

Critical Thinking through Asynchronous On-line Discussions

Hera Chu

Korea University

This paper investigates interaction patterns and critical thinking processes by which knowledge is constructed in an asynchronous on-line discussion in comparison with those of a face-to-face discussion through videoconferencing. The purpose is to show that conducting the on-line discussion as part of a learning process is an effective method for generating critical thinking. Participants were undergraduate students consisting of non-native speakers of Korean and Japanese. Online discussions have been seen as an effective means to encourage collaborative construction of knowledge. Based on the perspective of collaborative learning, the author adopts the Garrison et al. (2001)'s model as a basic framework for analyzing types or levels of critical thinking (i.e., trigger, exploration, integration, resolution). Quantitative measures of participation are conducted to determine the factors which affect the outcome of collaboration. The results suggest that in-depth thinking using higher levels of critical thinking was more likely to occur in asynchronous on-line discussions than in face-to-face discussions. This tends to be supported by collaboration and the way of triggering further responses. Based on the findings, this study attempts to illuminate the process of collaborative interaction in developing knowledge in the asynchronous on-line discussion.

1. Introduction

In the discussion-oriented class, a key educational objective is to encourage critical thinking among students about controversial issues which have no one right answer that the student can memorize for the examinations. 'Global English' under investigation is an undergraduate course which demands the acquisition and utilization of critical thinking skills as it is primarily designed to deepen and widen students' knowledge on the socio-cultural issues around their life through discussions via multiple channels: face-to-face through videoconferencing followed by on-line asynchronous discussions and chats. Thus, there is a need to evaluate students' use of such skills occurring in their discussions and how the recursive learning process through a variety of educational tools affect their use of critical thinking skills in order to ensure that the course has been effective in achieving its goals. The focus of this study is to evaluate on-line asynchronous discussions as part of the learning process for complementing weaknesses of face-to-face discussions in developing students' critical thinking. Research suggests that face-to-face discussions disadvantage students who are shy and low in oral fluency. (Warschauer, 1996)

On-line forums are known to give all students a greater equality of participation (Kern, 1995; Warschauer, 1996). In addition, online forums, like Bulletin board(BB) discussion, allow students to view other student's posts, learn through the exposure to different perspectives and

develop individual meanings, which in turn encourages critical thinking.(Lamy & Goodfellow,1999; Kamhi-Stein,2000; Garrison et al.,2001) The process of writing about what they have learned and thought engages students in an active learning experience, thus creating a collaborative learning environment that motivates students to learn together and to learn from each other.

However, while the increasing number of research has investigated the effectiveness of on-line discussions in terms of students' critical thinking between native speakers or between native and nonnative speakers in the higher educational settings, little research has been done with interactions among non-native speakers only. In the case of non-native speakers' discussions whether in general or via CMC, it is easy to become only a means of practicing language due mainly to the gap between learners' cognitive and language abilities although curricular goals are to generate critical thinking skills such as problem solving or knowledge construction as well as to develop language skills. It gives more reasons to investigate if the reported potential that on-line discussions have for facilitating critical thinking would hold true in nonnative students' on-line discussions as well.

This research, therefore, aims to assess the nature and quality of discourses emerging from asynchronous on-line discussion sessions among Korean and Japanese undergraduate students in comparison with those of a face-to-face discussion through videoconferencing. This will be accomplished first by investigating the depth and type of critical thinking in both modes of discussions, and then by illuminating participation patterns in on-line discussions to see whether or how they affect the level of learners' critical thinking based on the collaborative perspective.

2. Theoretical Framework: Critical Thinking and Collaborative Learning

Critical thinking is referred to as the ability to “construct experience and knowledge through the critical analysis of subject matter, questioning, and challenging of assumptions” (Dewey, 1959; Lipman, 1991 cited in Garrison et al., 2001b, p.1). This definition derived from the assumption that knowledge is not just transmitted, but created. According to Harasim(1997), knowledge construction in collaborative learning is fundamentally different from the one in the traditional “direct transfer” model in which the instructor is assumed to be the sore source of knowledge and skills. In the collaborative learning, learners are viewed as ‘active’ participants in the sense that “learners must participate and interact with the surrounding environments in order to create their own view of the subjects.”(Jonassen, 1994, p.5). As a result, knowledge can be socially constructed by means of peer interaction, evaluation, and cooperation rather than transmitted or reproduced. This, in turn, suggests that collaboration is crucial in critical thinking by which knowledge is constructed.

As mentioned earlier, on-line discussions have the potential to promote a collaborative learning environment which enables learners to reflect, formulate ideas and have more thoughtful responses. The significance of the collaborative context to the cognitive development has been supported by Lipman (1991) and Garrison et al.(2001) who believe that the development of a

'community of enquiry' is essential for the development of higher level, critical thinking skills within a virtual text-based environment. Garrison et al. (2001)'s 'practical inquiry model' was adapted for detecting the presence and process of critical thinking in this study. Their 'practical inquiry model' was considered to be a suitable basis because it was specially developed for understanding the nature of discourse used in computer conferencing in higher education. In this model, cognitive presence is operationalized as a tool to assess critical discourse and reflection. It is defined as "the extent to which learners are able to construct and confirm meaning through sustained discourse in a critical community of inquiry". (Garrison et al., 2001b, p.5). Cognitive presence, thus, can best be understood as critical thinking in this framework.

The inquiry process consists of four phases of cognitive presence: 1) triggering event, 2) exploration, 3) integration, and 4) resolution. According to the model, the active construction of knowledge progresses by the sequence above. The characteristics of each phase are described as follows (Garrison et al., 2001b, p.4):

- 1) *Triggering event* as an initiation phase begins a dialog about a particular issue. A problem emerging from experience is identified and recognized.
- 2) The second phase is *exploration*. Participants move between private reflection and social exploration as they strive to perceive and grasp the nature of the problem, and then move to a fuller exploration of relevant information being selective to what is relevant to the problem. This phase is characterized by brainstorming, questioning, and exchange of information.
- 3) *Integration* is the third phase in which participants begin to construct meaning from the ideas generated in the previous phase. The applicability of ideas is assessed in terms of how well they connected and describe the issue at hand.
- 4) *Resolution* involves a vicarious test of the adequacy of the proposed solutions.

The categories of the analysis for critical thinking for this study were constructed by modifying the Practical Inquiry Model by Garrison et al. (2001) as a basic coding framework and adding some features which are unique to this study.(see Method)

Based on the aforementioned theory and purposes of this study, this study addresses the following questions.

- 1) What are the types of critical thinking exhibited in the online discussion, and in what ways is that similar or different from those of the face-to-face videoconferencing?
- 2) How do the participation patterns(one-way or not) affect the level and the extent of critical thinking skills?
- 3) What are the patterns of critical thinking process displayed in threaded posts? And how does it affect the level and the extent of critical thinking skills?

3. Method

3.1 The Design of the course

This study examines online BB and face-to-face discussions from the undergraduate level course titled 'Global English' which is one of the courses constructing the KWCCDL project. Participants consisted of 25 Korean students and 26 Japanese students. Data were collected during the spring semester in 2004. The course, 'Global English' was held on a weekly basis to discuss a variety of social-cultural issues. Topics of discussions varied ranging from issues on North Korea to bullying and plastic surgery. The course was conducted in a combination of face-to-face sessions through videoconferencing and two other sessions using CMC tools. One was an asynchronous on-line discussion through a Bulletin Board system, and the other was synchronous on-line chatting sessions. Thus, the learners enrolled in this course met at three levels: face-to-face, on-line discussions and chatting with pairs. This recursive learning process provided students with multiple access to the subject matter.

The asynchronous BB discussion was introduced as a follow-up activity of the face-to-face videoconferencing. For the asynchronous on-line discussion, students were asked to post their messages outside of class time based on the contents discussed or presented in the face-to-face discussion. The students were directed to log in at least twice for one discussion topic first to enter their comment to a topic or formulate a question on it, and later to read and respond to replies others have made to that topic. Thus, dialogues were continuously made in ways that responses to the original messages or other posted responses become threaded. Student participation was counted toward their overall grade- students obtained credit for posting, and responding to the others – so that this on-line discussion is a vital part of the course work.

3.2 Materials and Procedures

Two Bulletin Board discussions and two weekly based face-to-face discussions were analyzed both qualitatively and quantitatively. The discussion topics chosen for investigating were 'Marriage Culture' and 'North Korea' in which students expressed a more interest. The level of participation was analyzed quantitatively based on the number of message or turns by the type of critical thinking and the number of threads and monologues. Also, by investigating participation patterns, it attempted to look at the flow of the discourse to see how collaboratively the discussions were held.

Qualitative analysis includes classifying students' posts or turns by the type of critical thinking. Messages were coded according to the modified version of the Practical Inquiry model.(Appendix) The unit of analysis was the complete message. Some modifications to the Practical Inquiry model were necessary because most first messages of the students in the on-line

discussion functioned as an initiative of a problem but with the demonstration of a deeper understanding on the problem. Accordingly, it was required to have a new category for classifying messages like the first example. The recursive process allowed participants to begin their discussion with some extent of understanding on the issue discussed. Or the reflective nature of asynchronous on-line discussions can also account for the reason. Therefore, a phase 'Comprehension' was introduced into the Garrison et al' s model with the basic function as an initiative of a problem shared by Recognition in order to fit the missing category.

The Comprehension phase also shares some functions of Exploration of the Practical Inquiry model. According to the model, earlier in Exploration, "students are required to perceive or grasp the nature of the problem"(Garrison et al, 2001b, p.4). At the same time, this stage in the Practical Inquiry model also requires students to move to a fuller exploration of relevant information being selective to what is relevant to the problem at the end of the phase, which demands busy work itself. Judging from the divergent role played by Exploration and the need for establishing new phase which fits this study, dividing Exploration of this model into two different phases, Comprehension and Exploration, seemed appropriate. In this way, the modified coding scheme of the Practical Inquiry model for this study was constructed as follows: *1)Recognition, 2) Comprehension, 3)Exploration, 4)Integration, and 5)Resolution*. Comprehension in the modified version functions as an initiative of a problem with the demonstration of a deeper understanding on the nature of a problem. Exploration, then, becomes the subsequent phase in which knowledge and alternatives that can help to solve a problem are searched and selected. Except for these modifications, the Practical Inquiry model remained almost the same and was used as a basis for investigating critical thinking in this study. A detailed description of categories for critical thinking analysis for this study is given in Appendix.

4. Results and Discussion

4.1 The Level of Critical Thinking: On-line Vs. Face-to-face Discussion

Each mode of communication revealed the presence of critical thinking during discussions except for phase 5, Resolution.(Tab.1.2) On-line discussions reflected 145 occurrences of critical thinking skills (90%) of a total of 160 posts, while face-to-face discussions demonstrated 47 cases (50%) out of 96 turns. Overall, the data suggests that the participants had a tendency to use a wider range and higher levels of critical thinking skills in the asynchronous on-line discussion than in the face-to-to discussion. In the on-line mode, the discussion centered on phase 3, Exploration (48%) and phase 2, Comprehension (28%) followed by phase 4, Integration (10%) and phase 1, Recognition (5%) as the least. In the meantime, the face-to-face mode had phase 1, Recognition (31%) most, with almost half as many cases of phase 3, Exploration (18%) as Recognition, and 1 case of phase 2, Comprehension. Thus, the results indicate that asynchronous discussions can be a

more effective tool than the face-to-face communication in developing critical thinking skills.

Tab.1 Relative frequencies for critical thinking levels by subject in on-line discussions

Subject	Total number of posts	Phase 1 Recognition		Phase 2 comprehension		Phase 3 exploration		Phase 4 integration		Phase 5 resolution		Other	
		n	%	n	%	n	%	N	%	n	%	n	%
Marriage culture	82	4	5	25	30	37	45	10	12	0	0	6	7
North Korea	78	4	3.3	19	27	40	50	6	7.7	0	0	9	11.5
Total	160	8	5	44	27.5	77	48	16	10	0	0	15	9.3

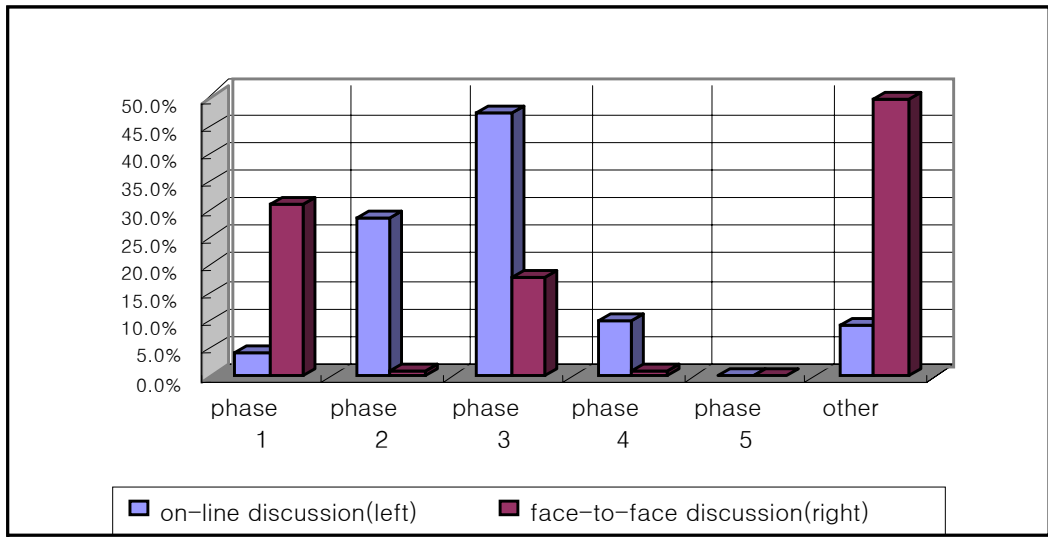
Tab.2 Relative frequencies for critical thinking levels by subject in face-to-face discussions

Subject	Total number of turns	Phase 1 Recognition		Phase 2 comprehension		Phase 3 exploration		Phase 4 integration		Phase 5 resolution		Other	
		n	%	N	%	N	%	N	%	n	%	n	%
Marriage culture	42	14	33	0	0	10	22.3	1	2	0	0	17	40
North Korea	54	16	29.6	1	1.8	7	12.9	0	0	0	0	30	55.5
Total	96	30	31	1	1	17	17.7	1	1	0	0	47	50

In terms of knowledge construction, table 1 and 2 displays that phase 4, Integration occurred 10% in on-line, 1% in the face-to-face discussion. These differences suggest that knowledge was created dominantly via on-line only. However, the fact that Integration was used less than 10 % and phase 3. Exploration was most common implies that participants focused more on exchanging information rather than constructing new meaning from the on-line discussions. Garrison et al.(2001) states, citing Kanuka and Anderson(1998), that because of the democratic nature of the medium and the way it is used, participants feel comfortable remaining in a continuous Exploration stage. Therefore, they further suggest computer conferencing require active teaching presence to move the process to more advanced stages of critical thinking.

Another important revelation is that problems were mostly triggered by phase 1, Recognition(30%) in face-to-face, but, interestingly by phase 2, Comprehension(29%) in the on-line discussion. Furthermore, given that critical thinking is more likely to be produced through on-line tools as the results of this study suggests, Comprehension as a problem initiating strategy is expected to contribute more to triggering further discussion than Recognition. This issue will be further discussed in the section 5.3 Patterns of Critical Thinking Process.

Fig 2. Comparison in depth of critical thinking by phase between f2f and on-line discussion



4.2 Participation Patterns: Monologues vs. Threaded Posts

Table 3 reveals significant differences in the depth of discussion between the cases when posts failed to invite further responses(monologues) and when they proceeded further discussion(threaded posts). Approximately, 70% of the total posts were threaded, while the rest of the posts were left unanswered. Considering the large size of the class, the result was not unexpected. Garrison et al.(2001a) states that to critically analyze and construct meaning, content must be limited. It seems to me that it applied to the on-line session of this study. Arranging discussion groups with small number of participants should be considered to avoid the excessive numbers of postings on the same topic. (Garrison et al., 2001) Monologues were reflected mostly in phase 2. Comprehension (58% in the “marriage culture” session, 40% in the ‘North Korea’ session), and then in phase 3. Exploration next(approximately 29%) for both on-line discussion sessions, but only one case of phase 3 integration. On the contrary, the most favored stages used in threaded posts were phase 3. Exploration(more than 55%), Comprehension(20%) followed by Integration(15.5%). It is rather surprising that Integration occurred more than 15% in the threaded posts while 1% in monologues.

Tab.3 Relative frequencies for critical thinking levels by the type of posts in on-line discussion

Subject Type	Marriage culture				North Korea			
	Monologues (29.2%)		Threaded posts (70.7%)		Monologues (34.6%)		Threaded posts (65%)	
	N	%	N	%	N	%	N	%
P1 recognition	1	4.1	3	5.1	1	3.7	2	3.9
P2 comprehen sion	14	58.3	11	19	11	40	10	19.6
P3 exploration	5	29.8	31	55	8	29.6	31	60.7
P4 integration	1	4.1	9	15.5	0	0	6	11.7
P5 resolution	0	0	0	0	0	0	0	0
Other	3	12.5	3	5.1	7	25.9	2	3.9
Total	24	100	58	100	27	100	51	100

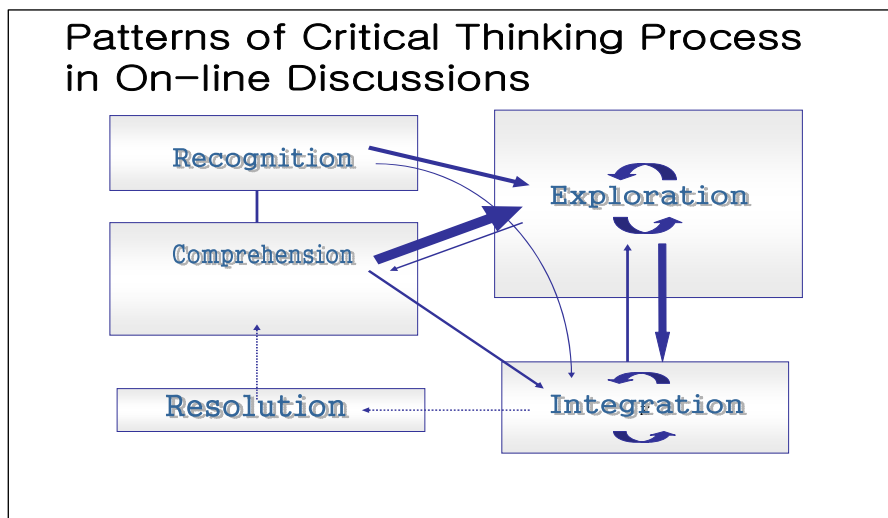
(1. Monologues refer to one-way interaction only without reply. 2. Posts involving two-way or multiple interaction were considered threaded posts, even though they did not invite further responses. i.e. posts which come at the end of a thread)

The results showed that the level of critical thinking was higher and wider when posts were threaded than left alone. Threaded posts generated not only higher levels of critical thinking but also knowledge construction almost only- 15 cases of Integration occurred out of a total 16 cases in the threaded posts. Integration stage tended to appear when the initiator of a thread actively responded back to replies of one's original postings (8 out of 15 cases). Or Integration seemed to be generated by other Integrations.(6 out of 15). This seems to lend supports to the view that collaboration contributes to cognitive developments. Then, this raises several questions: 1) what features are most stimulating in inviting responses of others, in turn, facilitating further discussions?, 2) How are such threads initiated and developed?

4.3 Patterns of Critical Thinking Process

Figure 3 illustrates the patterns of critical thinking process in the on-line discussion. Of the threaded posts, the phase which stimulated further responses most was phase 2. Comprehension in the both on-line sessions. The session for the topic 'Marriage culture' included 16 cases of threads which were initiated respectively by 'Comprehension' (9 cases/16), 'Recognition' and 'Exploration' (3 cases for each), and one unclassified item. The similar results were observed in the discussion for 'North Korea', displaying 'Comprehension'(7 out of 15 cases) as the most effective stimulus for threaded discussions followed by 'Recognition' and 'Exploration'(3 cases for each). Thus, most discussion started from phase 2. Comprehension.

Fig.3 Patterns of critical thinking process in on-line discussions



(Arrows indicate the flow of interaction. 1. The thicker the arrow, the more frequent the interaction is. 2. Dotted arrows indicate interaction which did not happen but possible to happen.)

As seen in Figure 3, critical thinking showed a strong tendency to move forward or sustain at a same level rather than go downward to lower phases. Another characteristic of the process is that participants tended to remain in the Exploration mode. It clearly demonstrates the necessity to establish some kind of knowledge organizers in the discussion who can guide participants toward the advanced levels of thinking as Garrison et al.(2001) suggest. It is also evident from fig.3 that no progress from the Recognition phase to the Comprehension phase appeared. As assumed in the stage of constructing the coding scheme based on the Practical Inquiry Model, Recognition and Comprehension were characterized basically as a initiative phase in which a particular problem or an issue is aroused, detailed functions to perform in each phase differ though. This raises a question as to the role of Comprehension compared to Recognition in terms of critical thinking development. Comprehension was indicated as most common in triggering further responses. However, unfortunately no evidence was found that Comprehension resulted in Integration whether through Exploration or not more than Recognition in the on-line discussion. However, from the fact that Comprehension triggered further responses most, Comprehension can be considered to be an effective factor in inducing a collaborative learning environment.

5. Conclusion

The purpose of this study was to evaluate on-line asynchronous discussions 1) as part of the integrated leaning process for complementing face-to-face discussions in developing students' critical thinking and 2)as a tool for developing critical thinking among non-native speakers. It is

concluded that critical thinking was present in both on-line(90%) and face-to-face discussions(50%), but the wider range and higher levels of critical thinking occurred considerably more in on-line discussions. Therefore, it suggests that on-line discussions can create opportunities for developing critical thinking, thus complementing face-to-face discussions in terms of developing critical thinking as an integral part of learning. However, participants mostly engaged in exchanging information rather than constructing new meaning in the on-line discussions.

To show asynchronous on-line discussions a tool for enhancing critical thinking among non-native speakers, this study examined whether the potential of on-line discussions among natives are proved to be true in non-native speakers' discussions. The potentials include promoting a collaborative learning environment which enables learners to reflect, formulate ideas and have more thoughtful responses. Integration where knowledge construction takes place was observed to occur when there was active participation from students. Thus, it suggests that collaboration did appear and enabled knowledge construction in the non-native speakers' on-line discussions as well. In addition, Integration tended to be also generated when discussions already reached a certain level of critical thinking, that is, another integration phase already appeared in the same thread. It is consistent with the finding from the observation of critical thinking processes in the on-line discussion that critical thinking tended to move forward or sustain at a same level rather than go downward to lower phases. These results imply that care needs to be taken to establish some kind of help from knowledge organizers who can move the thinking process upward.

To investigate the critical thinking present in both modes of discussions, this study adopted a Practical Inquiry model with some modifications. Most important were that Comprehension was introduced as a next level of Recognition with the function of initiating a problem with deeper understanding. Comprehension was indicated as most common in triggering further responses, thus considered effective in creating a collaborative environment.

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Appendix

* Critical thinking process coding model (adapted from Garrison et al. ‘Practical Inquiry Model’, 2001)

Phases	descriptors	indicators
Phase 1 recognition	<i>Initiative</i> An issue, dilemma, problem that emerges from experience is recognized and identified.	1.1 Recognizing a problem: - pass on information on its elements that culminate in a question 1.2 sense of puzzlement: - pose a question - messages that take discussion into new direction
Phase 2 comprehension	<i>Evocative</i> The nature of the problem is perceived, grasped and aroused.	2.1 Demonstrating understanding of the stated meaning of a problem: - describe, rephrase, explain a problem 2.2 Inferring the underlying values, beliefs and assumptions of a problem: - speculate, generalize a problem
Phase 3 exploration	<i>Inquisitive</i> Information, knowledge and alternatives that can help to solve a problem are searched and selected.	3.1 Analysis: - examine or break down information into parts - compare, contrast and sequence ideas or facts 3.2 Divergence - Unsubstantiated contradiction of previous ideas e.g, I think that dose not really matter....

		<p>3.3 Convergence - Unsubstantiated agreement of previous ideas</p> <p>3.4 Suggestions for consideration: - Author explicitly characterizes message as exploration; e.g., "Does that seem about right? Or "am I way off the mark?"</p> <p>3.5 Brainstorming : - Adds to established points but does not systematically defend/justify/develop addition</p> <p>3.6 Leaps to conclusion: - Offers unsupported opinions</p>
Phase 4 integration	<p><i>Tentative</i></p> <p>Knowledge is constructed in a new pattern by combining the ideas generated.</p>	<p>4.1 Convergence: - Reference to previous message followed by substantiated agreement; e.g., "I agree because..." - building on, adding to others' ideas</p> <p>4.2 Proposing tentative solutions: -Justified, developed, defensible, yet tentative hypotheses</p> <p>4.3 Connecting ideas, synthesis: - Integrating information from various sources(textbook, articles, personal experience)</p>
Phase 5 Resolution	<p><i>Committed</i></p> <p>Proposed solution or hypothesis is vicariously tested through experiments and consensus building.</p>	<p>5.1 Vicarious application to real word</p> <p>5.2 Testing solutions: Coded</p> <p>5.3 Defending solutions</p>