Primary teachers’ understanding of science and its impact on student learning

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Abstract

The educational reforms introduced in 1997 brought several changes to the Sri Lankan primary education. Environment Related Activities is an integrated subject introduced to the primary curriculum through reforms. Science is not directly included in the primary curriculum and it is integrated in Environment Related Activities. The aim of the study was to study the teachers’ knowledge and understanding of science subject matter and its influence on student learning. A qualitative study was conducted selecting three schools as research sites. Data collected with the use of participant observation, semi-structured interviews and documents were qualitatively analysed. Inadequacy of teachers’ science subject matter knowledge was evident from different lessons including bulbs, mirrors and reflection, sunlight, food and growth, comparing leaves, sink and float, sunlight and shadows and dissolving things in water. Teachers’ lack of subject matter knowledge resulted in developing misconceptions of students which acts as a barrier in future learning.

Key words: science, subject matter knowledge, student learning, misconceptions

1. Introduction

The education reforms introduced in 1997 resulted in several changes in the primary education in Sri Lanka and those changes were made in the structure, curriculum, teaching learning process and assessment. The new primary curriculum includes a language area and three other subjects; Mathematics, Religion and Environment Related Activities. Science is not directly included in the primary curriculum like in some of the countries and it is integrated in the new subject Environment Related Activities (ERA.) Certain other subjects that are Health and nutrition, Aesthetic subjects, Creative Work and Physical Education are integrated in this new subject. As it is emphasized in the grade one and two syllabi, teacher guides and according to Vitharana and Karunaratne (2005) the objective of integrating science through ERA in the primary stage is to develop science process skills of students which required them to learn science in the secondary stage. The foundation of learning science in the primary stage is crucial because if students possess misconceptions it will become a barrier in learning science in the later stages of education. Quite a large number of researches have been conducted in the literature related to primary teachers’ confidence in teaching science in other countries. (Appleton,1992; Harlen 1997; Holroyd & Harlen, 2006; Harlen & Holroyd, 2007; Appleton 2007). However in Sri Lanka only a very few studies have been conducted in the area of science education.
Sri Lankan primary stage of education is divided into three stages as key stage one, key stage two and key stage three. The aim of the research is to study about the primary teachers understanding of science and to find out its effect on student learning at key stage one which includes grade one and two.

2 Methodology

A qualitative study was carried out in three selected schools. Research sites were selected considering five criteria; simplicity, accessibility unobtrusiveness permissibleness and participation suggested by Spradley (1980) as cited by Burgess (1984).

2.1 Data Collection Methods

Data were collected with the use of participant observation, interviews and documents.

2.1.1 Participant observation
Total numbers of 129 lessons were observed from twelve teachers from grade one and two and transcripts were prepared for each lesson. The observed lessons were belong to different themes of the grade one and two ERA syllabus (Table 1.1). Teachers for classroom observation were purposively selected after discussing with them. Consent forms were obtained from each teacher prior to observations in order to maintain ethical considerations. Pseudonyms were used for the teachers and schools to maintain confidentiality.

2.1.2 Interviews
On the basis of the gathered data from observation, semi-structured interviews were conducted with twenty teachers including some of those observed. Interview transcripts were prepared for each interview with the help of the recorded data and field notes. [ 

2.1.3 Documents

Students’ notes, some of the artifacts, worksheets and curricular materials like grade one and two syllabi and teacher guides were studied as documents.

2.2 Data Analysis

Data gathered from participant observation, interviews and documents were qualitatively analyzed using thematic analysis and three themes were developed. In this article it is expected to present the results related to the theme science knowledge of teachers.

3 Results and discussion

Teachers’ understanding of science and its impact on learning will be discussed under sub headings. The evidences for knowledge and understanding on science are given under sub titles; bulbs, sunlight, mirrors and reflection, light sources, food and growth and comparing leaves.
3.1 Bulbs

Mrs. Waruni was a graduate teacher with a National Diploma in teaching. While she was conducting a lesson under ‘Play with light’ theme the discussion went with the students as given below.

<table>
<thead>
<tr>
<th>Miss. Waruni:</th>
<th>In your houses you have different methods to decrease and increase light. If you want large amount of light you have to use a large bulb and what type of a bulb do you use if you want less amount of light?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children:</td>
<td>Small bulbs</td>
</tr>
<tr>
<td>Miss. Waruni:</td>
<td>You have to find this type of different methods (Field notes)</td>
</tr>
</tbody>
</table>

This discussion led to build up a misconception that the amount of light depends on the size of the bulb. Though the children already have seen same size of bulbs with different wattage 25W, 40W and 60W in their houses, no one questioned the teacher. It is evident from the discussion that teachers’ lack of understanding about how the intensity of a light bulb varies with its wattage.

3.2 Mirrors and Reflection

There were instances where teachers were not very much concerned about their drawing necessary to facilitate the learner to understand science concepts. It was a lesson on mirrors and reflection. Mrs. Nimali who was a primary trained teacher stroke a torch light to a flat mirror and drew it on the blackboard as in Figure 3.1.

Mrs. Nimali’s drawing contradicts the laws of reflection because the angle of reflection is not equal to the angle of incidence. According to the way she drew the ray of light, the reflected ray should be marked on the same line. Although, Mrs. Nimali drew the diagram given in the textbook (Figure 3.2) she did not notice the position of the mirror there. Mrs. Nimali just copied on the blackboard without considering the position of the mirror. This indicates that the teacher did not have a clear idea about mirrors and reflection.

3.4 Sunlight

Use of terminology without having a proper understanding was evident from the observed lessons. Mrs. Perera was a primary trained teacher working at Nelungama K. V. She talked about the different ways of obtaining coloured lights when she prepared frames pasting various coloured tissue papers on them. After preparing those frames the children were taken outside and they enjoyed seeing different colours through frames. This activity was followed by a discussion as indicated below.

<table>
<thead>
<tr>
<th>Mrs Perera :</th>
<th>What colour do you see through the frames when you look at the sunlight?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amal:</td>
<td>The colour of the paper we pasted.</td>
</tr>
<tr>
<td>Mrs. Perera:</td>
<td>The shadow of the sun falls the earth. You can see it in the colour of your paper. Is n’t that so?</td>
</tr>
<tr>
<td>Students:</td>
<td>Yes. (Fieldnotes)</td>
</tr>
</tbody>
</table>

Teachers need to be very careful in using terminology especially at early years of schooling. Teachers’ lack of understanding on the concept of shadow led the students to learn misconceptions. It is not the shadow of the sun, it is the light of the sun or sunlight. It was evident that Mrs. Perera was unaware of that a shadow of an object is formed when it blocks out the light.

There were several other instances where teachers made incorrect explanations and statements in the ‘Play with light’ theme in the grade one and grade two classes. Mrs. Siriwardana was a graduate teacher with a National
Diploma in Teaching. When she was conducting a lesson she went on explaining and asked, “The sunlight falls on the trees and then it falls on the floor.” The children listened very attentively without uttering a word (Fieldnotes) Her statement indicated that the leaves of trees are like mirrors, which reflect light.

Mrs. Weerasena was a primary trained teacher with thirty years experience. In her lesson on mirrors she held the mirror directing sunlight into a basin of water. Children were asked to do the observations. Then she asked, “Now look at what happens. You see the shadow very clearly. Isn’t that so? Now what happens to the shadow when the mirror is changed?” (Fieldnotes). Like Mrs. Perera, Mrs. Weerasena also used the terminology ‘shadow’ without having a clear understanding. It is very important to be confident with the subject matter before working with the children. The following field notes show how Mrs. Nimali proceeded with the same lesson on sunlight in grade two.

Mrs. Nimali: Sunlight consists of different colours. It is very important. How does petals of flowers and Crotons get those colours? It is due to the sunlight. (Fieldnotes).

It was pleasing to hear the first sentence. Although pigments mainly responsible for colours of petals and leaves, inadequacy of her subject matter knowledge led the children to understand that the colours of petals and leaves are the colours of sunlight.

Mrs. Jayakody who was a primary trained teacher discussed about the sunlight in a lesson on the ‘Play with light’ theme in grade two. She built up the lesson using following discussion.

Mrs. Jayakody: How did you feel sunlight yesterday and the day before yesterday?  
Students: It has been reduced.

Mrs. Jayakody: Now it reduces gradually. Isn’t that so? Were you able to go outside of your houses last few days?
Students: We could not go.  
(One student explained one of her experiences.)

Ayesha: Madam we have an ‘Amberella’ tree in our garden. The leaves of that tree have turned yellow and fallen.

Mrs. Jayakody: It is due to increasing sunlight. Isn’t that so? Now do you see much sunlight? (It is about 11.30 a.m. but it was not a sunny day)

Students: No

Mrs. Jayakody: Now you cannot see your shadow. So there are situations when the light of the sun is more or less (Fieldnotes).

The last statement implies that the amount of sunlight can be decreased or increased. As we know the amount of sunlight is fixed and it does not increase or decrease but how we feel it, whether it is hot or not differs according to the time of the day. It happens due to the rotation of the earth in its axis and the location of our country in the earth close to the equator. As a result of the lack of basic understanding on the part of the teacher, children get misconceptions which acts as a barrier in constructing new knowledge in the secondary classes.
Mrs. Siriwardana in grade one built up the lesson on sunlight discussing with children as given in following field notes.

Mrs. Siriwardana: Can you remember few days before the rain? The sunlight was very hot. Isn’t that so?
Students: Yes
Mrs. Siriwardana: Those days the sun was very hot. Isn’t that so?
Students: Yes
Maheshi: We couldn’t walk along the road without slippers.
Mrs. Siriwardana: Yes, the sun is hotter than other days. Isn’t that so? What did it absorb from the earth, as the sun is much hot?
Students: Damp
Ramesh: It absorbs down.
Mrs. Siriwardana: Then what did we experience those days?
Students: Our feet became hot (Fieldnotes)

As a result of her explanation, the children are liable to misunderstand that the heat of sunlight varies according to the days. But as we know it does not change, how we feel the sunlight varies according to the position of the earth when it rotates around the sun. Except that there is another important thing. The teacher asked the children what the sunlight absorbed from the earth. When the children gave two answers, ‘damp’ and ‘absorbs down’ the teacher was silent and did not discuss it again. The sunlight does not absorb water; water evaporates as the result of heat from the sunlight. When children provide wrong answers it is the responsibility of the teacher to rectify their misconceptions by providing situations with hands-on experience to make them realize their mistakes by asking appropriate questions. In this situation she could have taken the children outside and allowed them to observe evaporating water from the wet soil or from a damped piece of cloth and conducted a live discussion on that experience. In this particular lesson the specific objective related to the sunlight is the ‘Students will understand that we obtain most amount of light from the sun’ (Syllabuses and teacher guide, Grade 2.) However, Mrs. Siriwardana hadn’t got the idea about the specific objective of the lesson therefore she went on explaining unnecessary things.

### 3.5 Food and Growth

Mrs. Jayakody who worked at grade two went on describing kinds of food and how they affect the growth of the body while she was handling the theme ‘The food we eat and drink’ as below.

Mrs. Jayakody: When you take dried fish, meat, fish, eggs and milk you will be able to be active and play and also do your school work well. The bones of your brain and head should grow in order to work well. (Fieldnotes).

She continued describing while the children were listening to her attentively. Although she told ‘bones of the brain’ the brain is a soft organ without any bones. Mrs. Jayakody may have misunderstood the brain with the cranium, which is made up of 8 bones.
3.6 Comparing Leaves
I could observe lessons where children developed misconceptions as a result of explaining unnecessary things. Mrs. Nimali took her children outside the classroom to teach them about plants in the school garden. While the children were in the garden teacher asked questions and compared a coconut tree and a mango tree as indicated below.

Mrs. Nimali: Now I am going to ask you a lot of questions. Are these two leaves similar?
Naduni: No
Anushi: Madam coconut leaves are long and the mango leaves are not long.
Mrs. Nimali: Yes, Now look at this. (Showing mango leaf)
Dilni: Madam, short

Mrs. Nimali: Yes, mango leaves are short. A coconut tree has a lot of leaves in one branch. Doesn’t it? Wait till I get a leaf. (She picked up a mango leaf). This is a leaf of a mango. I cannot pluck a branch of a coconut tree. Now one branch of coconut consists of many leaves (Fieldnotes)

Mrs. Nimali compared two leaves by holding a mango leaf with her hand and showing a coconut leaf. She compared a leaf of a mango tree with a leaflet of a coconut. According to Mrs. Nimali mango leaves are short, but it is incorrect. As she has tried to explain unnecessary facts learning outcomes of the lesson were left out.

3.7 Sink and Float
It was the first lesson of ‘Play with Water’ theme at grade one in Mrs. Siriwardana’s class. She had planned a lesson for the specific objective ‘Select objects which float and sink in water’. After spending five minutes in introducing the lesson, she discussed with the children asking several questions.

Mrs. Siriwardana: Now, answer this question. When we put a coconut into a river does it remain above the water or below the water?
Several students: Below
Others: Above
Iresha: It goes down. It does not float, as it is heavy.
Mrs. Siriwardana: Does it sink or float?
Most of the students: Float.
Mrs. Siriwardana: Coconut does not sink. It floats. Why is that?
Iresha: It floats, as it is not heavy.
Mrs. Siriwardana: If we put a coconut removing the husk, does it sink or float?
Several students: Sink.
Mrs. Siriwardana: Why is that?
All students: Because it is heavy.
Mrs. Siriwardana: When the husk is removed, it sinks, as it is heavy. What will happen if we put a coconut with the husk?
Several Students: It floats, as it is not heavy.
Mrs. Siriwardana: It floats, doesn’t it? Husk does not have a weight. Do you think the husk has got any weight?
Some students: No
Mrs. Siriwardana: No
Mrs. Siriwardana: Husk does not have a weight. It does not absorb water. If it floats for a long time in the water it will sink due to the absorption of water (Fieldnotes)
Moreover in her discussion she repeated the same question several times changing the objects whether they float or sink in water. When she asked about a tyre, feathers and coconut leaf noises of children echoed, “It floats as it hasn’t got a weight.” According to Mrs. Siriwardana, coconut husk and other objects (tyre, coconut leaf, feathers) haven’t got any weight but there are no objects without weight. Even a very tiny particle like an atom has a weight. Mrs. Siriwardana’s perception of weight was revealed at another occasions in the discussion with the students in the same lesson.

Mrs. Siriwardana: When we put a brick into water does it sink or float?
Gayathri: Sink
Mrs. Siriwardana: Hands up those who know.
(Student raised their hands)
Mrs. Siriwardana: Anushka
Anushka: Float
Mrs. Siriwardana: Doesn’t it sink?
Anushka: Sink
Mrs. Siriwardana: Son, It sinks, as it is heavy (Fieldnotes)

How Mrs. Siriwardana concluded the discussion prior to the activity was really surprising.

Mrs.Siriwardana: Then what will happen to the heavy things in water?
Students: Sink
Mrs. Siriwardana: Light things?
Students: Float
Mrs. Sriwardana: Now you have to do it and see (Fieldnotes)

Children had already come to a conclusion before doing the activity. This resulted in lack of motivation and interest towards the activity. In handling the activity each group was provided with a basin of water to put miscellaneous objects (a nail, flower, cotton wool, and rubber seeds) they had. The teacher asked a question showing each object whether it sinks or floats. After getting responses for all her questions the students were allowed to put the objects one by one into water.

How Mrs. Jayasekara in Randeniya Balika Maha Vidyalaya, planned the lesson for the above specific objective was quite different from Mrs. Siriwardana. In her class each group was provided with a packet of miscellaneous objects and a basin of water to put them without conducting any discussions prior to the activity. Although the children put the objects into basins of water, they were not really interested in what was really happening, because the guidance provided by Mrs. Jayasekara was insufficient to get the active involvement of the children. However, at the end of the sink and float activity Mrs. Jayasekara asked some questions from the children.

Mrs. Jayasekara: Now, can you remember what type of things sink?
Several students: Heavy.
Other students: Heavy things
Mrs. Jayasekara: Yes, heavy things. What type of things float?
Most of the students: Things that are not heavy.
Mrs. Jayasekara: Can you remember those things? (Fieldnotes)
The discussions held in the above two classes led the children to develop the misconception that heavy things sink and light things float. This is not only evident from the lessons in grade one but also from those in grade two. In conducting the first lesson on ‘Play with Water’ Mrs. Godage had planned an activity for two specific objectives ‘Identify direction of water flow’ and ‘Learn that things can be floated in water’. That activity was planned to flow water along banana sheath. On the second day Mrs. Godage started the lesson asking several questions related to the activity done in the previous day as shown in the following fieldnotes:

   Mrs. Godage :  Can you remember that we put different objects into flowing water?
   Students: Yes.
   Mrs. Godage: Heavy things sank. What type of things floated? Others floated. What has happened to the pieces of rigifoam?
   Students: They did not sink.
   Mrs. Godage: Pieces of stones?
   Students: They sank.
   Mrs. Godage : Why is that?
   Students: Because they are heavy  (Fieldnotes)

The misconception related to sink and float is emphasized during the first two years of schooling. This is a very unfortunate situation, because as Das (1985, p.135) indicates, “Once a concept is wrongly conceived, it is very difficult to correct.” It will finally obstruct the concept learning in the secondary stages and even at the tertiary level.

Furthermore inadequacy of subject matter knowledge of Mrs. Siriwardana led her to make some other scientifically incorrect statements during the sink and float activity. After allowing children to put most of the miscellaneous objects they brought, she made a statement, “Now children, everything in this environment either sink or float” (Fieldnotes) without giving any opportunities for children. Children can be easily misled because there are certain liquids like food colouring and vinegar, and some solids like salt and sugar which dissolve in water but neither sink nor float. Furthermore, in the same lesson Mrs. Siriwardana asked, “Children what will happen if anything absorbs water?” Children answered, “Sink.” Then Mrs. Siriwardana asked the children to put pieces of cotton wool into the water. Next several questions followed to emphasize that when anything absorbs water it sinks. Though it is correct in this situation (using cotton wool), it is impossible to make a generalized statement because things like a piece of sponge floats though it absorbs water.

Hence it is clear that most of the teachers do not have a clear idea about the correct concept of sink and float. According to Esler and Esler (1996, p.14), ‘Heavy objects always sink in water and light objects always float’ is a phenomenological misconception, which is associated with misinterpretations of natural phenomena. They further indicate that the best way to correct a phenomenological misconception is to use hands-on experience.

If the same mistake repeats as the sink and float activity the damages to construct knowledge will be serious. As Harlen (1985) states, “The longer the non-scientific ideas have been held, it is difficult to change them.” She further says, “Many children come to secondary science, not merely lacking the scientific ideas they need, but possessing alternative ideas which are a barrier to understanding their science lessons” (p.3.)
3.8 Sunlight and Shadows

Mrs Weerasena took her grade one children outside the classroom to observe (tread on) their shadows. Each pair of children was asked to tread on the shadow of his or her friend. Children enjoyed the shadow game very much. The specific objective related to the lesson on that particular day was, ‘Explain different situations when shadow is changed’. Although the children actively involved in the shadow game they did not learn anything from it. Mrs Weerasena could have easily guided the children to understand how the length of the shadow changes with the time of the day from 9.00 a.m. to 1.00 p.m.

I was surprised when I heard an informal discussion between two teachers of Randeniya B.M. V as given below: Mrs. Jayalatha asked from another teacher, “Tell me, how is the shadow in the morning?” Her friend Mrs. Jayasekara replied saying “It is long in the morning and in the evening (Fieldnotes).” Although I did not observe the lessons of Mrs. Jayalatha I knew later that she wanted to know about the shadow before starting the lesson on shadows the same day. This indicated that Mrs. Jayalatha who is teaching grade one in Randeniya B.M. V. is not sure how the length of the shadow varies with the time of the day. I doubt whether she is able to teach small children without leading them into misconceptions.

I realized that teachers in both grade one and two teach the length and the direction of the shadow by heart without doing any activity. Though the teachers asked the children to observe their shadows they were unable to relate that first hand experience when teaching the length and direction of shadows.

3.9 Dissolving Things in Water

Mrs. Gamlath asked her children to apply things like coconut oil, kerosene, soot, flour, and blue powder and immerse them in water. She had organized this activity for the specific objective ‘Demonstrate that water can be used to separate things combined each other.’ At the end of the activity, the teacher discussed with the children as stated below:

Mrs. Gamlath: You applied different materials on pieces of clothes and immersed them in water. Which material dissolved as soon as immersed in water? Blue powder dissolved. Isn’t that so? Flour also dissolved (Fieldnotes)

Later on in the same discussion, Mrs. Gamlath asked, “Now tell me things that dissolved very soon in water?” Children answered, “flour, soot, blue powder” (Fieldnotes.) According to her, these materials completely dissolve in water. However, all these three materials partially dissolve in water. In the same lesson she further explained as follows:

Mrs. Gamlath: Tell me what happens when we put coconut oil and kerosene oil into water? Do they dissolve like blue powder and flour? Did the coconut oil move down?

Students: Slightly dissolved.

Mrs. Gamlath: Slightly dissolved. A certain amount floated on water (Fieldnotes).

Things like coconut oil and kerosene oil do not dissolve in water. They are insoluble in water. At the end of the activity, the students recorded in their notebooks blue powder, soot and flour as the things that dissolved quickly in water and Mrs. Gamlath marked it as correct as shown in Figure 3.3 and 3.4.
3.10 Colour of Water

There were situations where teachers did not have a clear understanding about simple facts. In the ‘Play with water’ unit in grade two, Mrs. Gamlath asked her children to apply things like paint and soap on pieces of cloth and immerse them in half filled bottles of water. When the children finished doing the activity Mrs. Gamlath started a discussion as follows showing one bottle:

Mrs. Gamlath: What is applied on this piece of cloth? What did you have in the bottle before you immersed this piece of cloth?

All students: White colour water

Mrs. Gamlath: White colour water (Fieldnotes)

Not only Mrs. Gamlath but also three other teachers who taught grade two emphasized misconception that water is white in their lessons in ‘Play with water’ theme. The following excerpt shows how Miss Waruni discussed with children in the same activity described above:

Miss. Waruni: What is the colour of water before you immerse the piece of cloth?

Students: White

Miss Waruni: The bottles had white water. Isn’t that so? (Fieldnotes)

When children answered Miss. Waruni also agreed with them emphasizing making the children believe that water is white. Furthermore Miss. Waruni repeated it several times in her discussion with the children. Mrs. Jayakody in another theme ‘The sky we see’ talked about rainy days. She asked several questions from the children about the colour of raindrops.

Mrs. Jayakody: What is the colour of rain drops?

Students: White

Mrs. Jayakody: What colour was it when it fell down on your compound?

Students: Muddy

Mrs. Jayakody: Why does the colour of white rain drops change into muddy colour?

(Fieldnotes)

Mrs. Jayakody also stressed the colour of water as white several times in her discussion. It is the role of the teacher to correct the children saying ‘colour of water as white’ using a simple demonstration as showing a bottle of milk and a bottle of water. So it is necessary to relinquish this misunderstanding in the early grades.

Out of the twelve teachers observed highest educational qualification of seven were only up to O/L while three had completed up to A/L and two with a B. A degree. It was further revealed from the interviews those who completed A/L and degree too have learnt science up to O/L. According to a study conducted by Lloyd and Smith (1998) with pre-service primary teachers regarding the content knowledge questions, O/L equivalent is insufficient to make any significant difference to success and even the ones who qualified at A/L and studied science during the undergraduate courses were able to answer some questions but not all. Therefore it is clear that the science knowledge only up to O/L is insufficient to teach subject matter related to science even at the primary classes.
4. Conclusions

The study reveals that as a result of lack of understanding of science subject matter knowledge of primary teachers, students develop misconceptions at the early years of their education through Environment Related Activities. Inadequate understanding of science concepts were clear from the discussions that teachers conducted with students. The use of science terminology like shadow without having a proper understanding leads to develop misconceptions in both grade one and two. Inappropriate guidance given by the teacher while doing activities also affected to develop misconceptions. Over explanation, incorrect explanation and incorrect use of scientific terms resulted in developing misconceptions.

When teachers explain expected observation prior to the activities students do not get an opportunity to develop science process skills which is expected through ERA. Lack of paying attention to simple things like colour of water and the shape of leaves was also affects in establishing misconceptions. Science subject matter knowledge of primary teacher is vitally important in teaching ERA. Therefore lack of subject matter knowledge of primary teacher results in developing misconceptions, which acts as an obstacle in learning science in later stages. This was further evident from the study conducted by Karunaratne and Dias (2003) where they emphasize on the subject matter knowledge. The views of educationists show the harmfulness of these misconceptions in learning science in the secondary stage. (Carin, 1993; Esler & Esler, 1996). The results of the study were supported by the literature (Lloyd and Smith, 1998; Harlen and Jelly, 1989; Appleton and Kindt, 1999). Most of the teachers were not confident in teaching science related component in ERA due to their limited science background. It is evident that the science knowledge only up to O/L is insufficient to teach subject matter related to science even at the primary classes.

5. References


Table 1.1 Observed lessons in different themes

<table>
<thead>
<tr>
<th>Theme</th>
<th>Grade one</th>
<th>Grade Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>We and the school</td>
<td>04</td>
<td>06</td>
</tr>
<tr>
<td>Our home</td>
<td>05</td>
<td>08</td>
</tr>
<tr>
<td>Animals in the garden</td>
<td>06</td>
<td>03</td>
</tr>
<tr>
<td>Play with water</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>New year season</td>
<td>01</td>
<td>02</td>
</tr>
<tr>
<td>The sky we can see</td>
<td>09</td>
<td>11</td>
</tr>
<tr>
<td>The things we eat and drink</td>
<td>12</td>
<td>08</td>
</tr>
<tr>
<td>Play with light</td>
<td>12</td>
<td>09</td>
</tr>
<tr>
<td>Different places in the Environment</td>
<td>---</td>
<td>02</td>
</tr>
</tbody>
</table>

Figure 3.1 Teacher’s drawing on the blackboard

Figure 3.2 Diagram given in the textbook
Things dissolved quickly in water

- Watercolours
- Coconut oil
- Blue powder
- Soot
- Flour

Figure 3.3 Students’ recording in a note book – Mrs Gamlath’s class.

Figure 3.4 Translation of the student’s recording in Figure 3.3