Garhwal Region

Mathematics Winter Workshop – 2017

Venue – District Institute, Rudraprayag

From 03-Jan-17 to 06-Jan-17
Mathematics Winter Workshop – 2017

Venue – District Institute, Rudraprayag

Background:

The RtE act direct Indian Education System to insure quality education to each and every child. The primary condition for enabling quality education to every child is having the teachers of better professional capabilities. Our experiences of working in education for many years informs us that the reflection of teacher with better professional capabilities inherits the understanding of curriculum. This means understanding of objective of education and subject which she has been teaching, nature and pedagogy of that subject and along with this having well thought out viewpoint on the economic, social and cultural background of learner. The deep understanding of teachers on abovementioned aspect directly affect the quality of teacher-learner dialogue, educational experience of learner and creates a positive school culture and learning environment. The desire of teachers with such capabilities required continuous institutional interventions and Azim Premji Foundation is contributing to it from past many years. In addition to this the dynamic nature of education reestablished the continuity in professional development programs. Centering these concerns four district of Garhwal – Rudraprayag, Tehri, Chamoli and Pauri organize a voluntary winter workshop at Rudraprayag. Winter workshop at Rudraprayag was continuation of dialogues which were happens in the seeding districts (Rudraprayag, Tehri and Pauri) and at summer workshop at Parsundakhal.

Objective of winter workshop:

Most of the teachers of the group participating in the winter workshop were those who have participated in summer workshop at Parsundakhal and also participant of our voluntary discussion at TLC so while framing the objective, previous discussion kept in mind. This was our repeated concern of many discussion that we need to loosen our subject boundaries and design our events in such a way that it could cover the larger perspective issues of education. So in the winter workshop we kept discussion on corporal punishment and our beliefs, discipline versus physiological need of child of body movement and the notion of quality in education as an integral part of Mathematics winter workshop. In line with above discussion the objectives of mathematics winter workshop decided as below –

1. To establish interrelationship among mathematics subject perspective, pedagogy by taking concept prime numbers
   a) To discuss the method of identifying prime number by sieve of Eratosthenes and bring its historical viewpoint
   b) To generate concept of number of building blocks and develop classroom chart over it
   c) To explore relation of number building block primes and whole numbers
   d) To discuss pattern among the pattern present in the number building blocks
   e) To connect number building blocks with multiplication, division, multiple, factor, divisibility, LCM and HCF
2. To discuss the conceptual and pedagogical aspects of fraction
   a) To discuss historical perspective of fractions
   b) To discuss meaning of fractions
   c) To discuss idea of equivalence and comparison of fractions

Date of workshop – January 03 to 06 2017
Number of participants – 19 Teachers and APF members
Venue – Azim Premji Foundation office Rudraprayag
3. To generate discourse on issues of social perspective of education
   a) To discuss corporal punishment in the school
   b) To discuss child movements vs. discipline in school
   c) To discuss notion on quality in education

Note: Due to the time constraint discussion on the first objective could not happen but it was common consensus that we would discussing first objective in detail in the next summer workshop.

SESSION PLAN:

<table>
<thead>
<tr>
<th>03.01.2017 - Tuesday</th>
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| • Introduction, welcome and icebreaking activity | 10.00 AM - 10.30 AM  
Karan and Ashok |
| • Recall of summer workshop | 10.30 AM - 11.30 AM  
Ashok and Karan |
| • Tea | 11.30 AM - 12.00 AM |
| • Interrelation of prime and natural numbers | 12.00 AM - 01.30 PM  
Ashok and Nupur |
| • Observing pattern in prime number structure of natural number | 01.30 PM - 02.00 PM  
Ashok and Ankita |
| • Lunch | 02.00 PM - 03.00 PM |
| • Perspective of Education - Body movement | 03.00 PM - 05.00 PM  
Sanjay Semwal |

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<th>04.01.2017 - Wednesday</th>
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| • Feedback on previous day | 10.00 AM - 10.30 AM  
Karan |
| • Observing pattern in prime number structure of natural number | 10.30 AM - 11.30 AM  
Ashok and Ankita |
| • Tea | 11.30 AM - 12.00 AM |
| • Relating prime number structure of natural number with multiplication, division, factor, multiple, LCM, HCF, exponent etc. | 02.00 AM - 02.00 PM  
Ashok and Nupur |
| • Lunch | 02.00 PM - 03.00 PM |
| • Perspective of Education - Corporal punishment | 03.00 PM - 05.00 PM  
Jagmohan |

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<th>05.01.2017 - Thursday</th>
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</table>
| • Feedback on previous day | 10.00 AM - 10.30 AM  
Karan |
| • Need and historical perspective of fraction | 10.30 AM - 11.30 AM  
Karan and Ankita |
| • Tea | 11.30 AM - 12.00 AM |
| • Need and historical perspective of fraction | 12.00 AM - 12.30 PM  
Karan and Ankita |
| • Meaning of fraction | 12.30 PM - 02.00 PM  
Nupur and Ashok |
| • Lunch | 02.00 PM - 03.00 PM |
| • Perspective of Education - Notion of quality | 03.00 PM - 05.00 PM  
Naheem |

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| • Feedback on previous day | 10.00 AM - 10.30 AM  
Karan |
| • Meaning of fraction | 10.30 PM - 11.30 PM  
Nupur and Ashok |
| • Tea | 11.30 AM - 12.00 AM |
| • Categorization, equivalence and Comparison of fractions | 12.00 AM - 02.00 PM  
Ankita and Ashok |
Workshop Preparation:
Winter workshop of three districts Tehri, Rudraprayag and Pauri was done together keeping the context seeding districts in mind. The preparation of workshop start with t-con for finalization of objective and finalization of content. Some topic were started for first time and some of them was in the continuation of content of summer workshop. Perspective of subject was dealt with this group in last workshop also so same thoughts with integration with text content was envisaged. In this t-con responsibilities of facilitation also fixed. Post deciding the content facilitator group work upon chosen topic at respective locations. Before workshop a meeting happen for review, demo of sessions of every members. In this meeting we did mock of our session and shared feedback. Also made the list activities and resource material. Decision were taken on the logistic arrangement and purchase. All the team member was coordinating with teachers for participation in the workshop side by side.

Day wise report of Workshop - Day 1: Tuesday (03.01.2017)
Well, the day started with an ice breaking session, an activity which was conducted by two members. Several bigger shape square was cut into five different shapes and was kept in a basket which was distributed among teachers and they need to reform the big square in a group of five teachers and all teachers must have the different shapes in their hand. All the groups of teachers were busy in reshaping the bigger square, at last few hints were given to them how to re-shape it. The efforts were seen between the teachers, the curiosity like a kid to reshape it, which group can do it first.

As all of the group reshape the different pieces to from a bigger square within the time and the groups were made to sit together, then all of the teachers introduced and the learnings from it:

The responses of teachers - This activity will create interest among the kids. It can also be done in school. It will engage the kids, how to reshape the parts to form a bigger square. It will explain the understanding of part and whole. It is an interesting geometry activity. This activity can be done to work in a group. It will make children think. The understanding of sub parts, triangle, rectangle. How to break them and understand the shapes. Whether we keep the plate above the glass or glass over the plate. Easy to break a shape but difficult to re-shape it.
In the wake up, one of the team member laid the discussion of foundation, its values and culture. There is a need of conversation in education which is also in our culture. He quotes that in ancient Indian History in Buddhism or Jainism there is a tradition of intellect conversion also by quoting three types of conversations viz. ‘VAAD’, ‘JALP’ and ‘VITANDA’ and invited all presents to engage in the ‘VAAD’. After that he discussed forthcoming four days agenda of winter workshop. He shared that we will be starting with the summer workshop experience sharing. After that importance and interrelations of prime number and further the pedagogical and conceptual aspect fraction to be discussed. Bringing the context that education is complex endeavor he raised the need of dialogue on the general educational issues like corporal punishment, discipline in school and notion of quality in education.

After the sharing the agenda, discussion opened by asking the question about the questions, activities, topics, issues, area discussed in last summer workshop. With the list come out as -

1. Whether math is abstract or concrete?
2. The concept of L.C.M and H.C.F, what are the learning indicators, use of L.C.M in daily life, examples of L.C.M, what are factors and multiples, the process of finding L.C.M?
3. Sieve of Eratosthenes – Which help us in answering the question how to find prime number from 1 to 100 - Firstly making table from 1 to 100 and then taking 2 and find all multiples and cross the number, in similar way take 3, 5,7,11 and cross all the multiples of them.
4. Area and perimeter
5. Data Handling
6. ELPS (Experiences, Learner, Picture, Symbol)
7. Nature of mathematics, the patterns found in nature like in flower, Fibonacci series.

While writing all these bullets on the white board, facilitator kept asking the probing question about the detail of discussion and added where required. Once the list got prepared further categorization of experience sharing requested under the discussion held on Aims of Mathematics Education, Pedagogy of Mathematics Teaching, Nature of Mathematics and Activities which could be taken to classroom. The responses was below -

<table>
<thead>
<tr>
<th>Aim of mathematics education</th>
<th>Pedagogy</th>
<th>Nature of mathematics</th>
<th>Classroom Activity</th>
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<tbody>
<tr>
<td>• Mathematisation of thoughts(we see one bottle but we can imagine of 20 bottles while talking about 20 bottles ) • Abstract Thinking(how to build a house, where should be the entrance, living room; to think about how the city Mumbai is while living in Srinagar) • Logical Reasoning</td>
<td>The four important pedagogy are -ELPS E-Experience L-Language P-Picture S-Symbol</td>
<td>1. Abstraction 2. Mathematics is a language in which statements are accurate. 3. Contability</td>
<td>How to pictured object, we cannot see everything but we can think it.</td>
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With consolidation on every topic pointer, facilitator told that they would be discussing these issues in more detail when talking about the primes but further we would be discussing fractions. The discussion was facilitated by other member.

After that next member came up to discuss upon the history of fractions. He started the session by a question “where did we first used fraction in our life”. He raised that in his childhood when he divide half of an apple, he said it is divided into two parts, and when it is divided into three parts, then also he said that it is divided into two parts and so on.
The word fraction actually comes from the Latin "fractus" which means to break. To understand how fractions have developed into the form we recognize, we'll have to step back even further in time to discover what the first number systems were like. From as early as 1800 BC, the Egyptians were writing fractions. An extensive treatment of fractions appeared around 1600 B.C. in the Rhind Papyrus, which contained the work of Egyptians mathematicians. The Egyptians did not express fractions as ratios such as 2:5 or 2/5. They expressed ratios in unit fractions. What are unit fractions? A unit fraction is a fraction that has a numerator of 1 and the denominator is a positive integer. For example, 1/2, 1/5, and 1/5 are unit fractions. The Egyptians would then write $\frac{2}{5}$ as $\frac{1}{3} + \frac{1}{15}$

Of course, the Egyptians used their symbols to represent this fraction. $\frac{1}{3} + \frac{1}{15}$ would be represented as shown below:

![Fraction Representation](image)

The way we represent fractions today probably came from the Indian. Around A.D. 630, Brahmagupta would write the fraction two-fourths without the bar as $\frac{2}{4}$.

Then, the Arabs came up with the bar. However, the notation $\frac{2}{4}$ was mostly used due to typesetting constraints. The notion of numerator and denominator came from Latin writers. Up to the sixteenth century, the common denominator was found by multiplying the denominators. In the seventh century, the least common multiple was used extensively when adding and subtracting fractions. He shared a reading among all about the history of mathematics and were made to discuss in group about the nature of fractions in ancient time, how the bar came upon existence. After that we all summon up to have lunch and had an interaction with all the teachers their journey to reach Rudraprayag for the winter workshop.

After the lunch-break, a session on perspective i.e., “child movement and discipline in classroom” was facilitated by Sanjay Ji. The session was designed with an activity how to work in a large group, how to move in between activities, our exceptions from children how they behave in class and the consequences of misbehavior. Then an activity was done with the teachers on the same idea on how use our body in schools with the students.

**Session on perspective of Education – Body Movement**

After sharing the rationale of session raising the issues of physiological need of child of body need facilitator ask participants to conduct the activity. The instruction for conducting the activity was as follows:

1. We need to talk in the hall randomly without any instructions at first in a zigzag manner, few of us start talking in between and few of the teachers asked how to walk in which directions whether they can reverse back or not.
2. The second instruction was that we need to walk around the hall as we are new in the town, by observing our surroundings.
3. We need to increase our speed in walking, speedometer was set according to the age and if the age is 80 then we need to walk faster and if the age is 20 then normal as so on.
4. We need to walk such that we suddenly meet our old childhood friend in the road.
5. While walking suddenly a dog barks at us.

After this activity we sit together had some tea and the session continued by recalling our childhood memories when we were 5 years kid. We were made to recall our nick name which our parents or relatives or neighbors used to call us and our best friends name too, and any incidents or memories as a kids, almost all of the teachers shared their childhood experiences when s/he was a kid. One of the teachers shared that when she was a kid she along with her brother would wait for the windy day for the mangoes to fall down in windy days in their neighbors, so that they could go there and have
fun. One of them shared that they used to go in a house and disturb the old lady but she could beat them as she was too old and they enjoyed it so much.

All of the teachers enjoyed the activity session, we all went back to our childhood days and there was smile in everyone's face. Then he explained why young kids learn through movement? Children acquire knowledge by acting and then reflecting on their experiences, but such opportunities are increasingly rare in school. Children need opportunity to move in class. Then a reading materials was shared among all the teachers and was discussed on classroom management starts before you or your students step into the classroom. As a teacher, our relation with students starts when we meet them. Many teachers naturally form relationship with children. Post this discussion a video of Coke Studio for deaf was screened and the teachers shared theirs minutes on it:

Neutralities vanishes when we restrict them.

How to express our thoughts with body language or body sign, we can learn a poem or any reading by using our motion or body language.

To communicate and to learn. (2 way communication).

Using of facial expression to tell to receive.

1. Everything is new for him.
2. We want immediate result, but s/he need time.
3. Children should be given freedom, he should be allowed to go out, he sees the outside world and when he comes back he will concentrate.
4. If we are more child friendly-then society tells us that kids spend their time outsiders the teacher’s gets demoralized.
5. There is also time limitation because we have only 7 hrs. To spend with the children, so parents support are more important.
6. One of the teacher site an example that there a boy in class 9, he does not how to read Hindi, then how he will learn mathematics, but later on he got supported from his parents and passed math exam with flying colors.
7. We need to be positive, don't express for quick result.
8. One of the important minutes shared by the teachers was children learn by observation, or by watching a video quickly, then why not learn quickly with teaching them in class.

All children can learn. The society wants mechanical children i.e. to be programmed. We all will learn, its human tendency, we learn through play. The teachers highly appreciated the session of "Child movement and behavior" and most of the teachers shared their views on it and got new ideas on how they can use the rich context of theirs to enrich student's interest in class.

This was first day of the workshop. Teachers and member reached workshop venue in the morning and most of them were with their luggage and they check in into the hotel. In these circumstances, we could not conduct the internal feedback in the day end.

**Evening Session**

After the session of perspective, there was a break of one hour, the teachers enjoyed tea in winter and joy comes in sips, not gulps. On the demand of all teachers Dangal film was screened at evening, happiness was watching movies with all the teachers, enjoying the movie song "Hanikaarak Bapu", chanting with teachers. After the movie we all went back to our hotels, had dinner with teachers, sitting and discussing of the movie on the dining table, the beauty of Rudraprayag, and then biding good night.
Day 2: Wednesday (04.01.2017)

Second day started with feedback on previous day discussion about history of fraction in different civilization. Many teachers told about their ideas and learning from the previous day. Yesterday worksheet were given to the participants. In this worksheet there was 3 question at last of the worksheet illustrating method of division of three bread in 7 people by Egyptians. Discussion happened on three method of division of bread as described in the worksheet, although some other way to divide the bread came out during discussion.

But still there was confusion about symbols used by Egyptian of 2/3 and ¾ with some teachers which was later explained by another teacher. Further facilitator told about rules, belief on symbol and certain concept used by these civilizations. He further laid the details about Egyptian knowledge on fraction.

In the continuation of the session other member from foundation told that Egyptian used additional and positional method to read and write any numbers and it was like:

- Additional method (as used in roman system where we take a base number and add and subtract numbers by placing to and fro as 12 =XII)
- Positional method (as we used today where we use place value for writing any number as 78)

He told that Egyptian used additional method to write number up to 59 by using two symbol and after 59 positional method. The two symbol used by Egyptian were ! and n. This was also explain using the examples connection were made with present decimal number system. After this discussion again question arises about the representation of fraction 7/10 by Egyptians using the notion of unit fraction.
EXPLANATION ON 7/10 ON BOARD

Methods:

1. 7 bread is divided into half of each gives 14 piece. From 14; 10 piece is divided into 10 children and 4 piece left. Again these 4 piece is divided into 3 part each which left 2 piece of 1/6. These 2 piece is again divided into 5 part each one and 1/30 part given to each one so by this method we get

\[ \frac{7}{10} = \frac{1}{2} + \frac{1}{6} + \frac{1}{30} \]

2. In second method we divide every bread in three pieces and give 2 piece each which left 1 piece. We again divide 1/3 piece in 10 part and give 1 part to each which results

\[ \frac{7}{10} = \frac{2}{3} + \frac{1}{30} \]

3. In this method we first divide 5 bread in 10 part and remained 2 bread divide in 5 part each which gives

\[ \frac{7}{10} = \frac{1}{2} + \frac{1}{5} \]

4. In this method we divide each bread in 10 part and give 1 part to each person which gives –

\[ \frac{7}{10} = \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} \]

Also we can cross check this methods with another example 7/11, where 7/11 = 1/2 + 1/8 + 1/88

Facilitator further told that Arabian started using ratio as fraction. Indian were write fraction as 1 2 without using bar or line between them.

After the session of history, another facilitator started the session with a question-in a first bag there is 3 white ball and 2 red ball, in second bag there is 2 white ball and 1 red ball. If we write it in fraction first can be written as \( \frac{2}{5} \) (red) and second can be written as \( \frac{1}{3} \) but when we add these ball of two bag in a single one we get 5 white and 3 red which can be written as \( \frac{3}{8} \)

\[
\begin{align*}
&\text{3 white} &+& \text{2 whit} &\quad \text{5 white} \\
&\text{2 red} &+& \text{1 red} &\quad \text{3 red}
\end{align*}
\]

\[
\frac{2}{5} + \frac{1}{3} = \frac{3}{8}
\]

which is not correct why?

Few responses by teachers on this questions were - 2/5 is not a right representation? (In argument a question raised by a teacher that if it can be written 11 thousand 11 hundred 11)Then she asked next question as -

Compare 5/3, 9/7 which is very easy to compare. But if we compare 5/3, 3/2, 9/7, 7/5 it becomes difficult why? Or why it is difficult to compare when we deal with fraction

She further started with different meanings of fraction which are

1. Part of a whole
2. Measure meaning
3. Quotient meaning
4. Ratio Meaning
5. Operator meaning
The next activity was as- Two chocolate is divided in 5 children and 1 chocolate is divided into 5 and taken 2 part of it, which gives the result

2÷5 =2/5 (it shows that why division can be written as ratio)

(A teacher raised another case of ratio as fraction)--If in making of Prasad 3 part of sugar is mixed with 4 part of aata then the sugar in mixture will be of ¾)

Further on scale she explained how fraction can be shown -

In the explanation of operator meaning she explained ¾ of 12 means 3 times ¼ of 12 or it can be said that ¾ means 3 time ¼ of something. She also told that in case of ratio meaning second number can be treated as variable and with the help of that number we can obtain the first one. She then laid the discussion of part of whole concept as- Discrete group can be classified as homogeneous group and heterogeneous group. A teacher quoted on this that we don’t say statistics but ‘management of data’ in lower classes. After these meaning of fraction facilitator distribute work sheet to every teachers with some question based on described meanings.

Teachers worked with their work sheet and explained one by one on board.

Then she explained the questions-In case when we add two bag and add it as fraction it can’t be true because unit are not same in each case. She told that ¾ of 16 means that 3 times ¼ of 16 which means 12. A teacher explained the next question on number line by partnering the line in 20 part. Further some questions were explained on Ginmala by other team member. She further explained questions by measure meaning also. With this question she ended the session and it was now time for lunch in the roof-top.

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**Session on perspective of Education – Corporal punishment**

After the lunch, the next session was “corporal punishment. He started the session by introduction of himself and introduction of the topic. Further he gave a paper slip to each and every one and asked to write the situation when they beat or scold a children in their classes. Slips were taken and promise to discuss it later. After that two pictures were displayed and was asked to view what if they come to our house, will we accept them, our notion while looking for the first time. One of the picture was of a famous poet Nagarjun and other one was of a serial killer Charles Shobhraj. Generally
people make perception about someone on the bases of the way one is dressing. So the response were mixed and driven from the general perception of society.

After the response of teachers he told that our behavior is according to our belief: we see things with our belief. Our belief >>>> our behavior

Then he further display a video on our belief and our behavior from the movie TARE ZAMEE PA and told that that in video clip father think that child is naughty, lazy, stubborn but teacher try to find reason of his behavior. We think that child do his work only by beating. Facilitator further talk on belief of beating by distributing the slip prepare in the beginning of session. (according to points written by teachers)

Which was more commonly

1. When s/he doesn’t do home work
2. S/he doesn't come regularly
3. S/he doesn't follow school rules and regulation

He further connect this with our case study of Nagarjun vs serial killer. Then he distributed readings to read and discuss among the teachers. He further talked about corporal punishment

Of three type-

1. With student’s body and some equipment as stick, slapping, on back
2. Punish with his own body, stand up hand, making some curvature of body
3. Abusing

He further tells our common belief in our classes as -

- Head will look after each and every one and every activity of the class
- A model like prisoner of jail feared that watchman is continuously looking them
- The chair of teacher remains always on height
- It happens only somewhere that teacher are teaching in circle

When we talk with children then it make many problem solved. After a talk many time there is no need of beating. Reason why corporal punishment should be avoided and create fearless learning environment on the three bases:

- On Psychological basis
- On Social basis
- On philosophical basis.

**Evening Session**

After successful completion of academic discourse with teachers a cultural events was organized in the evening for enhancing connection with teachers and to make the workshop more vibrant and joyful. After the tea, everyone summon up in the hall for cultural events. The game of the music was as follows the bottle will be passes in circular way (as we were sitting) with music track and as soon as the music stop; s/he need to perform some activity. It was a very enjoyable
moments for all, many of them sang songs, jokes and poems. After singing session, the music was on and it time to dance; played few Garhwali track and Bollywood track and all the us danced together and created a good bonding among all the teachers.

**Day 3: Thursday (05.01.2017)**

All the teachers came on time in the cold morning, the third day started with the notion of second day’s feedback, the few minutes of the teachers were -

1. We only know the part-whole meaning, and now we came to know about the other meanings and how they are inter-related with each other.
2. Every teachers should know about the five meanings of fractions.
3. The video on fraction was good; and the methods which was shown in the video can be executed with children.
4. In how many ways we can deal with fractions, we learn from here.
5. Got to know about the history of fractions.

The next session was on “Equivalent fraction” and facilitator quoted few fractions viz. 1/7, 2/8, 3/2, 7/7, 8/3 and asked to participants - What do you think about those fractions and the teachers response were

1. Few were proper fractions.
2. Some improper fractions.
3. Value of some fractions were less than one.
4. Improper fractions can be converted into mixed fractions also.
5. In one of the fractions, numerator=denominator.
6. How can we relate 7/7 as five meaning of fractions?

Then the question raised among the group how to deal with the fraction 7/7 whether it is a proper fraction or improper fraction, or should we give a new name on such type of fractions. There were lots of arguments among the teachers few considered it as fractions and the others not.

The arguments of the teachers who considered it that 7/7 is not a fractions was

1. A filed is divided into 7 parts but it is not given, then how can it be a fractions.
2. 7/7 is a whole.
3. 7 parts taken out of total 7 parts.
4. We need to introduce new rule that numerator can’t be equal to denominator.

The arguments of teachers in favor of fractions were -

1. It is an improper fractions because its value is one.
2. Out of 7 parts I have given them all the 7 parts.
3. If 7/7 is not a fractions, then what about the fractions 56/7.
4. We can also say we have got 7/7 parts.

Also there was going a lot of discussion on the meaning of fraction and various types of understanding were surfaced. Then one of team member came upon clear the ambiguity among the part whole concept in fractions. He said the fractions 7/7=7(1/7) can also be seen as it is divided into 7 parts to 7 persons. He suggested to understand these question we could first understand the various understanding regarding these question and then take of our curriculum on it. There are multiple views on fractions, which are –

1. If is less than one then it is fraction, otherwise it is not.
2. Is fractions are positive rational numbers.
3. Whether pi/2 a fractions or not.

Finally we concluded our discussion that positive rational numbers are fraction and on the question on whether 7/7 as improper fraction, he said yes because in improper fraction, numerator is greater than denominator and also numerator is equal to denominator.

After that discussion took forward on equivalent fractions, what is the difference between equal and equivalent by posing the question -

\[
\begin{align*}
3+3 &= 6 \\
2+2+2 &= 6.
\end{align*}
\]

Whether the above two statements are equal or equivalent.

The teacher's views upon equivalent fractions were in equivalent fractions just the form changes, the position of number changes, we multiply it in equivalent fractions. In order to clear upon the discussion of equivalent fractions, four groups were made and articles were shared among the four groups.

1. One of the teachers among the first group came upon and clear out the difference between 1/4=2/8.He stated that in 1/4 out of four marbles I got 1 marbles while in 2/8 out of 8 marbles I got 2 marbles, here in the first case I got 1 marbles and in the second case I got 2 marbles.

2. In second group the teachers stated that 1/4=2/8 are not identical due to difference of numbers.

3. How to create equivalent fractions; form equivalent fractions of 1/2, the equivalent can form when we multiply numbers is both numerator and denominators, or else when we divide it.

4. Equivalent fractions can’t be form by addition or subtraction of numbers.

5. The equivalent fractions of 1/2 are 2/4, 3/6 and so on...
6. The equivalents fraction can be used to understand addition and subtraction viz

\[
\frac{1}{2} = \frac{1}{4} + \frac{1}{4}.
\]

\[
\frac{1}{2} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8}.
\]

One of the question was raised in the mind of teachers how we can see equivalent fractions in sense of operator.

For example 1/2 can be seen as 2/2*(1/2), i.e. it will double it, or halved of it. Here context is more important to understand 1/2. Till now we have discussed upon the history of fractions, its meaning and the equivalent fraction.

Comparison of fraction is one of the important topic in fractions, and it was facilitated other team member. He said how we can compare two fractions; what are the methods of comparing them, the teacher’s responses were making the denominator equal, also by making the numerator equal or by converting it into decimals, or by cross multiplication. Is there any alternatives for comparison of fractions? The teachers were curious to know what can be the alternative, he mentioned few methods like Benchmark method, finding out the missing part concept, more of less concept.

One of the teachers raised that how children see the marks of their subject and compare with others, like 3 out of 10, 7 out of 10, but they know 7 is more than 3.

Now the question arise in our mind what is bench mark model, how to compare fractions using a benchmark fractions; by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole, Then we record the results of comparisons with symbols >, = or < and then we justify the conclusions, e.g., by using a visual fraction model. Students must have the previous knowledge of like fractions.

1. How to compare fractions like 7/13 and 5/11 by using benchmark fraction?

\[
\frac{1}{2}
\]

\[
\frac{5}{11} \quad \frac{1}{2} \quad \frac{7}{13}
\]

\(\frac{1}{2}\) is benchmark here. Now we have to assess the position of 5/11 on above line. \(\frac{1}{2}\) could be also written as 5/10. 5/10 is greater than 5/11 because 5 piece of 1/10 size are bigger than 5 pieces of 5/11 size. Therefore the position of 5/11 will in left of \(\frac{1}{2}\). Similarly the position of 7/13 is right of \(\frac{1}{2}\).

Therefore we can conclude that 5/11 < 7/13
2. Comparison of fractions by the concept of missing part. How to compare \( \frac{10}{11} \) and \( \frac{12}{13} \) by this concept. The pictorial representation of \( \frac{10}{11} \) would be as below

\[
\begin{array}{c}
\text{12/13} \\
\text{1/13}
\end{array}
\]

The pictorial representation of \( \frac{12}{13} \) would be as below

\[
\begin{array}{c}
\text{10/11} \\
\text{1/11}
\end{array}
\]

Sometimes it is helpful to compare the remaining part instead of whole fractions. Here remaining parts are \( \frac{1}{11} \) and \( \frac{1}{13} \) and \( \frac{1}{11} \) is greater than \( \frac{1}{13} \). So opposite of this fraction \( \frac{10}{11} \) will be smaller than fraction \( \frac{12}{13} \).

A fraction \( \frac{31}{36} \) and \( \frac{30}{37} \) written on the board and was made to observe which fractions is bigger, how to compare it.

The views

1. One of the views among the teachers was that by making the numerator equal

\[
\frac{930}{1080}=\frac{930}{1147}
\]

The teacher laid the example that out of 10 units he could ran only 9 units and on the other one out of 11 units he could only ran 9 units, so the first case is bigger, henceforth \( \frac{930}{1080} \) is greater than \( \frac{930}{1147} \).

2. We take a rope which is of 930m length and first we divide it into 1080 parts and in the next case we divide it into 1147 parts,

3. We can also look such as

\[
\frac{(31*37)}{(36*37)} \text{ and } \frac{(30*36)}{(36*37)}
\]

From this we observe that the first fractions is bigger since in the numerator its units is one more than the second one. One of the conclusion raised by the teachers that for comparison of fractions we make the numerator equal or the denominator equal whichever is easy and quick.

In the wake up, one of the teachers noted few questions on the board which will be the easy method for comparing such fractions

1. \( \frac{5}{9} \) and \( \frac{9}{5} \)
2. \( \frac{9}{5} \) and \( 1\frac{4}{5} \)
3. \( \frac{4}{8} \) and \( \frac{8}{4} \).

How to compare three numbers, first we will compare two numbers and then we can compare with the third numbers.

Then facilitator listed out few questions on the board and told them to compare which methods is best for it. The question were

1. \( \frac{5}{9} \) and \( \frac{3}{7} \)
2. \( \frac{10}{11} \) and \( \frac{12}{13} \)
3. \( \frac{11}{23} \) and \( \frac{9}{17} \)
4. \( \frac{6}{13} \) and \( \frac{3}{14} \)
5. \( \frac{17}{19} \) and \( \frac{13}{16} \)
6. \( \frac{26}{11} \) and \( \frac{25}{12} \).

It was 2 pm time for the lunch-break so the teacher’s views for the question, their observation carried on the next day. We all had enjoyed the lunch and had few funny moments in the noon.

**Session on perspective of Education – Notion of Quality in Education**

After the lunch the session of perspective on the topic “Quality education” What are our notion of quality in education? What is a good School? Who is a good teachers? Few responses among the teachers were teachers should have some values, no route learning, teachers should come under fixed indicators, the needs that fulfil the society, should have moral and ethical values.

Then he raised a question “what is good education for us. The teacher’s responses were:

- Holistic development of a child.
- Fear-free education with entertainment.
- School where number of teachers are sufficient.
- Education that can connect from our daily life.
- Development of human value.
- Education which could fulfil basic indicators.
- Education which could fulfil needs of society.
- A student who can get job after education.

Then he divided all the teachers into three groups to view from different perspective “what is good education for us”. The first group was to view from “teachers” perspective “what is good education for us”. Then the teachers collectively discussed and raised few points;

- Education that can connect with our daily life.
- Education should be according to curriculum.
- Teachers should not engage with other activity.
Teachers should be discipline.
Quality to raise a question.
Teachers should not give the burden of home-work.

The second group was to view from “parents” perspective “what is good education for us”. The responses were:

- Education that could create interest in children.
- Education that could make holistic development of a child.
- Fear free and tension free education.
- To develop the life style
- Development of moral quality.
- The one who can face challenges of their life.
- Education who can create different talent in a child.
- After education s/he can get a good job.

The third group was to view from “those person whose children doesn’t read in school” perspective, the responses were:

- Students should be free from problem.
- Holistic development.
- Sensitive towards society.
- Develop to ask a question.
- Education for employment.
- To conserve our culture and tradition.

After that a reading was shared among all, the understanding that were built in the workshop regarding quality education were as follows:

What does quality mean in context of education? The responses that build by the teachers were:

1. Learners who are healthy, well-nourished and ready to participate and learn, and supported in learning by their families and communities.
2. Environments that are healthy, safe, protective and gender-sensitive and provide adequate resources and facilities.
3. Content that is reflected in relevant curricula and materials for the acquisition of basic skills, especially in the areas of literacy, numeracy and skills for life and knowledge in such areas as gender, health, nutrition, and HIV/AIDS and peace.
4. Process through which trained teachers use child-centered teaching approaches in well-managed classrooms and schools and skillful assessment to facilitate learning and reduce disparities.
5. Outcomes that encompass knowledge, skills and attitudes, and are linked to national goals for education and positive participation in society.
The teachers were so responsive in this session, it shows the enthusiasm of a teacher and all of teachers had tea as the session ended.

**Day 4: Friday (06.01.2017)**

The fourth day started with some common issue of schools raised by teachers. Arti madam quote an incident of his school that once an official investigator scolded her only because she didn't mention unit of rupees in his record. A teacher gave an example of his school and told that our positive behavior made many problem solved.

After these issue facilitator asked suggestion, venue, or topics of summer workshop. One of the teachers suggested a place somewhere in Tehri as a venue for summer workshop. On the topic of summer workshop many one suggested that we should talk about geometry in next workshop, a teacher quoted some example from congruency and told that we must talk about these topic in next workshop.

After such type of discussion facilitator started with a bunch of question on all 6 method explained on previous day. They asked to teachers that to compare fractions by any methods of all 6 type, which one is convenient.

Method - 1 (Equal denominator)
Method - 2 (Equal numerator)
Method - 3 (Converting in decimal)
Method - 4 (Benchmark method)
Method - 5 (Remaining part)
Method – 6 (More and greater)

For the explaining, following question taken –

1. 5/9 and 3/7
2. 10/11 and 12/13
3. 11/23 and 9/17
4. 6/13 and 3/14
5. 17/19 and 13/16
6. 26/11 and 25/12.

**EXPLANATIONS BY TEACHERS-**

- Question 1 was described by benchmarked method by a teacher using ½ as benchmarked
\[5/9 > 5/10 \text{ and } 3/7 < 3/6\]
\[= 3/7 < 5/9\]

Question 2 was solved by a new method by a teacher where he described
When in comparing two fraction difference between denominator and numerator is same then fraction with small numerator is less than the second one. Hence 10/11 < 12/13

Question 3 was described by benchmark method by a teacher as below
11/23 < 11/22 and 9/17 > 9/18 hence 11/23 < 9/1
So considering \(1/2\) as benchmark we can compare easily

4th question was solved by making equal numerator of both fraction
As 6/13 > 6/28 so 6/13 > 3/14

Question 5 was solved by a teacher with remaining part method
As 3/16 > 2/19 hence 17/19 > 13/16

Question 6 can be easily compared by converting in mixed fraction
26/11 = 2 + 4/11 and 25/12 means 2 + 1/12

Now 4/11 > 1/12 hence 26/11 > 25/12

So finally each and every question was checked by different method and solved by most convenient method. In some question some teachers suggested some others way of comparing fraction. In some questions teachers suggested that guessing is more convenient than all of them. One of the member asked and help them solved all question. This session was mainly for the follow up of previous day session.

After this small follow up One of the member distributed feedback form and travelling allowances form to all teachers. He also asked suggestion for the topic and place for summer workshop. Few teachers suggested we can discuss some part of geometry in summer workshop. A teacher also suggested place for summer workshop which is somewhere in Tehri district. We also asked oral feedback about any changes according to teachers in summer workshop.

After collecting TA and feedback form we decided to distribute certificate for participation in a rotational method in which certificate were randomly distributed to random teachers and asked them to call the name of teacher which certificate he/she got and then gave to him. It seemed interesting to all teachers. After this distribution of certificate a teacher recited a poem which was composed by herself on fraction. It was a very nice poem which was praised by all.

The session ended with the poem, it was now time for the lunch, we all went on the roof-top for the lunch, it was the last collective lunch of winter workshop, few emotional moments were seen among the teachers, teachers saying goodbye to each other, we all personally greeted all the teachers for their support and active participation in the workshop. We arranged them lunch for the day and say good bye and thanks to each and every teacher personally. It was really a wonderful day for me seeing teachers happy after the workshop and meeting good bye. Finally, I would like to take this opportunity to place on record my hearty thanks to all the facilitators for conducting such a beautiful mathematical workshop and the dedication in the field, an event like this cannot happen overnight, the wheels start rolling months ago and all teachers for their enormous cooperation in the organization of the event.