Collaboration Interaction Model

-A model designed to trace the development of knowledge construction in an online mathematics collaboration environment.

- The idea is to track the flow of the chat logs. Learners exchange textual postings to facilitate interaction, communication, shared understanding and knowledge construction. (Stahl, 2005).

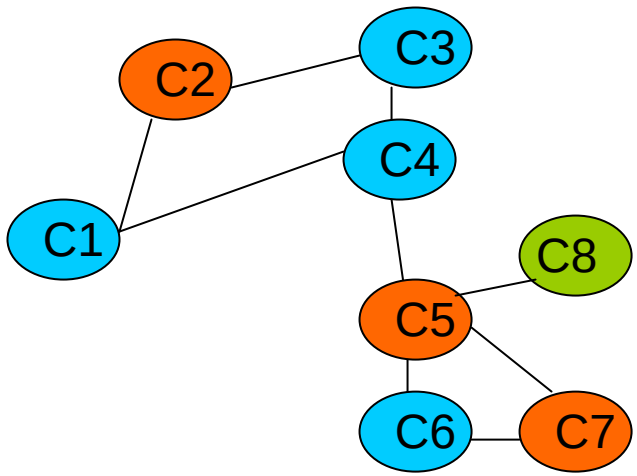
-The model is applicable for 3-Person Team / 4-Person Team/5-Person Team

Cn Student A's Contribution

Cn Student B's Contribution

Cn Student C's Contribution

where $n > 0 \quad n \in Z_+$



A snap short of Collaboration Interaction Model

Collaboration Interaction Model

Assumptions:

1. The Model does not directly address any design issues. It does not analyze the design of the software or compare it to other designs.

2.The Model is designed to understand how learners make use of mental resources, the conversion of such mental resources into representation to collaborate in a mathematical environment

3.The Collaboration Interaction Model is a methodology used to trace the development of knowledge construction within a online collaborative environment.

4. The methodology is descriptive and attempts to look into how online collaboration takes places (Suthers, 2006). This descriptive method could help instructional designs review different ways the existing design could improve.

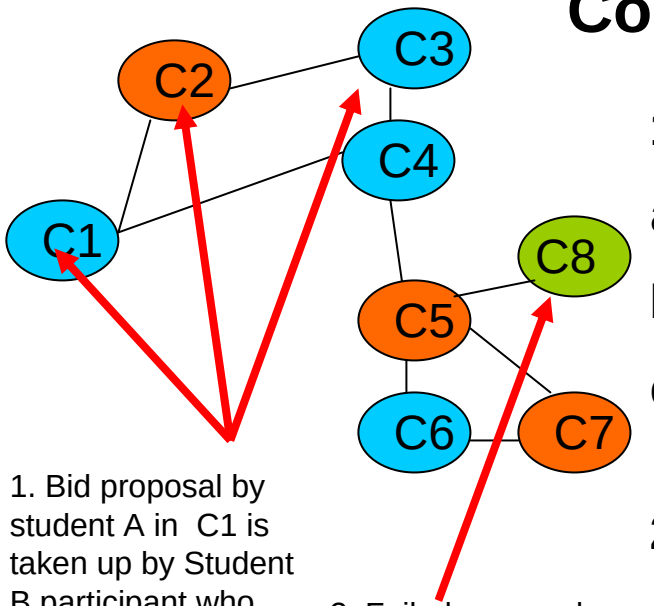
Motivation for the development of Collaboration Interaction Model

1. Contributions are sent as complete units, there is a probability that the arrival of the contributions arrive at different order to the participants. By focusing analysis on the relationship between adjacent contributions does not give an holistic view on the relevant relationships between contributions. (Suthers, 2006)The Collaboration Interaction Model is designed to analyze the relationship between any contributions.

2. The complexity of analysis cannot be reduced by shrinking the time window to search for relevance relations to adjacent contributions. There is a chance that any contribution could be taken up again. (Suthers, 2006) The Collaboration Interaction Model combines a series of intersubjective and intrasubjective contributions not constraint with a time window for analysis.

2. Prior knowledge places an important role in knowledge construction. The Collaboration Interaction Model seeks to understand how participants come to a shared understanding with the manipulation of prior knowledge, intrasubjective uptakes and intersubjective uptakes.

Collaboration Interaction Model



1. Bid proposal by student A in C1 is taken up by Student B participant who modifies the contribution to C2 and Student A elaborates this modification in C3

2. Failed proposal not taken up by any participant in this stage but not necessary this failed proposal will not be taken up in future stages

1. **Maths proposal adjacency pair (Stahl,2005a)**

a. A proposal bid made by Student A

b. Bid is taken up by Student B or Student C

c. Elaboration of the proposal by members of the group. (c) is the repeat of a to c

2. **Failed Proposal(Stahl, 2006)**

a. A proposal bid made by Student A not taken up by another students. (Ignored)

b. Breakdown situations are often worth analyzing carefully, for they can expose in the breach practices that otherwise go unnoticed, taken for granted in their smooth execution.

(The Collaboration Interaction Model illustrates a maths proposal adjacency pair and a failed proposal)

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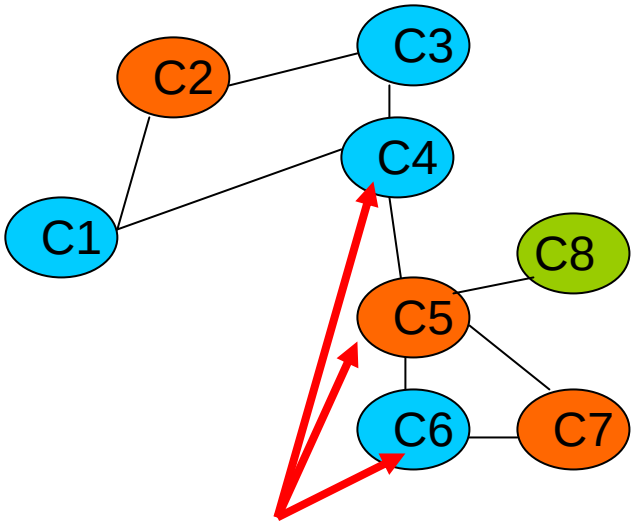
Cn Student B's Contribution

Cn Student C's Contribution

where $n > 0 \quad n \in Z_+$



By analyzing C5 with C4,C6,C7,C8

and using (a) to (h) as a guide, conditions for successful proposal-counter conditions can be understood.

Cn Student A's Contribution

Cn Student B's Contribution

Cn Student C's Contribution

where $n > 0 \quad n \in Z_+$

3. Conditions for Successful Proposal – Counter Conditions to avoid Failed Proposal (Stahl, 2006)

(a) A clear semantic and syntactic structure,

(b) Careful timing within the sequence of postings,

(c) A firm interruption of any other flow of discussion,

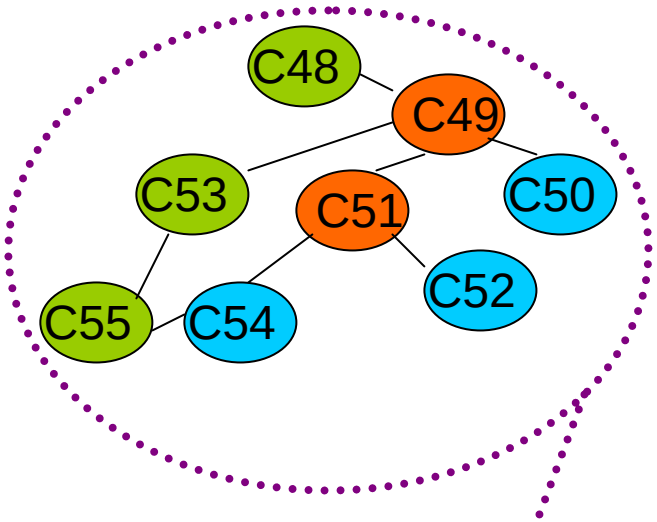
(d) the elicitation of a response,

(e) The specification of work to be done

(f) A history of helpful contributions.

(g) The level of mathematical background knowledge assumed in a proposal must be compatible with the expertise of the participants

(h) The computational methods must correspond with their training.



Shared meaning is constructed across pairs or triplets of posting (contributions) by three participants. A group unit analysis of

C48,C49,C50,C51,C52,C53,C54,

C55 is essential for the study meaning making create at group level rather then by several individuals.

4. Group Cognition (Stahl, 2006)

a. Meaning is created at the group unit of analysis rather by particular individuals

b. Shared meaning is constructed across pairs or triplets of postings by more than one participant

c. Unit of meaning is the interaction itself, this is a group phenomenon not an individual one

Collaboration Interaction Model

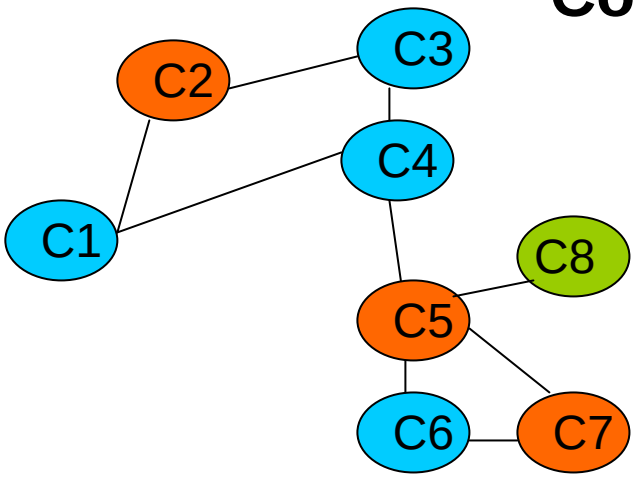


Diagram 1: Representation of the interaction of contributions between three students. The flow is dialectic and there is no constraint of choice by the contributor to uptake any previous contribution.

Cn Student A's Contribution

Cn Student B's Contribution

Cn Student C's Contribution

where $n > 0 \quad n \in Z_+$

How it works?

Diagram 1 shows the process of how contribution interact with one another in an collaborative environment. Each node represents the contributor and the contribution number. The contributor is represented by the color of the nodes. In this case there are three students (three colors). The contribution number is a sequential running number assigned to the chat script.

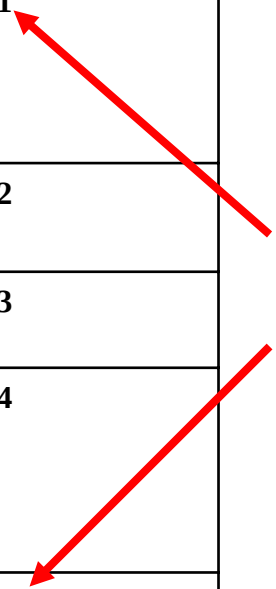
Definition of a contribution?

A contribution represents a *concept/definition/*

symbol/expression articulated with one or more textual representation in the chat transcript. Each contribution is assigned a contribution number in the chat transcript. The contribution number and color forms the node in the Collaboration Interaction Model.

Collaboration Interaction Model

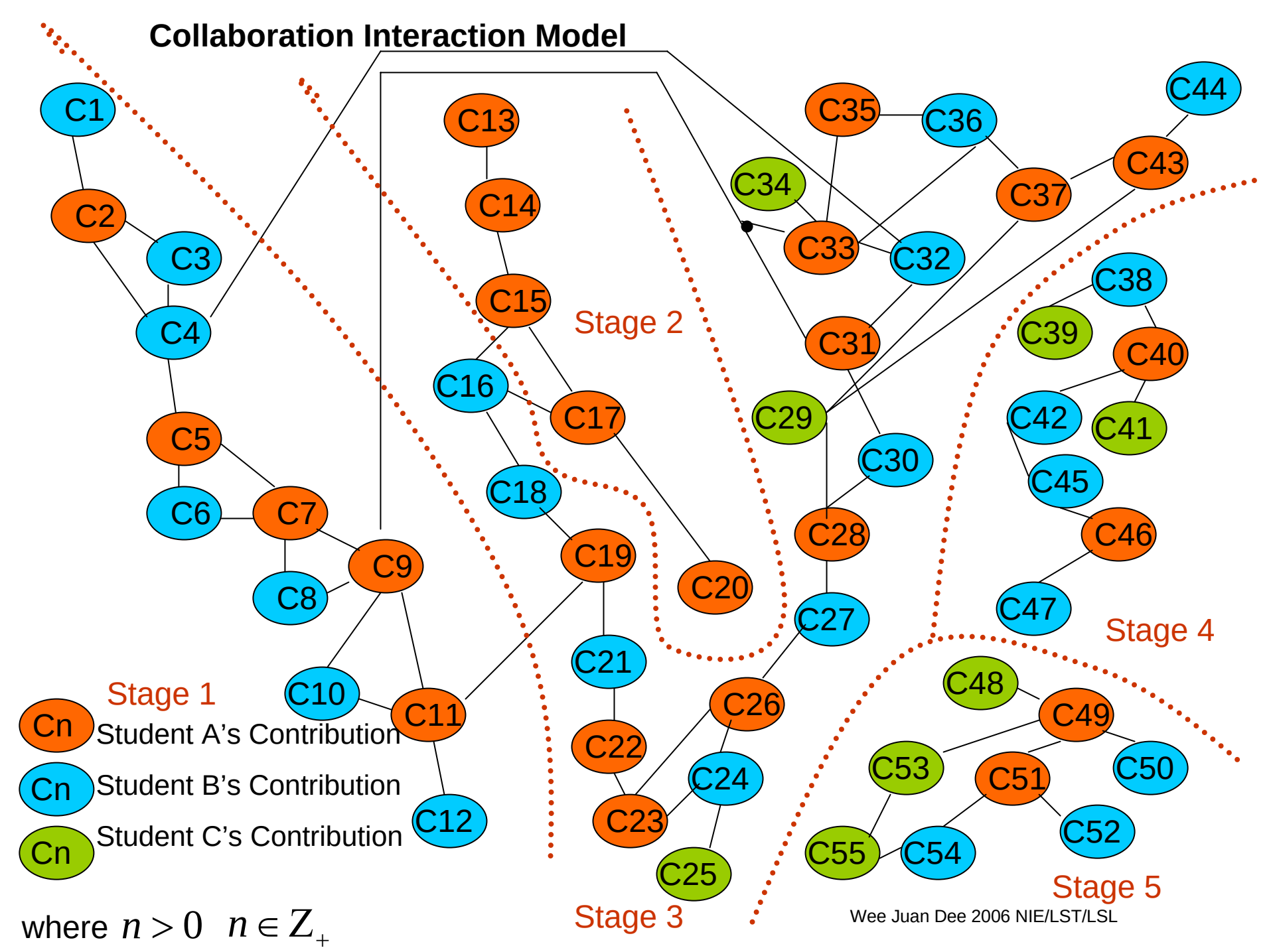
Time	Student Name	Chat Transcript	Contribution
4:21:00 Line 1	Lee Zhi Xiong	Ok	**C1**
4:21:07 Line 2	Lee Zhi Xiong	Lets do it	
4:27:59 Line 3	Chung Zhiwen	(2), (2 + 20), (2 + 20 + 200)	**C2**
4:28:08 Line 4	Lee Zhi Xiong	No!	**C3**
4:28:53 Line 5	Lee Zhi Xiong	2(1), 2(1+10), 2(1+10+100) +2(1+10+100+...)	**C4**
4:29:03 Line 6	Lee Zhi Xiong	Something along this line	
4:29:20 Line 7	Chung Zhiwen	2(1+11+111.....)	**C5**
4:30:53 Line 8	Lee Zhi Xiong	try to calculate	**C6**
4:32:41 Line 9	Chung Zhiwen	1st term ->2, 2nd term-> 2(1+10), 3rd term - >2(1+10+100)	**C7**



C1 shows the contribution of two textual posting by Lee Zhi Xiong

C5 shows the contribution of one textual posting by Chung Zhiwen

Table 1: Chat Transcript from VMT Chat


Collaboration Interaction Model
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Stage 1
Stage 2
Stage 3
Stage 4
Stage 5
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Student A's Contribution
Cn
Student B's Contribution
Cn
Student C's Contribution
where $n > 0 \quad n \in Z_+$
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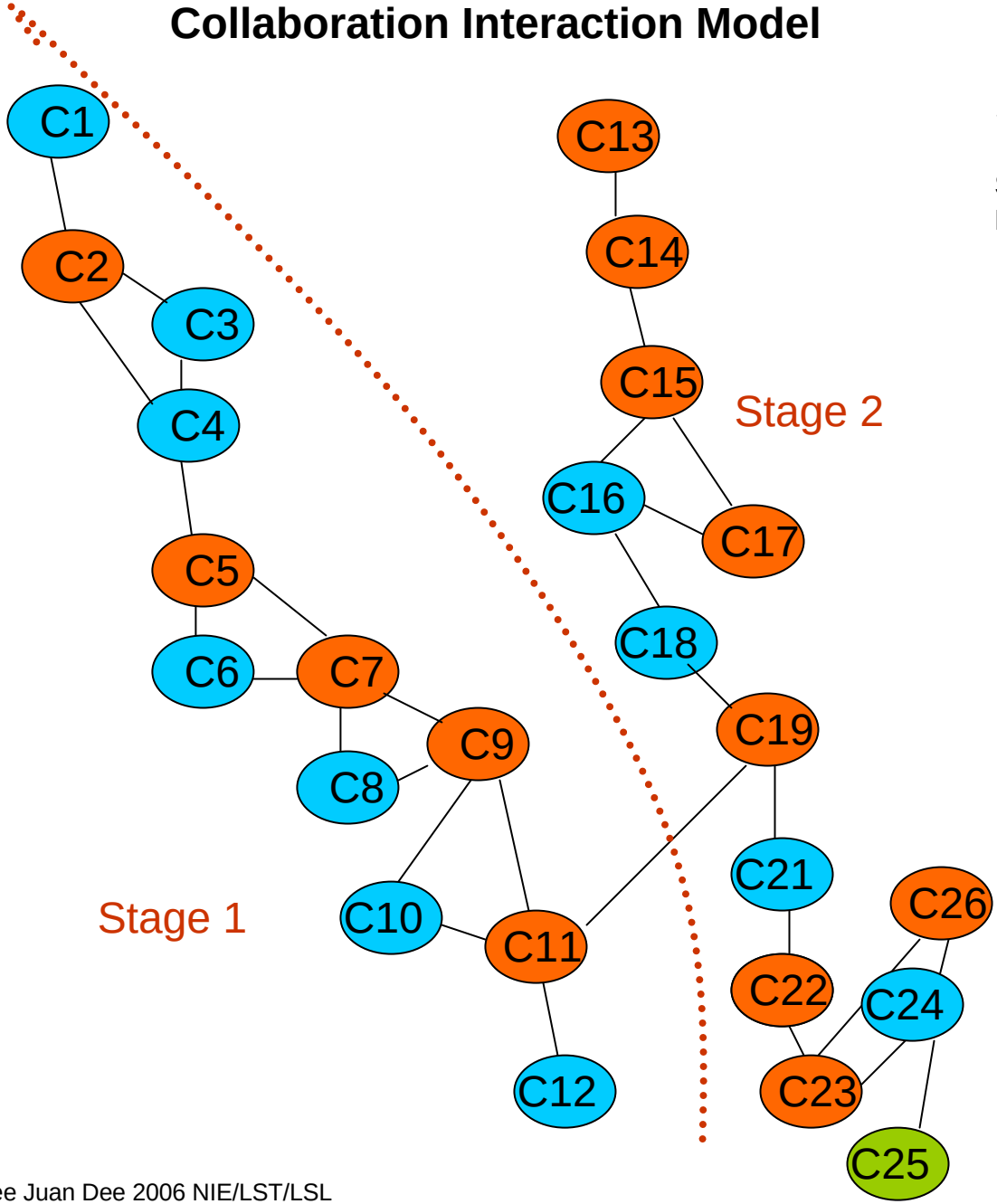
Collaboration Interaction Model



Stage Transition

Stages in Collaboration Interaction Model

This framework illustrate the how students negotiate meaning to solve mathematical problems. For a start, three students will come together with a task in mind. They will commence at stage 1. They will move from one stage to another state when there is a shift in the direction of the discourse. The reason for the directional shift in the discourse needs to be analyzed A directional shift could implicate a smooth transition to shared understanding before the shift.

Cn Student A's Contribution

Cn Student B's Contribution

Cn Student C's Contribution

where $n > 0 \quad n \in Z_+$

Collaboration Interaction Model

Stage 1 Stage 2 Stage 3 Stage 4

Stage Transition

1. **What is a stage transition?**

   Stage Transition occurs when a participant takes the initiative to propose an extension or new concept/formula/strategy of the subject that will cause a shift in the direction of discourse. This shift represents the stage transition.

2. **What causes a stage transition?**

   (a) Shared understanding reached between two or more participants which more often relies on the completion of any task allocated by the problem. This leads to the shift of direction in the discourse

   (b) Any participant have achieving some form of understanding of the subject individually shifting the direction of the discourse into another direction without the common consensus of other participants.

Collaboration Interaction Model

Stage 1 Stage 2 Stage 3 Stage 4

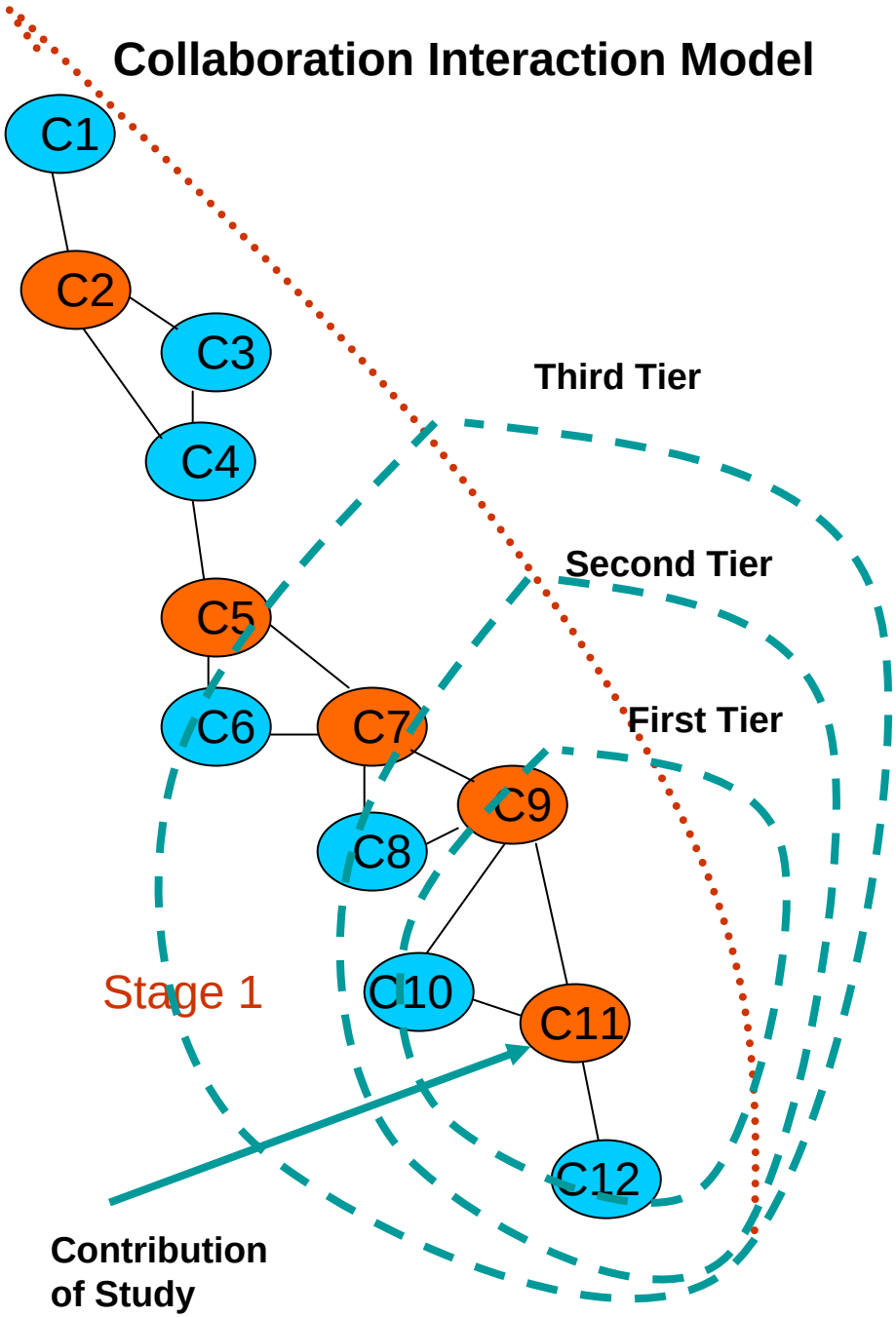
Stage Transition

3. **What happens when shared understanding is not reached?**

   Stage Reversal occurs when shared understanding is not reached among two or more participants. A stage transition is the cause of a shift in direction of the discourse. Taking for example stage 1 going to stage 2. Stage 1's discourse is in a different direction from Stage 2's discourse but in a Stage Reversal, Stage 2 proceeds on Stage 3 where Stage 3 shares similar direction of the discourse as Stage 1. Stage 1 and Stage 3 will consist of similar intrasubjective and intersubjective contributions. The probability of an reoccurrence of a Stage Reversal is dependent on

   (1) The level of shared understanding in the direction of the discourse that has resulted in Stage Reversal

   (2) The usefulness of the knowledge constructed in the direction of the discourse resulting the Stage Reversal applied in later chat segments.



Tracing Newly Constructed Knowledge using the Collaboration Interaction Model Tier Analysis

At a glance, the number of contributions can be traced by each student. Taking for example contribution C11. In order to understand how student A has achieved till stage C11. The first tier contribution which is C10,C9 and C12 will be analyzed followed by the second tier C8 and C7, followed by the third tier of contributions C6 and C5. This analysis will indicate the development of newly constructed knowledge via a tracing through various tiers of contributions. .The process of knowledge construction and how students mediate a shared understanding from this process can be studied by analyzing the influence of the tier contributions on the contribution of study

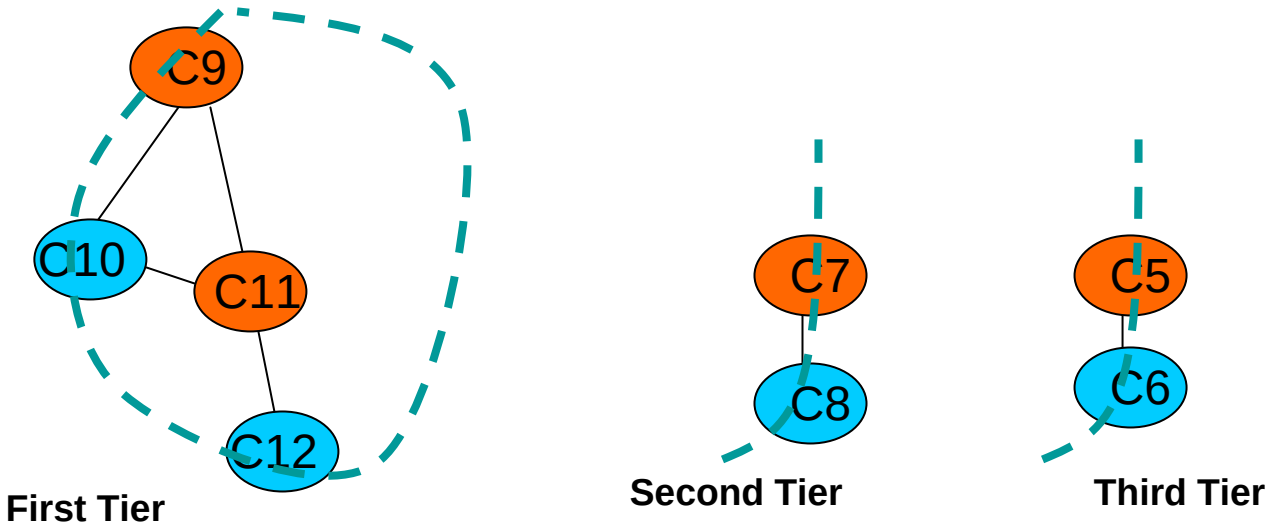
Cn Student A's Contribution

Cn Student B's Contribution

Cn Student C's Contribution

where $n > 0 \quad n \in Z_+$

Collaboration Interaction Model



When do we use Collaboration Interaction Model Tier Analysis (CIMTA)?

CIMTA is to use to trace back the path of knowledge construction. In a mathematic chat transcript, participants represent mathematical concepts and argument in term of mathematical symbols and formulas. It is argued that the influence of contributions on contributions by the participants lead to knowledge construction. By using CIMTA, the path leading to the construction of knowledge and the path the newly constructed knowledge is used for further knowledge constructed can be studied.

Taking for example a contribution of Study C11 is a mathematical symbol represented by the participant. The first tier analysis indicates the contributions influencing the construction C11 as well as contributions that C11 has influenced. In order to create the first tier of contributions, all the nodes that are directly linked to C11. The second tier analysis indicates the contributions (C7,C8) influencing the first tier analysis contributions (C9,C10,C12). The third tier analysis indicates the contributions (C5,C6) influencing the second tier analysis contributions(C7, C8)

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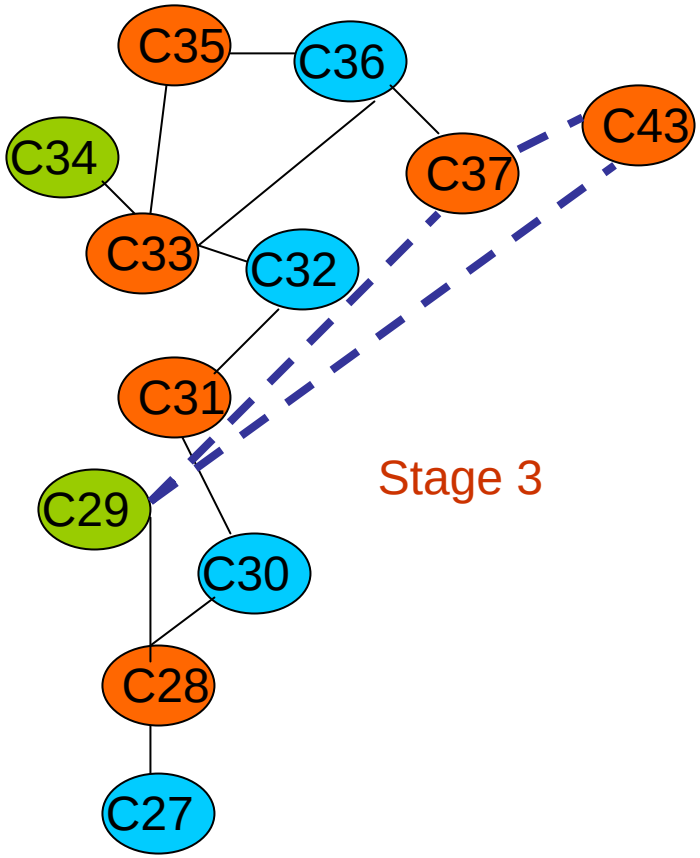
Collaboration Interaction Model



Taking up an earlier failed proposal in the Collaboration Interaction Model

C29 represents a failed proposal. C29 is was not taken up until later on in the chat transcript. C37 and C43 was a response contribution to C29. This failed proposal was used in the negotiation to obtained a shared meaning among student. It will be interesting to analyze why the proposal was not taken up until much later in the chat segment

Cn Student A's Contribution

Cn Student B's Contribution

Cn Student C's Contribution

where $n > 0 \quad n \in Z_+$

Information Uptake

- An event of a participant manipulating with the previously expressed information. This manipulation can be the addition, modification the existing information or relation to new information (Suthers, 2006)
- Uptakes relations must meet the criteria that the uptake was evidenced by observable manipulations or by reference to or reuse of information content (Suthers, 2006)

Intrasubjective Uptake

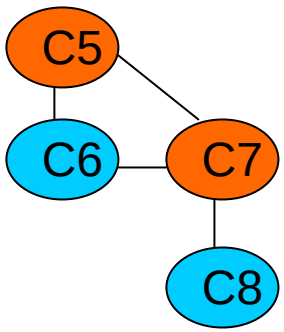
- The manipulations of items that were most recently manipulated by the same participant. (Suthers, 2006)
- In Collaboration Interaction Model, Intrasubjective Uptake is defined as manipulation of representations (Mathematical Symbols, Concepts, definitions) by the same participant at within the time frame of the chat.
- Intrasubjective Uptake will be traced throughout the Collaboration Interaction Model. More importantly, how Intrasubjective Uptake contributes to knowledge construction.

Intersubjective Uptake

- The manipulations of items that were most recently manipulated by other participant. (Suthers, 2006)
- In Collaboration Interaction Model, Intersubjective Uptake is defined as manipulation of representations (Mathematical Symbols, Concepts, definitions) by different participant at within the time frame of the chat.
- Intersubjective Uptake will be traced throughout the Collaboration Interaction Model. More importantly, how Intersubjective Uptake contributes to knowledge construction.

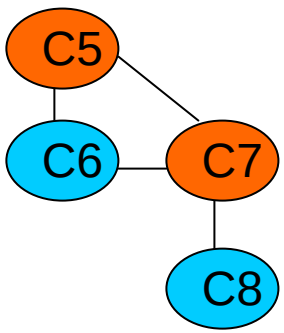
Types of Uptakes

- Intrasubjective Uptakes : Participant uptake their own contributions



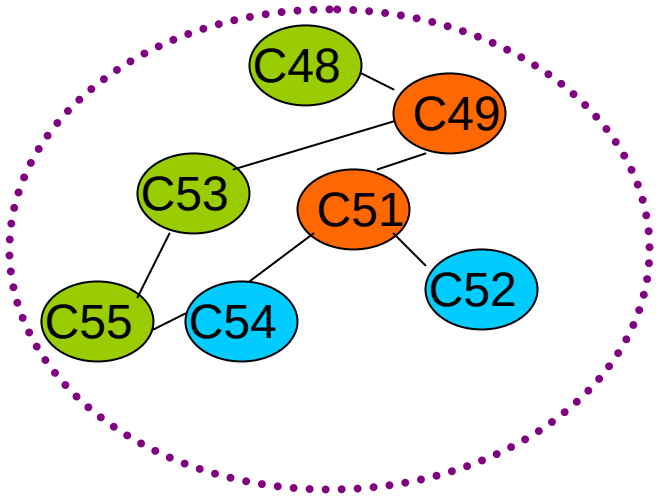
The contribution node C5 is intrasubjective Uptaken by contribution node C7 . There is a line connecting the two nodes. This connections implies that C7 is influenced by C5.

- Intersubjective Uptakes : Participant uptake other participant's contributions



The contribution node C6 is intersubjective Uptaken by contribution node C7 . There is a line connecting the two nodes. This connections implies that C7 is influenced by C6.C6 is contributed by a different participant to that C7.

Intrasubjective and Intersubjective Uptakes

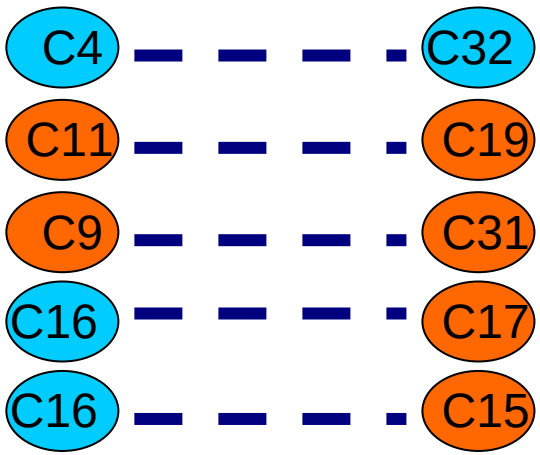


Meaning is created at the group unit of analysis rather by particular individuals (Stahl, 2006). The analyze of Knowledge construction consists of several intrasubjective and intersubjective uptakes of contributions by different individuals. The contributions are manipulated This manipulation can be the addition, modification the existing information or relation to new information (Suthers, 2006). The newly created contribution may be further manipulated (intersubjectively or intrasubjectively) to form new contributions. The Collaboration Interaction Model investigates how knowledge is constructed through the series of manipulations of contributions.

Intrasubjective and Intersubjective uptakes across stages

Reasons for Intrasubjective and intersubjective uptakes at across stages

1. A stage reversal has occurred. Shared understanding has not been mediated hence causing a stage reversal.
2. The contribution is required for knowledge construction in the other stages
3. When a stage transition occur, the discourse shifts in direction. Intrasubjective an intersubjective uptakes across stages indicates that a contribution in an earlier stage is manipulated and use for knowledge construction in a later stage.



Stage 1 to Stage 3 Intrasubjective uptakes

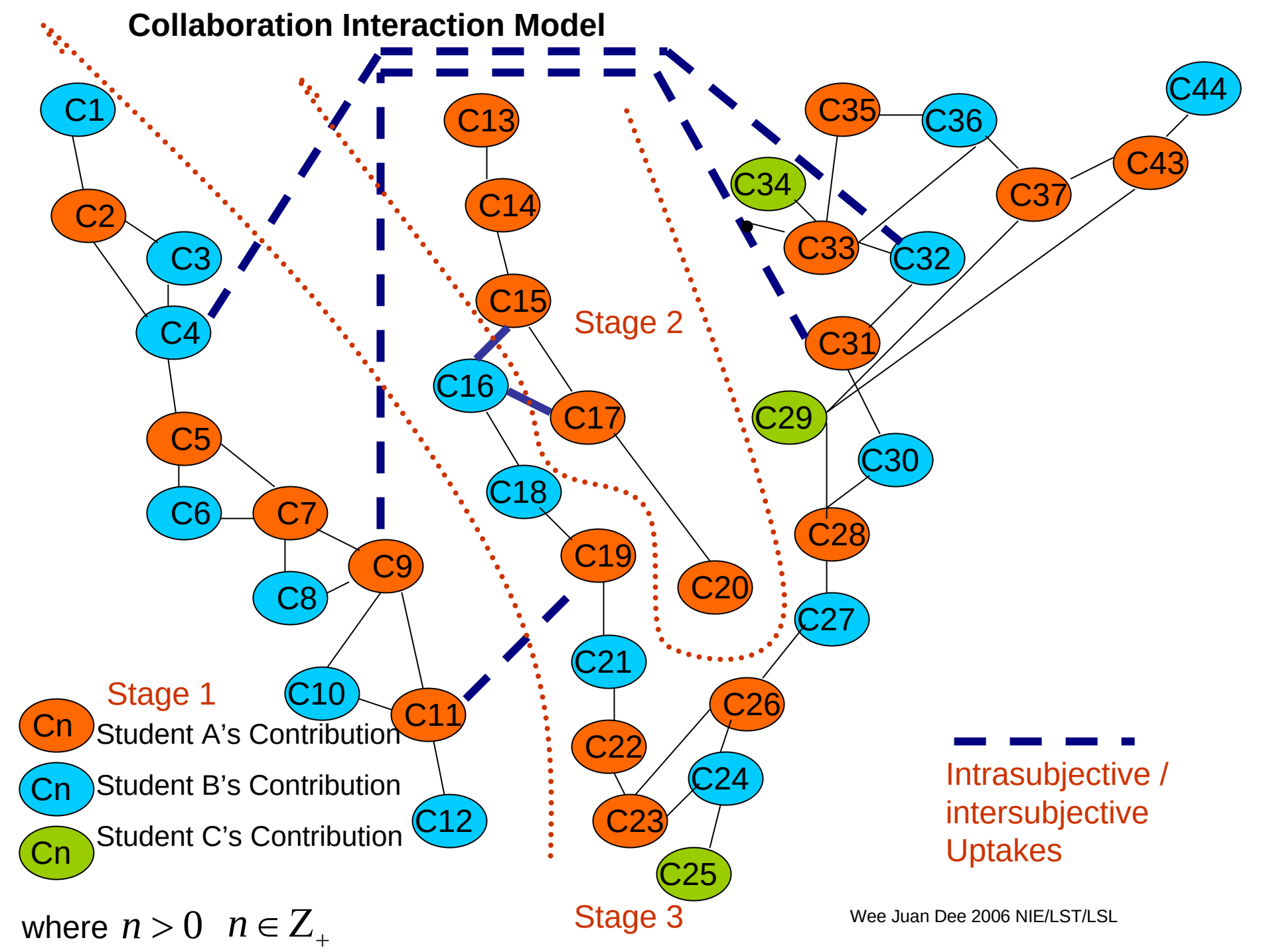
Stage 1 to Stage 3 Intrasubjective uptakes

Stage 1 to Stage 3 Intrasubjective uptakes

Stage 2 to Stage 3 Intersubjective uptakes

Stage 2 to Stage 3 Intersubjective uptakes

(See the Collaboration Interaction Model (next slide) for the Intrasubjective and Intersubjective uptakes across stages)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Stage 1
Stage 2
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Cn Student A's Contribution
Cn Student B's Contribution
Cn Student C's Contribution
Intrasubjective / intersubjective Uptakes
where $n > 0 \quad n \in Z_+$
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Collaboration Interaction Model

Data Collection;

1. All chat data are chat logs of mathematical sessions between three to four students from Jurong Junior College

2 All students have prior knowledge on the subject. The students received training to the extent that the level of mathematical background knowledge assumed in a proposal must be compatible with the expertise of the participants. (Stahl, 2006)

3 Some descriptions within the textual posting have be improved for readability by an international audience

4 Detailed Analysis of the chats using the Collaboration Interaction Model are found in Processed Data 06S17Team 3.pdf