00:16:45 Ankur: Ankur guides Jeff to share his previous logic**. Communication improvement**

Michael: Michael states each can be made into two different combinations, thus multiplication is used. “That’s why. Don’t ask us anymore**.” Communication Improvement**

Jeff: Jeff calls over the researcher, who stays at her location, to explain. Jeff offers for Ankur to explain. Jeff begins writing, and almost sits down waiting for Ankur to explain.**Researcher guidance; informal presentation**

Romina: Romina tells Jeff to explain. **Communication improvement**

00:18:00 Ankur: Agrees with Jeff and Romina. Researcher asks how this relates to towers and (a+b)^n. **Researcher guidance; collaboration**

Michael: “You asked us why we multiplied.” **Communication improvement**

Jeff: Agrees with Ankur and Romina. Jeff finalizes his explanation, and erases his work as Romina notes those are all the combinations. **Informal presentation**

Romina: Romina, Jeff, and Ankur agree they are not yet at the researcher’s question. **Communication improvement**

00:18:30 Ankur: Not visible.

Michael: Tells Jeff to explain the new part. Helps Jeff explain that (n-x) is the number they are choosing from. He states it is three choose two for this problem. **Communication improvement**

Jeff: Jeff continues at the board by dividing the three factorial by n minus x factorial**. Informal presentation**

Romina: Checks Jeff’s work as he writes**. Checking answer**

00:19:30 Ankur: Listening. **Disengagement**

Michael: Helps Jeff explain by agreeing with one factorial. Explains the variable substitution for five choose three; explains five choose two. **Communication improvement**

Jeff: Jeff continues explaining by substituting three and two. Jeff asks if the ‘x’ is for ‘raising it to two,’ but continues without input. He also notes the factorial will eliminate all the combinations they do not want**. Informal presentation**

Romina: Listening**. Disengagement**

00:20:00 Ankur: Not visible.

Michael: Continues discussion noting many repeats are removed by division. **Communication improvement**

Jeff: Jeff notes they are subtracting, but Michael points out (n-x) is in the denominator. **Informal presentation**

Romina: Not visible. Heard discussing at table inaudibly. **Collaboration**

00:20:20 Ankur: Not visible.

Michael: Indicates Jeff wants to move on, but he does not know how to explain. **Communication improvement**

Jeff: Adds multiplying by x factorial in the denominator. Jeff notes they do not know how to explain the final term; Michael mocks the question to come about it. **Informal presentation**

Romina: Romina asks if this is related to the repeat combinations, but Michael notes he does not know for sure because it is Robert’s idea. **Clarifying the problem**

00:20:55 Ankur: The researcher puts proving on Ankur, asking if he is convinced. **Researcher guidance; verifying completion**

Michael: Points out five factorial is the total number of combinations. **Communication Improvement**

Jeff: Jeff attempts to explain by solving five choose two at the board. He calculates aloud with the group. **Informal Presentation**

Romina: Working on her calculator. Jeff checks the answer with her, and he notes they are faster than the calculator**. Checking Answer**

00:21:20 Ankur: Not visible. “I get it, I get it**.” Emotions related to math**

Michael: Michael attempts to explain the terms being moved around in different spots. Michael clarifies that Jeff should substitute ‘x.’ **Communication improvement**

Jeff: Jeff and Michael claim their work makes sense, then attempt to ensure the researchers agree. (They reply they are waiting for the explanation to be finished.) Continues substituting, and finishes explaining that ‘x’ is their chosen number of a color. **Researcher guidance; informal presentation**

Romina: Watching Jeff at the board, checking his work. **Checking answer**

00:22:20

**Group Engagement Type Count**

|  |  |
| --- | --- |
| **Behavior** | **Count** |
| Checking answer | 3 |
| Clarifying the problem | 1 |
| Communication improvement | 11 |
| Collaboration | 2 |
| Disengagement | 2 |
| Emotions related to math | 1 |
| Informal presentation | 8 |
| Researcher guidance | 4 |
| Verifying completion | 1 |