Analysis of Case 1, Stage 2, Lesson 1, Episode 1, 2, 3

**1. Analysing the talk:**

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| S | Utterance | Move | Q | R | F | Remarks |
| 1.T | Where do we find electric circuits? S1 | I | H |  |  | \* H: CP of 'Understand; inferring' , open Q |
| 2.S1 | In most the electric devices | R1 |  | H |  | \* H: CP of 'Understand; inferring' |
| 3.T | Most of the electric devices. And not most, all the electric devices^. As long as you have an electric device, I find an electric circuit inside it. Is it just inside the electric devices we can find electric circuits? Think about it | F  I | H |  | Ev | \* H: CP of 'Understand; inferring' |
| 4.S2 | No, we find it outside | R2.1 |  | L |  | \*Based on following the answer in turn 8; L |
| 5.T | Where outside? | F | H |  | EL | \* H: CP of 'Understand; Explain' |
| 6.S2 | Outside. In the classroom for example, I mean (…?) | R2.2 |  | H |  | (…?) inaudible |
| 7.T | You mean within the device? | F | L |  | EL |  |
| 8.S2 | Yes, inside the device | R2.3 |  | L |  |  |
| 9.T | Ok, sit down, thanks. What do you think? She said it's necessary to be within the electric device. S3 | F  I | H |  | C0 | \* H: CP of 'Evaluate; critiquing' |
| 10.S3 | May be the electric device is connected to the circuit | R3 |  | H |  | \* H: CP of 'Analyze; organize' |
| 11.T | Excellent. May be this device is a part of an electric circuit. I might find the electric circuit outside also, outside the electric device. The electric device might be part of an electric circuit and also it is connected to an external circuit. I mean, it might be internal inside the device or external. I mean, the electric circuit in the device, the device won't work unless it's connected to an external circuit. You understand it? So, this electric circuit might be simple and might be complicated.  What's the difference between the simple circuit and the complicated one? And what do I mean by the word complicated? What does complicated mean? | F  I | H |  | Ev | \* H: CP of 'Analyze; differentiate' |
| 12.S4 | Simple, might be connected to one device | R4.1 |  | L |  | \* L: CP of 'Understand; interpret' |
| 13.T | Connected? | F | H |  | EL | \* H: CP of 'Understand; explain' |
| 14.S4 | With one device ()  The complicated contains more than one device | R4.2 , F  R4.3 | - | L | EL | () T mutters here: Ummm (elaborative F) |
| 15.T | You mean, the simple contains one device and the complicated has more than one. Ok, if I brought a big device like TV. Inside it, there is also a circuit. This circuit inside is simple or complicated and it's inside one device? | F  F | H |  | C0  EL | \* H: CP of 'Understand; explain' |
| 16.S4 | Complicated | R4.4 |  | L |  | \* Based on her explanation in turn 18; L |
| 17.T | Why complicated? | F | H |  | EL | \* H: CP of 'Understand; explain' |
| 18.S4 | Cause it embodies more than one device | R4.5 |  | L |  |  |
| 19.T | More? In the TV for example or the fridge or … | F | - |  | EL | … T repeats the same query, and S4 doesn't reply, so another pupil offers to answer |
| 20 S5 | May be in the simple circuit, the components are less and more in the complicated one | R5 |  | H |  | \* H: CP of 'Analyze; differentiate' |
| 21.T | Excellent. You said half the answer (). The simple circuit as your friend has said has few components whereas the complicated circuit is distinctive that it has many components. Whether the components are few or many, the important thing I must ensure in the circuit is what? | F  I | - |  | Ev | () T points to S4  -not categorised because it’s part of NI/A |
| 22.S6 | The movment of charges | R6 |  | - |  | -not categorised because it’s part of NI/A |
| 23.T | Yeah, good. I ensure a closed path that charges or dynamic electricity move through. So, the circuit can be simple and can be complicated but the important thing here that its components are connected together in a way that allows the electric charges to move through circuit. If I ask you for example,  Which circuit is more complicated; the one that links the street lamps or the one inside the laptop? Yes S7 | F  I | H |  | Ev | \* H: CP of 'Apply; Implement' |
| 24.S7 | The one for the street lamps | R7 |  | L |  | \* L: usual thinking in terms of the number |
| 25.T | Street lamps' circuit is more complicated. What do you think? | F , I | H |  | C0 | \* H: CP of 'Evaluate; critiquing' |
| 26.S8 | The one for the laptop is more complicated | R8.1 |  | H |  | \* H: CP of 'Analyze; compare' |
| 27.T | Why? | F | H |  | EL | \* H: CP of 'Understand; explain' |
| 28.S8 | Cause the laptop – is complicated. Why? Cause there is internet and circuits. I mean, yeah the circuit is small but its components are more | R8.2 |  | H |  | \* H: CP of 'Analyze; organize' |
| 29.T | Yeah, excellent. Cause the components are several and various. For the street lamps, it's the same component…. | F |  |  | Ev | …T continues the explanation in a NI/A talk |
| **Example 2** | | | | | | |
| 1.T | Now, who defines electric circuit? | I | L |  |  | \* H: CP of 'Understand; define' |
| 2.S1 | The electric circuit is a circuit that connects any matter with the electricity and it's made up from components like transistors and capacitors | R1.1 |  | L |  | \* H: CP of 'Understand; define' |
| 3.T | We don't want details. As a general definition, It's what? | F , I | L |  | Ev |  |
| 4.S1 | It's a device that's connected | R1.2 |  | L |  |  |
| 5.T | A device?! | F |  |  | Ev | ?! T is disapproving the answer |
| 6.S1 | It's an electric circuit that connects any device with electricity | R1.3 |  | L |  |  |
| 7.T | Still, you're not saying the definition I'm looking for.  Ok. No problem. Lets take opinions | F  I | L |  | Ev | \* H: CP of 'Understand; define' |
| 8.S2 | It's a group of devices connected together to carry (move) the electric circuit | R2 |  | L |  |  |
| 9.T | A group of devices connected together to carry (move) the electric circuit  Another opinion | F  I | L |  | C0 |  |
| 10.S3 | It's a group of main components connected with wires | R3 |  | L |  | \* H: CP of 'Understand; define' |
| 11.T | A group of main components connected with wires.  Still I want a precise articulation | F  I | L |  | Ev |  |
| 12.S4 | It's a closed circuit that allows the electric currents to move through | R4 |  | L |  |  |
| 13.T | Not a closed circuit. A closed path that charges are moving through. The important thing here is a path that guarantees the movement of electric charges (B). But the concept of the circuit has more than this. There are components, devices but a closed path with a group of components where charges move in…Ok? Now lets see the components of the simple electric circuit that we're gonna deal with in the lab… | F |  |  | Ev | (B) T writs on board the definition  ..Repetition for the same information  …T continues a NI/A talk |

**2. Characterizing the talk:**

|  |  |
| --- | --- |
| Class of the talk | Teacher-Pupil talk   * Example 1, Turns 1-11: I/A , Turn 11: NI/A   Turns 11-21: I/A , Turn 21-23: NI/A  Turns 23-29: I/A , Turn 29: NI/A  - Example 2: Turns 1-13: I/A , Turn 13: NI/A |
| Purpose of the talk | * Example 1, I/A,1: Exploring pupils' views , NI/A: Reviewing/confirming the scientific views   I/A, 2: Exploring pupils' views , NI/A: Reviewing/confirming the scientific views  I/A, 2: Applying a scientific view , NI/A: Concluding the scientific application   * Example 2, I/A: Identifying the pupils' views of a scientific concept * NI/A: Developing the scientific concept |
| Content of the talk | * Example 1, I/A 1, 2: Personal/Scientific views of Theoretical Scientific subject matter * NI/A1,2: Scientific view of Theoretical Scientific subject matter * I/A 3: Personal/Scientific views of Theoretical Everyday/Scientific subject matter * NI/A3: Scientific view of Theoretical Everyday/Scientific subject matter * Example 2: I/A: Personal/Scientific views of Theoretical Scientific subject matter * NI/A: Scientific view of Theoretical Scientific subject matter |
| pattern of the talk | * Example 1, I/A,1: I-R1-Ev-I-R2.1- EL-R2.2- EL -R2.3-C0-I-R3-Ev , NI/A:---   I/A, 2: I-R4.1-EL-R4.2- EL -R4.3- C0, EL-R4.4- EL-R4.5- EL-R5-Ev , NI/A: I- R6- Ev  I/A,3: I-R7-C0-I-R8.1- EL-R8.2-Ev , NI/A:---   * Example 2: I/A,1: I-R1.1-Ev,I-R1.2-Ev-R1.3-Ev-I-R2-C0-I-R3-Ev-I-R4-Ev , NI/A:--- |

**3. Quantitative indicators**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Class of talk** | Question (Cognitive level) | | Response (Cognitive Skill) | | Follow-up | | |
| Low | High | Low | High | Ev | Co | El |
| **Ex1, Authoritative, 1** | 1 | 4 | 2 | 3 | 2 | 1 | 2 |
| **Ex1, Authoritative, 2** |  | 4 | 4 | 1 | 1 | 1 | 5 |
| **Ex1, Authoritative, 3** |  | 3 | 1 | 2 | 1 | 1 | 1 |
| **Ex2, Authoritative, 1** | 5 |  | 6 |  | 5 | 1 |  |

**4. Narrative account:**

The examples here are part of the first lesson videotaped after the intervention. These are very interesting ones as they show how the teacher, who used to be very Authoritative in the first stage, is starting and trying to practice more Dialogic talk. Although all the examples here have been characterized as Authoritative, they actually show low level of authority with signs of dialogic attempts.

The first example is made up of three parts, each with both Interactive and Non-Interactive Authoritative types of talk. In the Interactive turns in the first two parts, the teacher is seeking to explore the pupils’ views regarding the places in which electric circuits can be found in the first example (1-11), and the difference between simple and complicated circuits in the second example (11-21). After raising some ideas by pupils, the teacher was ending the discussion by evaluating the raised views and reviewing the scientific ones through a Non-Interactive Authoritative talk. In the third part, the teacher was aiming to apply the scientific view concluded in the second part more specifically by initiating the question in turn 11. After listening to the possible answers, she ended up the discussion by evaluating the pupils’ opinions and concluding the scientific view.

If we start to analyse the first part, we can see that it starts, in its first three turns, with a typical sequence of Interactive/Authoritative talk (I-R1-Ev). The teacher asks a question, S1 answers and the teacher immediately provides an evaluation for the response by correcting it and then affirming the right view. In the turns after, though, the teacher exchanges a longer talk with S2 (3-9) without evaluating her responses (I-R2.1-EL-R2.2-EL-R2.3-C0). Instead, she chose to move the control to the rest of the class by inviting them to comment on S2’ view in turn 9. Accordingly, S3 provides a different opinion which is to be appraised by the teacher and contributes, therefore, to evaluating S2’s view. In her attempt to practice less Authoritative talk, therefore, the teacher has implemented two strategies; listening to a pupil’s view without evaluating it and allowing another pupil to provide a different opinion on one hand, and to evaluate indirectly the raised point on the other hand.

The two strategies have been also used in the second part and in a more obvious way. The teacher has initiated the discussion about the difference between simple and complicated circuits in turn 11. She kept it with just one pupil; S4 for most of the episode (I-R4.1-EL-R4.2-EL-R4.3-C0,EL-R4.4-EL-R4.5-EL). She even meant to continue the discussion with this pupil as the last move shows (EL). S4, however kept silent, the thing that necessitates the teacher to allow another pupil; S5 to answer, who has provided, in turn, the right view. At this point, the teacher did offer an evaluation, not just by appraising and approving S5’s answer, but also by commenting critically on S4’s uttered responses. The pattern of the talk her is very similar to the patterns usually noticed in Dialogic episodes; one initiation with many responses and elaborative follow-ups, and the absence of evaluative follow-ups till the very end of the episode. Thus, if the pattern of the talk, and also its purpose, exhibit a Dialogic type of talk; how has this part of the episode been characterized as Authoritative?

It’s the understanding of the uttered talk in this part of the episode that specified it to be Authoritative. If we focus on this exchange of talk and more on the follow-up moves, we can see that the teacher was elaborating S4’s answers in order to help her end-up with the right scientific view uttered eventually by S4 (look, for example, at the elaborative follow-up in turn 15). This raises, however, the question; was the teacher’ purpose to develop the scientific idea of complicated circuit or to explore the pupils’ views about it?

I’m arguing, though, that the talk here has been meant to achieve the second purpose, where the three parts of the whole example gather within the first purpose of developing the scientific idea. In fact, what was happening, not just in this part, but in the whole two examples from this lesson, is that the teacher was attempting to practice the basic type of Dialogic talk of identifying and listening to pupils’ opinions, as explained through the training intervention. Her authoritative attitude, however, has persisted to interfere with her attempts and she was hanging between listening to opinions without evaluating them or evaluating these opinions. Although for most of the time during these excerpts, she succeeded in not to disapprove the incorrect opinions, she could not do the same for the right ones for which, she was providing immediate appraise for their correctness.

What is also interesting about this example in terms of the Authoritative/Dialogic transaction is the purpose and the content of the talk in addition to what we have mentioned about the patterns of moves. The first two Interactive/Authoritative parts were uttered with the purpose of exploring pupil's views; the purpose usually assigned to the Dialogic type of talk. The content of the discussed personal and scientific views refer to Dialogic talk. Though, the purposes and the content of the Non-Interactive parts indicate that the teacher although explored the pupil's views, her focus was directed to the scientific ones, and so the content of the Non-Interactive parts was of scientific views only and the purpose of the talk was to review and confirm these views.

For confirming the scientific view discussed in the second part, the teacher has not done so through the Non-Interactive Authoritative talk she controlled, but also through the third part with its two shifts; Interactive and Non-Interactive Authoritative talk. She initiated the talk in this part to confirm the scientific view regarding the simple/complicated circuit by relating it to everyday experience. She guided the talk in this part with less authority as she listened to the two possible answers. However, her enthusiasm with the right view; the aforementioned attitude, manifest itself through her extended talk with the pupil that uttered this view compared to the closed talk she exchanged with the pupil who offered the incorrect answer. Again such flow for the talk indicates the teacher's hanging between the authoritative and the dialogic manners in guiding this talk.

Nevertheless, we can talk about a smooth and purposeful shift between the two types of talk; Interactive and Non-Interactive Authoritative talk. Through practicing the shift for three times, the teacher could make some of the pupils' view available as she could present the scientific view and relate it to everyday experiences. She did this through the pupils and with less authority from her side compared to the authority over the talk that she used to practice throughout the first stage.

In relation to the quality of the moves in the different parts of this example, we can see that most of the posed questions were of high cognitive level. This is because the teacher was asking about both personal and scientific views as well as explanations for these views. Consequently, the pupils offer answers of different cognitive levels; low and high depending on their thinking about the questioned issues. Certainly, though, the high quality responses would not have been offered if the teacher has not opened the chance for the pupils to speak them out through her questions that asked for high cognitive processes to be answered.

Let's move now to the second example, which is very similar to the first example. It is similar in the sense that the teacher was hanging between Authoritative and dialogic manner in guiding the talk. In this example, the teacher initiated the talk by asking for a definition of electric circuit following different theoretical and empirical activities related to electric circuits. In the lesson before, the teacher actually gave the scientific definition for the electric circuit. However, it seems that the pupils didn't capture that precise definition as the teacher did not plan actually for the pupils to memorize it at that time. The other thing here is the context in which the teacher has asked this query. The question came directly after the pupils being given some chips that contain many and different electric pieces, and being asked to try to identify some of these components and to follow their connections.

All the information from the empirical activity and the theoretical discussions, therefore, has influenced the pupils' thinking about the definitions. Consequently, the four pupils who participated in the talk had offered different articulations of the definition. The teacher, however, was not satisfied with these definitions and she was asking for the precise scientific articulation of the definition. She refused the first and the second definitions provided by S instantly and openly in turns 3 and 7. She then held back to more dialogic and announced in turn 7; ''No problem. Let’s take opinions''. So, she kept a dialogic manner in taking the third definition from S2 and invited for another opinion (turn9). When she got the forth definition from S3, though, she could not keep that dialogic manner and again shows her authoritative attitude in turn 11; ''Still I want a precise definition''. When she got the fifth definition and the nearest one to the scientific one she is looking for, she decided to correct it herself and to explain it more through a Non-Interactive Authoritative talk.

If we focus on the pattern of the moves, then we can see the Authoritative sequence of (I-R-E) dominates except for the part when the teacher tried to reduce her authority to listen to opinions without evaluating them. As I have mentioned, she succeeded in doing this for just one opinion as marked in the following pattern; I-R1.1-Ev,I-R1.2-Ev-R1.3-Ev- (I-R2-C0) -I-R3-Ev-I-R4-Ev

This example is also similar to the one before in terms of its purpose of exploring pupils' views and its content of personal and scientific views of theoretical scientific content of the subject matter (definition of electric circuit). In terms of the quality, though, I was confused in categorizing it for this excerpt. Two attributes, though, have influenced my judgment of low quality for all the questions and answers;

* 1. The fact that the definition has been mentioned in the lesson before. Not to mention the familiarity of pupils with electric circuits from a surface level. I imagine, therefore, that any answer would have not been built over thoughts of high cognitive processes
  2. For the aforementioned reason, the main question about the definition has been categorized as low. The other questions asking for other opinions have been also categorized as low, although I usually assign such question to high cognitive level as it asks the pupils to think deeply and challenge each other's ideas. In this case, however, the teacher was not really asking for such an analysis. It was just an utterance that she didn't really mean it as it is clear from her reaction. So, it is like she was asking for another definition which means she is asking the same low level question again and again till she got the one close to the one she consider it right.

Analysis of Case 1, Stage 1, Lesson 2, Episode 4

**1. Analysing the talk:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S | Utterance | Move | I | R | F | Remarks |
| 1.T | …you said that when closing the circuit, the bulb lights? I wanna know, since I close the switch till the bulb lights, how long it takes? Does it take a short period of time or a long one? Or will it lights instantly? Yes S1 | I | H |  |  | …T has given the pupils five questions which were written in the board, this is the 1st one  \* H; CP of ‘Create: hypothesize’ |
| 2.S1 | Instantly | R1.1 |  | H |  | \* H: CP of ‘Create; hypothesize |
| 3.T | You mean at the moment we close the circuit, the bulb lights?()  S1 is saying instantly. Write her answer. Instantly (B).  Anyone has another opinion? S2 | F , R1.2  F  I | -  H | - | EL  C0 | () S1 is nodding yes.  (B) writes on board  \* H; CP of ‘Create: hypothesize’ |
| 4.S2 | Short | R2.1 |  | L |  | \* L: Usual answer in its context |
| 5.T | Short. You mean after a short period of time the bulb will light()  Ok.  Any other opinion?() So no one is saying after a long period? | F , R2.2  F  I | -  H | - | EL  C0 | () S1 is nodding yes, not categorised because it is confirming R in turn 4  () No one raise hand |
| 6.Sg | No | Rg |  | - |  | -group answer: not categorised |
| 7.T | Ok.  Let's see how many of you agree with S1? 12. Ok. How many supports S2? 13.  What about the rest of you? | F  I, Rg ,F  I | -  - | - | C0  - | -not categorized because it is part of NI/D |
| 8.Sg | Not taking any side | Rg |  | - |  | - laugh |
| 9.T | You have to take one of the three opinions…  What forms of energy are given out by the electric bulb? | F  I | H |  | C0 | …closes the discussion with a NI/D talk to move to the 2nd question  \* H as the teacher meant it to be open to any answer |
| 10.S3 | Light | R3 |  | L |  | \*L: CP of ‘Remember: describe’ |
| 11.T | Light (B), other opinion? | F  I | H |  | C0 | (B): T writes on board  \*H: follows the categorization in turn 9 |
| 12.S4 | Light and heat | R4 |  | H |  |  |
| 13.T | Light and heat (B)  What do you think girls?...  Ok. S4 is insisting on her opinion | F  I , Rg  F | - | - | C0  - | (B) T writes on board R4  … All of the girls supports S4 but S3 insist it's just light  -not categorized because it is part of NI/D |
| 14.T | Now, what's the source of this energy? | I | H |  |  | 3rd question  \* H: CP of ‘Understand’ explain’ |
| 15.S5 | The battery | R5.1 |  | L |  | \* L: usual answer in its context although correct |
| 16.T | The battery, you mean the energy used in the bulb is coming from the battery? Ha? ().  What do you think? Anyone has another opinion? S6 | F , R5.2  I | -  H | - | EL | -not categorised because it’s just confirming  () is nodding yes |
| 17.S6 | Kinetic. Its main source is the kinetic energy | R6.1 |  | L |  | \* L:Based on following the answer in turn 9 |
| 18.T | Girls, when I say its source, I mean where does it come from, not its form | F | L |  | EL |  |
| 19.S6 | The battery | R6.2 |  | L |  | \* L: usual answer in its context |
| 20.T | Ok, it comes from the battery # | F |  |  | C0 | # T is interrupted by S7 |
| 21.S7 | From the things inside the resistance | R7.1 |  | H |  | \* H: unusual answer in its context |
| 22.T | Comes from things inside the resistance, what's inside the resistance? () | F | H |  | EL | () some pupils answer: resistance and laugh  \*H: CP of ‘Understand: explain’ |
| 23.S7 | (…?) From the wires inside the bulb | R7.2 |  | H |  | (…?) inaudible |
| 24.T | So you say, the energy comes from the wires inside the bulb. One of you said the battery and S7 is saying from the wires inside the bulb (B). Any other opinion? | F  I | H |  | C0 | (B) T writes on board |
| 25.Sg | No | Rg |  | - |  |  |
| 26.T | Who agrees with S6? Who agrees with S7 ?...  So, all of you agree… | I , Rg,  F | - | - | C0 | () everyone agree with S6 |
| 27.T | Ok, the next question, how did the energy come to the bulb? | I | H |  |  | 4th question  \* H: CP of ‘Understand’ explain’ |
| 28.S8 | Cause the electric charges move in the wire through the circuit | R8.1 |  | H |  | \* H: CP of ‘Understand’ explain’ |
| 29.T | The movement of charges through the wire (B).Still it's not clear, how # | **F** | H |  | EL | # T is interrupted by S8  \* H: CP of ‘Understand, explain’ |
| 30.S8 | I mean it starts. It moves from the battery and through the wire | R8.2 |  | L |  | \*L: Usual thought in its context |
| 31.T | So the charges are moving through the wire. How does this relate to the energy? I'm talking now about the energy. You said by the movement of the charges, how? Explain it to me | F | H |  | EL | \* H: CP of ‘Understand, explain’ |
| 32.S8 | Cause they are - when the switch is closed, the charges start to move - - till they reach the bulb | R8.3 |  | H |  | - pause  - - silence & hesitation  \* H: CP of ‘Understand, explain’ |
| 33.T | The charges move. Kinetic energy - till they reach the bulb and it lights. So is the kinetic energy the reason for the lightness of the bulb? | F | H |  | EL | - pause  \* H: CP of ‘Understand, explain’ |
| 34.S8 | I mean the charges move | R8.4 |  | L |  |  |
| 35.T | They move but I just wanna know how the energy that you're talking about and saying it's from the battery, how did the charges move it to the bulb? You're saying, the charges are moving, Ok? I agree with you. But still you haven't link it to the energy. How did the energy reach the bulb? () | F | H |  | EL | () S8 does not answer and S9 offers a response |
| 36.S9 | By the wire cause the wire is conductive for the energy. So the charges moved till they reached umm what's its name # | R9.1 |  | L |  | \* repeated information  # S9 is interrupted by T |
| 37.T | It's the same as S8 .  From where did the charges move? | F  I | H |  | C0 | \* H: CP of ‘Understand, explain’ |
| 38.S9 | From the battery of course | R9.2 |  | L |  |  |
| 39.T | So they start moving from the battery and move till they come to the bulb. So the start of the movement will be from the battery # | F | - |  | EL | # T is interrupted by S9 |
| 40.S9 | Yeah | R9.3 |  | - |  |  |
| 41.T | so they …(B)  Still you haven't explained how the energy got there? And then | F  F | H |  | C0  EL | …(B) repeat the answer and write it on the board  \* H: CP of ‘Understand, explain’ |
| 42.S9 | I mean the charges (…?) in the wire, when we open the switch they # | R9.4 |  | H |  | (…?) inaudible  # S9 interrupted by T  \* H: Unusual answer in its context |
| 43.T | The charges are basically there in the wires? # | F | H |  | EL | # T is interrupted by S9  \* H: CP of ‘Understand, explain’ |
| 44.S9 | Cause we're connecting them to the battery # | R9.5 |  | L |  | # S9 is interrupted by T |
| 45.T | So because they're connected to the battery, they're there in the wires, but before they're not there in the wires? | F | H |  | EL | \* H: CP of ‘Analyse, organize’ |
| 46.S9 | I don't know () | R9.6 |  | - |  | () confused, so |
| 47.T | It's ok, you're doing fine. Yes S10 | F  I | H |  | C0 | \* It’s like the teacher asking S10: what do you think? |
| 48S10 | The battery gives an electric energy and it passes through the wires # | R10.1 |  | H |  | # S10 is interrupted by T  \* H: CP of ‘Analyse, organize’ |
| 49.T | How does it pass it through the wires? | F | H |  | EL | \* H: CP of ‘Understand, explain’ |
| 50S10 | Cause the wires are connected to the electricity, the electrons will move through them | R10.2 |  | L |  |  |
| 51.T | You said that the battery gives the circuit an electric energy, how? | F | H |  | EL | \* H: CP of ‘Understand explain’ |
| 52S10 | Cause it has chemical substances that help producing an electric energy. So the electrons will move through the wires till they reach the bulb | R10.3 |  | H |  | \* H: CP of ‘Understand: explain’ |
| 53.T | Ok, I agree that the battery gives the circuit electric energy. Then you said the electrons will move through the wires. Where is the link between them?... | F | H |  | EL | \* H: CP of ‘Analyze: organize’  …skip some turns |
| 54S10 | Cause everything in life has energy, so the energy in the battery will move through the wires # | R10.4 |  | H |  | # interrupted by T |
| 55.T | So the energy has the ability to move through the wires? | F | H |  | EL | \* H: CP of ‘Understand explain’ |
| 56S10 | Yeah, it moves yeah | R10.5 |  | H |  | \* H: Unusual answer in its context |
| 57.T | Ok, why did you say the charges here? | F | H |  | EL | \* H: CP of ‘Understand explain’ |
| 58S10 | Cause the energy is made up of charges | R10.6 |  | H |  | \* H: Unusual answer in its context |
| 59.T | Energy is made up of charges. Let's write your answer (B). and then the energy will move through the wires. The energy…. So we will keep these answers to the next lesson and will discuss… | F |  |  | C0 | (B) writes on board  … repetition  … closing the talk |

**2. Characterizing the talk:**

|  |  |
| --- | --- |
| Class of the talk | Teacher-Pupil Talk   * 1. Turns 1- 7: I/D - Turns 7-9: NI/D * 2. Turns 9- 13: I/D - Turn 13: NI/D * 3. Turns 14- 25: I/D - Turn 26: NI/D * 4. Turns 27- 59: I/D - Turn 59: NI/D |
| Purpose of the talk | * I/D, 1.2.3.4: Exploring pupils' views * NI/D, 1.2.3.4: Reviewing pupils' views |
| Content of the talk | * I/D,1.2.3.4: Personal views of Theoretical Scientific subject matter |
| pattern of the talk | * I/D, 1: I-R1.1-EL-R1.2-C0-I-R2.1-EL-R2.2-C0-I- Rg-C0 - NI/D: I- Rg-C0- I- Rg-C0 * I/D, 2: I-R3-C0-I-R4-C0 - NI/D: I-Rg-C0 * I/D, 3: I- R5.1-EL-R5.2-I-R6.1-EL-R6.2-C0-R7.1-EL-R7.2-C0-I- Rg - NI/D: I- Rg-C0 * I/D, 4: I-R8.1-EL-R8.2-EL-R8.3-EL-R8.4-EL-R9.1-C0- I-R9.2-EL-R9.3-C0,EL-R9.4-EL-R9.5-EL-R9.6-C0-I-R10.1-EL-R10.2-EL-R10.3-EL-R10.4-EL-R10.5-EL-R10.6-C0 - NI/D: --- |

**3. Quantitative indicators**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Class of talk** | Question (Cognitive level) | | Response (Cognitive Skill) | | Follow-up | | |
|  | Low | High | Low | High | Ev | Co | El |
| **Dialogic, 1** | 0 | 3 | 1 | 1 | 0 | 3 | 2 |
| **Dialogic, 2** | 0 | 2 | 1 | 1 | 0 | 2 | 0 |
| **Dialogic, 3** | 1 | 4 | 3 | 2 | 0 | 2 | 3 |
| **Dialogic, 4** | 0 | 15 | 6 | 8 | 0 | 4 | 13 |

**4. Narrative account:**

These excerpts are from the second lesson videotaped after the intervention. After her attempt to practice more dialogic talk in the first lesson, the teacher succeeded in this lesson to show extraordinary dialogic practice in guiding the discussions with the pupils. Here, we have a shift between Interactive and Non-Interactive Dialogic talk that repeats four times throughout this example. In the four parts, the teacher was trying to explore the pupils’ views through the Interactive exchange, and review these views through the Non-Interactive ones. All the discussions here have been initiated, in fact, around four questions that the teacher had written in the board, and was exploring the pupil’s views for these questions one by one.

For the first question in turn 1, the teacher asked the pupils about their opinions in regard to the three possible answers for this query. Through the exchanged discussion, the teacher listened to two pupils offering two of the three opinions, and elaborated them before closing the talk about each opinion by commenting on it (restating or rephrasing it). No one offered the third possible answer, and the whole class was divided between the first two answers. The talk, therefore, took the sequence of (I-R-EL-R-C0) and repeated once with each pupil; (I-R1.1-EL-R1.2-C0)-(I-R2.1-EL-R2.2-C0)-I-Rg-C0. This means that in practicing Dialogic talk, the teacher was listening to certain opinion, elaborates it if needed before commenting on it. Without any evaluation for the first discussed opinion, she moves to the second to do the same and so on. And this is nearly what happened in the third part, but repeated with more pupils as more opinions were offered; (I- R5.1-EL-R5.2)-(I-R6.1-EL-R6.2-C0)-(R7.1-EL-R7.2-C0)-I-Rg.

When the offered opinion is not elaborated, then the talk follows usually the sequence (I-R-C0); as we can see in the sequence of the Dialogic talk in the second part of this example; I-R3-C0-I-R4-C0 .

The forth part entails the same sequence. However, it is different in the sense that each sequence extends for a longer exchange through more elaborative moves as the teacher was keeping elaborating each pupil’s answer and going into its details. This resulted in longer Dialogic excerpt on one hand, and more contributions on the part of each pupil throughout the whole pattern on the other hand; (I-R8.1-EL-R8.2-EL-R8.3-EL-R8.4-EL)-(R9.1-C0-I-R9.2-EL-R9.3-C0,EL-R9.4-EL-R9.5-EL-R9.6-C0)-(R10.1-EL-I-R10.2-EL-R10.3-EL-R10.4-EL-R10.5-EL-R10.6-C0).

It is striking to see the teacher practicing a Dialogic talk for so long, and that all this long talk has been exchanged with just three pupils. This means that the pupils were given the chance to get engaged in the discussion and that they shared with the teacher the control over the talk. In addition, the pupils thoughts presented through such long exchange of talk revealed misconceptions and conceptual difficulties in addition to scientific views. It can be argued then that Dialogic talk, long ones especially, can make the opposite opinions, incorrect and correct ones, clear to the whole class, not by the teacher, but the pupils themselves. Presenting opposite opinions might open the chance for the pupils to have an internal debate about these opinions. Probing a pupil's view into detail can also open the chance for the pupil who is presenting this view as well as other pupils, to see the inconsistency, shortcoming…etc in his/her view. This might lead him/her to criticise this view, might reach the scientific view, might at least show him/her the mistaken thoughts about it that can convince or make it easier to convince him/her with the right scientific view when presented by the teacher.

These learning outcomes resulting from Dialogic talk can be also supported by the teacher planning of instruction based on the views resulting from these Dialogic types of talk. For example, the teacher in this lesson took the pupils' opinions about the time the bulbs need to glow after connecting the circuit. The girls chose the two alternatives of instantly and short. In the following lesson, as we will see, the teacher asked them to perform an experiment to test their choices. This means that the girls have been given the chance through the Dialogic talk to predict or put assumptions or vote for them before they could test them by the experiment. This gives them the chance to practice the scientific mode of inquiry, which wouldn't have initiated without a Dialogic discussion in which they are allowed to offer their assumptions without being denied.

In the second part, one pupil has insisted on her opinion although the whole class has not agreed with her and this is in itself a positive indicator of learning. In spite of the correctness of the view or not, it is good for the pupil to practice her right in expressing herself and insisting on what she believes. At the end and for school science, the pupils have to follow what is considered as scientific facts. Through the Dialogic talk, however, the pupils can practice their rights in speaking out their thoughts without being refused or denied, to defend these thoughts, and to change them when they get convinced with their incorrectness. And then they can follow the scientific view and may be keeping their thoughts that had the chance to defend for themselves if they are not still convinced. It is a skill per se for the pupil to find a balance between her views and the other view and to implement both of them each in its context.

We can see similar situation in part three, in which one pupil came with the idea of the energy coming from kinetic energy and another pupil came with idea of the things inside the resistance as a source of the energy. Superficially, they might be considered incorrect answers or to be denied as sources basically, as the teacher did with the answer of kinetic energy. Thinking about the pupils’ thoughts of these as sources of energy in the electric circuit reflects high cognitive processes practiced by these pupils. The teacher asked about the energy produced by the bulbs and the pupils were thinking of the battery as the initial source of this energy. They were, however, thinking about the transform of the energy in the middle between the electric energy coming from the battery and the light energy produced by the bulb. What happens in the way between these forms of energy is what the pupils were thinking about. A source for a thing means literally that this thing is coming from that source, Hence, thinking about the kinetic energy (the movement of charges) as a carrier of energy and what happens inside the resistance as a factor in producing the light and light, are really brilliant. The teacher’s reaction to these ideas is very crucial. I'm arguing, however, that being provided with a dialogic environment in which such opinions have the chance to be announced is an advantage in itself as it is part of enhancing the pupils’ intellectual skills.

The forth example reflects the insights on learning I have referred to through the first three parts. In addition, it is a good example of how a teacher negotiates the pupils’ views about scientific issues. Such talk can be seen as lessons to the pupils to learn how to negotiate the discussed issues, how to analyse what is said, how to follow the inconsistence or the logic of others views and how to evaluate them. It also can teach the pupils how to analyse their views and how to put their thoughts together to support their views. This practice of Dialogic talk has actually resulted in remarkable views offered by the pupils.

In terms of the pattern of moves, it is worth highlighting the pattern of the NI/D types. Normally, we would not have a pattern for the Non-Interactive talk whether Authoritative or Dialogic. It happens sometimes that the teacher takes answer from a pupil but within a Non-Interactive attitude, and such answer would be just a part of her control over the talk. In this case, however, the teacher was reviewing the pupils’ views by taking votes of the class on the offered opinions. So, it is Non-Interactive Dialogic in the sense that the teacher was reviewing the pupils’ views, and it wasn’t Interactive in the sense that the pupils were not providing answers. They were just raising their hands or uttering funny comments to show their approval or disapproval of certain opinions. I considered these excerpts, therefore, as Non-Interactive Dialogic talk with a common sequence of; I-Rg-C0.

The content of the talk in all the Dialogic parts entailed personal views of theoretical scientific subject matter regarding the information related to the four posed questions. This has reflected on the quality of the answers which differed between low and high depending on the pupils' level of thoughts about those questions. However, the quality of the teacher's questions was specified with the teacher's attitude to practice Dialogic talk and it is, in fact, which influenced the content to be focused on the pupils' personal views. If we focus on the quantitative results from the four parts, we can see how questions of high cognitive levels have dominated the Dialogic talk. The teacher was asking for the pupils' thoughts and so the Initiated questions came as open questions which necessitate the pupil's to generate hypothesises about what might be answers to the posed questions. The elaborative questions have been also of high quality as the teacher was asking the pupils to practice high cognitive processes in explaining and analysing the thoughts behind their answers. Consequently, many of these answers came to reflect such high cognitive processes which resulted, therefore, in many responses of high quality.

The point here is that the dialogic attitude of the teacher has defined the content to be about the pupils’ personal views; defined the quality of the questions to be of high level and influenced the quality of the responses to be of high level, and defined the pattern of the talk to follow a sequence of moves built over the follow-ups of comment and elaboration. On the other hand, the three aspects of content, quality, kinds and pattern of moves are highly dependant on and influenced by each other, which means that mutual relationships exist between the three of them. And the three together have a mutual relationship with the dialogic attitude of the teacher.

Analysis of Case 1, Stage 1, Lesson 3, Episode 2,3

**1. Analysing the talk**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S | Utterance | Move | Q | R | F | Remarks |
| 1.T | In the last lesson, we asked these questions () and we tried to answer them. We've stopped at this question; describe how the current move and specify its direction? S1 Mentioned the story of the charges and said that the charges are the ones – lets go back to her answer #.  Energy is made up of charges, and the charges, what happen to them? | F | - |  | EL | () The five questions are written on Board  # S1 interrupts and says; move  \* This move is characterized as F because T is trying to follow-up some of the ideas raised by S10 in the last lesson  \* The quality of NI/D & NI/A are not to be categorized as meant only to make the intended information available to the class |
| 2.S1\* | Move till they pass the whole parts of the circuit and reach the bulb which lights | R1 |  | - |  | \* S1 here is S10 in the previous episode of lesson 2  -not categorised because it is part of NI/D |
| 3.T | Good. Have a seat. She said that charges are moving in the circuit till the bulb lights.  The movement of charges is representing what? We've explained in previous lessons that the movement of charges represents something. What does it represent? Or what does it produce? | F  I | - |  | C0 | -not categorised because it is part of NI/A |
| 4.S2 | The move of current | R2 |  | - |  | -not categorised because it is part of NI/A |
| 5.T | Current. The formation of electric current^ (check the V 4 the time)  Ok. I want to describe how the electric current moves in the circuit. This current that you're talking about, that it moves in the electric circuit. Describe it, where does it start from? What does it pass through? And Is it definitely that this current moves through the all parts of the circuit or just through certain parts of the circuit? | F  I | H |  | Ev | ^ Affirmation tone  \* H: CP of 'Analyze, organize'- open question |
| 6.S3 | The current starts moving from the battery | R3.1 |  | L |  | \* L : Usual, expected misconception |
| 7.T | So, it starts from the battery. The start of this current is from the battery. We come back to the question that S9 has answered () and said that charges start their movement from the battery till they reach the bulb. Of course, we've explained that the movement of charges constitutes the current. This means you're supporting S9. It starts from the battery till they reach the bulb? | F  F | - |  | C0  EL | () T looks at the board in which she wrote some of the pupils' ideas from the last lesson, and here she is referring to S9's idea in the previous episode of lesson 2  - T is asking just to confirm |
| 8.S3 | ---Yeah. Then the positive goes - then meet together - the bulb needs positive and negative charges | R3.2 |  | L |  | ---pause and silence - short pause  \* L: Usual, expected thought |
| 9.T | So this bulb needs positive and negative.  Ok, come and show us this movement in the electric circuit () | F  I | L |  | C0 | \* H: Cp of 'Understand; Interpret'  ()S3 walks off to the board to draw the path of the current in the simple circuit which is already drawn in the board |
| 10.S3 | ( Explains by talking and drawing that the negative charges will come out of the negative pole of the battery and pass through the wires, and positive charges starts from the positive pole and pass through the wires too, and when the two meet together in the bulb, it lights. She, however, mentions that positive charges do not cause the bulb to light up) | R3.3 |  | L |  | \* L: Usual, expected misconception |
| 11.T | S3 is saying that the current starts from here, passes, passes, passes till it reaches the bulb and lights. Also the positive charges but don't light up the bulb. Let's write S3's answer. So, the path of the current as she said: (B)   1. Starts from the negative pole of the battery till it reaches the bulb and completes its round. 2. The positive charges start from the positive pole. Ok, how do they go to bulb? | F  F | H |  | C0  EL | (B) T utters the two points of 1 & 2 while writing them on the board  \* H: CP of 'Understand; explain' |
| 12.S3 | They pass like this () | R3.4 |  | L |  | () She points by her hand to a round move |
| 13.T | So they also complete their round? | F | - |  | EL | - T is asking just to confirm |
| 14.S3 | Yes | R3.5 |  | - |  |  |
| 15.T | Starts from the positive pole till they reach the bulb and completes its round (B) but don't light up the bulb? | F  F | H |  | C0  EL | \* H: CP of 'Understand, explain'  (B) T writes on board: completes its round |
| 16.S3 | No | R3.6 |  | L |  |  |
| 17.T | Don't they help in lightening the bulb | F |  |  | EL |  |
| 18.S3 | No. unless the negative and positive meet in the bulb | R3.7 |  | L |  |  |
| 19.T | So the bulb lights by the meeting of the charges in the bulb (B).  Is there anyone has a disapproving opinion in describing the path of the current? | F  I | H |  | C0 | (B) T writes on board the uttered point |
| 20.S4 | I don't disagree totally. I mean, I disagree with her when saying that it completes its round. It doesn't complete its round. It changes, I mean the lightning - still it has a kinetic energy. Then, it starts to loose its kinetic energy to light and heat, so the bulb lights because - I mean the energy has been lost because of the resistance | R4.1 |  | H |  | - Short pause  \* H: complex answer that entails high level thinking about energy |
| 21.T | You've gone to the energy, you're saying that these charges… and when reaches the bulb it's to be transformed into what?... | F |  |  | EL | … A complex I/D talk with S4 continues to move then to S5 in the next example |
| **Example 2** | | | | | | |
| 1.T | …Does anyone have another opinion? Let's hear S5 | I | H |  |  | \* H: CP of 'Create; generate hypothesis' |
| 2.S5 | It doesn't work. I mean, it will transform from light to heat. It will end up | R5.1 |  | H |  | \* H: CP of 'Understand, explain' |
| 3.T | You mean these electrons, I mean these charges, will change to? | F | L |  | EL | - not categorized cause it's to confirm only |
| 4.S5 | Light # | R5.2 |  | L |  | # T interrupts S5 |
| 5.T | Light before, and after the light # | F | L |  | EL | # S5 interrupts T |
| 6.S5 | Heat | R5.3 |  | L |  |  |
| 7.T | It transforms into heat and then spills out # | F |  |  | EL | # S5 interrupts T |
| 8.S5 | Yeah, spill out as heat till the energy of the battery ends up | R5.4 |  | H |  | \* H: CP of 'Understand, infer' |
| 9.T | So these charges that are moving in the wire might finish one day | F | H |  | EL | \* H: CP of 'Analyze; attribute' |
| 10.S5 | Yeah, they finish | R5.5 |  | - |  | \* Yes/No answer not categorized (confirm) |
| 11.T | They finish. So, if I brought this wire, Could it ends from charges in one day? | F | H |  | EL | \* H: CP of 'Understand; explain' |
| 12.S5 | Miss. The wire doesn't have charges. It's a conductor for the movement | R5.6 |  | H |  | Although it's a mistaken view, but in this context it's H: CP of 'Analyze; differentiate' |
| 13.T | It doesn’t have charges. It's just a conductor for charges. So, where do the charges come from? | F | H |  | EL | \*H: CP of 'Analyze; attribute' |
| 14.S5 | Aren't they coming from the battery !! | R5.7 |  | L |  | !! Wonder tone |
| 15.T | So this battery has charges that feed the wire (). And these charges might one day end up ().  So, this is S5's opinion. The charges are in the battery basically, the wires let these charges to pass. Pay attention. And then the charges when consumed up into heat, they'll finish. Ok? How many of you supports S5? () And the rest of you?  Who is the brave one who disapproves S5? ()  You're disapproving her? | F , R5.8  F, R5.9  F  I , Rg  I , R6.1  I | -  -  H | -  -  -  -  - | EL  EL  C0 | ()S5 mutters: yes  ()S5 mutters: yes  - not to categorize Q/R for confirming  () group of pupils raise their hands  ()S5 raises her hand  - not to categorize moves of Non-Interactive talk  \* H: CP of 'Evaluate; judge' |
| 16.S6 | Yes. The battery here gives kinetic energy for the charges to move and may be the battery # | R6.2 |  | H |  | # T interrupts S6  \*H: CP of 'Understand; explain' |
| 17.T | The battery gives the charges a kinetic energy that helps them to pass through. From where these charges are coming basically that it helps them to pass through? | F | H |  | EL | \*H: CP of ‘Understand, explain' |
| 18.S6 | --- From the wire | R6.3 |  | H |  | --- Silence |
| 19.T | Come from the wire. What do you think? She is telling us that the charges are coming from the wire? What do you think? () | F  I | H |  | C0 | \* H: CP of 'Evaluate; judge'  () T directs the Question to the class |
| 20.S6 | I mean, what I know that the battery gives kinetic energy | R6.4 |  | H |  | \* H: CP of 'Understand, explain' |
| 21.T | She knows that the battery gives kinetic energy.  Ok, these charges are coming from where? S7, I heard you saying something and then you stopped, what do you think? | F  I | H |  | C0 | \* H: CP of 'Create; generate hypothesis' |
| 22.S7 | The wire has neutral charges () | R7.1 |  | H |  | () S7 shows hesitation  \* H: CP of 'Analyze, attribute' |
| 23.T | S7 is saying that the wire has charges, and that the battery gives the charges kinetic energy. This means you're () raising a new opinion completely against to what S5 has said. Is this right? | F | - |  | EL | () In Arabic it's obvious that T means by you here, both S6 and S7 |
| 24.S7 | The wire is a matter, and every matter has neutral charges | R7.2 |  | H |  | \* H: CP of 'Understand; explain' |
| 25.T | So, this wire has charges? | F | - |  | EL |  |
| 26.S7 | Yes | R7.3 |  | - |  |  |
| 27.T | Who believes her? | I | H |  |  | \*H: CP of 'Evaluate; judge' |
| 28.S8 | Yeah, right, cause the wire is a matter and the battery also has charges | R8.1 |  | H |  | \* H: complex answer that entails partly high level thinking |
| 29.T | So, you're uttering an opinion different to what S6 & S7 have said. New opinion | F |  |  | C0 |  |
| 30.S8 | Ok. And then. The wire and the battery have charges and so the all charges pass and reach the bulb and the bulb lights | R8.2 |  | L |  |  |
| 31.T | All the charges, positive and negative pass? | F | - |  | EL |  |
| 32.S8 | Yes | R8.3 |  | - |  |  |
| 33.T  34.T | All the positive and negative charges pass. That's enough for now () We've heard different opinions. Some are saying that the battery is the source of the charges and passes these charges to the wires. And the wires are conductive for the movement and so the bulb lights. This is basically the opinion of S5, but S7 said No. the wires have charges…  Ok let's try and see and let's memorise our answers. We're gonna do an activity now. From this activity, I wanna you to focus on the first two questions and investigate for their answers. And then we will do another activity from which we'll answer questions 3 & 4…now we'll design an electric circuit… | F  I |  |  | C0 | () T says so because some pupils raise hands to participate    …A NI/A talk continues and moves then to performing the first activity, which after comes the talk in the next example |
| **Example 3** | | | | | | |
| 1.T | …Now, observe the lightning of the bulb, does it light instantly or it gets delayed? | I | L |  |  | …This talk is exchanged while the class performing the activity of checking the lightning of the bulb in a simple electric circuit with normal length of wires  \* L CP of ‘Remember: describe’ |
| 2.Sg | Instantly | Rg |  | L |  | \* L CP of ‘Remember: describe’ |
| 3.T | Now. Notice the energy transformation | I | L |  |  |  |
| 4.Sg | Light and Heat | Rg |  | L |  | \* L CP of ‘Remember: describe’ |
| 5.T | Now, everyone pay attention to me. You've done the activity. How much time did it take? | I | L |  |  |  |
| 6.S1 | It lights instantly | R1 |  | L |  | \* L CP of ‘Remember: describe’ |
| 7.T | Instantly. You mean the bulb lighted instantly once we've closed the circuit. We'll write this answer. So, the answer of the 17 pupils was right ().  What the kind of the energy produced in the bulb? | F  I | L |  | Ev | () T is referring to the pupils' answers in the previous episodes from lesson 2 |
| 8.S2 | Light and heat… | R2 |  | L |  | …T continues the I/A talk about light and heat to move to the I/D talk starting from the next utterance |
| 9.T | Light and heat (B). So all of you have observed the bulb lights instantly. Ok, if I brought now instead of the short wires I've used, I use very loooong wires, Will the bulb light instantly? Or after a short period of time? Or after a long period? What do you think? | F  I | H |  | Ev | (B) T writes on board  \* H: CP of 'Create; hypothesize' |
| 10.S3 | Instantly | R3.1 |  | L |  | \* L depending on the explanation in turns 17-19 |
| 11.T | Instantly. So, if I used wires, their length, for example, equals the length of the class, Will it light instantly? Does it take a period of time? What do you think? How many of you agree with S3?  S4, you've said you disagree with her, why? | F  I | H |  | EL | \* H: CP of 'Understand; explain' |
| 12.S4 | May be because the charges need time till they arrive | R4.1 |  | L |  | L: Usual misconception |
| 13.T | May be because the charges take time to reach the bulb. Because charges are coming from where to take time? | F | L |  | EL |  |
| 14.S4 | Come from the battery | R4.2 |  | L |  |  |
| 15.T | Come from the battery, and of course the journey will be longer. This is S4's point of view. S3, you're saying instantly, why? Don't they take time to move from the battery to the bulb? | F  F | H |  | C0  EL | \* H: CP of 'Understand; explain' |
| 16.S3 | No | R3.2 |  | L |  | L: Based on the following explanation |
| 17.T | Why, Are they fast like the flash-lighting? | F | L |  | EL |  |
| 18.S3 | Yes | R3.3 |  | L |  |  |
| 19.T | So, the bulb lights instantly because of their high speed? This is the reason?(). S5 | F , R3.4  I | - | - | EL | - Q & R not categorized (confirm)  () S3 is nodding positively |
| 20.S5 | ... For example, if we notice the ones at home. When we turn them off, they go out immediately () | …R5 |  | H |  | …skip some turns from the I/D talk  () She is referring to electric devices  H: CP of 'Apply; implement' |
| 21.T  22.T | …So, you're saying this happens cause charges are fast…  S5 is saying because of the speed of the charges, and S6 is saying because of the power of the battery, Ok?  Let's hold this question to answer tomorrow, but think about it. Now, let's do the activity with the long wires. All of you, pay attention… | F  F |  |  | C0  C0 | …T continues a short with S5 and moves then to listen shortly to S6 who talks about the power of the battery  …A NI/A talk continues about performing the activity |

**2. Characterizing the talk:**

|  |  |
| --- | --- |
| Class of the talk | Teacher-Pupil talk   * Example1, Turns 1-3 : NI/D - Turns 3-5: NI/A - Turns 5- 21 : I/D * Example2, Turns 1-15: I/D - Turn 15:NI/D * Turn 15-33: I/D - Turn 33: NI/D - Turn 34: NI/A * Example3, Turns 1-9: I/A - Turns 9-21: I/D - Turn 21: NI/D - Turn 22: NI/A |
| Purpose of the talk | * Example1: NI/D: Reviewing pupils' ideas - NI/A: Introducing a scientific issue * I/D: Exploring pupils' ideas * Example2, I/D: Exploring pupils' ideas - NI/D: Reviewing pupils' ideas * I/D: Challenging pupils' ideas - NI/D: Reviewing pupils' ideas * NI/A: Introducing a scientific activity to test pupils' opinions      * Example3, I/A: Deciding about the right opinion - I/D: Challenging pupils' ideas * NI/D: Reviewing pupils' ideas - NI/A: Introducing a scientific activity |
| Content of the talk | * Example1,2 , NI/D , I/D: Personal views of Theoretical Scientific subject matter * NI/A: Scientific view of Empirical Scientific subject matter * Example1,2 , I/A, NI/A: Scientific views of Empirical Scientific subject matter * I/D, NI/D: Personal view of Theoretical/Empirical Scientific subject matter |
| pattern of the talk | * Example1, NI/D: EL-R1-C0 NI/A: I-R2-Ev * I/D: I-R3.1-C0-EL-R3.2-C0-I-R3.3-C0-EL-R3.4-EL-R3.5-C0-EL-R3.6-EL-R3.7-EL-R3.7-C0-I-R4.1-EL… * Example2, I/D (1-15): I-R5.1-EL-R5.2-EL-R5.3- EL -R5.4-EL-R5.5-EL-R5.6-EL-R5.7-EL-R5.8-EL-R5.9-C0 * NI/D:--- (I-Rg.) * I/D (15-33): I-R6.1-I-R6.2-C0,EL-R6.3-C0-I-R6.4-C0-I-R7.1-EL-R7.2-EL-R7.3-I-R8.1-C0-R8.2-EL-R8.3-C0 * NI/D: --- , NI/A:--- * Example3, I/A: I-Rg-I-Rg-I-R1-EV-I-R2-EV * I/D: I-R3.1-EL-I-R4.1-EL-R4.2-C0-EL-R3.2-EL-R3.3-EL-R3.4-I- R5…C0 * NI/D: --- , NI/A:--- |

**3. Quantitative indicators**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Class of talk** | Question (Cognitive level) | | Response (Cognitive Skill) | | Follow-up | | |
|  | Low | High | Low | High | Ev | C0 | EL |
| **Ex1, Dialogic** | 1 | 4 | 6 | 1 | 0 | 5 | 6 |
| **Ex2, Dialogic 1+2** | 2+0 | 4+5 | 3+1 | 3+6 | 0+0 | 1+4 | 8+4 |
| **Ex3, Authoritative** | 4 |  | 4 |  | 2 | 0 | 0 |
| **Ex3, Dialogic** | 2 | 3 | 5 | 1 | 0 | 3 | 5 |

**4. Narrative account:**

Here, we are looking at three extraordinary examples from the third lesson. They are interesting examples in terms of the level of Dialogic talk, the shift between the different classes, the dialogic manner of the teacher, and the contributions of pupils and their roles in guiding the talk. I go through these examples one by one to examine the distinctive characteristics about each one of them.

Example 1: What does capture the interest in this episode is its start with the class of NI/D talk. The talk in this episode has been initiated to continue the discussion of the previous lesson regarding the five questions. By the end of the previous lesson, the teacher finished taking the pupils' opinions of the first four questions and just stopped with S10’s view of how does energy reach the bulb (4th question). So, she is starting here by reviewing S10's answer to this question, by restating it with the help of S10 (refereed to as S1 in this lesson) through the first three turns. As the teacher was actually following-up what has been said in the lesson before, I considered the first move of this episode as a follow-up, and as the teacher has done this by participating S1 in reviewing her view, I have considered it as elaborative F followed by a response from S1 and finally a comment from the teacher. The three turns together of (EL-R1-C0) refer, though, to Non-Interactive Dialogic talk as the teacher meant to control the talk in reviewing S' view.

Before she moves to the fifth question about describing the route of the current through the circuit, she chose to control the talk verbally and intellectually to make the meaning of electric current available to all the pupils before speaking their ideas in answering this question. Again, the teacher participated a pupil in her lecturing about the electric current, and the class of the Non-Interactive Authoritative talk took three turns of; (I-R2-Ev).

What the teacher has done, therefore, is to initiate a NI/D talk to review a pupil's opinion about previously discussed question, and before moving to the next question, she controlled a NI/A talk to introduce the main concept that the next question depends on. She then shifted the talk to be Interactive, so she can get the pupils' ideas about the issue raised by this question. The shift in the classes of the talk has thus followed the teacher's teaching purposes as inferred from the flow of the talk.

From turn 5, therefore, the discussion of the fifth question begins and continues and extends along the whole second example. I've separated this long discussion into two examples just to make it easier to follow the analysis as the whole talk entails different shifts between the classes of the talk.

Through the discussion from turn 5, the teacher exchanged the talk with one pupil only; S3 before listening to S4 at the end of this example and to S5 & S6 in the following long example. This means that the pupils' participation was not confined to uttering superficial views. They have been engaged, instead, in an intellectual discussion/argument as the teacher was actually negotiating with them their spoken views. Through the Interactive Dialogic part of this example, S3 started to present her view in relating the current to the battery as its source, and the teacher connected this view to another pupil's contribution from the previous lesson. By doing so, the teacher wanted this mistaken view to be clear to everyone, so pupils can grasp it before they announce their agreement or disagreement with. To ensure this clarity, the teacher went on exchanging the talk with S3 by asking her for more clarification by keeping elaborating her answers; I-R3.1-C0,EL-R3.2-C0-I-R3.3-C0,EL-R3.4-EL-R3.5-C0-EL-R3.6-EL-R3.7-EL-R3.7-C0). Moreover, she asked S3 to interpret part of her idea about the movement of charges into a drawing that can show the route of charges (Turn9). In the mid of the talk, also, she reviewed S3's contribution by putting it into two points and writing them on board (turn 11) before continuing her elaboration of S3's ideas through the following turns (11-19). It is not before she thought that she revealed all S3' thoughts about the presented opinion, that the teacher shifted the talk to the class asking for another opinion in turn 19. In turn 20, S4 starts to present a more complex opinion in which we can see some brilliant thoughts about the energy within the whole system of the electric circuit's work. The talk for revealing S4's view continues (I-R4.1-EL…), but I have not included it through this analysis.

It is to be noticed, though, that although most of the teacher’s questions were of high quality as she was asking for more analysis and explanation, S3's responses were not of high quality. So, there is no cognitive correspondence between the questions and responses in this Dialogic example. This is, however, not because the teacher asked for certain high answers and didn't get them. Rather, as the teacher was asking S3 to explain her view, S3 was doing so, but her view was reflecting basically thoughts of low cognitive level as she was showing expected misconceptions. This means, therefore, that high quality questions in Dialogic talk are not expected to invite necessarily for responses of high quality. Meanwhile, this does not mean that such pupils' contributions of low cognitive level are not valuable. They are valuable because they reflect the pupils’ thinking, the thing that indicates that the pupils are sharing the teacher the control over the flow of the talk. They are also valuable because they reveal important misconceptions, and it is useful to open the awareness of the whole class of their existence instead of presenting them by the teacher only. Exposing misconceptions by pupils is an advantage in itself as the planning of teaching can be built over them, so they can be analysed, worked on correcting them and trying to convince the pupils with the right scientific view instead.

In regard to the content and the pattern of discourse, I think the three examples reflect the same characteristic for each class, so I shall put them together at the end of this analysis.

Example2: here we have the binary of Interactive, Non-Interactive Dialogic talk repeating twice followed by a Non-Interactive Authoritative talk through which the teacher had introduced a scientific activity to test some of the pupils’ views that were raised in answering the five questions. In overview, the teacher took the opinions of the pupils for the five questions during this lesson and the lesson before. After finishing with the fifth question, she started to guide the teaching towards some activities that can be used to examine some of the raised opinions to reach then the scientific views through Authoritative and Dialogic discussions as we will see in next example.

Now for this example, the first Dialogic binary of talk has been guided to continue exploring the pupils’ views of the fifth question that was already started in the previous example. One pupil; S5, had spoken out her opinion through this first Dialogic part. S5’s opinion entailed talking about the transform of energy in which she showed high level thinking about the energy from the battery and its transform to other forms in the bulbs. When the discussion moved to the source of the charges, S5 showed the expected misconception about the battery as a source of these charges. However, the uttering of this misconception happened through a very interesting exchange of talk between S5 and the teacher.

There are different lessons we can learn from the exchange of the talk between the two;

1. S5’s misconception about the battery as a source comes from a confused perception of the relation between charges and energy. S5 believes that the battery is a source of energy and that there is a relation between charges and energy, both of which are right scientifically. This has led her to think about charges and energy to have the same entity, the thing that resulted into two misconceptions; 1) as the battery is the source of energy, so it is the source of charges (turns 11-15); 2); as energy produced in the battery will be consumed in the bulbs which will result eventually in the energy ending up one day, so the charges will do similarly (turns 7-10).
2. The relation between charges and energy is quite tricky even scientifically. The teachers were, in fact, focusing on revealing and correcting the misconceptions regarding the charges; their source, movement and conservation. The shortcoming in dealing with the relation between the charges and the energy would result in misconceptions in understanding the whole system of the electric circuit’s work similar to the ones that are expected to exist because of the charges’ misconceptions.
3. S5’s logical thinking about energy, charges and the relation between the two (point1) made her very convinced with her view of the battery as a source of charges. This was obvious in her firm response in turn 12 that the wire does not have charges and her wondering tone in turn 14 that reflects her belief that the battery as a source is something unquestionable. This opens, though, a question about the effectiveness of the cognitive coding I’m following in this framework. Both of S5’ responses in turns 12 & 14 have been considered as to reflect low cognitive level as they show expected misconceptions. Analysing deeply S5’s contributions through earlier utterances shows that S5 is practicing, in fact, high cognitive processes in thinking generally about the work of the circuit. I argue here, however, that for S5‘s early contribution about energy, the responses had been categorized of high quality, and in themselves, the responses in turns 12 & 14 are of low quality. In spite of this, limitation on the inference of the quality persists.

In summary of this first binary, the teacher practiced the dialogic manner to explore S5’s view into detail before reviewing it through the Non-Interactive part in turn 15. As she was doing this, the pattern had been dominated by the (EL-R-EL-R…C0) sequence that have been stimulated by just one initiation; I-R5.1-EL-R5.2-EL-R5.3-EL-R5.4-EL-R5.5-EL-R5.6-EL-R5.7-EL-R5.8-EL-R5.9-C0. What is worth mentioning here is the informality of the talk as the teacher and S5 were following each other’s reactions promptly which appeared, for example, in both interrupting each other’s talk (turns 3-8). S5's courage in expressing her thoughts quickly and strongly in addition to the informality of the talk, both reflect a more neutral relation of power, where the two poles (the teacher and S5 in this case) share the verbal and the intellectual control over the talk without any dominance from any one of them.

In fact, we can imagine that 55’s confidence with her view, as well as the view familiarity, have both influenced most of the girls in the class to agree with her as it appears from the utterances in turn 15. So, when S6, S7 & S8 expressed different views in the second Dialogic part, the teacher was more of challenging these views than to just exploring them. This has been caused also by the unfamiliarity of these views that are built around the view of the wire as a source of charges.

The second Dialogic part starts with S6 expressing thoughts of high cognitive level regarding the forms of the energy and the source of the charges. In spite of the brilliance of her contribution, she was not as sure as S5 was and has not presented her ideas strongly as S5 has done. Rather, her hesitation was obvious in her silence (see turn 16) as in her way in expressing her view saying for example in turn 20; ‘ I mean, what I know that …’, as to defend herself and attributing her view to external source rather than to her thinking about it.

The teacher's reaction to the pupils' opinions in this Dialogic part is what has specified the purpose of the talk here to challenge the pupils' ideas rather then to explore them only as I mentioned earlier. This can be spotted in different follow-ups made by the teacher and through the initiations she was making to stimulate other pupils to criticize and judge the presented ideas:

* …She is telling us that the charges…. What do you think? (turn19)
* She knows that the battery…What do you think? (turn21)
* S7 is saying that the wire has….You're raising a new opinion against…Is this right? (turn23)
* Who believes her? (turn 27)

The purpose can be also confirmed through the kinds of moves. In the excerpts through which the teacher explore a pupil's idea into detail, the talk tends to be characterized with more elaborative follow-ups and less comments and the nearly absence of new initiations apart from the first and main one. In the excerpts through which the teacher explores in surface a group of pupils' ideas, the talk tends to be characterized by more comments, less elaborative follow-ups and more initiations, but with the same content repeats to just ask for another opinion. In such excerpts through which the teacher challenges pupils' ideas, the talk tend to be dominated by both comments and elaborative follow-ups with more initiations to ask for support to the presented views; I-R6.1-I-R6.2-C0,EL-R6.3-C0-I-R6.4-C0-I-R7.1-EL-R7.2-EL-R7.3-I-R8.1-C0-R8.2-EL-R8.3-C0.

After the teacher listened to distinctive ideas from the pupils through the Interactive part, she then practiced a Non-Interactive Dialogic talk with the repeated purpose of reviewing the raised opinions, but in a way that highlight the points of differences between these opinions. She then held the intellectual control over the talk to introduce a scientific activity that is planned to be performed by the class in order to help them decide about the correct opinion for the first and the second questions. After performing this activity, the third example begins.

Example 3: here the scenario is: I/D for challenging pupils' ideas, followed by a NI/D talk for reviewing these ideas and ending with NI/A talk for introducing a scientific activity for testing pupils' idea; the same scenario in the second part of the previous example. The bridge between the two scenarios is the I/A talk that took place to confirm the correct view based on the result of the first activity introduced at the end of the previous example. In this Authoritative talk, the teacher discussed with the class their observations from the activity to confirm the view of the time the bulb needs to light after the circuit is connected. All the questions and answers, therefore, were of low cognitive level as they were related to direct observations. The value of this excerpt, though, doesn't stem from the quality of its moves. Rather, it comes from the place of this excerpt among the classes of talk before and after it, and from the value of the shift between the classes. As expected in Authoritative excerpts, the pattern of moves here was dominated by evaluative follow-ups and devoid of elaborative and comment ones within the conventional sequence of (I-R-EV). However, there were answers that had not been followed up by the teacher, which can be attributed to the nature of the content as empirical scientific subject matter, where the teacher was just listening to very obvious observation that didn't need to be followed-up; I-Rg-I-Rg-I-R1-EV-I-R2-EV.

The teacher wanted to challenge the view confirmed by the result of the first activity by changing one variable; the length of the wires. Before doing the activity under the new condition, she chose to take the pupils' prediction about it. She did this through an Interactive Dialogic talk in which she listened to the pupils' predictions and asked for justifications for them. Although the teacher was directing questions of high cognitive level, the offered responses were of low quality as the pupils had not practiced high cognitive processes in thinking about the posed questions and had not used the brilliant ideas presented in the Dialogic talk of the previous example. The dialogic atmosphere, though, has motivated S5 to think about everyday experience in deciding about her prediction (turn 20). In fact, S5 has raised the talk about this application again in next lesson to initiate a discussion about a justification for the result of the second activity that has been introduced through the NI/A excerpt in this example and being performed by the class just before the end of this lesson.

Lastly, for the pattern of moves here; I-R3.1-C0-I-R4.1-EL-R4.2-C0-EL-R3.2-EL-R3.3-EL-R3.4-I- R5…C0, we can see that the sequence of (I-R-EL-R…C0) repeats with each of the three pupils participated in the I/D discussion. For S3, though, we see firstly the sequence of (I-R-C0) as the teacher took her opinion and just comment on it. However, after discussing with S4 her opinion and the justification behind, the teacher decides to go back to S3 and ask her for a justification. Such Non-linearity of turns is noticed to be happening in Dialogic classes of talk and not Authoritative, which refer to less informality and distribution of power between the participants in Dialogic talk.

Analysis of Case 1, Stage 1, Lesson 4, Episode 1,2

**1. Analysing the talk:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S | Utterance | Move | I | R | F | Remarks |
| 1.T | …so there're negative charges that go in the bulb. Where do they come from? | I | H |  |  | …T is continuing a discussion about; why the bulb lights instantly, after performing two activities with long and short wires  \* H: CP of 'Analyse; break down' |
| 2.S1 | Because of the movement. I mean because of the battery, that we put there, there will be a (…?) between the wire and the battery  - from the wire they came | R1.1 |  | H |  | \* H: CP of Analyse; break-down'  (…?) inaudible  - pause |
| 3.T | So they'll come from the wire? They don't come from here? () | F | H |  | EL | () T points to the battery |
| 4.S1 | I mean when they go there, the battery will give negative charges but will enter from there () | R1.2 |  | L |  | () S1 points to the part of the circuit near the bulb, but T seems not to hear it  \* L: usual misconception |
| 5.T | So still the battery will give charges | F | L |  | EL |  |
| 6.S1 | Negative. But that **pole** doesn't give, it will get from the bulb | R1.3 |  | L |  | **Pole**: the positive pole in battery  \* L: usual thought in its context |
| 7.T | Ok, this will get from the bulb. The battery will give negative charges () and these negative charges will go to? The bulb. In their way like this, moving, moving, moving, doesn't it take a time? | F | H |  | EL | () S1 is nodding yeah  \* H: CP of 'Understand, explain' |
| 8.S1 | No, no, cause when they move – when we switch on they'll enter from there() | R1.4 |  | H |  | () S1  points again to the part of the circuit near the bulb  \* H: CP of 'Create; hypothesize' |
| 9.T | So when these moves these will move? () | F | H |  | EL | () points to: 1st these, charges near the battery, 2nd these, charges near the bulb |
| 10.S1 | Yeah | R1.5 |  | H |  |  |
| 11.T | At the same time? ()  These and these will move together? ()  What do you think girls? S1 is saying…  So you do explain by this the Instant lightning? ()  What do you think S2 ? | F, R1.6  F, R1.7  F  I , R1.8  I | -  -  -  H | -  -  - | EL  EL  C0 | () S1 is nodding yeah  () S1 is nodding yeah  … repeat the point (NI/D)  () S1 is nodding yeah  - not categorized: confirm previous answers  \* H: CP of 'Create; generate hypothesis' |
| 12.S2 | May be the charges are basically moving on their own from the beginning | R2.1 |  | H |  | \* H: CP of 'Create; hypothesize' |
| 13.T | Do you agree or disagree with S1? | I | H |  |  | \* H: CP of Evaluate; judge' |
| 14.S2 | A little (). Basically it has - the charges are moving there from the beginning | R2.2 |  | H |  | () laugh , - pause  H: CP of 'Create; hypothesize' |
| 15.T | Where do they move? | F | H |  | EL | \* CP of 'Understand; explain' |
| 16.S2 | They move in the wire^ and go to the bulb | R2.3 |  | H |  | ^ affirmation tone  H: CP of 'Create; hypothesize' |
| 17.T | So when the circuit is opened, the charges are moving | F |  |  | EL | \* CP of 'Understand; explain' |
| 18.S2 | No, it's not they're moving. I mean it must - once the switch is off, the charges will meet together and complete the movement around. They move around, but. They move around - they don't move around in the wire | R2.4 |  | - |  | - pause with hesitation  \* not categorized: answer is confused  - pause with hesitation |
| 19.T | Where do they move around? | F | H |  | EL | \* CP of 'Understand; explain' |
| 20.S2 | I mean they're there. There () | R2.5 |  | H |  | -pause , () girls laugh |
| 21.T | They're there. If we take part of this wire and zoom it, and saw the charges there as S1 has said. Now you're saying they're moving around, where? | F | H |  | EL | \* CP of 'Understand; explain' |
| 22.S2 | They move there, in their places | R2.6 |  | H |  | \*H : CP of 'Analyze; organize' |
| 23.T | Their place ... | F | - |  | EL | …skip some turns in which S2 looks like thinking aloud about the battery and the bulb, but she changes her mind to come again to the charges in the wire. |
| 24.S2 | No, they're there. It, it - the wire, and once we close it they'll continue their movement. May be they were - but when opened - once we close it the movement will keep on | R2.7 |  | H |  | - pause  \*H : CP of 'Analyze; organize' |
| 25.T | How they're when it's opened? You're saying they move. How it is this movement? I just want you to explain this point | F | H |  | EL | \* H: CP of 'Understand; explain' |
| 26.S2 | They're moving in the wire | R2.8 |  | H |  | \*H: CP of 'Understand; explain' |
| 27.T | In the wire, in which direction? | F | H |  | EL | \*H: CP of 'Understand; explain' |
| 28.S2 | Umm - may be - ()  No, not randomly. May be this direction | R2.9  R3 |  | L  H |  | - pause, () S3 is saying randomly (H)  \* L for R2.9 |
| 29.T | So they're moving in a directed way | F | H |  | EL | \* H: CP of 'Understand; infer' |
| 30.S2 | No- they can't be --- | R2.10 |  | H |  | - pause, ---silence  \*H : CP of 'Analyze; organize' |
| 31.T | S3 is saying randomly, what do you think? | F | H |  | EL | \*H : CP of 'evaluate; check' |
| 32.S2 | Randomly?! - No # | R2.11 |  | L |  | - pause, # S2 is interrupted by T |
| 33.T | So directionally, they move in a directed way | F | H |  | EL | \*H: CP of 'Understand; explain' |
| 34.S2 | No - I don't know how- May be randomly --- And after we close the circuit they will move around - before they don't move around | R2.12 |  | H |  | - pause --- silence  \*H: CP of 'Analyse; organize' |
| 35.T | Ok, thanks S2 , have a seat. S2 is saying that the charges are moving randomly. Once we close the circuit, they will enter the bulb and it lights. Ok? And S1 said that they are there basically, just near the bulb and when the switch is off. They will go inside the bulb - so S1 what do you think, when they were there near the bulb, were they moving? Or they just started moving when we closed the circuit? | F  I | H |  | C0 | - pause  \*H: CP of 'Analyse; break down' |
| 36.S1 | They move. In their places, but when we close it, they'll move. They'll move from the battery through the wires… | R1.9  … |  | H |  | …skip some turns which show S1 thinking about charges from the battery and the wire  \*H: although her idea about the battery and the wire together giving charges, but her answer shows an analytical thinking |
| 37.T | Ok, this is enough, enough. Let's try to explain now one thing, why do the bulb lights instantly, but before, we need to see the situation of the charges before the circuit is closed, and their situation after the circuit is closed? Ok? Let's see this flash (). It will help to explain things. Ok? pay attention. Now, you see this electric circuit? Is it closed or opened? And why? | F  I | L |  | C0 | () T switches off the lights of the class and displays the flash  \* L: about direct observation from the flash |
| 38.S4 | It's closed, cause there is no gap there () | R4.1 |  | L |  | () actually the switch is on |
| 39.T | There is no gap. Ok, if it's closed, we're not supposed to see something? | F | H |  | EL | \* H: CP of 'Apply; execute' |
| 40.S4 | The bulb lights | R4.2 |  | H |  | \* H: CP of 'Apply; execute' |
| 41.T | So, is it closed? | F | L |  | EL | \* L: about direct observation from the flash |
| 42.S4 | Opened, cause the bulb doesn't light | R4.3 |  | L |  |  |
| 43.T | Good. Now, this circuit contains two kinds of conductors that we mentioned in the last lesson. The matters that conduct (or convey) the electric current. We mentioned metals as conductors and which other type? In the first lesson, we talked about the matters that conduct the electric circuit | F  I | L |  | Ev | \*L: CP of: 'Remember; recall' |
| 44.S5 | Salts | R5.1 |  | L |  |  |
| 45.T | Salts, or Ionic solution, a solution that has what? ().  But when the salts dissolve in water, they produce something? What? S5 | F , I, Rg  I | L  L | L | Ev | () group of pupils answer: salts  \*L: CP of: 'Remember; recall' |
| 46.S5 | Negative and positive ions | R5.2 |  | L |  | \*L: CP of: 'Remember; recall' |
| 47.T | So I can take sodium chloride and dissolve it in water? What kind of ions I'll get? S6 | F |  |  | EL |  |
| 48.S6 | Positive ion of sodium and negative ion of chloride | R6 |  | L |  |  |
| 49.T | Excellent. …This is the solution I'm talking about…let's zoom in…let's focus on the movement of…describe what happens now… | F |  |  | Ev | …An NI/A talk continue, then again, T starts to ask questions interactively |

**2. Characterizing the talk:**

|  |  |
| --- | --- |
| Class of the talk | Teacher-Pupil talk   * Example1, Turns 1-11 : I/D - Turn 11: NI/D * Turns 11-35: I/D - Turn 35: NI/D   Turns 35-37: I/D - Turn 37: NI/A  Turns 37-49: I/A - Turn49: NI/A |
| Purpose of the talk | * I/D1,2,3: Justifying a scientific observation using pupils' ideas - NI/D1,2 : Reviewing pupils' ideas * NI/A, 1: Introducing a scientific design to explain the scientific observation * I/A: Exploring the scientific design - NI/A,2: Describing the scientific design |
| Content of the talk | * Dialogic talk: Personal views of Theoretical Scientific subject matter * Authoritative talk: Scientific view of Theoretical/Empirical Scientific subject matter |
| pattern of the talk | * I/D: I-R1.1-EL-R1.2-EL-R1.3-EL-R1.4-EL-R1.5-EL-R1.6-EL-R1.7-C0 - NI/D: C0-I-R1.8 * I/D: I-R2.1-I-R2.2-EL-R2.3-EL-R2.4-EL-R2.5-EL-R2.6-EL-R2.7-EL-R2.8-EL-R2.9-R3-EL-R2.10-EL-R2.11-EL-R2.12-C0 * NI/D:--- * I/D: I-R1.9-…-C0 (R and EL) - NI/A: --- * I/A: I-R4.1-EL-R4.2-EL-R4.3-Ev-I-R5.1-Ev-I-Rg-I-R5.2-EL-R6-Ev - NI/A: --- |

**3. Quantitative indicators**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Class of talk** | Question (Cognitive level) | | Response (Cognitive Skill) | | Follow-up | | |
|  | Low | High | Low | High | Ev | C0 | EL |
| Dialogic 1 | 1 | 4 | 2 | 3 |  | 1 | 6 |
| Dialogic 2 |  | 10 | 2 | 10 |  | 1 | 10 |
| Dialogic 3 | 0... | 1.. | 0... | 1... |  | 1 | ... |
| Authoritative | 5 | 1 | 6 | 1 | 3 |  | 3 |

**4. Narrative account**

The example from this lesson is a very long one that entails 7 shifts between the different classes of talk. At the end of the previous lesson, the teacher challenged the pupils' thinking by suggesting the ‘big circuit’ activity to examine if the bulb will lit instantly if the circuit is connected by very long wires. They did the activity, and had seen that it does. In this example, the pupils are trying to justify the instant lightning. Four pupils in total had offered their opinions. This example entails the opinions of the last two pupils, not including hence the first two ones. As it is obvious, the teacher did exchange a long talk with both pupils and tried also to put the thoughts of the two together. This can be spotted in turn 35 when she initiated the talk again with S1, asking for her view in relation to what S2 has proposed. Overall, the discussion with these two pupils went through 4 shifts between the two classes of Dialogic talk; I/D to NI/D to I/D to NI/D to I/D. All the I/D talk went on with the purpose of justifying the scientific observation of the instant lightening using pupils’ ideas and thoughts. In the NI/D ones, the purpose of the talk was to review the ideas raised through the I/D talk. The content of all of this Dialogic talk, therefore, entailed personal views of theoretical scientific subject matter. After the last I/D, the teacher took the control over the talk verbally and intellectually to introduce a scientific design, as it will be discussed later on. The content, therefore, shifted to entail now the scientific view of the discussed theoretical scientific subject matter and compliment it with empirical content that could explain and support the scientific view.

In their attempt to justify the instant lighting, the pupils knew that they need to hypothesize not just the source of the charges, but also the nature of the charges’ movement and how they reach the bulb instantly. The first two pupils tried to attribute this to a very high speed of charges, that it takes the charges very short time to reach the bulb, so we as human beings will see the bulb lights instantly. The opinions of the two pupils included here, however, try to attribute the instant lighting to the charges in the wires in terms of their places and their kinetic situation prior to the connection of the whole circuit.

We have seen in the previous lesson how the class had approved the initial idea of the battery as the source of charges, that when the unexpected idea of wires as a source has been offered, the teacher tried to challenge it to encourage the rest of the class to think deeply about it. We have also seen that another pupil has supported the idea and tried to justify it, where another pupil also supported it without abandoning, however, the idea of the battery as a source. The teacher has not provided any evaluation for these opinions, and so the uncertainty about the source of charges continues through the talk of this lesson. Though, it seems that the idea of the wires as a source had found a place in the pupils' minds even without being approved by the teacher. The justification for this idea that has been provided by the pupils in last lesson seems to have convinced some in the class.

Although S1 here still mixes it up with the battery as a source, she is trying to use the idea of the wire as a source to justify the instant lightening. S2 is going further in thinking not about the charges existing in the wires but as them moving in the wire as well. Surprisingly, S2 is the same pupil, in the previous lesson; S5 who presented very strongly her view of the battery as a source and denied the wire as to have charges. One of the advantages of the Dialogic talk, therefore, is that it gives the chance for the pupils not to come up with extraordinary scientific ideas only, but allows also these ideas to be assimilated by other pupils without being confirmed and lectured about by the teacher.

In addition, when these ideas are more challenged through the Dialogic talk itself and in relation to scientific observations; these ideas develop to a higher level to answer more difficult questions and to reveal more complicated scientific facts. S1' and S2's responses in this example show such development of ideas. Yes, both of them were showing hesitation when presenting their remarkable ideas, but then, don't we expect a hesitation in offering such ideas? In spite of their uncertainty, they still ended up with those ideas. Although S1 mixed up things, she repeated twice that charges; 'will enter from there' (turns 4 & 8) and insisted on her view when the teacher kept challenging her in turn 11. Similarly, S2, in what it seems that she is talking to herself and challenging her thoughts, we see her comes back again and again to the same point;

* 'They move in the wire' (turn16)
* 'They're there. There' (turn 20)
* 'They move there, in their places' (turn 22)…
* 'No, not randomly. May be this direction…No, they can’t be' (turns 28 & 30)
* 'Randomly?! –No…'I don’t know. May be randomly' (turns 32 & 34)

What is remarkable about the teacher here is that she was giving them the chance to think and re-think loudly. In her elaboration of their answers, she was trying to make them deconstruct their thoughts, analyse and organize them in order to develop them towards more logical account that will eventually leads to the scientific one. This means that the teacher was not using the Dialogic talk just to explore the pupils' ideas. She was actually motivating the pupils indirectly to themselves explore their ideas and check them for logic and consistency in justifying scientific facts. She was approaching the scientific view by motivating the pupils to develop their thoughts by re-thinking them loudly.

It is not surprising, therefore, that the sequence of (I-R-EL-R-EL…-C0) repeats itself through the pattern of moves in the three Interactive-Dialogic parts;

* I/D, 1: I-R1.1-EL-R1.2-EL-R1.3-EL-R1.4-EL-R1.5-EL-R1.6-EL-R1.7-C0
* I/D,2: I-R2.1-I-R2.2-EL-R2.3-EL-R2.4-EL-R2.5-EL-R2.6-EL-R2.7-EL-R2.8-EL-R2.9-R3-EL-R2.10-EL-R2.11-EL-R2.12-C0
* I/D, 3: I-R1.9-…-C0 (R and EL)

After listening to so many opinions regarding the five questions and what followed, the teacher decided to hold the control over the talk and start to reveal the scientific views in relation to all the posed questions. She planned to do this by displaying a computer flash that shows the situation of the electric circuit before and after it is connected and the situation of the charges before and after the circuit is connected. So, she practiced a Non-Interactive Authoritative talk (turn 37) firstly to introduce this scientific design. Then she allowed the participation of some pupils to explore and set the scene of the displayed flash (turns 37-49) before she holds again the verbal control over the talk to describe what happens exactly in the electric circuit using the playing flash (turn 49). The content of these Authoritative parts was of scientific views regarding theoretical and empirical scientific subject matter. So the shift from Dialogic to Authoritative talk has witnessed also a shift in the kind of the content from personal to scientific view, and from just theoretical scientific subject matter to theoretical and empirical subject matter as the teacher was using the flash to show what happens empirically inside the circuit.

Regarding the pattern of discourse in this Authoritative part, we can see that a similar sequence to the one noticed in Dialogic parts exists here. Instead of the comment follow-up move in the conventional sequence of Dialogic classes; (I-R-EL-R-EL…-C0), the evaluative follow-up move persists in the Authoritative one; (I-R-EL-R-EL…-EV). Though, the elaborative move repeats in the Authoritative excerpts, in a much less frequency than in the Dialogic one; I-R4.1-EL-R4.2-EL-R4.3-Ev-I-R5.1-Ev-I-Rg-I-R5.2-EL-R6-Ev.

In terms of the quality of questions and answers, the quantitative indicators just show how the Dialogic parts are dominated by moves of high quality, where the Authoritative one is mostly devoid of them. Even the one of low quality in Dialogic ones reflect pupils' views to the discussed issue and so they still hold themselves to some kind of thinking even if it does not seem to reflect high cognitive processes. In the Authoritative ones, the pupils' answers might reflect their thoughts of course. They sometimes, however, hide the pupils thoughts as they are uttered just to match what is considered a scientific view.

Analysis of Case 1, Stage 1, Lesson 5, Episode 1

**1. Analysing the talk:** Example 1,2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S | Utterance | Move | I | R | F | Remarks |
| 1.T | …What's the kind of energy in the bulb? | I | L |  |  | …This episode took place at the beginning of lesson 5 after T has explained the scientific point of view in the previous one  L: CP of 'Remember; recall' |
| 2.S1 | Light and heat | R1 |  | L |  | L: CP of 'Remember; recall' |
| 3.T | Good, the energy produced in the bulb are light and heat. Sit down. Now, pay attention, the question still here, what's the source of this energy that lights the bulb? | F  I | L |  | Ev | L: CP of 'Remember; recall' |
| 4.S2 | The battery | R2.1 |  | L |  |  |
| 5.T | The battery. So the source of this energy is the battery.  Ok, and we've said how did it reach to the bulb? | F  I | L |  | Ev | L: CP of 'Remember; recognize' |
| 6.S2 | The battery organizes the process of charges that - the close charges enter instantly to the switch, Umm, then go to the battery | R2.2 |  | L |  | - pause |
| 7.T | Enter the switch?! | F | - |  | EL | -not categorized uttered to confirm |
| 8.S2 | No, the bulb. And perform the process that is called unreal to the protons | R2.3 |  | L |  |  |
| 9.T | It's not that it's unreal. It's just to differentiate between the electronic and the conventional current. I want you to focus now on the charges, how did they take the energy to the bulb? | F  I | L |  | Ev | L: CP of 'Remember; recall' |
| 10.S2 | We've said that the battery organize the movement of charges in the electric circuit towards the bulb and the charges close to the bulb enter it and it lights | R2.4 |  | L |  | L: CP of 'Remember; recall' |
| 11.T | No, still you haven't connected it. We've said that the bulb lights and it gets the energy from the battery, how? Explain to me, how did the bulb get this energy? | F  I | L |  | Ev | L: CP of 'Remember; recall' |
| 12.S2 | The battery, when we're connecting the electric circuit,. The battery has a chemical substance and it's the one which will give the energy to the charges, and so the charges will carry that energy to the bulb to light | R2.5 |  | L |  | L: CP of 'Remember; recall' |
| 13.T | Excellent. The charges will carry the energy from the battery to the bulb. Do you understand? ().  Of course, this energy that these charges carry, what's its kind? | F  I | L |  | Ev | () group of pupils mutter: yeah, but not categorized because T didn't mean it as a Q |
| 14.S2 | Electric # | R2.6 |  | L |  | # T interrupts S2 |
| 15.T | Electric^  When reach the bulb # | F  I | L |  | Ev | ^ Affirmation tone  # S6 interrupts T |
| 16.S2 | The energy changes to be light and heat | R2.7 |  | L |  |  |
| 17.T | Excellent, it transforms to light and heat.  Girls, to understand well what S2 have said, we will make two drawings from which you'll be able to understand what happens in the electric circuit. I'll imagine that I have here a bakery… | F |  |  | Ev | …T starts a long NI/A talk about the analogy of the (Bakery-Supermarket) and mentions how it relates to the simple circuit without giving pupils the chance to do this |

**2. Characterizing the talk:**

|  |  |
| --- | --- |
| Class of the talk | Teacher-Pupil talk   * Turns 1-17: I/A * Turns 17: NI/A |
| Purpose of the talk | * I/A: Developing a scientific idea * NI/A: Introducing / explaining a teaching analogy |
| Content of the talk | - Scientific views of Theoretical scientific subject matter |
| pattern of the talk | Example1, I/A: I-R1-Ev-I-R2.1-Ev-I-R2.2-EL-R2.3-Ev-I-R2.4-Ev-I-R2.5-Ev -I-R2.6-Ev-I-R2.7-Ev  NI/A: --- |

**3. Quantitative indicators**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Class of talk** | Question (Cognitive level) | | Response (Cognitive Skill) | | Follow-up | | |
|  | Low | High | Low | High | Ev | C0 | EL |
| **Authoritative** | 7 |  | 8 |  | 7 |  | 1 |

**4. Narrative account:**

Here we have one simple example from the last lesson to be characterized. I have chosen one example only because this lesson was highly controlled by the teacher and it was devoid of any Dialogic talk. After practicing Dialogic talk for most of the lesson time in the three previous lessons, the teacher controlled the talk here though a highly authoritative attitude. This can be attributed to two reasons;

* The teacher thought that she had listened to so many opinions regarding different details of the electric circuit and how it works. She decided that it is the time now for presenting the scientific views by her without being interrupted by more discussion. She thought that instead of being Dialogic, she can use everyday analogy (Bakery-Supermarket analogy) (see appendix 3) to support her authoritative attitude in presenting the scientific account in the sense that the analogy would simplify the presented information and make it easier to be assimilated by the pupils.
* She was worried about the time (she expressed her worry to the researcher). She planned to cover all the topics related to the electric circuit through specified number of lessons. As the three previous lessons were dedicated mostly to pupils' opinions only, she felt in pressure by the time. This has been obvious in her attitude in this lesson in which she hold not just the intellectual control over the talk but also the verbal one though very long episodes of Non-Interactive/Authoritative talk.

As the lesson was dominated by Non-Interactive Authoritative talk, I decided to take one example only that entails both Interactive and Non-Interactive Authoritative classes of talk. Most of the examples for this teacher from the first stage were from the Authoritative type, so we do not need to repeat ourselves with the same characteristics from this type of talk. Now, let's move to the example itself.

After using the flash to explain about the movement of the charges and their role in carrying the energy to the bulb at the end of the previous lesson, the teacher started this lesson by reviewing what has been said. She knows as a teacher that for the scientific information to be understood and assimilated by the pupils, she needs to repeat talking about them, explain them more and confirm them through different teaching activities. The example here shows her trying to get the explanation from S2, before moving to presenting new analogy that would provide more explanation. S2, though, did not provide the teacher with the answer she is looking for from the beginning. The teacher, therefore, continued exchanging the talk with S2 to lead her to the desired answer. We can say then the talk went on to develop the scientific idea of the charges carrying the energy from the battery to the bulb.

As the teacher was guiding the talk towards the scientific point of view, she has been evaluating the responses offered by S2 immediately, and so the talk was built over the conventional sequence of (I-R-E) as can be easily noticed from the pattern of discourse of this example; I-R1-Ev-I-R2.1-Ev-I-R2.2-EL-R2.3-Ev-I-R2.4-Ev-I-R2.5-Ev-I-R2.6-Ev-I-R2.7-Ev. It is clear also that the pattern is dominated by the evaluative follow-ups moves and devoid of comments and elaborative moves except for one elaborative follow-up in turn 7 that does not reflect actually a question that asks for a piece of information. S2 made a mistake in turn 6 in using the word switch instead of bulb, and the teacher wanted just to correct her through her elaborative move in turn7.

Although this excerpt does not show questions and answers of high quality as they were reflecting only the cognitive level of 'Remember', it is encouraging to see that the whole talk has been exchanged with one pupil only except for one turn for S1. I believe, however, that S2's insistence on trying to offer the desired answer is what has kept the talk with her. After any evaluation from the teacher, S2 was providing more explanation for her answer and she kept trying till she could offer the desired view. Based on understanding of the context; the gestures of the teacher in this specific situation and the personality of S2 (she is one of the girls in the participating group), I believe it is because of the pupil's attitude that the talk had continued with her only and not really because of the teacher's attitude.