	8
Total	400	146	70
%	64.94	23.70	11.36

A total of 596 evaluative remarks were observed following student responses (see Table 4). Of these evaluations, 60% was low level and 40% was high-level. On average, teachers made 9 low-level evaluations and 6 high-level evaluations per lesson.

Table 4. Teacher evaluations

	Low-Level Evaluation	High-Level Evaluation
N	39	39
Mean	9.23	6.05
Min	0	0
Max	23	23
Total	360	236
%	60.40	39.40

When dynamic variables were examined separately for each subject, it was observed that their frequencies in Science were slightly more than other subjects (see Table 5). Approximately one-third of teacher questions were high-level and almost half of the teacher evaluations were high-level. Teachers used six uptakes on average, which was the highest among all subjects. Students asked two questions on average during Science lessons, one more than on average.

Table 5. Dynamic variables in Science

	High-Level Questions	High-Level Evaluatios	Student Questions
N	4	4	4
Mean	5.50	10.25	2
Min	2	3	0
Max	12	19	4
Total	22	41	8
%	29	47	10

In Mathematics, the lowest numbers of high-level teacher questions and student questions were observed (see Table 6). Of the teacher questions, only 18% were high-level; 38% of teacher evaluations were high-level, 2% of all questions were student questions and finally, 16.5% of teacher evaluations consisted uptake.

Table 6. Dynamic variables in Mathematics

	High-Level Questions	High-Level Evaluatios	Student Questions
N	13	13	13
Mean	3.08	5.31	0.38
Min	0	0	0
Max	9	10	3
Total	40	69	5
%	18	38	2

In Social Studies, approximately one-fifth of teacher questions and one-third of teacher evaluations was high-level (see Table 7). Twelve percent of all evaluations included uptake and students asked one question per lesson.

Table 7. Dynamic variables in Social Studies

	High-Level Questions	High-Level Evaluatios	Student Questions
N	8	8	8
Mean	3	4.13	1.13
Min	1	0	0
Max	7	13	6
Total	24	33	9
%	21	33	7

In Literacy, similar to Science, teachers asked slightly more high-level questions (29%) and did slightly more high-level evaluations (41%) (see Table 8). Ten percent of all evaluations included uptake and similar to Social Studies, students asked one question per lesson.

Table 8. Dynamic variables in Literacy

	High-Level Questions	High-Level Evaluatios	Student Questions
N	14	14	14
Mean	4.29	6.64	1
Min	0	0	0
Max	14	23	3
Total	60	93	14
%	29	41	6

4. Discussion

This descriptive study examined the use of dynamic discourse variables, namely high-level teacher questions, high-level teacher evaluations and student questions in various subjects taught by primary teacher candidates. It has been observed that the questions were overwhelmingly asked by teacher candidates. While teacher candidates used numerous low-level questions in classrooms, they did not use high-level questions and task-related questions sufficiently. It has been found that teacher candidates use significantly more lower-level evaluations in classrooms. High-level teacher questions and student questions were observed in Science more compared to other subjects. This may stem from the fact that science classes cater to the curiosity of students and are directly related to their daily life. Based on findings, it is recommended that future efforts in teacher education inform pre-service teachers about what dynamic discourse variables are and their importance in student learning.

Pre-service teachers may not be familiar with individual students and may not have enough information about their needs and interests. Therefore, they might have preferred low-level questions and evaluations. Research shows that as individuals gain more knowledge they tend to ask higher order questions (Büyükalan, 2002). As new teachers gain more knowledge and experience they might focus more on how students construct knowledge; thereby, prefer high-level questions in their instruction.

The main reason for the lack of task-related questions is that students in the observed classrooms did not do a lot of tasks since the pre-service teachers mainly preferred teacher-centered, whole class instruction. This may also be why students asked very few questions. There are other reasons for the absence of student questions in classrooms. The tasks might be uninteresting for students, student-centered activities may not be used adequately in classrooms and teacher might feel that they would lose control of classroom management when students ask questions (Chin & Osborne, 2008). Furthermore, in this study, the pre-service teachers might have focused on finishing the tasks on time rather than allowing students to ask questions. Research point out that students need to be given the necessary time to formulate questions (Baysen, 2003; Wilen, 2004).

High-level questions, high-level evaluation and student questions play important roles in creating dialogic zones of interaction. Understanding how these variables function in a classroom will help pre-service and in-service teachers provide engaging instructional environments and foster student learning. Teacher candidates need to be shown that dialogic discourse is an effective way in children's understanding; and they need to be aware of their roles in a dialogic discourse (Mercer, Dawes, & Staarman, 2009).

In Storey's (2004) study with early childhood education teachers, participants improved their questioning skills after receiving a training on how to ask higher-order, open-ended questions. First, the teachers received a theoretical instruction on types of questions, the importance of higher-order questions, ideal wait time, etc. Then, they analyzed and assessed their own questioning based on the theoretical instruction. After working in groups to practice developing questions and receiving feedback, teachers worked with co-teachers in their classroom by observing each other and providing constructive feedback. Finally, teachers taught their own lessons independently. During post-workshop teaching, they asked significantly more higher-order questions compared to pre-workshop teaching.

Future research in this field might focus on the development of teacher candidates in terms of using dynamic variables in classrooms. Their lesson plans and teaching can be analyzed before and after receiving training on questioning. The influence of using dynamic variables on students' understanding can be examined for different subjects. The most important element that makes discourse truly dialogic is student questions (Nystrand et al., 2003). Therefore, the approaches that encourage students to ask questions can be experimented. Especially when content is uninteresting for students, methods such as drama, storytelling, discussion, and games can be utilized.

Although this study contains rich observational data, it is limited in some aspects. First of all, our sample is limited to 39 pre-service teachers and their respective students in four public schools. The findings may not be generalized to all pre-service teachers in Turkey. A second limitation is that each classroom was observed only once. The goal of this study was to reach as many pre-service teachers as possible in order to examine the trends in questioning. Thus, the findings might be content specific. Finally, the teachers and students in the classrooms might not have behaved naturally due to the observer effect. The pre-service teachers

were informed that their classrooms would be evaluated in terms of teacher and student behaviors and interactions. However, it is not possible to know if pre-service taught the same when there was no observer in their classrooms. This is the main limitation in all observation studies (Daymon & Holloway, 2010).

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