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

**1. Analysing the talk**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S | Utterance | Move | Q | R | F | Remarks |
| 1.T | …Ok, let's get in now to the changes that happen to the rocks. Rocks also go through changes. They can be physical and can be chemical. Yesterday, I went to one of the places near **Nizwa**, called…. It’s a mountain. A strange mountain in a way. If you come to check this mountain, you see that its rocks are generally brown inside, but from the outside it's like they've been splattered with a black powder. Glorious to God, you see most of the rocks like spotted. It's like you brought a black powder and sprayed it all over the mountain. You get also astonished by the shapes of the rocks. God, how much strange things you can see. Of course you can see such things all over the world. In your way to **Wilayat Al-Hamra** there is also a cave, may be you've visited ! | I | - |  |  | …T closes an I/A talk about definition/ examples of chemical change.  - Nizwa: name of a town/place in Oman  - in Arabic a different word has been used but with the same meaning for powder in English  - Hamra: name of a town in Oman |
| 2.Sg | Yeah | Rg |  | - |  |  |
| 3.T | Some of you have visited, **Huta Cave**. Who did?...  What did you see inside? Anyone describes what she saw inside the cave | I | L |  |  | - Huta; the name of the cave  …group of pupils raise their hands  \* L: CP of ‘Remember, describe’ |
| 4.S1 | I saw rocks and # | R1.1 |  | L |  | # S1 got interrupted by T |
| 5.T | What have you noticed about the rocks? -- What were the features of the rocks? Were they from the smooth type? Were they flat? What? | F | L |  | EL | -- S1 is hesitated  \* L: CP of ‘Remember, describe’ |
| 6.S1 | Like -- holes | R1.2 |  | L |  | -- hesitation |
| 7.T | Holes, ok | F | - |  | EL |  |
| 8.S1 | Were sharpened | R1.3 |  | L |  |  |
| 9.T | Sharpened. Good. Like hanging down with a sharpened shape. That’s nice. S2 | F |  |  | C0 |  |
| 10.S2 | Of course the rocks are not similar - I mean they are different in shape and they've - they've different colours from each other | R2 |  | L |  | \* L: CP of ‘Remember, describe’  - pause |
| 11.T | Good | F |  |  | C0 |  |
| 12.S3 | This means the cave went through changes for a long time | R3 |  | H |  | \* H: CP of ‘Analysis, attribute’ |
| 13.T | Yeah, good. S4 | F |  |  | C0 |  |
| 14.S4 | There is something strange in the cave cause from inside there is water and so, stalagmite and stalactite formed and there was a whole change, but from outside, in the road to the cave there are smooth mountains. I mean their rocks are smooth. Seems like marbles (…?). but from inside, it's dark, steam rises and there are small cracks where air get in, and, and because of evaporation stalagmite and stalactite have formed and remained still | R4 |  | H |  | \* H: CP of ‘Analysis, differentiate’, complex answer |
| 15.T | This is nice S2 , ok. Here is a picture from the Huta cave () This picture for the flooring of the cave and this is for the roof, part of the roof. The other picture is not for the cave. It's from another Arabic country, but may be the stalagmites and stalactites are more obvious here. These rocks like - dissolved and hanged in a strange way. So something happened to these rocks. Ok, this is what we're going to try to know. What happened to such rocks? And this is another picture …. So we will get to know about these rocks and to which type they belong.  These rocks are from the calcic rocks type. It's one kind of the sedimentary rocks. You've been taught the different groups of rocks…, igneous, sedimentary and metamorphic rocks. Our lesson today is about the limestone rocks, a kind of sedimentary rocks. You got to know in grade 8 about the chemical symbols and formulas. If we start with the calcium….So the chemical formula of calcium chloride is CaCO3. CaCO3 is….Of course, you don't have all these information in the textbook about CaCO3, but I presented so you can know if the practical activity you're going to perform produce the substance of calcium carbonate. How can I know that the substance produced in the activity is indeed calcium carbonate. What I'm supposed to notice about it as a substance? Yes S5 | F  I | H |  | C0 | () visual images are displayed in the board  - pause  …similar description  … reminding the pupils  … explaining related formulas  … telling detailed information about CaCO3 through a visual display in the board  \* H: CP of ‘Create; hypothesize’ |
| 16.S5 | Precipitates. There will be a precipitate in the water | R1.1 |  | L |  | \* L: CP of ‘Remember, recognize’ (This feature of CaCO3 has been mentioned before) |
| 17.T | First, it will appear as a precipitate. What's the kind of this precipitate? What's its colour? | F  I | L |  | Ev | \* L: CP of ‘Remember, recognize’ |
| 18.S5 | White | R1.2 |  | L |  | \* L: CP of ‘Remember, recognize’ |
| 19.T | It'll be white^ How can I test from a another direction? Listen, Im gonna do what? A chemical experiment. Have you read about it? You know you're gonna perform a reaction between two substances? This will produce another substance which is supposed to be Calcium Carbonate. We wanna prove that this substance being produced is CaCO3. .S5 said that its colour is white, Right? Another thing. What indicates it's CaCO3? yes S6 | F  I | H |  | Ev | ^ confirmation tone  \* H: CP of ‘Create; hypothesize’ |
| 20 S6 | if it's like chunk, I'll try to dissolve it in water and check it does dissolve or not | R2.1 |  | H |  | \* H: CP of ‘Create; hypothesize’ |
| 21.T | Solubility. So, if it dissolves, does it mean it's Calcium Carbonate? | F | H |  | EL |  |
| 22.S6 | No | R2.2 |  | H |  |  |
| 23.T | No. Well done. So I'll test what? Its solubility and so I can make sure that the substance produced is . good, let's see a sample of this substance… | F |  |  | Ev | …starting another episode |

**2. Characterizing the talk**

|  |  |
| --- | --- |
| Class of the talk | Teacher-Pupil talk   * Turn 1: NI/A - Turns 1- 15: Interactive/Dialogic I/D * Turn 15: NI/A - Turns 15-23: Interactive/Authoritative I/A |
| Purpose of the talk | * NI/A: Opening up the topic * I/D: Exploring pupils’ views about the topic * NI/A: Introducing / describing the topic * I/A: Framing certain details of the topic |
| Content of the talk | * NI/A, I/D: Personal views of Theoretical Everyday content * NI/A, I/A: Scientific views of Theoretical Scientific content |
| pattern of the talk | * NI/A: --- - I/D: I-Rg-I-R1.1-EL- R1.2-EL-R1.3-C0-R2-C0-R3-C0-R4- C0 * NI/A:--- - I/A: I-R1.1-Ev -I-R1.2-Ev -I-R2.1-EL-I-R2.2-Ev |

**3. Quantitative indicators**

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

**4. Narrative account**

In this episode, the teacher aims to open up a talk about Calcium Carbonate (CaCO3). In doing this, she establishes a gradual move from describing rocks in general to specify sedimentary rocks to emphasize then its main constituent; CaCO3. This gradual move is performed through a shift between different classes of talk. By initiating an Authoritative talk about some of her observations to rocks, the teacher succeeds in directing the pupils' attention to the topic in discussion. She then hands part of the control over the talk to the pupils by bringing into sight an experience lived by some of them, and by inviting them to tell their thoughts about it without being evaluated. She then takes the lead again to incorporate her view and some of the pupils' thoughts using visual images. She continues her authority over the talk by reciting prepared information about what she is planning to emphasize; CaCO3. Via an explicit request, she then invites the pupils to participate in a discussion through which she guides them towards a certain feature in characterizing CaCO3.

So, in achieving the general teaching purpose of opening up the topic of CaCO3, the teacher drew multiple sub-purposes around content of different types and through different classes of talk. She started a Non-Interactive/Authoritative talk to tell her everyday view with the purpose of setting up the scene for the intended topic. She implemented then an Interactive/Dialogic talk to explore the pupil's everyday thoughts about it. Through another turn of Non-Interactive/Authoritative talk, she achieves the purpose of introducing the intended topic through a combination of everyday and scientific content. In the last turn in the episode, the teacher guides the pupils in an Interactive/Authoritative way towards a right scientific answer for a theoretical question concerning an empirical procedure intended to be performed in a successive lesson.

Here, we can see, therefore, two types of Non-Interactive/Authoritative class of talk. The first entails an everyday content where the second goes around scientific information. The teacher used the first type to open an Interactive Dialogic discussion, where an Interactive Authoritative talk followed the second type of the scientific content.

Regarding the two types of the Interactive talk in this episode, where the first is Dialogic and the second is Authoritative, some differences can be noticed. Although the Dialogic turn in this episode is longer than the Authoritative one, there are fewer initiations in the Dialogic turn than the Authoritative one. This feature can be perceived more obviously by looking at the Initiation to response rate. It is 3:7 in the Dialogic turn and 4:4 in the Authoritative one.

Once the teacher initiated the talk at the beginning of the Dialogic turn, she has been listening to different responses from the pupils and commenting on or elaborating their answers without providing any evaluation and so, didn't need to do another initiation. The turn-taking looks more flexible. The pupils in turn 8, 10,12 and 14 were participating in an open discussion rather than answering questions. These responses also show how pupils share the power in guiding the talk.

In the Interactive Authoritative turn, however, the teacher initiates a question, receives a response and evaluates it to initiate another question and so forth. The pupils were answering questions and getting evaluative feedback rather than participating in an open discussion, which reflects more control over the talk by the teacher. However, There is no obvious difference can be made between the Dialogic and Authoritative classes of talk regarding the level of the teacher' questions and pupils' responses. Questions of low and high cognitive levels and responses of low and high cognitive skills are seen in both types of talk.

Regarding the influence of the talk on the pupils' learning, it looks like the Dialogic talk has attracted more participation from the pupils than the Authoritative one. However, no distinction can be drawn in the cognitive skills used by the pupils to respond to the questions initiated in the two classes of talk.

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

**1. Analysing the talk**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S | Utterance | Move | I | R | F | Remarks |
| 1.S1 | # but that substance. I mean to be easier, Calcium Carbonate. It's, I mean, it's a chalk | IS | H |  |  | # S1 interrupted T's talk  \* H: CP of ‘Evaluate; checking’ |
| 2.T | It can be a fundamental example. It's one kind of Calcic rocks that contain the substance of Calcium Carbonate | FT |  |  | C0 |  |
| 3.S1 | Cause in some parts of the world, after they swash the water and everything. I mean places, meters, kilometers called the chalk land | FS |  |  | C0 |  |
| 4.T | The chalk land. Good. If you remember from the second picture, the second picture I displayed yesterday. Yesterday I displayed two pictures, one about the Huta cave and one was for the …the second. The second picture in which you saw like a waterfall and a plain land and also (…?). most of those are salt rocks and also chunks from the kind that S1 talked about. Ok? Thanks for your observation S1. Ok, now the experiment's steps… | FT |  |  | C0 | …previous description  (…?) inaudible  …I/A and NI/A talk |
| 5.S2 | # Miss, I have a question, the balance doesn’t measure the weight of the **clock glass** (evaporating basin)? | IS | L |  |  | # interrupted T's talk about the groups' work  L: Procedural question |
| 6.T | Your friend said we **zero** it | RT |  | L |  | - zero it: put the balance on zero |
| 7.S2 | We zero it. Yeah | FS | L |  | EL | - The tone of S2 indicates that she is questioning T’s response; so, how does this answer my question?  \* L: CP of ‘Remember; describe’ |
| 8.T | We zero it,  so? | RT  IT | L | L |  | -T is asking S2 about what is she is asking for |
| 9.S2 | No, I mean after we put the substance on the clock glass and weigh it | IS | L |  |  | - S2 is rephrasing her question in turn 1  L: Procedural question |
| 10.T | That’s it, you don't measure it. See, what are you doing? You put now the clock glass. The balance is working now ()… | RT |  | L |  | * T is providing an answer to S2‘s question   () T performs a demonstration and talks about it (NI/A) |

**2. Characterizing the talk**

|  |  |
| --- | --- |
| Class of the talk | Pupil-Teacher talk   * Turns 1- 4: I/D - Turn 4: NI/A * Turns 5-10: I/A - Turn10: NI/A |
| Purpose of the talk | - Responding to pupils' queries |
| Content of the talk | * I/D, NI/A, 1: Personal/Scientific views of Theoretical Scientific subject matter * I/A, NI/A, 2: Scientific views of Empirical Scientific subject matter |
| pattern of the talk | * I/D: IS-C0T-C0S-C0T - NI/A:--- * I/A: IS-RT-ELS-RT -IT-IS- RT - NI/A: --- |

**3. Quantitative indicators**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Class of talk** | Question (Cognitive level) | | Response (Cognitive Skill) | | Follow-up | | |
|  | Low | High | Low | High | Ev | Co | El |
| Dialogic |  | 1 |  |  |  | 3 |  |
| Authoritative | 4 |  | 3 |  |  |  | 1 |

**4. Narrative account**

These excerpts from lesson two are taken from two episodes; 2 and 3. They demonstrate three classes of talk according to the communicative approach. They are distinctive, however, because they are initiated by pupils and not by the teacher as normally happen. S1 initiates the talk in the first turn by wondering implicitly why they have to talk about Calcium Carbonate as a mysterious substance when there is a very simple example of it; chalk. The teacher then responds to this initiation by supporting S1’s view, the thing that encourages S1 to follow-up the teacher’s response by providing more information about what she has raised. The teacher then followed-up S1‘s contribution by repeating the key notion in her talk, to take back then the authority by trying to assimilate S1 ‘s view with some old information presented by her in the lesson before.

Skipping some turns, we see another example of a talk initiated by a pupil. Here S2 is asking a question about one of the experiment’s procedures which has been already discussed during the lesson. The teacher offered an answer, but S2 doesn’t understand how the teacher’s response answers her query, nor does the teacher understand what exactly is not clear to S2. The talk continues to reveal the misunderstanding to end with the teacher explaining through a practical demonstration the answer to S2’s question.

In terms of the communicative classes, the first example has been classified as an Interactive/Dialogic followed by a Non-Interactive/Authoritative class of talk. The content of the example here is built over a pupil’s view which is actually driven from old scientific information. Although it is a very simple excerpt, it shows in fact a student negotiating a piece of scientific knowledge with the teacher. The pupil initiated the talk by providing a suggestion. The teacher reacted in the way that allowed the talk to flow between the two without her giving a direct evaluation. It is right that she took the lead immediately afterwards, but she did listen to the pupil’s contribution and exchanged the information with her. The second example has been classified as an Interactive/Authoritative followed by a Non-Interactive/Authoritative talk. In this turn, the pupil asked a direct procedural question, the teacher tried to understand the pupil’s difficulty with that procedure and then provided a demonstrated scientific explanation for it.

It is worth looking into the kinds of moves in both examples. In the Dialogic turn, it is the nature of the pupil’s initiation as a suggestion, and how the teacher did react to that suggestion that made the two follow-up each other’s talk (turns 2-4). We notice in this example, therefore, an initiation move followed by a follow-up move. The teacher did respond to the pupil’s initiation, but that was by commenting on her contribution rather than providing an answer to it. The pattern of moves continued to be an exchange of follow-up moves. The Authoritative excerpt reflects somehow a usual pattern of moves in general (I-R-I-R...), but with exchange of roles as the pupil is asking and the teacher is responding. This pattern would have included only two moves of Initiation from the pupil and answer from the teacher, if the mis-understanding has not happened. It was a bit confusing trying to categorise the different moves whether I, R or F. In fact, categorising the kinds of moves in pupil-teacher talk is more difficult than doing so in the talk initiated by pupils. Nevertheless, I believe that following the heart meanings of the three moves as explained by theoretical account of the framework (chapter 3), not judging the moves from their general structures hence; is the key criteria in judging the kind of the move (as reflected by some of the remarks in explaining the categorisation of the moves in the excerpts above).

Regarding the two classes of Non-Interactive/Authoritative talk in the two examples, there is one feature that needs to be highlighted. In the first example, the pupil could not initiate a Dialogic talk only, but stimulated also a Non-Interactive/Authoritative talk in which the teacher tried to portray the pupil’s view in the visual images displayed by her in the lesson before. The second example is distinguished with its empirical content. To answer the student’s question, the teacher was lecturing the scientific explanation verbally, but through a practical demonstration of how does this work. One pupil did actually explain about the balance before and the teacher assumed that it is understandable by the rest of the pupils and so did not explain it practically. It is the pupil’s procedural initiation here that specified the content of the Authoritative talk of the teacher to be empirical.

Moreover, in such examples of a class talk initiated by pupils, I think we can check the pupils’ learning in terms of the cognitive level of their initiations and the cognitive processes that seem to be implemented in their responses or follow-ups. As for the pupils’ participation as a learning outcome, I believe it doesn’t need to be examined here because such talk would not have existed without the pupils’ participation basically. Thus, the participation here is an advantage in terms of the learning outcomes whether the talk is Authoritative or Dialogic.

As to the cognitive-levels/skills in the examples of this lesson, we see an initiation with a high cognitive-level in the Dialogic turn and one with a low cognitive-level in the Authoritative turn. In fact, this can be seen as a cause that contributed to draw the first example to be Dialogic and the second to be Authoritative. In both types, however, the pupils’ contributions to the talk are of low cognitive-skills.

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

**1. Analysing the talk**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S | Utterance | Move | Q | R | F | Remarks |
| 1.T | So, the two substances of sodium chloride and calcium carbonate. The two chemical substances appeared as a white powder. How can I differentiate between the two? Which is the one that remained in the filter paper? And which is the one that went down with the precipitate and after the evaporation. After evaporating **it**, it remained as a white powder substance in the glass? Is this the carbonate? Or carbonate is the one in the filter paper? How…? | I | H |  |  | - T means its solution  … T repeat the query with different words  \* H: CP of ‘Understand, explain’ |
| 2.S1 | Calcium Carbonate didn't dissolve in water | R1.1 |  | L |  | \* L: CP of ‘Remember, recognize’ |
| 3.T | Uhaaa | F | - |  | EL | -not categorised because it’s not a question |
| 4.S1 | And that in the filter paper -- sodium chloride dissolved | R1.2 |  | L |  | --hesitation  \* L : CP of ‘Remember, recognize’ |
| 5.T | Dissolved in water. You're raising the dissolving point. I might use it as a clue for differentiation. I mean, if I brought now some water and dissolved **this** precipitate. If this white powder has dissolved, so which one will it be? | F  F | L |  | C0  EL | - T rises the filter paper  \* L: CP of ‘Remember, recognize’ |
| 6.S1 | The salt, sodium chloride | R1.3 |  | L |  |  |
| 7.T | And if the one in the glass has dissolved, then it' is the sodium chloride^. So in this case, the measure in differentiating between the two substances is which one to dissolve, and which one to form a precipitate. It's the measure to differentiate between NaCl & CaCO3. In your expectation, and basically before the dissolving process. Before they dissolve. **Ha**, at the time of the reaction, when mixing the two substances - After they've been mixed in the test tube, you filtered it, right? What do you think? From the beginning, which is the substance that remained in the filter paper? And why? - One of them went through the filter paper with the water. Whish one is it? The second didn't go down with the water which means it didn't get mixed up with water? So what do you think this substance is? Yes S2 | F  I | L |  | Ev | ^ affirmation tone  - Ha: curious tone  - pause  - pause  \* L : CP of ‘Remember, recognize’ |
| 8.S2 | Calcium Carbonate | R2 |  | - |  | \* L: CP of ‘Remember, recognize’ |
| 9.T | Good, CaCO3 . So, CaCO3 doesn't dissolve in water basically. So how it can go through the filter paper with the water?! Because it remained in the filter paper means it hasn't dissolve. So we expect it to be CaCO3.  Ok, we will bring two glasses to try to dissolve the two substances and observe which one… | F  - |  |  | Ev | …T performs a practical demonstration to test their expectation and continues a NI/A talk |
| Example 2 | | | | | | |
| 1.T | What's the kind of change in step3? | I | L |  |  | \* L : CP of ‘Understand, classify’ |
| 2.S1 | Physical change | R1.1 |  | L |  | \* L : CP of ‘Understand, classify’ |
| 3.T | Was physical change. What was the step? Dissolving the **chemical substance**. The one who was holding the test tube? What did you notice about it? -You said the kind of change Umm, what S1? | F  I | L |  | C0 | Chemical s.: Sodium Carbonate  - pause |
| 4.S1 | Physical | R1.2 |  | L |  |  |
| 5.T | Good, S1 thinks it's physical. This is S1's opinion. Because she said what? What makes you choose this? | F | H |  | EL | \* H : CP of ‘Understand, explain’ |
| 6.S1 | It changes. Without the change of the substance | R1.3 |  | H |  | \* H : CP of ‘Understand, explain’ |
| 7.T | Without changing the substance, cause it's a process of what? | F | H |  | EL |  |
| 8.S1 | Dissolving | R1.4 |  | H |  |  |
| 9.T | Dissolving. Nice. Because it is a dissolving process (B). This is S1's opinion - But let me give you a small hint. If this process, take a seat S1. Who did dissolve the sodium carbonate, and started to shake it? What did she notice while she was holding it? Yes S2 | F  I | L |  | C0 | (B): T writes on board  - pause |
| 10.S2 | When was shaken, the temperature got high | R2 |  | L |  | \* H : CP of ‘Remember, describe’ |
| 11.T | That’s good^. You noticed a rise in the temperature. All the ones that were holding the tube noticed this? | F  I | - |  | Ev | ^ affirmation tone  - not categorized because T is just asking for a confirmation |
| 12.Sg | Yeah | Rg | - |  |  |  |
| 13.T | So, if there is a rise in temperature, then this means that something strange happened in such case. Means that this substances # | F |  |  | C0 | # T got interrupted by S3, and it seems that T was intending to continue commenting rather than looking for elaborating the answer |
| 14.S3 | Absorbed | FS |  |  | C0 | -As the teacher didn’t ask for an answer in the turn before, nor did she take it into consideration in the turn after. Then I considered it Comment, not response |
| 15.T | Didn't dissolve in a normal way. You remember in grade 7, dissolving meant only the particles separate…but what happened to the chemical substance in this case? It reacted with water, and what did it do? It absorbed heat so you felt it cold? Or released heat and you felt it hot? | F  I | L |  | C0 | …T gives an example of dissolving NaCl  \* L: CP of ‘Remember, label’ |
| 16.Sg | It released heat | Rg |  | L |  |  |
| 17.T | Released heat^,  so do I consider it physical? | F  I | L |  | Ev | ^ affirmation tone  \* L: CP of ‘Remember, label’ |
| 18.Sg | Chemical | Rg |  | L |  |  |
| 19.T | Because it released what? … | F |  |  | Ev | …T affirming the answer |

**2. Characterizing the talk**

|  |  |
| --- | --- |
| Class of the talk | Teacher-Pupil talk   * Example1, Turns 1-9 : I/A - Turn 9: NI/A * Example2, Turns 1-9: I/D - Turns 9-19: I/A |
| Purpose of the talk | * Example1: Developing a scientific idea * Example2, I/D: Exposing a misconception * I/A: Developing a scientific idea |
| Content of the talk | * Example1, I/A: Personal/Scientific views of Theoretical/Empirical Scientific subject matter   NI/A: Scientific views of Theoretical/Empirical Scientific subject   * Example2, I/D: Personal views of Theoretical/Empirical Scientific subject   I/A: Scientific views of Theoretical/Empirical Scientific subject |
| Pattern of the talk | * Example1, I/A: I-R1.1-EL-R1.2-C0, EL-R1.3-Ev   NI/A: --- (I-R2-Ev)   * Example2, I/D: I-R1.1-C0-I-R1.2-EL-R1.3-EL-R1.4-C0   I/A: : I-R2-Ev-I-Rg-C0-C0(s)-C0-I-Rg-Ev-I-Rg-Ev |

**3. Quantitative indicators**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Class of talk** | Question (Cognitive level) | | Response (Cognitive Skill) | | Follow-up | | |
|  | Low | High | Low | Low | Ev | C0 | EL |
| EX1, Authoritative | 2 | 1 | 3 |  | 2 | 1 | 2 |
| EX2, Dialogic | 2 | 2 | 2 | 2 |  | 2 | 2 |
| EX2, Authoritative | 3 |  | 3 |  | 3 | 3 |  |

**4. Narrative account**

Again, we are looking at two examples from the third lesson with three classes of talk. They are different, however, in respect of the teaching purpose. Here, the teacher is trying to work on the topic initiated previously. In the first part of the first example, the teacher is trying to develop the idea of the substance’s solubility to be a measure in differentiating between unidentified chemical substances. In doing this, she used an Interactive/Authoritative talk followed by a Non-Interactive one to review authoritatively the whole theoretical idea and to prove it then empirically through a practical application.

The teacher, here, did listen to what S1 was saying without evaluating her answer initially, which, in return, caused confusion to whether this talk should be classified as Authoritative or Dialogic. However, the context indicates that this idea has been raised before as the example in lesson one illustrates. It has been opened up in the first lesson, but in this lesson, the teacher wants to implement the idea empirically to decide about the findings of the experiment. Here, she chose an Authoritative way in the sense that the talk was directed to a certain scientific view, but she practiced it with a low level of authority as she was, mutually, developing the idea with the pupil and not just by her own. It is after six turns that the teacher finally evaluated S1's answer (I-R1.1-EL-R1.2-EL,C0-R1.3-Ev), although she could do this from the third turn as the right view has been initiated by S1 in her first response. However, this first response was not clear enough, and this might be seen as to define the teacher's reaction to be of a low-level authority by prompting this incomplete answer. On the other hand, the teacher could have looked for a more accurate answer from another pupil, but her attitude in listening to pupils is what made her keep developing the idea with S1. Therefore, we can envisage that the type of talk in this example has been influenced by both; the nature of the pupil's response and the attitude of the teacher in addition to the intended purpose.

Confusion happened also with the seventh turn to whether classify it as Non-Interactive/Authoritative class or not as it is a big turn with a ‘review flavour’. Looking deeply at it, however, reveals that this turn should be divided into two parts. In the first one, the teacher was actually making a follow-up move. As clarified, she has not provided any evaluation before, but in this turn she was actually giving a feedback to all the responses given by S1. In the second part, she started to initiate a talk about the same idea but from a different side. This time, however, she practiced a higher verbal and intellectual authority in reverse to the low-level authoritative attitude she followed when talking to S1. In this initiation, she was repeating the question in different words and with explicit explanation that can lead easily to the answer she wants the pupils to utter. Consequently, S2 provided the desired short answer in turn 8, to move the control over the talk again to the teacher to start the Non-Authoritative talk in turn 9.

This example similar to some of examples presented previously entails a theoretical and empirical scientific content. It is distinctive here to look at the questions raised by the teacher in turns 1 and 7. In these initiations, the teacher was making also a description of the empirical procedures related to the raised questions, the thing that produced, eventually, long turns of talk. On the other hand, this has resulted in defined questions which specified, in turn, the pupils' answers to be short and simple. Regarding the content of turn 9, again we see a description of empirical procedures, but not for ones that had been done. Rather, it is about a current practical activity performed by the teacher during the talk itself. Overall, it seems that such talk about scientific empirical activities take long turns to be explained and requires the authority of the teacher.

The second example from this lesson shows an Interactive/Dialogic talk followed-up by an Interactive/Authoritative one. The Dialogic part of this example (turns 1-9) looks similar to the Authoritative one in the first part of the preceding example (turns 1-7), in the sense that the teacher was exchanging the talk with one pupil for several turns (I-R1.1-C0-I-R1.2-EL-R1.3-EL-R1.4-C0). Although such examples can be put within the purpose of working on some scientific ideas, there is a difference between the two. As clarified, the purpose in the previous example was to develop the scientific idea of the solubility by giving share to pupils in doing this. In this example, the teacher was aiming to do the same as it appears in the Interactive/Authoritative talk in the second part. However, the pupil's incorrect answer has led the talk to be Dialogic in its first part. In fact, the teacher used S1's incorrect response to make it explicit what she regards as a misconception, in assigning all the dissolving processes to the physical change. The nature of the pupil's answer, therefore, has inspired another teaching purpose which might have not been planned by the teacher for that specific situation. The new unplanned purpose, in turn, has driven the talk to follow a new route and exhibits, therefore, a different type of talk. Again, the nature of the pupil's response and the teacher's attitude, together have influenced the type of the uttered talk.

After the Dialogic exchange to reveal a misconception, the teacher interacted with the class authoritatively (turns 9-19) to explain that misconception and correct it indirectly. Therefore, although we can't see a difference in the cognitive skills of the pupils' responses between the Dialogic and the Authoritative types of talk in this example, there is a learning outcome from another kind. The two types of talk together have contributed to disclose a misconception, explain it and attempt to correct it. It can be also argued that this wouldn't have been happening if the teacher had not interacted dialogically with S1's incorrect answer.

Lastly, in terms of the patterns of moves in both examples 1 and 2, there are the usual differences in addition to a new similarity. As expected and seen from previous examples, the Authoritative talk entails evaluative follow-ups and, and so characterized with the I-R-E pattern. The Dialogic talk, in opposite, doesn't show evaluative follow-ups. The number of initiations, compared to the responses is larger in authoritative patterns than the Dialogic ones. This last feature, however, can be spotted in these two examples only if we exclude the first part of the I/A talk in the first example. As stated above, this part shows a low-level of authority for which its pattern of moves (I-R1.1-EL-R1.2-EL ,C0-R1.3-Ev-I-R2-Ev) is, actually, similar to the one noticed in the Dialogic part in the second example (I-R1.1-C0-I-R1.2-EL-R1.3-EL-R1.4-C0) in the sense that the teacher was commenting on or elaborating one pupil's responses.

Analysis of Case 2, Stage 1, Lesson 4, Episode 5,7,8

**1. Analysing the talk**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S | Utterance | Move | I | R | F | Remarks |
| 1.T | …Let's continue. Ok, next step,8. Yes S1 | I | L |  |  | …discussion of preceding steps  \*L: CP of 'Understand; classify' |
| 2.S1 | Step 8, physical change | R1.1 |  | L |  | \*L: CP of 'Understand; classify' |
| 3.T | Physical change.  What's step 8? | F  I | L |  | C0 | \*L: CP of 'Remember; recall' |
| 4.S1 | Umm. spilling some acid on -- the precipitate | R1.2 |  | L |  | -- hesitation |
| 5.T | On the precipitate. You remember the clock glass. We took the precipitate in the filter paper. All the groups saw what happened to the precipitate when putting some drops of the acid () What've you noticed at first? | F  I | L |  | C0 | () some pupils mutter: Yeah  \*L: CP of 'Remember; describe' |
| 6.S1 | After we spilled the acid -- I mean it melted | R1.3 |  | L |  | -- hesitation |
| 7.T | Melted?! Dissolved # | F |  |  | Ev | # T got interrupted by S1 |
| 8.S1 | Dissolved | FS |  |  | C0 |  |
| 9.T | Good.  Although we've said before that, what happened to it in the water? | F  I | L |  | Ev | \*L: CP of 'Remember; recall' |
| 10.S1 | Doesn't dissolve | R1.4 |  | L |  |  |
| 11.T | Doesn't dissolve^  In the acid, what happened? | F  I | L |  | Ev | ^ Affirmation tone  \*L: CP of 'Remember; recall' |
| 12.S1 | It dissolved | R1.5 |  | L |  |  |
| 13.T | What do you expect this to be? | I | L |  |  | \*L: CP of 'Understand; classify' |
| 14.S1 | Chemical | R1.6 |  | L |  |  |
| 15.T | So you've changed your answer. So you believe the kind of change in this case what? | F | - |  | EL | * Not categorised because T is just asking for a confirmation |
| 16.S1 | Chemical | R1.7 |  | - |  |  |
| 17. T | Chemical. So there was a dissolving process. Dissolving means that the first substance reacted with the second one and it turned it to a solution in this case. Good, so in step 8, what's the change? (). Because an acid reacted with a substance. Here what happened? because the features of the substance changed. It wasn't a soluble normally, but it has been dissolved by the acid. Its features have changed in respect to the solubility cause … | F |  |  | Ev | () some pupils answer: chemical  … T continues NI/A talk |
| Example 2 | | | | | | |
| 1.T | You did the practical activity…what can you say as a final conclusion? | I | H |  |  | …summary  \* H: CP of ' Understand, summarize' |
| 2.S1 | That rocks go through several physical and chemical changes throughout their formation. And that we can make rocks or calcium carbonate | R1.1 |  | L |  | \*L: CP of 'Remember; recall' |
| 3.T | And we can, in laboratory, produce the substance of calcium carbonate which is the main constituent of rocks.  Yes S2 , you wanna add something? | F  I | - |  | Ev | -S2 raises her hand  \* not categorized as it's just a reaction from T to S2 who raised her hand |
| 4.S2 | We can say that limestone rocks go through several physical and chemical changes for a long period of time | R2.1 |  | L |  | \*L: CP of 'Remember; recall' |
| 5.T | Good | F |  |  | Ev |  |
| 6.S2 | And so, we could see from this activity the **evidences** of a chemical change. We saw the existed precipitate. It indicates a chemical change. Also the change in colour and the change in temperature | R2.2 |  | H |  | -evidences are not the focus of this activity basically, and so the response is categorized as H, CP of 'Understand; conclude' |
| 7.T | Excellent. It's indeed as she said - She noticed that there're evidence for chemical change, release of heat, the precipitate, the colour change. All of these are evidences that indicated what? The happening of chemical change. So, our conclusions…  Yes S3 | F |  |  | Ev | - pause  …repeating conclusions  \*S3 raises her hand |
| 8.S3 | Miss if this calcium carbonate doesn't dissolve in water. So umm when it comes - For example the sea water. For example we said last year that rivers, how they become salty? Cause when it flows it takes with it the saltiness from the rocks and carries it to the sea water | IS | H |  |  | - pause  \* H: CP of 'Evaluate; detecting' |
| 9.T | Saltiness from rocks? Which kind of salts in rocks? | IT | L |  |  | \* L: CP of 'Understand; exemplify' |
| 10.S3 | Saline | R3.1 |  | L |  | \* L: CP of 'Understand; exemplify' |
| 11.T | Saline, which are soluble, and which one dissolves? | F |  |  | C0 | - T didn't mean to ask. She was just thinking loudly about it. It's just her way when saying things that she put them into questions |
| 12.S3  12.T | Food salt  There are other salts, Sodium Chloride is a salt | R3.2  F |  | L | C0 | -means NaCl  -T & S3 are talking at the same time |
| 13.S3 | Yeah | FS |  |  | C0 | - The pupil wasn't responding here to a Q |
| 14.T | It's soluble in water and you've seen how it dissolves in water. So what? **These** basically are kinds of saline, but calcium carbonate is not one of the salts that can be carried. These are soluble salts and there are precipitates | F |  |  | C0 | -T points to the reaction equation written in the board |
| 15.S3 | Yeah, it cannot carry it. So it remains still | IS | H |  |  | \* H: CP of 'Understand; justify' |
| 16.T | See what happens? May be when the acidity of water increases for example… | RT |  | H |  | … T talks about the acidity of water and erosion factors as reasons that might explain the existence of CaCo3 in water. In this turn, she slightly changed her mind about the answer in the previous turn |
| Example 3 | | | | | | |
| 1.T | We will discus some simple questions. But anyone has a question or anything not convinced about? Yes S1 | IT | H |  |  | \* CP of 'Evaluate; checking' |
| 2.S3 | Miss, but in which places sodium carbonate and calcium chloride can be found in nature? In which place so that it can leads to the formation of the rocks? | IS | H |  |  | - these are the reacted substances in the reaction done practically in the lab  \* H: CP of 'Analysis; Attribute' |
| 3.T | When we say that this substance, calcium carbonate is produced by a chemical reaction (…?) | RT.1 |  | L |  | (…?) inaudible |
| 4.S3 | Yeah, but in which places they can be found? | IS | H |  |  |  |
| 5.T | In the places that have such substances. The places, you know that metals or rocks contain chemical substances. In nature, you can find for example mountains that contain iron, mountains contains sulphur. Mines that contains I don't know somewhat - I mean you can find these substances in nature in different places in the world | RT.2 |  | L |  | \* L: CP of 'Remember; recognize'  - pause |
| 6.S3 | It means these rocks. Not all the rocks have the same colour (…?) | IS | L |  |  | (..?) inaudible |
| 7.T | No, not the same colour. Impossible of course. Their different colours are obvious. Maybe **this** is chemical. It's a reaction held in the lab. But in nature we will talk about stalagmite stalactite… | RT.3 |  | H |  | \* H: CP of 'Analyze, attribute'  - this: points to the equation  … T closes the raised point |

**2. Characterizing the talk**

|  |  |
| --- | --- |
| Class of the talk | Teacher-Pupil talk   * Example1, Turns 1-17 : I/A - Turn 17: NI/A * Example2: Turns 1-7: I/A   Pupil-Teacher talk   * Example2: Turns 8-16: I/D - Turn16: NI/A * Example3: Turns 1- 7: I/D - Turn 7: NI/A |
| Purpose of the talk | * Example1: Developing a scientific idea * Example2, I/A: Reviewing concluding ideas   Pupil-Teacher talk  - Example2, I/D , NI/A: Responding to a pupil's question   * Example3: Responding to a pupil's question |
| Content of the talk | * Example1, I/A: Scientific view of Theoretical/Empirical Scientific subject matter * Example2, I/A: Scientific view of Theoretical/Empirical Scientific subject matter   I/D: Personal/Scientific views of Theoretical Everyday/Scientific content  NI/A: Scientific view of Theoretical Everyday/Scientific content  - Example3: I/D: Personal/Scientific views of Theoretical Everyday/Scientific content  NI/A: Scientific view of Theoretical Everyday/Scientific content |
| pattern of the talk | * Example1, I/A: I-R1.1-C0-I-R1.2-C0-I-R1.3-Ev-C0(S)-Ev-I-R1.4-Ev -I-R1.5-I-R1.6-EL-R1.7-Ev   NI/A: ---   * Example2, I/A: I-R1.1-Ev-R2.1-Ev -R2.2-Ev   I/D: IS-IT-R3.1-C0-R3.2-C0-C0(S)-C0-IS-RT  NI/A: ---   * Example3, I/D: IT-IS.1-RT.1-IS.2-RT.2 -IS.3-RT.3   NI/A: --- |

**3. Quantitative indicators**

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

**4. Narrative account**

Here we have three examples from lesson 4 and which represent two types of talk. The first example and the first part of the second example stand for teacher-pupil talk, whereas the talk is initiated by pupils in the second part of example 2 and example 3. Both examples of the talk initiated by the teacher have been classified as Interactive/Authoritative, mainly because the teacher was providing evaluations for the pupils' contributions. The first one comes within the purpose of working on the discussed topic while the second characterizes the purpose of closing down the topic. The two, however, show good practice of Authoritative talk.

Although the first example follows the usual pattern of moves of I-R-F/E, it is notable how the pattern replicates six times with just one pupil. In this excerpt, the teacher exchanges the talk with S1 for 17 turns, in which she leads the pupil to the right scientific view. She succeeded in doing this without giving an immediate evaluation for the incorrect answer of S1 in turn 3. Instead, she chose to revise with S1 her observations of what happened in the experiment, the thing that resulted in S1 herself changing the answer to the correct one. The teacher then focused on confirming the right second answer in a Non-Interactive/Authoritative way.

In this Authoritative talk whether Interactive or Non-Interactive, it is useful to highlight the content. Here, the talk is a mixture of theoretical and empirical content through which the teacher could easily make the pupil amend her initial incorrect response and by which she was attempting to convince the whole class with the right scientific view. From this, we might then look at the nature of the content as a factor in stimulating a certain type of talk in addition to the teacher and the pupils factors as explained in the examples from lesson 3. I believe that the nature of the empirical content about very obvious observations in the experiment and the nature of the theoretical content in discussing a simple example of chemical change, have both influenced the talk to take the authoritative route.

The second example of the Authoritative talk in this lesson is a small one and characterizes, as stated, the purpose of closing-down by reviewing conclusions from the topic. It started with the usual pattern of moves of I-R-E, but it went on without the teacher making another initiation (I-R1.1-Ev-R2.1-Ev-R2.2-Ev) simply because one pupil (S2) wanted to speak out her concluding thoughts. As these thoughts were correct scientifically, the teacher provided an evaluation by appraising S2 and confirming her thoughts. This can be seen, in return, as a talk of a low-level of authority as the teacher did listen to what S2 wanted to say. It is again the nature of the content that gave this flavour of low authority as it was based on what have been done and discussed.

In the last turn of the Interactive/Authoritative talk in the second example (turns 1-7), a third pupil raised her hand to initiate a new class of talk (turns 8-16). It has been classified as an Interactive/Dialogic type of a pupil-initiated talk. In this excerpt, S3 was negotiating some scientific knowledge with the teacher. Her high-level question reflects her confusion in explaining the existence of Calcium Carbonate in water bearing in mind the fact about its insolubility in water. This query surprised the teacher and printed in her mind initially the same difficulty faced by S3. This resulted, consequently, in a miscommunication between the teacher and the pupil. The first response of the teacher in her reaction to S2's question was by focusing on the understandable part of the query; the saltiness in water. S3 was not looking for this answer because she meant to use this understandable piece of information in a comparison with the insoluble Calcium Carbonate to highlight the reasoning difficulty faced by her.

Focusing on the uttered talk in this excerpt, though, shows that the miscommunication happened because the teacher was, in fact, thinking about the query loudly. This appears in turns 9 to 14 and more specifically in turns 11 and 12. In turn 11, it looks like the teacher was asking a question to S3, who acts by providing an answer in turn 12. The teacher, however, was asking herself that question and so she responded to it at the same time with S3 in turn 12. Her first finding from the 'loud thinking' appears in turn 14 and which, in fact, confirms the pupil' difficulty rather than solving it. This stimulates S3 to challenge the teacher follow-up by initiating the query again implicitly. It is in turn 16 when the teacher reach to a view that she thinks is scientifically convincing for her as well as for the pupils. Thus, she continued in explaining this view through a Non-Interactive talk without being interrupted by S3 who seems to be convinced by this answer.

It was confusing whether to classify this class of talk as Dialogic or Authoritative. It is Dialogic in the sense that the teacher has not provided an evaluative feedback, nor she was guiding the talk to a certain point of view. This, however, can be opposed by the fact that the teacher was not aware initially with an acceptable scientific point of view, and when her thinking led her to that view, she spoke it out authoritatively in turn 16. This suggests, in turn, that the talk should be classified as Interactive/Authoritative. Though, this is a talk initiated by a pupil; a talk that has been initiated to raise a difficulty in order to get an explanation for it. The teacher didn't neglect it or tried to discard it although she wasn't aware of an explanation at the beginning. Instead, she thought loudly about it by exchanging the talk with S3 who in turn, was taking notice of what the teacher is saying. In fact, both the teacher and S3 were following-up each other's talk (as the teacher reacted to S3's initiation in turn 8 by making herself a relevant initiation to S3 in turn 9) despite of the miscommunication between them. This, basically, is what made the decision to classify the excerpt from 8 to 16 as Interactive/Dialogic and as a Non-Interactive/Authoritative in its turn of 16. Such understanding of the context of what exactly was happening in this excerpt has helped also in deciding about the kind of moves whether I, R or F, which gets more difficult to be decided about in the talk initiated by pupils in general (IS-IT-R3.1-C0-R3.2-C0-C0(S)-C0-IS-RT).

Example three also illustrates an excerpt of a talk initiated by pupils. It came within the same lesson of the previous example and been initiated actually by the same pupil. S3 is trying in this query to relate the chemical reaction happening in the laboratory to what is happening in nature. Her wondering mind was thinking of where the chemical substances of Sodium Carbonate and Calcium Chloride, whose their reaction together produce Calcium Carbonate, can be found in nature. Again, unexpected question that surprised the teacher, made her think loudly, and prompted her to just utter her personal view of what she thinks it might be a reasonable explanation. It is in the last turn where the teacher seems more confident with her answer in confirming that such reaction is performed in laboratories while calcium Carbonate can be produced in nature by other kinds of chemical reactions such as the one that produces stalagmite and stalactite that is to be discussed in successive lessons.

I faced the same confusion in classifying this talk as in the previous example. I decided, though, to classify it as Dialogic based on a similar justification to what I presented earlier. The teacher has not neglected the question, nor did she control the talk. In fact, the excerpt shows a pattern of moves of a pupil asking and a teacher responding, and which has repeated three times (IT-IS.1-RT.1-IS.2-RT.2 -IS.3-RT.3), the thing that exhibits a pupil's control over the talk.

Overall, I would also like to argue her that the nature of the content in the two excerpts in addition to the teacher's attitude in listening to what her pupils think about (as explained above), have both influenced the talk to be Dialogic. In the tow examples, the talk was a mixture of a theoretical scientific and everyday content because it expresses an exchange of personal thinking or justification (for both the teacher and the pupil) of some scientific information. Basically, the nature of the pupil's initiation content has been characterized as a high-level question because it reflects the pupil's attempt to relate scientific knowledge with her personal thoughts. Such high-level initiations (as in lesson 2 and this lesson) did influence, actually, the teacher's reaction to make her share with pupils the control over the talk which produced, eventually, a Dialogic type of talk.

Analysis of Case 2, Stage 1, Lesson 5, Episode 1,3,5,7,8

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S | Utterance | Move | I | R | F | Remarks |
| 1.T | …so what are the new concepts in the lesson that you want to know about? Yes S1 | I | H |  |  | …talks about the practical activity 2  \* H: open question asking for pupils thoughts |
| 2.S1 | Red phenol | R1 |  | L |  | \* L: she is asking about a concrete concept |
| 30T | Ok. Red phenol. This is may be a new concept to you. So red Phenol (B). what's else? S2 | F  I | H |  | C0 | (B): T writes on Board |
| 4.S2 | Basically what do we mean by the evidences of chemical change | R2 |  | H |  | \* H because she is asking about an abstract concept |
| 5.T | Evidences. Good. The definition of the evidences of chemical change. The word evidence here. Any other concept that you need? Is there another concept you wanna know about in this lesson? Yes S3 | F  I | H |  | C0 |  |
| 6.S3 | Soda | R3 |  | L |  | \* L: the concept is well known, and T also answers it immediately |
| 7.T | Don't you know it? It's the sodium carbonate used in cakes and other stuff. You can find it at home (). That’s it? So these are the main concepts… | F |  |  | Ev | () S3 nodded positively  … T continues in an I/A talk |
| 1. T | …Your friend's asked about the Red Phenol as a new concept. Red Phenol. An indicator. What do you know about the word indicator? Yes S1 | I | H |  |  | …talk about the experiment and connects between the previous example and this one  \* H because the question is open, not specified to red phenol or to a definite aspect of indicators |
| 2.S1 | It is, mean a substance whether a solution or a precipitate () | R1.1 |  | H |  | () in Arabic, she used the meanings of these 2 words as adjectives rather than nouns which indicates that she meant to say a liquid or a solid and it seems that T got it  \* H: CP of 'Understand, explain' |
| 2.T | Beautiful | F |  |  | Ev |  |
| 3.S1 | Or substances from nature like tea leaves | R1.2 |  | H |  | \* H: CP of 'Understand, explain' |
| 4.T | Excellent | F |  |  | Ev |  |
| 5.S1 | This substance () is used to know if the acid is alkali, I mean if the solution is alkali, if it is more than thing | R1.3 |  | H |  | () S1 means the indicator  \* H: CP of 'Understand, explain' |
| 6.T | Just to know acidic or alkali generally? | F | H |  | EL | \* H: CP of 'Understand, explain' |
| 7.S1 | Or maybe if it's chemical or physical | R1.4 |  | H |  | \* H: CP of Understand, infer' |
| 8. T | Beautiful. Means it indicates something is happening. May be as you said, acidic or alkali. What's important, it shows something, well done. Indeed the indicator in general as your friend's said can be a liquid. It can be leaves… | F |  |  | Ev | … T continues a NI/A talk about indicators |
| Example 3 | | | | | | |
| 1.T | …after that? 2 | I | L |  |  | …talk about the change in step 1  \* L: CP of 'Understand; classify' |
| 2.S1 | We put 2 ml of Calcium Chloride and added it to the solution of the Phenol and water, and the change..Umm..chemical cause we noticed a fall in the temperature cause it was 25 and became 24 | R1 |  | H |  | \* H: CP of 'Understand; explain' |
| 3.T | Beautiful. This is an observation in their group. Are there other opinions in groups? | F  I | L |  | C0 | -S2 raises her hand  \* L: CP of 'Understand; classify' |
| 4.S2 | During the mixing, the temperature hasn't changed. It remained constant, Umm..normal, constant | R2 |  | L |  | \* L: CP of 'Remember; describe' |
| 5.T | Constant. It hasn't affected the temperature. Good, other groups? | F , I | L |  | C0 | -S3 raises her hand |
| 6.S3 | With us, there's no effect on the temperature and the colour of the solution hasn't changed | R3.1 |  | L |  | \* L: CP of 'Remember; describe' |
| 7.T | No change in colour, so you consider it a change what? | F | L |  | EL | \* L: CP of 'Understand; classify' |
| 8.S3 | Physical | R3.2 |  | L |  |  |
| 9.T | Your group S4, what do you have? | I | L |  |  | \* L: CP of 'Understand; classify' |
| 10.S4 | It went up a little | R4.1 |  | L |  | \* L: CP of 'Remember; describe' |
| 11.T | Went up. Sure? By touch or by the thermometer? | F | L |  | EL | \* L: CP of 'Remember; recognize' |
| 12.S4 | Thermometer | R4.2 |  | L |  |  |
| 13.T | Ok, this is your opinion, your group? () | F, I | L |  | C0 | () T indicates to a new group |
| 14 S5 | Chemical | R5.1 |  | L |  |  |
| 15.T | Chemical, why? () You had a thermometer or by touch? | F | L |  | EL | () T S5 is showing hesitation |
| 16 S4 | By touch | R5.2 |  | L |  |  |
| 17.T | What happened to the temperature? | F | L |  | EL | \* L: CP of 'Remember; describe' |
| 18.S5 | The temperature, after, Umm.. increased | R5.3 |  | L |  |  |
| 19.T | So you agree, by touch. Maybe an increase. Ok, the remaining group?  What do you consider the kind of change? | F  I | L |  | C0 | \* L: CP of 'Understand; classify' |
| 20.S6 | Physical | R6.1 |  | L |  |  |
| 21.T | Physical, why? | F | H |  | EL | \* L: CP of 'Understand; explain' |
| 22.S6 | Cause the colour of the substance didn't change and, and -- no heat, normal | R6.2 |  | H |  | -- hesitation |
| 23.T | You depended on touch or thermometer? | F | L |  | EL | \* L: CP of 'Remember; reconize' |
| 24 S6 | Touch | R6.3 |  | L |  |  |
| 25.T  26.T | Ok -  In relation to the touch, we can't say it's a precise measure to examine a change in temperature because…For the other groups they mentioned that adding Calcium Chloride hasn't changed the colour … | F  F |  |  | C0  Ev | - Pause  …T continues a NI/A talk |
| Example 4,5 | | | | | | |
| 1. S1 | But Miss, for example, baking the cake, is this considered a chemical change? Cause it changes, cause its taste isn't as before | IS.1 | L |  |  | \* L: Simple question related directly to the explained information |
| 2.T | We will come to this in successive lessons | FT.1 |  |  | Ev | \* T is not providing an answer so it's not categorized as response |
| 3. S1 | But what's the evidence in baking the cake? For example, its colour doesn't change cause every thing has its colour | IS.2 | L |  |  | \* L: Simple and showed mistaken conception |
| 4.T | S1 is asking. Good . She is saying that when baking the cake, right? You have the bread soda. You put Soda Bicarbonate.  So then, what's the evidence of a reaction or a change? Yes S2 () | FT.2  IT | L |  | C0 | \* Here it's more obvious, than turn 2, to categorize it as F and not R  () S2 raises her hand  \* L: CP of 'Understand, identify', because T mentioned 'Bread Soda' known to the pupils |
| 5. S2 | It blows-up | R2.1 |  | L |  | \* L: CP of 'Remember; describe' |
| 6.T | Blows-up, so what happened? | F | H |  | EL | \* H: CP of 'Understand; explain' |
| 7. S2 | Chemical reaction | R2.2 |  | L |  | \* L: CP of 'Understand; classify' |
| 8.T | Yeah, but what's the evidence? Blowing-up means what? () | F | H |  | EL | () different answers can be heard by pupils  \* L: CP of 'Understand; explain' |
| 9. S2 | Rising of a gas | R2.3 |  | H |  | \* L: CP of 'Understand; explain' |
| 10.T | Rise of gases. Good. Because a gas rises. This leaded to what? The blowing-up of the dough or the cake in general. This indicates a change. This is one of the evidences and we'll come to this when discussing reactions and foodstuff and its relation to what? Chemical change whether… | F |  |  | Ev | … T continues a NI/A talk |
| 1. S1, | (…?)S1: The growth of human being, Is it a physical or a chemical change? | IS.1 | H |  |  | (…?) this is the meaning of a small exchange of talk between T and S1 but the exact words are not audible because it happened at the end of the lesson when all the pupils were busy writing in their textbooks  \* H: CP of 'Analyze; deconstruct', Complex question |
| 2.T | What do you think? | IT.1 | H |  |  | \* H: CP of 'Create; hypothesize' |
| 3. S1 | The change happens in his/her height, width, size but then s/he can't return back to what s/he was before. | IS.2 | H |  |  | \* S1 is expressing her confusion whether to consider it physical or chemical, and so this move is characterized as an I and not R  H: CP of 'Analyse; deconstruct', complex answer |
| 4.T | What do you think, physical or chemical? ()  A very beautiful question. The body of the human being grows in general, but your friend is saying that of course it cannot be returned to what he was since he was young. A change has happened, an increase in his size, height, width and so on. Right? What's the kind of change in this case? | IT.2 | H |  |  | () most of the pupils were wondering what the question is about, So T chooses to repeat their mate's question and confusion  \* H: CP of 'Create; hypothesize' |
| 5. Sg | Chemical | Rg |  | - |  | \* cannot be categorized without explanation |
| 6.T  7.T | Chemical. Because you suppose it can't be gotten back ()  I'll give you a simple example. I won't focus on all the different parts of the body…For example, the stomach, it churn up the food and mix it with the acid, the hydrochloric acid. You know that the stomach produces the gastric juices, right? It mixes with the food and it works on transforming the food. These are chemical reactions. Ok? But there is a physical change in your bodies in respect to the growth in the number of the cells in the human body. Focus precisely on the number of the cells. Also physical changes in the filtration process and…for example, the kidney, what happens in the kidney? () | F  F  I | - |  | C0  Ev | () a group of pupils raise their hands to answer but the teacher choose to control the talk at this stage  () T starts a short I/A talk to practice then again a NI/A one |

**2. Characterizing the talk**

|  |  |
| --- | --- |
| Class of the talk | Teacher-Pupil talk   * Example1, Turns 1-5 : I/D - Turn 5-7: I/A * Example2, Turns 1-8: I/A - Turn 8: NI/A * Example3, Turns 1-25: I/D - Turn25: NI/A   Pupil-Teacher talk   * Example4, Turns 1-10: I/A - Turn10: NI/A * Example5, Turns 1-4: I/D - Turn 4: NI/A |
| Purpose of the talk | * Example1: Opening up an issue (Identifying pupils' vague concepts ) * Example2: Working on the issue (Explaining the scientific concept) * Example3: Working on the topic (Investigating pupils' observations and opinions)   Pupil-Teacher talk   * Example4,5: Responding to pupil's questions |
| Content of the talk | * Example, I/D, I/A: Personal views of Theoretical Scientific subject matter * Example 2: Personal/Scientific views of Theoretical Scientific subject matter * Example3: Personal views of Theoretical/Empirical Scientific subject matter   - Example4,5: Scientific view of Theoretical Everyday/Scientific content |
| pattern of the talk | * Example1, I/D: I-R1-C0-I-R2-C0   I/A: I-R3-Ev   * Example2, I/A: I-R1.1-Ev-R1.2-Ev-R1.3-EL-R1.4-Ev   NI/A: ---   * Example3, I/D: I-R1-C0-I-R2-C0-I-R3.1-EL-R3.2-I-R4.1-EL-R4.2-C0-I-R5.1-EL-R5.2-EL-R5.3-C0-I-R6.1-EL-R6.2-   EL-R6.3-C0  NIA: --- (EV)   * Example 4, I/A: IS.1-Ev-IS.2-C0-(IT-R2.1-EL-R2.2-EL-R2.3 -Ev)   NI/A: ---   * Example5, I/D: IS.1-IT.1-IS.2-IT.2-Rg-C0   NI/A: --- (EV) |

**3. Quantitative indicators**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Class of talk** | Question (Cognitive level) | | Response (Cognitive Skill) | | Follow-up | | |
|  | Low | High | Low | High | Ev | C0 | EL |
| Ex1, Dialogic |  | 2 | 1 | 1 |  | 2 |  |
| Ex1, Authoritative |  | 1 | 1 |  | 1 |  |  |
| Ex2, Authoritative |  | 2 |  | 4 | 3 |  | 1 |
| Ex3, Dialogic | 11 | 1 | 10 | 2 |  | 5 | 6 |
| Ex4, Authoritative | 3 | 2 | 2 | 1 | 2 | 1 | 2 |
| Ex5, Dialogic |  | 4 |  |  | 1 | 1 |  |

**4. Narrative account**

Five examples have been chosen from the last lesson in this stage because more talk has been uttered through. The first three examples represent a teacher-pupil talk where the last two examples symbolize a talk initiated by pupils.

Although the first example is a small one, it has been classified into two classes of talk of Interactive/Dialogic (turns 1-5) and Interactive/Authoritative (turns 5-7). The two classes characterize, in general, the purpose of opening up an issue. Most specifically, the talk was built over the aim of the teacher to identify what the pupils believe are incomprehensible concepts in relation to the experiment planned to be performed during the lesson. This purpose in itself is what has driven the first part to be Dialogic, while S3's response in turn 6 is what has shifted the class of the talk to be Authoritative.

The two parts follow the normal pattern of moves of I-R-F. They differ, though, in the nature of the follow-up move. In the Dialogic part, the teacher just comments on the pupils' contributions with neither providing any kind of evaluation, nor even elaborating them (I-R1-C0-I-R2-C0). However, when S3 asks about the known concept of the Soda, the teacher chose to react authoritatively by giving an evaluative feedback in explaining what is meant by it and relate it to everyday experience (I-R3-Ev).

In this simple Dialogic example, there is a good point to be spotted. Although the characterized examples so far do not illustrate any significant difference in the cognitive skills, there is a higher probability for the talk, with lower-control from the teacher, to offer a chance for responses with high cognitive skills. In this excerpt, for example, the teacher initiated an open question. The first pupil's response was of a low cognitive skill as she was asking about a concrete concept of 'Red Phenol'. The second response was of a high cognitive skill, however, because S2 was thinking of an abstract concept of 'evidences'. In fact, the lack of understanding of this concept; why certain observations are recognized as evidences and when to consider them as evidences and when not, is a main cause for the pupil's difficulties in deciding about the kind of change whether physical and chemical.

The teacher did respond to S1's query about the concept of 'Red Phenol' as the discussion of the second example in the next section will show. Unfortunately, she did not open a deep discussion about the word 'evidences'. She just focused on listing the four evidences based on the practical activity, as all the teachers in the pilot and the main studies have done; the expected performance normally. What I want to say here, is that the Dialogic talk in this excerpt could stimulate a pupil's response that could have affected the learning outcomes positively, if elaborated.

In the second example, the teacher responds to part of the talk initiated in the first example by opening a discussion about the concept of Red Phenol which has been stimulated by S1 previously. The talk here stands for the purpose of working on the issue as the teacher was trying to explain what has been introduced before. This excerpt illustrates an Interactive/Authoritative talk (turns 1-8) and ends with a Non-Interactive/Authoritative one in which the teacher was evaluating what has been said and reviewing the scientific view about it.

The Interactive part is another example of a low-level Authoritative talk as the whole excerpt is exchanged between the teacher and only one pupil; similar to the first example from lesson 4. This example is also distinctive with its pattern of moves as it starts with an initiation from the teacher, but goes on without any other initiation (I-R1.1-Ev-R1.2-Ev-R1.3-EL-R1.4-Ev). It is striking to see how the control over the talk is highly shared between the teacher and S1 although the talk has been classified as Authoritative. It is Authoritative in the sense that the teacher was looking for the scientific view. S1 has provided responses that reflect high cognitive skills and which present the desired scientific view at the same time. The teacher followed-up these responses by appraising S1, elaborating for more explanation and confirming what is said, and this is what makes it Authoritative, but of a low-level of authority. It is worth to highlight here how the low-level Authoritative talk imitate the Dialogic one in terms of the pattern of moves, the share of control and its capacity to invite responses of high cognitive skills.

Example 3 is another example of an Interactive/Dialogic talk initiated by the teacher that ends with a Non-Interactive one in its last turn. It is different from the ones before in this stage, though, because it is the first and the only Dialogic type with such a long exchange of talk (25 turns) and various participations (6 pupils). The talk is initiated here to start working on the intended issue by investigating some of the pupils' observations of the performed experiment in this lesson and their opinions of the kind of the change based on these observation. Again, the nature of the purpose is what has specified the talk in this excerpt to be Dialogic. The nature of its theoretical content about the pupils' opinions and its empirical content about the pupils' observations, have also contributed in keeping the dialogic flavour of this excerpt for 25 turns.

In its pattern of moves, the excerpt also shows an interesting collection of sub-patterns of moves as the teacher's follow-ups and the pupils' responses were differing from a group to another (I-R1-C0-I-R2-C0-I-R3.1-EL-R3.2-I-R4.1-EL-R4.2-C0-I-R5.1-EL-R5.2-EL-R5.3-C0-I-R6.1-EL-R6.2-EL-R6.3-C0). Although we can see here an initiation each time the teacher starts the talk to each group, the content of the initiation is actually the same. It has been repeated by the teacher as a matter of organizing the discussion as a necessary part of the control over the talk that she shared vastly with the pupils.

One the other hand, the responses of pupils here reflect low cognitive skills and do not support, thus, a high quality of learning in terms of this outcome. However, this can be easily understood within the content; an empirical about direct observations and a simple theoretical of deciding about the kind of change. The learning outcomes, though, can be approached from the participation side. Six pupils have participated in a direct exchange of talk with the teacher, but they were, actually, expressing their groups' views. This means that all possible responses, approximately, had been enlightened, the thing that represents in itself a positive learning outcome.

The last two examples from this lesson stand for the talk initiated by pupils. The first example presents a second excerpt of an Interactive/Authoritative talk initiated by a pupil in addition to the example from the second lesson. The nature of the content of that example concerning a procedural question is what motivated the teacher to respond in an authoritative way. In this example, though, it looks like the simplicity of the pupil's question and its direct relation to the topic of the lesson is what has drawn the talk to be Authoritative. At the beginning, the teacher reacted to the question by trying to discard it to successive lessons when the reactions and foodstuff will be discussed in more details. However, the pupil moves the question to be more relevant to the evidences. Here, the teacher used the question to direct the attention to certain evidence; the rise of gas. When she rephrased the question for the rest of the class, she meant to mention the 'Bread Soda' although S1's initial query does not show any reference to this chemical substance. As intended, S2 responded positively to the hint provided by the teacher. The teacher then elaborated S2's responses from turn 5 till she reached the exact answer of a rise of a gas in turn 9. She appraised then S2's answer and carried on a Non-Interactive/Authoritative talk about this particular example and about the chemical change in general.

As stated, the low level of the question initiated by the pupil in this excerpt might be perceived as to specify the type of the talk to be Authoritative. Although the pattern of moves started to take the sequence of IS, FT between turns 1 and 4, it changed to follow the pattern of I, R, F in teacher-pupil talk. This shift happened when the teacher has directed S1's question to the class to answer it.

The second example shows a very interesting query of a high level about the growth of human being. The teacher liked the question and responded initially in a dialogic way. She asked the pupil who initiated the question about her opinion who has expressed, in fact, her confusion on whether this considered as a chemical or a physical change. Then the teacher chose to speak out the question and S1's confusion to the rest of the class who were busy with copying some of the information from the board, and so did not hear the question. The immediate response from most of the pupils was chemical although some have said physical, but it seems that the teacher could hear only the answer chemical. She then repeated S1's view which regards the human growth as a chemical change in the sense that the human body can not return back to what it was before. She did this in her following-up (turn 6) to the pupils' answer in turn 5 and appeared as she was asking a question which motivated a group of pupils to answer positively. The tone of her voice, though, suggests that she was talking to her self loudly, which indicates her concurrent thinking about the query while exchanging the talk with the pupils.

Thus, the teacher exchanged a Dialogic talk to explore the pupils' thoughts about the question and has not evaluated their answers till she took the control over the talk (turn 7) to speak in details about her personal view of what she considers the right scientific explanation. Though, the teacher could have opened a longer Dialogic talk about it as a number of pupils expressed their desire to utter their thoughts about it. This talk, however, has taken place at the end of the lesson; the thing that might have affected the teacher's decision to take the authority and presents the possible right explanation.

This excerpt demonstrates, as other three previous examples of a pupil-teacher talk have shown, that the pupils' initiation of a high cognitive level is most probable to stimulate a Dialogic exchange of talk. This talk entails usually a mixture of scientific and everyday content which allows both the teacher and the pupils to relate the scientific content to everyday experiences, which in turn can be perceived as a positive learning outcome. It also illustrates an interesting pattern of moves and one that is totally different from the usual patterns (IS.1-IT.1-IS.2-IT.2-Rg-C0). In this pattern, it is easy to see how the control over the talk is shared by the teacher and the pupil who initiated the talk basically.