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Online Discussion in an Independent Academic BBS Forum: Two Case Studies

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This study analyzed two cases, totaling 56 messages, from the math board, an independent academic discussion forum in a Bulletin Board System (BBS) Website. A new coding framework was introduced and employed to do content analysis of the messages of the two cases. With this framework, five key variables were examined: (1) cited times, (2) cognitive skills, (3) evaluation, (4) invitational form, and (5) social cues. Transcript content analyses showed that the messages structures of the two cases were coherent but fragile. Participants were more likely to respond to the latest messages in the discussion. Also, they were likely to both post and respond to critical messages and messages with personal idea. But they seldom posted questions to invite answers. Lastly, participants were not likely to develop informal conversation with others during the discussion.

Key words: online discussion; BBS; academic forum

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Online discussion forum is getting increasing use in instruction and learning (Littleton & Häkkinen, 1999; Schrage, 1990) for its many advantages over traditional face to face interaction or other kinds of distance interaction forms (TV, phone, email, online chatting room, etc.), such as, removal of time and space restrictions (Barnes & Greller, 1994; Mehlenbacher Miller, Covington, & Larsen, 2000; Schwartz, 1995), allowing for more egalitarian mode of communication (Ruberg, Moore, & Taylor, 1996; Willis, 1991).

Most current studies focused on dependent forums, which are related to specific courses (Davidson-Shivers, Muilenburg, & Tanner, 2001; Hara, Bonk, & Angeli, 2000; Mazzolini & Maddison, 2003; Thomas, 2002) to do content analysis of online discussion (Henri, 1992; Mowrer, 1996). These researches have shown that online discussion can promote active and critical thinking (Greening, 1998; Thomas, 2002). Students processed course information at a fairly high cognitive level in online academic discussion (Hara et al., 2000). Also, they found that the ways in which instructors post to forums can influence students' discussions and perceptions (Mazzolini & Maddison, 2003).

This study extended this line of research by examining how participants interact with one another in an independent academic discussion forum. Instead of using course related forums which may involve both teachers and students and have many requirements for them, I selected the math board, an independent academic discussion forum of a Bulletin Board System (BBS) Website, to do the content analysis of discussion messages. In contrast with course related forum, discussion within such forum is entirely voluntary, carrying no intrinsic assessment weight (Mazzolini & Maddison, 2003), and receiving no disturbance or influence from course restrictions or instructor interventions.

In particular, this study tried to answer the following two questions:

1. What are the characteristics of the structure of discussion messages in online independent academic forum?
2. What kinds of messages are participants more likely to post or respond to in online independent academic forum?

In this study, I introduced a new framework for analyzing BBS messages. Then, I used it to code two cases from the same discussion forum. Finally, I did qualitative and quantitative analyses of the two cases to address the two research questions. Through this effort, the findings of this study are expected to improve our understanding of the interaction pattern and participants' preferences in independent discussion settings, and thereby inform teacher interventions in online course related forums.

Theoretical Framework

Online discussion forum is one kind of computer mediated communication environments (Thomas, 2002). It can be used for social interaction only, for discussion of assignments and other assessable work, as a collaborative tool for individual project groups, for tutorial purposes, or as a central part of the teaching strategy (Mazzolini & Maddison, 2003). Online discussion forum can generate and enhance two-way synchronous or asynchronous interaction, which is one distinguishing characteristic as compared with other forms of non face-to-face interaction, such as TV, phone, email, or online chatting room (Rosman, 1999).

When applied into instruction and learning, online discussion forum has been suggested as a beneficial tool for leading enhanced learning outcomes of students (Thomas, 2002). For instance, online discussion can increase "wait-time" and general opportunities for reflective learning and processing of information (Hara et al., 2000; Harasim, 1993). It also can promote increased student engagement, collaborative thinking, critical analysis, and social construction of knowledge (Dehler & Parras-Hernandez, 1998; Ruberg et al., 1996; Warschauer, 1997). The lack of nonverbal cues, and the associated depersonalizing of communication, allows for a more egalitarian mode of communication (Ruberg et al., 1996; Willis, 1991). Another benefit of online discussion is that it can provide a permanent record of one's thoughts for reuse. Moreover, researchers can use the record to track student development both over

extended periods of time as well as within a single online session (Hara et al., 2000).

However, online discussion may also have many weaknesses. For example, lacking of visual communication cues (Kuehn, 1994), such as gestures, smiles, or tone of voice, may force users to make certain assumptions about the audience (Hara et al., 2000). Also, "active listeners" or "lurkers" might read but not respond to the messages (Shapard, 1990) during the discussion process. In addition, as online discussion is highly mediated, design faults of the interaction platform, such as low-level stability (Mehlenbacher et al., 2000), lack of necessary tools, tiring interface or navigation missing (Klassen, Vogel, & Moody, 2001), can place users at a distinct disadvantage.

The benefits and disadvantages of online discussion forum have been widely debated (Kang, 1998). Earlier research tended to focus on the accessibility or impact of it, or its effects on society, teaching, and student learning (Romiszowski & Mason, 1996). While researchers recently paid much attention to the social or cognitive processes exhibited in the online discussion transcripts as well as the interactivity patterns among the students (Davidson-Shivers et al., 2001; Hara et al., 2000; Mazzolini & Maddison, 2003). In particular, they were likely to explore the following four dimensions: cognitive skills, evaluation, invitational form, and social cues.

Cognitive Skills

The cognitive skills dimension characterizes the depth of processing revealed in the content of discussion messages (Hara et al., 2000). Henri's (1992) framework classified cognitive skills into five levels: elementary clarification, in-depth clarification, inferencing, judgment, and application of strategies. At this dimension, Hara et al. (2000) employed Henri's (1992) framework to analyze an online conference related to a traditional graduate level educational psychology course. Their results showed that students were processing course information at a fairly high cognitive level in online discussion.

Evaluation

The evaluation dimension characterizes how the current speaker assesses the previous action and the current problem-solving trajectory (Goodwin & Goodwin, 1987; Pomerantz, 1984). Chiu (2000) classified the evaluation dimension into three categories: supportive, critical, and unresponsive. Supportive actions tend to reinforce the direction of the current problem-solving approach (Sacks, 1987). Criticisms tend to alter the problem-solving trajectory by identifying flaws and developing alternatives (Chiu, 2000). Unlike criticisms, unresponsive actions do not acknowledge the previous speaker, which in some contexts suggest that his or her proposal was unworthy of comment (Chiu, 2000).

In the "critical" category, Norris and Ennis (1989) classified it into three levels for evaluating students' critical thinking: (1) Low: messages in this category displayed a lack of critical thinking; (2) Medium: messages in this category displayed only minimal evidence of critical thinking; (3) High: messages in this category displayed a high level of critical thinking. With this taxonomy, Thomas's (2002) study showed that the virtual learning space of an online forum can promote participants' critical thinking.

Invitational Form

The invitational form dimension encourages participation from the audience to different degrees and also includes at least three possibilities: statements, questions, and commands (Chiu, 2000). Statements declare information unintrusively without eliciting participation from others. In contrast, questions invite audience participation somewhat intrusively by articulating an action/information gap for them to fill, thereby requesting an action, problem information and/or an evaluation. Finally, commands demand audience participation.

At this dimension, Davidson-Shivers et al.'s (2001) comparison between synchronous and asynchronous online discussion showed that the proportion of questions in chatting mode was more than that in threaded discussion.

Social Cues

Social cue of a message was a part of statement not related to formal content of subject matter (Henri, 1992). Social cues might include a self-introduction, expression of feeling (e.g., "I'm feeling great ..."), greeting (e.g., "Hi, everyone"), closure (e.g., "That's it for now"), jokes, the use of symbolic icons (e.g., :) or : –)), and compliments to others (Hara et al., 2000). The frequency of the social cues might be an indicator of the level of learner focus on the task (Henri, 1992). Specifically, Walther (1996) argues that, the more effective online discussion is, the less socioemotional communication exists.

Hara et al.'s (2000) research at this dimension showed that social cues and signals are needed in the early period of online discussion process to help participants feel more comfortable working together and build common ground. Davidson-Shivers et al.'s (2001) comparison between synchronous and asynchronous online discussion indicated that there were more social cues in chatting mode than in threaded discussion.

Method

Participants and Situation

In this study, I selected two discussion cases from the math board, an academic discussion forum of the Bulletin Board System (BBS) Website of Peking University. On the math board, Peking University students and some visitors outside discuss topics related to mathematics. These students are among the best in China. Most of them should be about 18 to 30 years old (from undergraduate to postgraduate). They use nicknames in discussion, knowing little of the specific characters of each other, such as gender, age or background on the Website. They visit the same forum of the site just because of common interests and join in specific discussion topics spontaneously and instantaneously. The math board, like other academic boards in the BBS site, is stable and not related to any course. It is free for

entrance or leaving, with little requirement or limitation for participants' activities.

Data

The two cases were with the most messages posted on the math board in the past two months. All posted messages were included. One case's topic was "teachers who often ask questions are better", in which 7 members wrote 25 messages. The other was "Please recommend some math books written in English for me!!!", in which 10 members wrote 31 messages. On the math board, most topics were cold. Over 98% topics got less than 10 responses. Although there were about 10 new topics added to the board on average per day in the past two months, most of them cannot get much discussion.

Analyses

Methods employed in analyzing online discussion have evolved from survey research or evaluative case studies methodology of the past two decades to the content analysis of quantitative data widely being used recently (Hara et al., 2000). Content analysis is a generic name for a variety of textual analyses that typically involves comparing, contrasting, and categorizing a set of data (Hara et al., 2000; Schwandt, 1997). While doing the content analysis, a proper coding framework is needed to make the data more simplified and understandable.

In this study, considering the characteristics of messages in academic forum of BBS environment, I referred to and revised the analytical frameworks of Henri (1992), Chiu (2000), Norris & Ennis (1989) and Davidson-Shivers et al. (2001) into a new theoretical framework (see Appendix A). Five key variables were identified in it for measuring online discussion messages, namely, cited times, cognitive skills, evaluation, invitational form, and social cues.

Cited times. Each message can be cited and thereby responded to by later messages. In these two cases, the cited times of messages varied from 0 to 3.

Cognitive skills. Cognitive skills measures whether the message contains personal idea or not. It has two levels, PI (Personal Idea), e.g., "for the question, in my opinion, ...", and NPI (Non Personal Idea), e.g., "I also think so".

Evaluation. Evaluation measures whether the current message supports or criticizes its earlier message. It has two levels, + (Supportive), e.g., "agree!" or "you are right", and –(Critical), e.g., "what you said can be wrong if ...".

Invitational form. Invitational form measures whether the message asks for an answer or not. It has two levels, S (Soliciting), e.g., "you said we should do like that, but why?", and NS (No Soliciting), e.g., "I'll try as you said".

Social cues. Social cues measures whether the message contains words showing personal feelings or not. It has two levels, PF (Personal Feeling), e.g., "four times seven equal to twenty four?! are you kidding? ", and NPF (Non Personal Feeling), e.g., "four times seven cannot equal to twenty four".

Through applying the coding framework, I made the messages transcripts simplified (see Appendix B for coding results). Then I did qualitative and quantitative analyses based on the coding results. In particular, I used flow charts of the messages to observe the messages relationship and structure. Also, I calculated the proportion of different messages on the above five variables to do comparisons across messages. The comparisons included comparison on one variable (e.g., comparing the proportion of critical messages with the proportion of supportive messages on the evaluation variable) and comparison across two variables (e.g., comparing the proportion of cited times of critical messages with that of supportive messages, that is, comparing across variables of cited times and evaluation).

Results and Discussion

This section firstly introduces general characteristics of the two cases. Then,

example messages of them are given and explained in short. Lastly, summary statistics of messages followed at five aspects: structure of messages, cognitive skills, evaluation, invitation form, and social cues.

General Characteristics of Messages

There were totally 17 members and 56 messages. Case 1 had 7 members and 25 messages. Average words per message were 86 Chinese characters. Case 2 had 10 members and 31 messages. Average words per message were 75 Chinese characters.

The topic of case 1 was "teachers who often ask questions are better". Under it, the starter posted a long message with 2,121 words. At the end of the message, the starter said, "Many mathematics branches were interrelated, such as Combinatorics and Probability." This view drew much attention and elicited controversies among the participants, with 19 messages. The other 6 messages of the case talked about an example used in the starter's message. All messages were discussing about specific mathematics issues. No message cared about the starter's initial assertion in the topic: "teachers who often ask questions are better". At the end of discussion, the members reached no agreement.

The topic of case 2 was, "Please recommend some math books written in English for me!!!". In the message, the starter wanted to find some good English version math books. He or she also wanted to know where to buy them. The first three messages gave some references books in turn. Later messages began to discuss whether these books were proper for the starter. Controversy between participants happened. At the end, they reached no consensus solution for the starter.

Example Messages

A dialogue was selected from each case as the example messages (translated from Chinese). See below.

Case 1

Def : The last sentence of the starter's message is nonsense.

Binomial Expansion cannot be related to probability because combinatorics is not a branch of probability.

Kar : I didn't read the whole paper. Just talk about the Binomial Expansion only.

You cannot say there is no relation between them. The starter didn't explain the relation in detail.

For example, as for the expressions: (p+1-p)^n=sum_{i=0}^n C(n, i)p^i (1-p)^{n-i}, the distribution of the items right is Binomial Distribution. On the other side, the expressions of Binomial Expansion can be used to validate Binomial distribution as a distribution. The relationship between them is not in depth, but they do have a relation.

Also, many questions of discrete probability can be the questions of combinatorics. So, combinatorics and probability can not contain each other.

Def gave negative evaluation of the earlier message at first. The word "nonsense" expressed personal feeling. Then, Def used one sentence to argue personal view together with a simple reason. Kar showed disagreement at first. Then, he or she expressed personal view clearly by an example. At last, Kar reiterated his or her view again.

Case 2

HuY: For Functions of Real Variables, read "Measure Theory" of Halmos.

As for Number Theory, you can read "Introduction to Number Theory" of Mr. Hua. This book is excellent.

For Probability, you can learn the book of Wang Zikun, written in Chinese. It is very good. Another book in English is called GTM. I forget the author.

lit : Don't recommend books carelessly. The book "Introduction to Number Theory" is not proper for beginners.

As for Number Theory, if you have learned Elementary Number Theory, you can read:

GTM 07 Serre, A Course in Arithmetic (French version, read it if you know French)

> GTM 84 Ireland and Rosen, A Classical Introduction to Modern Number Theory
> GTM 74 Davenport, Multiplicative Number Theory
> GTM 97 Koblitz, Introduction to Elliptic Curves and Modular Forms
> GTM 190 Esmonde and Murty, Problems in Algebraic Number Theory
> (I attended the class taught by Prof. Ram Murty, an authority of Number Theory in Canada. He took this book as the textbook.)
> These books were published by Springer-Verlag. You can buy them with Visa Card on Web. You'd better borrow them from the library. Each book is not easy to learn. Buying them can be a waste of money.

HuY's message recommended 3 books in response to the request of the starter. But he omitted other questions of the starter. In lit's response, it criticized HuY's message with the word "carelessly", showing personal feeling. Then, lit posted his or her recommendations. Some personal notes were added to the recommendation in the brackets. After that, lit told the starter where to buy them and gave some suggestions. Lit answered the starter's questions in detail.

Summary Statistics

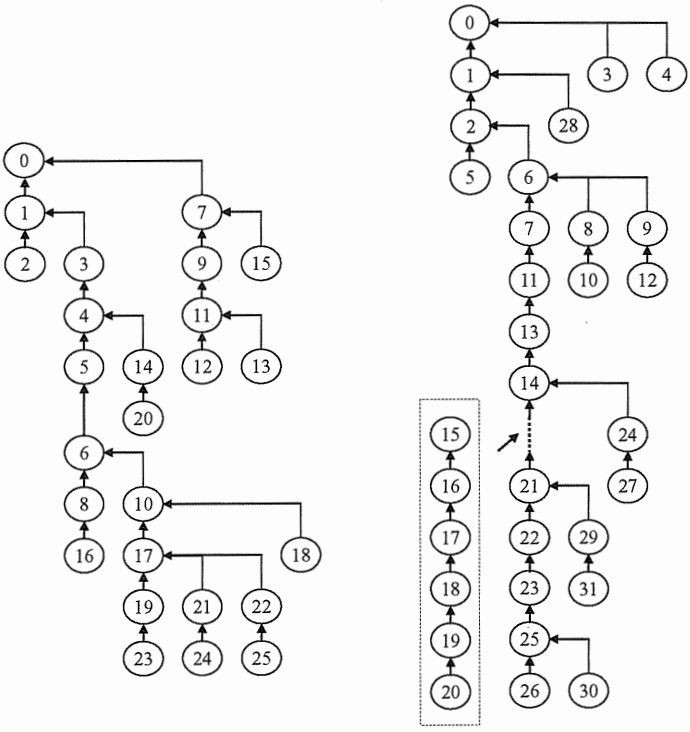
Structure of messages

In each case, every message must respond to only one earlier message. As a result, all messages linked together, leaving no isolated one (see Figure 1). This was different from Hara et al. (2000) and Thomas's (2002) researches on course related forums, where one message may respond to no message or more than one earlier messages in the discussion. This difference was caused by different design styles of the forums. In this study, the style of the BBS forum made each message reply to only one earlier message.

For every message of the two cases, the content of it must relate to its earlier message. That is, the overall discussion contents of each case were interrelated. On the other side, 72% messages in case 1 and 81% messages in case 2 got less than one response (see Table 1). That is, little chance of

repetition or duplication of contents can take place in the messages. For the above two reasons, discussions in such forum may have conditions to be coherent conversations. This result contradicts Thomas's (2002) view that branching structure of online forum leads to repetition comments and promotes an incoherent development of ideas.

Figure 1 Messages Flow Charts of Case 1 And Case 2



Although contents of the messages of the two cases were coherent, the structures of them seemed fragile. In the two cases, 36% were terminated messages that had no next message. 40% were single-track messages that had one next message. Only 24% were multi-track messages that had two or three next messages (see Table 1). This means that if one specific single-track connection was cut, all later messages would lose, thus destroying the messages structure. Lack of multi-track messages makes the messages

Table 1 Summary Statistics of Messages of the Two Cases

Variables	Teaching case	Textbook case	Total
Messages	25	31	56
Mean words per message *(Chinese character)*	86	75	81
Cognitive skills			
Personal Idea	56%	74%	66%
Non Personal Idea	44%	26%	34%
Evaluation of previous message			
Critical	20%	42%	32%
Supportive	80%	58%	68%
Social cues within the message			
Personal Feeling	52%	68%	61%
Non Personal Feeling	48%	32%	39%
Invitational form			
Soliciting	12%	6%	9%
No Soliciting	88%	94%	91%
Cited times by later messages			
0	40%	32%	36%
1	32%	49%	40%
2	24%	16%	20%
3	4%	3%	4%

structure fragile. Maybe such fragile messages structure is formed for the reason that, most participants include new comers, were more likely to post messages in response to the latest messages (see Appendix B for more information). So, every message cannot get enough responses.

Perhaps we can infer that, if the participants are not interested in the latest messages of a topic, they will be reluctant to post anything and choose to leave, making the discussion thread be over. This inference can partly explain that why hot topics were rare in the forum. Actually, in the forum, only a very small proportion (less than 2%) of topics can be discussed by more than 10 messages.

Cognitive skills

In these two cases, messages containing personal ideas were 56% and 74% respectively (see Table 1). Totally, 66% messages had personal ideas. 34% messages had no personal ideas, which can be simple agreement or disagreement, simple question or answer, or quotation of others (people outside the discussion). Furthermore, 76% PI (Personal Idea) messages got

later responses, while only 42% NPI (Non Personal Idea) messages got later responses.

Theses two results may show that participants in such forum are not likely to post or respond to simple message without personal idea or additional content, which is consistent with face to face conversations (Halliday & Hasan, 1976). The results also support the view that online discussion forums promote cognitive engagement of participants (Thomas, 2002).

Evaluation

There were more critical messages than supportive messages in the two cases, with the proportion of 68% to 32% (see Table 1). Moreover, 74% of critical messages got later responses, while only 44% of supportive messages got responses. These results suggest that participants are more willing to post or respond to critical instead of supportive messages, which supports the view that online discussion can increase critical analyses (Dehler & Parras-Hernandez, 1998; Ruberg et al., 1996, Warschauer, 1997). But for the responses to critical messages, 71% of them were also critical messages. This implies that disagreement elicits disagreement in the discussion. Participants are hard to be persuaded in such discussion.

In addition, 79% of the critical messages were also PI (Personal Idea) messages. In contrast, only 39% of the supportive messages were also PI messages. That is, critical messages are more likely to contain personal ideas than supportive messages. It may implies that when a participant is about to disagree, he or she is likely to elaborate the disagreement with personal idea as justification. This is also consistent with face-to-face conversation (Chiu & Khoo, 2003).

Invitational form

Of the 56 messages, messages with obvious enquiring words to get answers were only 5, account for 9% of all messages (see Table 1). Moreover, none of the 5 soliciting messages was message showing puzzlement about the meaning of its earlier message or asking for explanation for understanding it. Also, in the 56 messages, only 1 message misunderstood its later message.

These results imply that messages can be understood well in such discussions. Maybe this is partly because online discussion can increase "wait-time" (Hara et al., 2000) for posters to prepare their messages comprehensible, and for repliers to understand the earlier messages fully.

Social cues

Of all the messages, 61% were PF (Personal Feeling) messages, which were more than NPF (Non personal Feeling) messages (see Table 1). But only 53% PF messages got responses. In contrast, 82% NPF messages got responses. That is, messages mixed with personal feelings were less popular than messages without personal feelings.

These results may imply that, in such academic forum, although participants want to express personal feelings during the conversation, they are unwilling to develop informal conversation with others. Ahern et al.'s (1992) claim that encouraging informal communication will increase participants' interaction was not necessarily supported here.

Perhaps this is because if a person wants to have informal conversation or achieve friendship with others, he or she would rather enter other forums that are specially prepared for that kind of interaction in the BBS Website. While in the academic discussion forum, one would rather focus on the academic part instead of the social cues part of a message. As a result, less socioemotional communication makes the discussion more effective (Walther, 1996).

Conclusion

To help to understand the structure of messages and participants' posting and response preference in online independent academic discussion forum, this article designed a coding framework and did content analyses of two cases chosen from math board, an independent forum for discussing math related topics in a BBS Website.

From the results and discussion above, we may know that, although multiple

messages of a hot topic in such forum have conditions to be coherent, the structure of them can sometimes be fragile. Also, we may get some of the participants' preferences in such forum. Firstly, participants enter the forum and join a specific discussion because of common interests. Secondly, they will be more willing to respond to the latest messages in discussion. Thirdly, they are more likely to post or respond to critical messages or messages containing personal idea. Also, they are likely to justify their disagreements with personal ideas. But they are hard to be persuaded by others. Fourthly, they will make their messages easy for comprehension, thus avoiding misunderstanding. Lastly, they are not likely to develop informal conversation or achieve friendship with others in such an academic forum.

Based on the participants' preference in the discussion, we may infer some characteristics of such independent academic forum in the BBS Website. Such forum is good for discussion of topics built on common interests. The issues of discussion should better be controversial, such as a new theory or method, thus participants can come into different sides to controvert and argue by posting personal ideas. Such forum is also good for discussion of content because participants are likely to focus on the content. Participants are not likely to post words for informal conversation or friendship development in the discussion, which are irrelevant to the content. But, this is also a weakness of such forum for it is hard to build friendship between participants through the discussion. Another weakness is that such forum does not promote consensus or a common solution to a problem in the discussion.

The results derived from the independent academic forum can give some suggestions for teacher interventions in course related online forums. Firstly, teachers can make the topic more controversial for getting hot discussion. Secondly, because students are more willing to respond to the latest messages, critical messages, or messages with personal idea, teachers should intervene to encourage such kind of messages or add them when absent. Specifically, teachers can let the latest messages be critical or with personal idea to arrest students' eyes and thus keep the discussion hot. Lastly, because students

seem unwilling to have informal conversation with others in an academic forum, teachers can add another forum designed specially for informal communication or friendship achievement among them. With two discussion forums instead of one, students can have formal and informal conversation separately. But the effect of such an arrangement needs to be tested further.

Limitations

The main limitation is the small number of cases used. In this study, I only analyzed two cases, totaling 56 messages. So the findings of the study can only be tentative. Also, the taxonomy in the coding framework does not capture fine gradations within each category and omits the influence of many factors (Chiu, 2000). In this study, each dimension of the framework has only two opposite factors. So, messages with meaningful difference can be approximately coded into the same type. For example, "I think the book is not proper for a beginner" and "as shown in the first chapter of this book, it requires a large amount of complex knowledge, e.g., ... so, if you haven't learned something about these, you will find this book hard to learn" are both coded as PI (personal idea) messages, but they may have different effect on participants' understanding and responses.

In addition, I omitted much information of messages or participants in this study, such as, post time and time interval of messages, nickname, personal statement and visit times of participants. Such omitted information can be part of explanation of the characteristics of online discussion.

Future Research

Many questions remain. For example, is it very difficult to reach consensus in these online discussions in general? Is the coherence of these 2 cases unusual? Does the nature of the starter question matter? Do different participants have different posting or response preference? By addressing these questions, we may know more about the discussion in online independent academic forum.

Future analyses can employ new methods to model the relationships among sequences of messages and test their generality, for example with the statistical methods introduced in Chiu & Khoo (2003). Other future researches include various comparisons of messages. For instance, we can compare the messages between different cases (hot vs. cool discussion, discussion about a problem vs. discussion about a new theory) in the same forum or across different discussion forums in the BBS Website. Also, researchers can join the discussion to observe what will happen if there is a hidden moderator in the discussion. While doing analyses in these researches, maybe new coding frameworks should be created to fit in with specific discussions. This can be another work of the future.

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Appendix A: Framework of Coding Schemes

Cited times

0: the message gets no later response

1: the message is cited by 1 later message

2: the message is cited by 2 later messages

3: the message is cited by 3 later messages

Cognitive skills

PI (Personal Idea): message responding to previous message with personal views and interpretation (judgment, inference), e.g., "I think ...", "in my opinion,..., for example,...", "because ..., the reason can be ...".

NPI (Non Personal Idea): message containing only simple question or answer (yes, no), fact description or repetition of others' views without inference, e.g., "as somebody or the book said,...", "that's funny", "yeah, agree!", "I also think so", "I don't understand, can you tell me more about it?".

Evaluation

+ *(Supportive)*: agreeing with the previous message, or trying to give more proof for it, e.g., "agree!", "you are right", "same idea with me", "thank you, I understand it now", "I'll add a proof for your idea, that is ...".

– *(Critical)*: showing doubt on some points of the previous message, or trying to put forward alternative view, e.g., "you are wrong", "I don't think so, my opinion is that ...", "something you said can be right, but, ...", "I will show you a counter example ...".

Invitational form

S (Soliciting): with a question attempting to solicit an answer, or drawing attention to specific point of previous message for further discussion, e.g., "you said that's the reason, why?", "this is my view, do you agree

with me?", "what are you talking about, I don't understand.".

NS (No Soliciting): answer or comment on previous message without any attempt to get response, e.g., "yes, that's true", "I don't agree with you, because …", "as for this question, my answer is …".

Social cues within the message

PF (Personal Feeling): message containing the part of personal feelings expression, including the use of special words (e.g., "yeah!", "too bad", "are you kidding?!") or symbolic icons (e.g., "^_^" or ":)").

NPF (Non Personal Feeling): message without showing obvious personal feelings, including no words intending to show personal feelings.

Appendix B: Coding Results of Case 1 and 2 from Math Board of the BBS Website Of Peking University

Table B1 Coding Result of Case 1 (Topic: Teachers who often ask questions are better.)

	Msg. No.	Person ID#	Earlier Msg. No.	Cited times	Cognitive skills	Evaluation of previous message	Invitational form	Social cues within the message
0: *topic*		din						
1	00:00:00	Muy	0	2	NPI	–	S	NPF
2	01:17:43	Def	1	0	NPI	+	NS	PF
3	02:10:36	Din	1	1	NPI	–	NS	NPF
4	02:24:24	Muy	3	2	NPI	–	NS	PF
5	02:27:04	Def	4	1	PI	+	NS	PF
6	02:32:24	kar	5	2	PI	–	NS	NPF
7	02:39:45	sma	0	2	PI	–	NS	PF
8	02:40:43	Muy	6	1	NPI	–	NS	NPF
9	02:41:32	Muy	7	1	NPI	–	NS	NPF
10	02:41:43	Def	6	2	PI	–	NS	NPF
11	02:43:20	sma	9	2	PI	–	S	NPF
12	02:43:58	Def	11	0	NPI	–	NS	PF
13	02:46:12	Muy	11	0	PI	–	NS	NPF
14	04:34:19	din	4	1	PI	–	NS	NPF
15	04:39:25	din	7	0	NPI	–	NS	NPF
16	04:45:09	kar	8	0	PI	–	NS	PF
17	04:53:11	kar	10	3	PI	–	NS	PF
18	04:54:49	din	10	0	PI	–	S	PF
19	05:03:34	new	17	1	PI	–	NS	PF
20	05:08:23	new	14	0	PI	–	NS	PF
21	05:31:59	Def	17	1	PI	–	NS	NPF
22	08:33:04	ein	17	1	NPI	+	NS	NPF
23	18:53:23	kar	19	0	PI	+	NS	PF
24	18:57:13	kar	21	0	NPI	–	NS	PF
25	18:57:23	kar	22	0	NPI	+	NS	PF

Table B2 Coding Result of Case 2 (Topic: Please recommend some math books written in English for me!!!)

	Msg. No.	Person ID#	Earlier Msg. No.	Cited times	Cognitive skills	Evaluation of previous message	Invitational form	Social cues within the message
0: *topic*		cui						
1	00:00:00	HuY	0	2	PI	+	NS	NPF
2	01:07:29	lit	1	2	PI	–	NS	PF
3	01:15:42	lit	0	0	PI	+	NS	NPF
4	12:01:39	little	0	0	NPI	+	NS	NPF
5	28:06:52	lxw	2	0	NPI	+	NS	PF
6	34:45:14	little	2	3	PI	–	NS	PF
7	46:39:30	Ati	6	1	PI	–	NS	PF
8	48:12:55	lit	6	1	PI	–	NS	PF
9	48:19:41	lit	6	1	PI	–	NS	NPF
10	48:23:58	little	8	0	PI	–	NS	PF
11	48:27:47	little	7	1	PI	+	NS	PF
12	48:47:32	little	9	0	PI	–	NS	PF
13	58:53:45	sha	11	1	PI	–	NS	PF
14	59:05:28	little	13	2	PI	–	NS	PF
15	59:09:27	sha	14	1	PI	–	NS	PF
16	59:14:19	little	15	1	PI	–	NS	PF
17	59:15:11	sha	16	1	NPI	+	NS	PF
18	59:19:17	little	17	1	PI	+	NS	NPF
19	59:20:42	sha	18	1	PI	–	NS	PF
20	59:22:18	little	19	1	PI	–	NS	NPF
21	59:24:09	sha	20	2	NPI	+	S	PF
22	59:25:26	little	21	1	PI	+	NS	NPF
23	59:27:37	sha	22	1	PI	–	NS	PF
24	61:43:01	WIN	14	1	PI	–	NS	PF
25	65:26:19	jou	23	2	PI	–	NS	NPF
26	70:18:36	sha	25	0	NPI	+	S	PF
27	70:25:26	sha	24	0	NPI	+	NS	PF
28	70:44:20	Bil	1	0	PI	–	NS	NPF
29	70:45:24	uki	21	1	PI	–	NS	NPF
30	70:46:35	uki	25	0	NPI	+	NS	PF
31	72:49:30	dav	29	0	NPI	+	NS	PF