

Mathematics teachers' professional learning behaviors in online learning community: A case study on "Milky Tribal" blogs, China

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Background

Online learning communities have become more and more important for teachers' professional development in recent years (Wang & Fang, 2010). In China, the research about the online learning community has been theoretically conducted while almost few substantially and practically involved in the case study on the teachers' professional learning behaviors such as online interactive learning and knowledge construction of collaborative learning in the online learning community. This paper aims to bridge the gap by tracking Junior High school mathematics teachers' professional learning process in taking "Milky Tribal" Blogs as an example which have been developed as teaching & research platform for all Junior and Senior High schools teachers' professional learning in Guangdong province of China since July 2005.

Methods

The research highlights and analyses all logs and comments posted on the discussion topics from the section of "Junior High School Mathematics" in Milky Tribal" Blogs in order to discuss the knowledge construction in the online learning community of mathematics teachers from Junior High schools. For the purpose of analysis on the texts of all the logs and posts, the three dimensions are developed such as "the contents and manners involvement in the online learning community; the total number of posts from and interactions among learners; and the behaviors and characteristics of knowledge construction", and their respective corresponding sub-level dimensions are also available in this study (see Table1).

Table 1. Three dimensions and their corresponding sub-level dimensions

Analysis dimensions	Sub-level dimensions
The contents and manners involvement in the online learning community	The topic content of the teaching & research in the online learning community.
The total number of posts from and interaction among learners	a. Posts Basis; b. Responses to the posts in the forum ; c. Role distribution
The behaviors and characteristics of knowledge construction	a. Coding system of knowledge construction behaviors; b. Knowledge construction stages

A. The contents and manners involvement in the online learning community

The contents covered in the discussion topics of online teaching & research

The online teaching & research is a new mode of teaching & research, which emerged along with the development of the online learning community, and is the core content of the logs. The following are the categories and their corresponding characteristics of online teaching & research (see Table 2).

Table 2. The categories and their corresponding characteristics of online teaching and research

Discussion topics	Core characteristics
Teaching material analysis and teaching strategies discussion	The evaluation of the teaching materials, the analysis of the teaching goals, and the teaching methods and suggestions for different topics.
The discussion problems of classroom teaching	The problems left over from the classroom discussion; evaluation, analysis and discussion on the teachers' teaching designs; evaluation on the specific teaching contents based on the criteria of academic quality assessment; reflections on specific topics; discussions on teaching reflections and teaching designs.
The suggestions and strategies for a pre-exam review	The review strategies, suggestions and approaches for pre-exam review for the specific lessons; the arrangement of review stages; and the design and implementation of review lessons
Directions and analysis for question- setting of exam	The analysis of previous test questions; the discussions of mathematics test questions; and the guidelines of question-setting.
Teachers' work experience exchanging	The working experience communications between teachers; and the discussion on the work plan, key points, and periodic working arrangements.
The discussion of students' learning	The students' understanding of core knowledge and the discussion of improving the learning interests.

B. Total number of posts from and interaction among learners

a. Post sources or basis

Post sources are usually based on the topic contents, the previous posts, and none-quotes (see Table 3), and their core characteristics are described accordingly.

Table 3. Posts sources

Posts sources	Core characteristics
Topic contents	Making analysis, reflection and evaluation on contents involved in the topic discussion, providing the evidence to exemplify their own views, or bringing forward his or her own teaching suggestions
Previous posts	Numbers of responding to others' posts, or providing the explanation or solutions to the questions proposed by others or questioning other's opinions or viewpoints
None-quotes	Only raising his or her own questions irrelevant to the topic contents, or posting items unrelated to topics

b. Numbers of responses to the Posts

In order to analyze the learners' replies to others' posts, 543 posts were chosen from the 8 items of topic contents about the online teaching & research with the selective

criterion such as more representative, more browses and comments, more heated discussions, and high quality comments.

Table 4. Table for number of responses to posts

Number of Response (times)	Characteristics description
0	Only reflection or reply to the topic content without getting responses from other learners
1	Getting one time of response from others
2	Getting two times of responses from others
3	Getting three times of responses from others
4	Getting four times of responses from others
5	Getting five times of responses from others
6	Getting six times of responses from others

c. Role Distribution

The online interaction relationship among the learners is established on the basis of mutually making posts and responding to them from each other. Therefore, the closeness of relationship between them is dependent upon the numbers of the posts and responses to them. In the online learning community, the extent of activities and the interactive relationship among the learners makes the variance of the learners' role distribution. Four kinds of role of members are defined based on the numbers of responses to the topics or other posts.

Table 5. Role categories and sorting criterion

Role categories	Sorting criterion
Core members	Playing a core role in the whole online forum discussion, facilitating other learners to participate in the discussion, driving the whole discussion move on, and playing the leading role in connections and communications among learners.
Active members	Making more than 10 posts in total including replies to the topic contents and also to others' posts
Semi-active member	Making the number of posts between 3 and 10 including responses to other's posts.
Peripheral members	Only responding to the topic content without replies to other posts or with number of less than 3 comments.

C. Knowledge construction

a. Behaviors and characteristics of knowledge construction

According to the coding system of the content analysis proposed by Gan (2006) and to the content of the posts involved in this study, the author proposes the category coding table of knowledge construction for learners' posts and their responses, as per which eight interactive behaviors of learners fall into the category. The specific Classification and coding criteria are shown as follows:

Table 6. Category & coding table for the knowledge construction behaviors

Category	Core Characteristics Description
Analysis / Reflection	Making an analysis, reflection and evaluation on concepts, ideas, and thoughts involved in the topic discussion
Provision of the teaching strategy	Elaborating and answering the questions in topic discussion, and providing the suggestions and strategies for teaching
Support	Showing the agreement with other's opinions and/or ideas
Conflict / Question	Opposing against others' opinions, or putting forward the viewpoints or ideas contrary to others'
Defense	Holding firm their points of view, and further exemplifying their own views
Question Raising	Raising questions as per teaching, or according to the opinions of others
Deepening / consultations	Enforcing others' opinions; or explaining their own points of view; or clarifying misunderstandings; or putting forward their own proposals
Emotional Communications	Expressing friendship, encouragement, compliments, or thanks

b. Collaborative Knowledge Construction Stages

The author tries to classify the knowledge construction into five stages based on the five stages within Interaction Model demarcated by Gunawardena, Lowe, & Anderson (1997), and makes an analysis on the learners' possibly accessible levels of thinking and knowledge construction within groups during the discussion.

Table 7: Table for Knowledge Construction Stages

Knowledge construction Stages	Categories
Stage One	Sharing or Comparison
Stage Two	Inconsistency
Stage Three	Negotiation or Remodeling
Stage Four	Testing of the tentative construction
Stage Five	Representation or application of newly constructed Knowledge

Results

A. The contents and manners involvement in the online learning community

Analysis on the content involved in discussion topics on online teaching & research

The author has made the quantitative statistics on the classifications for discussion topics on online teaching & research. It can be seen that, among the discussion topics, there accounts for a large percentage (with 47.3%) of discussion on the problems of classroom teaching. The problems involves some mis-concepts, knowledge points, mathematics subjects, and math problems which require be resolved through communications and discussion, which shows that the teacher puts more emphasis on the classroom teaching which is critical for provision of better instruction by the teacher for students.

B. Total number of posts from and interaction among learners

a. Analysis on the post sources or basis

The author has already collected the reference basis for 543 comment posts. During the discussion, the posts highlighting the topic content accounts for 80% of 543 posts, which indicates that learners are able to make more or less reflection or analysis on the specific teaching content and make a cognitive involvement in the discussion. To some extent, it is possible that the learners' active participation in discussion of topic content can upgrade their own professional knowledge and resolve the different levels of questions of others. In addition, it is obvious that a large percentage of posts highlighting the topic content shows that learners have higher autonomy in the discussion and never deviate from the discussion in question, which play an important part in the collaborative learning.

b. Analysis on responses to posts

The author has collected the number of original posts as well as the times of posts to which other learners responded in the discussion for the purpose of having a better understanding of the learners' interaction and participation. It can be seen that 340 of 443 posts, accounting for 76.7 % only focused on the discussion of topic content and had no direct responses to the content from other learners in online learning discussion. In addition, each of 40 original posts acquired one time response from other learners, 26 original posts two times responses and 15 original posts three times responses, accounting for 9%, 5.9%, 2.9%, respectively. However, there was lower percentage of the posts with 4 times, 5 times and 6 times responses to the comments on the original posts. The result indicates that majority of student made an analysis/ a reflection/ a comment only on the topic content of the original posts but not on the other learners' viewpoints upon the content.

Generally, the learners' interactions were mainly represented in the linear interaction way and their overall inductive consciousness was weak in their interactions. And furthermore, the learners responded to the topic content of the original posts only in a simple way. Although the interaction existed in the discussion, there wasn't too much enough. Throughout the discussion, there was no receipt of responses from other learners to many an original post and there were even less posts with more than four times responses.

c. Analysis on role distribution

The author found that in the study, 118 participants in total could be divided into the core members, active members, semi-active members, and peripheral members, respectively on basis of the numbers of posts or responses to the posts they made. The statistical result indicates that:

a. the percentage of active members accounts for 16 % among all the learners, and only 18 active members within the entire group made the largest number of posts, including the posts responding to the topic content and the ones responding to other's posts, which made it known that there was too much online communication and discussion by way of making posts among the group and more learners have already established closer relationship with each other and actively involved in online interaction and learning;

- b. the percentage of semi-active members accounts for 25 % among all the learners. Such members, to some extent, could participate in the online learning but the extent of their interactions had its limitation within a group of a few learners;
- c. the percentage of peripheral members is the highest, reaching 59 % among all the learners, which shows that they are a group of isolated learners and rare participators (called lurkers) in the online learning. The posts they posted only responded to the topic content without responses to other posts; and
- d. otherwise, the percentage of core members is 0 %, which means that there is no core member who can play a leading role in driving the online discussion move on.

C. The behaviors and characteristics of knowledge construction

a. Analysis on the behaviors and characteristics of knowledge construction

According to the different coding categories, the author has presented logically all the posts, collected the meaningful unit number and percentage of different categories, and obtained the coding results. It can be seen from the above table that there exists the different number of various types of posts under the different discussion topics, but here, the author only highlighted the analysis on the percentage of each content type.

Throughout the discussion, we can see that, (1) the Type Reflection/Analysis accounts for the largest percentage of the total, 32 %, which indicates that learners can make a reflection and analysis on the discussion topic, or analysis, evaluation and reflection on the views of others; (2) the percentage of Type Provision of Strategy accounts for 27.9% of the total to the effect that learners can make a decision, evaluation, and criticism on the topic content or any other person's viewpoints, facts and solutions from others' posts and put forward their own suggestions, or can reply to the questions from the topic content or from the others' posts and propose their own suggestions and teaching strategies to resolve variety of questions in learning; (3) the percentage of Type Support accounts for 5% of total which means the learners agree with or favor or support the others' viewpoints from the posts; (4) the Type Defense accounting for 12.4 % of the total posts shows the learners defended against their previous viewpoints by providing their explanation and evidence in order to support their ideas or viewpoints or resolve other's confusion on the knowledge; (5) 8.3% of total posts in Type Conflict/Question demonstrates that, in posting their posts, learners can contemplate on the content of others' posts and then make query or question about it, and that such posts are most useful in exploring the extent and depth of the knowledge; (6) 4.1 % of total posts in Type Question Raising is about that learners can put forward their own questions about the topic content in discussion or about others' viewpoints in order to seek the opinions or solutions from others; (7) only 7% of total posts in Type Intensification /Negotiation shows that learners only share knowledge with others or defense against others' viewpoints, and none of these posts makes the integration of the shared knowledge; and, (8) 2.5 % of total posts in Type Emotional Communication has no direct relationship with the topic discussion but establishing the close connections between learners and intensifying the emotional experience and community attachment.

In general, learners could not only make an analysis or reflection of the topic content or the content from others' posts and resolve the variety of questions related to the professional knowledge but provide the effective teaching suggestions and strategies for other learners as well, which, to some extent, promoted the increase of the teachers' professional knowledge.

b. Analysis on developing stages of knowledge construction

In order to make a further analysis of the distribution of different content types in developing stages of Knowledge Construction, the author analyzed the various content types and fits them into each different developing stage according to the notion of collaborative knowledge construction, and obtained the results.

In general, the level of the knowledge construction in question is developing only up to Stage 3- Negotiation or Reconstruction and falls into medium one. Firstly, the most posts center the analysis and reflection (39%), and comments (6%) on the topic contents only; Secondly, too low is the percentage for the content types such as questions raising (10%) as per others' posts, conflict (3%) or defense of information from others' posts (6%); And thirdly, there is lack of integration, representation, and application of the knowledge points, and devoid of systematic discussion of the questions from the posts although learners can put forward teaching suggestions and strategies.

Conclusions

The result shows that: firstly, as per online teaching and research, the majority of topics are related to classroom teaching issues and knowledge points. Secondly, the extent and depth of learners' discussion are limited from the point of view of total number of posts from and interaction among learners. And thirdly, the level of knowledge construction is not too much high from the viewpoint of the knowledge construction in collaborative learning. In a word, in those posts are mostly used the knowledge of the teaching strategies, of the students' understanding, and of the result feedback.

The study not only provides reference for the development of the online learning communities, and effectively promotes the knowledge construction during teachers' learning, but offers an analytical framework as well for understanding and assessing how online learning community affects mathematics teachers' professional development (Wang, 2011).

References

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