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A Three-dimension Model of the Assessment of Collective Cognitive Responsibility in KB Community

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Abstract: The creation and advancement of knowledge in Knowledge Building (KB) community depends on KB members' willing and ability to take responsibility for collective cognition. However, practitioners and researchers are all lack of effective methods to motivated and evaluate the collective cognitive responsibility (CCR)of members in KB community. On the basis of literature review and previous research, this study constructed a three-dimensional theoretical model which include cognitive level, behavioral level and cultural level. A design-based research (DBR) method was used to assess the collective responsibility of Grade 3 students for improving the knowledge of digital video clipping techniques in a secondary vocational school of Nanjing. The assessment model was revised through three processes: the establishment of KB discourse rules, the adjustment of cognitive evaluation methods and the normalization of network behavior data. Qualitative and quantitative analysis were used to assess 688 notes posed by 31 students and their network behaviors on the ShuKe platform. At the same time, the results of peer evaluation of CCR among the group members are systematically analyzed, it is found that the assessment results of the three-dimension model are basically similar to those of the above-mentioned results, especially for those students who contribute the most or the least to collective cognition in KB community.

Introduction

Scardamalia suggested that the creation and advancement of knowledge depend on KB members' collective cognitive responsibility (CCR) (Scardamalia, 2002). Although some scholars (Zhang J & Scardamalia M,2009; Calixto Gutiérrez-Braojos,2014)have done some works for CCR, there are still many problems to be explored. Such as: what are the manifestations of community member assuming CCR? How to assess? What dimensions should be assessed? How to test the effectiveness of the assessment? At the same time, the tools in Shuke (similar tools as in KF) are not suitable for assessing CCR and some new assessment methods need to be developed. The researcher constructs a three-dimensional theoretical model based on literature research and theoretical research for CCR (see the Figure 1）

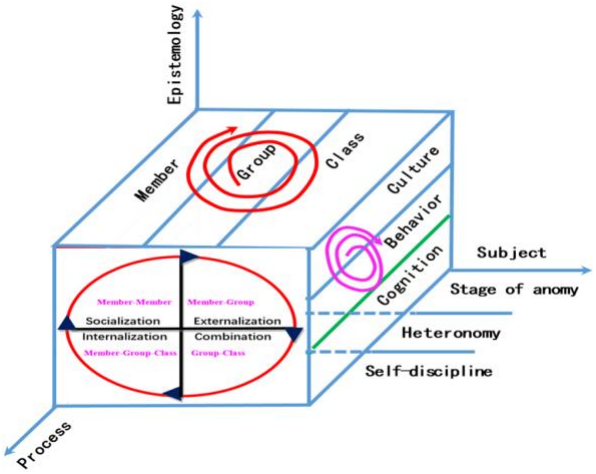

Figure 1. Three-dimensional theoretical model

Method

Participants

Participants included the researcher (He is also a teacher in class) and 31 students from class 2 Grade 3 in Nanjing Xuanwu Secondary Vocational School which is carrying out teaching reform with the Knowledge Building theory. There were 13 boys and 18 girls in this class. In order to further promote the research of this project, two assistant teachers (master graduate student A and master graduate student B) majoring in KB theory from Nanjing Normal University participated in the research for collecting and recording data.

Procedure

The public discussion "Is one of the central ways that a learning community expands its knowledge" (Bielaczyc,1999). In this study, the researcher designed and adjusted the content of the course according to the teaching plan, the instructure design is shown in Figure 2, and the actual process is shown in Figure 3.

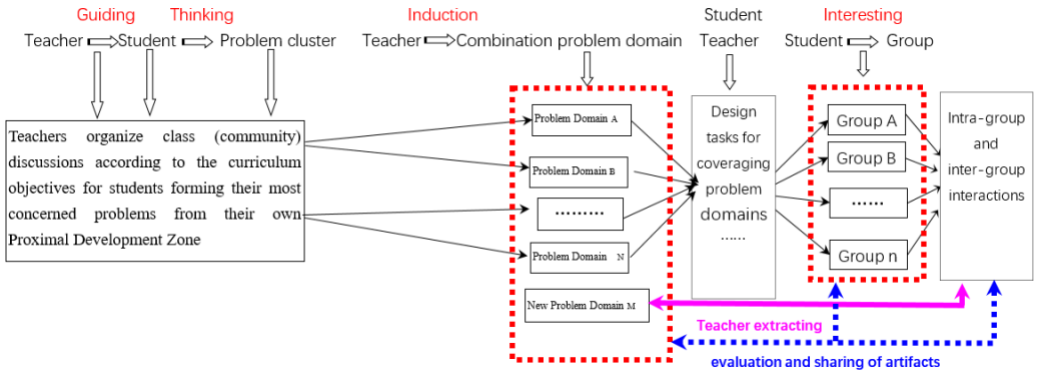

Figure 2. Instructional design

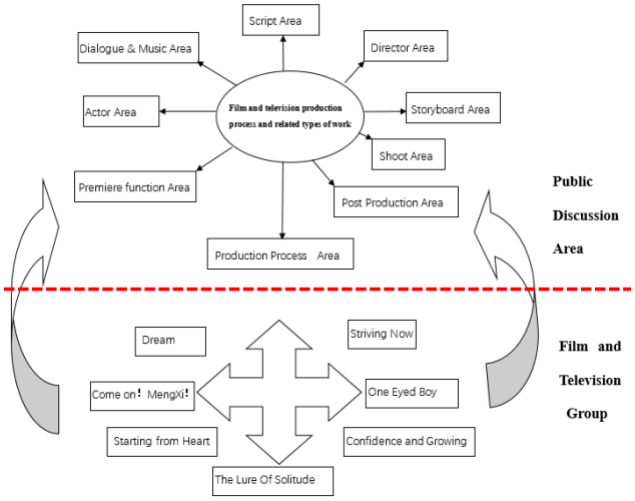

Figure 3. Problem Domain in *Shuke* platform

A design-based research (DBR) method was used to assess the collective responsibility from cultrue, behavior and congnition in this paper, the iterative process is as following.

Cultural Dimension

1 week (Beginning): The teacher introduces ShuKe to the students and they are very interested in posting their ideas in ShuKe.

2-3 weeks (Stage of anomy): Students voluntarily post their ideas without any criterions and requirements, and only a few students post their ideas in ShuKe with the disappearance of curiosity.
4-5 weeks (Heteronomy): In order to enhance students' participation, the teacher requires each student to post at least a note and build on a note in shuke. Although the number of ideas has increased, many of them are meaningless responses such as your idea is very important, your idea as the same mine and so on.
6-9 weeks (Formation rules): Through knowledge building circle and knowledge building poster, knowledge building rules and the knowledge building culture is gradually formed.

Behavioral Dimension

The commonly methods of evaluating CCR adopted by researchers are quantitative statistics of community members' network behavior.
10-11 weeks: the researcher mainly uses the tool of Contribution rate in ShuKe to assess members' network behavior. However, these statistics are based on time and not separately calculated members' CCR in the specific problem areas. How to solve this problem?
12-13 weeks: This study constructs the member activity index（MAI）for assessing community members' CCR referring to Activity Index formula (J.D. Frame, 1977).

$$MAI = \frac{NMF/NMC}{NAMF/NAMC}$$

MAI: Member Active Index
NMF: The number of notes posted by member A in Field K
NMC: The number of notes posted by member A in Community
NAMF: The number of notes posted by all members in Field K
NAMC: The number of notes posted by all members in Community

Cognitive Dimension

The commonly methods of evaluating members' CCR by researchers are the online discourse analysis by evaluating the epistemic levels of students' inquiry and explanation. (Eddy Y.C. Lee, Carol K.K. Chan & Jan van Aalst,2006). However, there are also some ideas are declarative descriptions shown in Figure 4 and Figure 5, not questions or answering questions.

Figure 4. Declarative Description in *Shuke* Platform

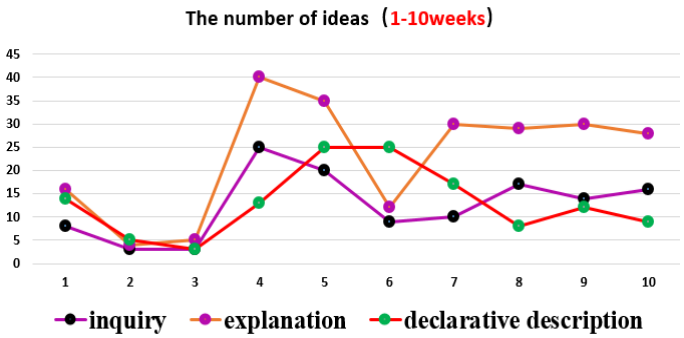

Figure 5. Distribution Curve of Declarative Description

According to Piaget's theory of Genetic Epistemology, the author constructs a cognitive depth model (see Figure 6) referring to Biggs' SOLO（Structure of Observed Learning Outcomes,1982) model and Webb's DOK（Depth of Knowledge，2002) model for assessing these declarative descriptions.

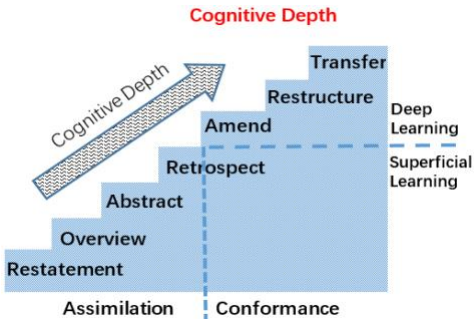

Figure 6. Cognitive Depth Model

Peer evaluation

How to test the effectiveness of the assessment model? The peer evaluation was used in this study. It can promote members' responsibilities and learning motivation (Race,1998). At the same time, the teacher's evaluation is considered for avoiding reciprocal effect. The paper constructs a formula for Peer Evaluation Score According to Strabo's peer rating method (Strabo,2010):

$$PES = (\sum_{i=1}^{n} PES - MAS - MIs)/(n-2)*0.6+TES*0.4$$

N: Number of Community Member PES: Peer Evaluation Score
AES: Average Evaluation Score MAS: Maximum Score of peer evaluation
MIS: Minimum Score of peer evaluation TES: Teacher Evaluation Score

Coding

In this research, both cognitive depth and peer evaluation were coded according to the evaluation criteria. The Rating Scheme for Cognitive Depth is shown in table1 and the coding of cognitive depth is shown in table 2.

Table 1: The Rating Scheme for Cognitive Depth

Rating	Description	Content Explanation
1	Restatement	Give opinion without evidence or elaboration; repeat or simply restate a fact or a statement that has been made, cut and paste is used rather than making their own interpretation.
2	Overview	Give factual information and general description; give a brief summary; responses are usually centered on facts and topics.
3	Abstract	Can make a summary of the problem and different ideas, make a reasoning based on relevant information.
4	Retrospect	Make assertions supported with explanation, evidence and relevant examples.
5	Amend	Adjust and Correct one's ideas and concept according to others ideas.
6	Restructure	Synthesize different points of views and make a 'rise-above' summary.
7	Transfer	Can analyze problems in depth, explain problems from a theoretical level, and propose the solutions to the other related problems.

Table 2: Coding of Cognitive Depth

Student ID	DATE	Title	Ideas	cognitive depth
12	September 26	Script evaluation	I see a lot of psychological state in the script of Come On Mengxi. The script is different from the novel. The script language needs to be expressed by dialogue, voiceover, body language. The psychological state appears in the script. After shooting, the audience may not understand it, or some other questions. There is also a little use of punctuation in the script, the script is for actors, directors to see, improper use of punctuation will make people unable to understand, or do not understand, read more laboriously. The above is for reference only.	4
18	September 3	Screenwriter	Screenwriter are mainly responsible for the plot of a movie and the actor's lines. In addition to these, they can also recommend actors to directors or give advice to actors according to the needs of their own plots. Writers are the creators of scripts and literary writings. They mainly complete the overall design of programs in the form of written expressions. They can either create original stories or adapt existing stories. Generally, after a good script is created, the script will be submitted to the director for examination. If it fails to pass the examination, the script can be re-created together with the director.	2
14	September 26	Storyboard	Storyboard is the concrete implementation of the director's ideas, which can be well represented by drawing or writing.	3
29	September 26	Script language	The language of the script includes two aspects: dialogue and stage direction. The dialogue are what the actor say in the play, including dialogue, monologue and narration. The dialogue in this play is very few, not very complete, monologue, narration is not very specific.	3
10	September 26	The Soul of clipping	Digital media is the use of visual information, the so-called soul is the author's ideas and creativity. Montage is just a technique. This technique is the experience of generations of editors. Only by expressing your creativity skillfully can you create soul-like editing.	2

All students' ideas were scored by the author, and a second rater independently scored 30% of the sample according to the rating scheme for cognitive depth. The inter-rater reliability of cognitive depth was .86 based on Pearson Correlation. The peer evaluation of community members's CCR is carried out from five dimensions (see the table 3) through questionnaire in *Shuke* platform.

Table 3: Peer Rating Dimension and Rating Scheme

Sequence Number	Dimension	Score
1	Involvement in group discussions	5 4 3 2 1
2	Contribution to data retrieval and collation	5 4 3 2 1
3	Contributions to the organization and coordination of team tasks	5 4 3 2 1
4	Contribution to idea diversity	5 4 3 2 1
5	Contribution to Group Reflection and Works Revision	5 4 3 2 1

Result

After the comparative analysis of students' cognitive depth, activity index and peer rating results, the distribution curves are shown in figure7 to 9.

Figure 7. Distribution Curve of Average Active index

Figure 8. Distribution Curve of Cognitive Depth

Figure 9. Distribution Curve of Average Peer Evaluation Score

By comparison, we can find that the results of Activity Index and Cognitive Depth evaluation are basically consistent with those of peers' evaluation, especially for those students who contribute the most or the least CCR in KB community (see the table4). In view of the above data findings, the MAI and the Rating Scheme for Congnitive Depth can be used to assess members' assuming collective responsibility in a specific problem domain.

Table 4: Peer Rating Dimension and Rating Scheme

Score	Peak	Trough
MAI Score	4,7,10,11,14,17,20,23,26,28,31	3,6,8,9,19,21,24,27,30
Congnitive Depth Score	8,10,12,14,16,20,23,26,29,30	3,6,9,19,21,24,27,31
Peer evalution Score	2,4,7,10,14,16,19,23,26,29,30	3,9,19,21,24

Discussion

This study only evaluates CCR in behavioral dimension and cognitive dimension, but lacks cultural dimension. In order to test the validity of the evaluation model and method, the three-dimension model of the CCR Assessment should be adopted in more rounds of teaching practice.

Next Steps

The researcher will use the word segmentation tools to segment students' ideas in each problem domain, and build the Radar Map of keywords to count the distribution of keywords for measuring the members' CCR in the corresponding problem domain in the future research. On the other hand, how to construct an assessment method of evaluation KB culture will be the focus of follow-up research.

References

Strijbos J.W, Sluijsmans D.(2010).Unravelling peer assessment: Methodological, functional, and conceptual developments. *Learning & Instruction*,4,265-269.

Frame J.D. (1997).Mainstream research in Latin America and the Caribbean. *Interciencia*, 2(3),143–148.

Biggs J.B, Kevin F, Colls. (1982).Evaluating the Quality of Learning. *The SOLO Taxonomy (Structure of the Observed Learning Outcome)*. New York: Academic Press.

Webb N.(2002). Depth-of-Knowledge Levels for Four Content Areas. Madison: Wisconsin Center for Educational Research.

Zhang J, Scardamalia M, Reeve, et al.(2009). Designs for Collective Cognitive Responsibility in Knowledge-Building Communities. *Journal of the Learning Sciences*,18(1),7-44.

Eddy Y.C. Lee , Carol K.K. Chan , Jan van Aalst.(2006). Students assessing their own collaborative knowledge building. *International Journal of Computer-Supported Collaborative Learning*, 1(2),277-307.

Scardamalia M. Collective Cognitive Responsibility for the Advancement of Knowledge.In Bereiter C(Ed.),*Liberal education in a knowledge society*(pp. 67-98). Chicago: Open Court.

Bielaczyc K, Collins A.(1999). Learning communities in classrooms: A reconceptualization of educational practice. In Charles M (Ed.), *Instructional-design Theories and Models: A New Paradigm of Instructional Theory*(pp. 269-292). Lawrence Erlbaum.

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