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Analysis on the Evolution Process of Emergent Roles in Knowledge Building Community

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Abstract: In a KB community, different kinds of emergent roles are generated in the whole process of teaching and learning. The problems are how to distinguish and trace these roles, how to select teaching strategies? This study focus on a Grade 3 students' emergent roles evolution of STS class(science-technology-society) in a semester (16 weeks). Data resources were collected from teaching discourse as well as classroom observation and students interview. Results suggest that Five kinds of emergent roles are automatically generated in the KB instruction. As time changes, teachers should adopt different teaching strategies to help students to change from the initial question proposer, skeptic, proponent to the final theory - builder and synthesizer. The teaching strategies should be taken as following: Authoritative information should be Introduced at the right time; the conflicts of students' diverse cognition should be triggered; students' consensus on issues should be promoted; students' ability to comment and reflect should be cultivated; the discussion of knowledge building class circle should be organized regularly.

Introduction

The core idea of the new curriculum reform of the Ministry of Education is "everything for the development of students", that is, in the classroom, teachers should stimulate students' enthusiasm for learning, give full play to students' main role, encourage students to actively explore and cooperate, and promote students' in-depth understanding and flexible application of knowledge. The main role of students in the inquiry process is related to their roles and responsibilities. After long-term follow-up and observation of teaching practice, researchers found that role-playing and its changes in classroom teaching can effectively stimulate the individual responsibilities and positive dependence of group members and improve the effect of classroom teaching. From a sociological perspective, there are two different types of roles in the learning community, namely, Scripted Role and Emergent Role. Kollar (2006) pointed out that emergent roles are spontaneously generated in the process of learning activities. These roles are not students' roles assumed by teachers in teaching design, but roles negotiated or self-set by students' actual needs in the inquiry process. The focus of this study is emergent role, which is opposite to scripted role.

Research Question

Which kinds of roles are generated in the teaching discourse? How do these emergent roles evolve? What kinds of teaching strategies should be adopted according to the law of evolution in this process?

Method and Process

A design-based research (DBR) method was used to explore the types, evolution rules and corresponding teaching strategies of students' emergent roles in this learning community.

Course: STS class(science-technology-society)
Student: A grade three student in Nanjing baiyunyuan primary school（28 in total,10 boys and 18girls）
Research Aids: Shuke Forum
Environment: classroom &computer room
Teaching method: knowledge Building
Class hours: a total of 16 weeks, about 44 ~ 48 class hours

Teaching Theme: " Water Pollution Around" ---The “Li Wei River” Near the School
Teaching process: According to the time process, it is divided into four stages, each of which is four weeks.

On-the-spot investigation, problem situation (weeks 1 to 4) :In the classroom, the teacher showed the students the photos of the status of the “Li River” and stimulated the interest of students. In order to make students have a more intuitive experience, teachers and some researchers led students to observe the Li River and collected water samples for classroom observation and discussion. The teacher guided the students to express their opinions in combination with observation and daily experience. Teachers and students found that some of the questions raised by the students cannot be explained by the existing information, so the teacher led the students to investigate the surrounding residents and merchanted to obtain more information.

Clearing the theme, group exploration (weeks 5 to 8): According to the research situation in the first stage, the teacher divided the research theme into four sub-themes, that is, ”sludge diversion”, “domestic sewage”, “water purification plants that can purify water” and “mystery of goldfish death” based on the opinions put forward by the students, for example, “Why is the goldfish dying in the Li River ?” “How to deal with the residential sewage?”, etc. Based on their own interests, students formed a new research group, expressed their opinions in the group, and used the authoritative materials such as books to conduct in-depth research.

Improving Views, Collaborative Construction (Weeks 9 to 12): In the process of multiple group discussions and class discussions, students improved their opinions by constantly searching for new materials. At the same time, students begin to pay attention to the opinions of others, can actively contact and cite other people's opinions, realize collaborative learning, and jointly improve their opinions. In the course of the discussion, the views collide with each other and many new ideas or conjectures are generated.

Summarizing and reflecting, and forming a system (weeks 13 to 16): After expressing one's own opinion, group discussion and class sharing, the students have a deeper understanding of the topic of “water pollution around”. The teacher leads the students to review the process of inquiry and guide the students to make a summary. The knowledge is simply sorted out and the students are asked to write a summary of the course in the lesson forum.

Analysis and Results

“Emergent roles” Content-encoding System:

The study’s analysis sample is taken from the teaching discourse of the experimental class. The " turn " is used as the coding analysis unit, and the turn represents the switching of different types of emergent roles. Referring on Maria Chuy and Zhang Jianwei (2011) for the division and description of the five types of emergent roles in the KB instruction, the researchers give specific characteristics of each emergent role, as shown in Table 1. In order to more accurately distinguish and record the emergent roles, the paper draws on the research of content analysis model by Herri (1991) and Pena-Shaff (2001), and designs the contentive coding system of “Emergent roles”, as shown in Table 2. The first category of the coding system is five emergent roles, each of which contains a second-level sub-category to ensure accurate classification of the teaching discourse. After determining the coding categories at all levels, the coding samples are listed for each analysis category, so that the coder can more clearly grasp the meaning for each category.

Table 1: Specific Characteristics of Emergent Roles

Emergent Roles	**Specific Characteristics**
question proposer	Ask questions or describe phenomena.
skeptic	Conflict with other learners’ views and be in opposition.

proponent	Put forward suggestions for improvement.
theory-builder	Use authoritative information to explain the idea and restate one's own view.
synthesizer	Present the experimental scheme and consider its feasibility; Summarize; Reach a consensus.

Table 2: Content-encoding system of Emergent Roles

Class 1 category	**Class 2 category**	**Class 3 category**	**Example**	**coding**
question proposer	**Elaboration**	Narrate concepts and facts	My point of view: the seeds of plants have germ, the germ will grow into small bud, with bud it can grow.	Aa1
		Define concepts and terms	The earth revolves around the sun while rotating. This movement of the earth is called the rotation of the earth.	Aa2
	Question	Well-structured problem: a general problem that needs to be discussed and clarified in terms of concept, meaning and implication.	What do snails look like?	Ab1
		Ill - structured and reflective questions: questions require deep thinking and exploration without direct answers	Seeds need soil to germinate, can they germinate without soil?	Ab2
skeptic	**Conflict**	Put forward alternative or opposite positions	The smell disappears when it rains.	Ba1
		Don't agree with others	I don't agree that mucus is ...	Ba2
		Large differences, contradictions and fierce opposition to others' opinions	I strongly oppose it.	Ba3
proponent	**Support**	I agree with others' contributions and views.	I agree with XX's view.	Ca1
		Express sympathy for others' views and comments	I also feel ...	Ca2
	clarification	Contrast different ideas, comparing similarities and differences	XX thinks that the temperature is related to direct sunlight, while YY thinks that it is related to the revolution of the earth. Are there any similarities between them?	Cb1
		throw out a suggestion	My suggestion is: the length of the wooden stick used to measure the shadow should be the same and as well as the measuring place.	Cb2
theory-builder	**Defense**	Restate ideas	Use new information to maintain your original views.	Da1
		Further elaborate on one's own previous views	Through my own experiments, I found my previous view was	Da2

			correct.	
	Explanation	Explain views with scientific facts	My rabbit ...	Db1
		Analogy	So do we	Db2
	Quote	Quote authoritative views	Some experts said ...	Dc1
		Link concepts, views, propositions	How is Li Wei River polluted? Information we have learned: I saw someone throwing rubbish into the river on the road.	Dc2
		Bibliography, authors, references, etc.	Refer to " XX"	Dc3
		Link to other websites	Provide links	Dc4
synthesizer	**Assessment**	Evaluate the applicability of the scheme	This plan is not feasible because it will harm snails.	Ea1
		Make a value judgment	His idea is very useful to me.	Ea2
		Evaluate the topic	I can't do any more research on this problem.	Ea3
	consensus	Clarify misunderstanding	I mean ...	Eb1
		Negotiate related concepts and evaluation criteria	We think revolution means ...	Eb2
		Reach an consensus or agreement	We all think that temperature is related to direct and oblique incidence.	Eb3
	synthesis	Draw a conclusion	Plants need water, sunlight and soil to grow.	Ec1
		Come to general principles	When plants grow, the temperature should not be too high and the water should not be too much.	Ec2
		Set forth predictions and assumptions	The temperature may also be related to …;	Ec3
		Propose a solution to the problem	To deal with the water pollution, we can start from ….	Ec4
		Analyze and summarize the solving process of problem	Our research process on this issue is as follows: …	Ec5

Reliability test:

Internal reliability:

Scorer reliability test: Two researchers simultaneously fill Class 2 category into Class 1 category (Note: If you think that there is no primary code in the secondary code, you can leave it blank). Comparing the classification results of the two researchers, find out the number of categories agreed and the number of classifications agreed by the two researchers, and bring them into the formula: A=2D/(N+M)和R=2A/(1+A). Get the average mutual agreement between the two researchers A=2*8/(11+11)=0.73; the classification consistency coefficient R=2*0.73/(1+0.73)= 0.84.

External reliability:

Kappa coefficient method: Two researchers pre-coded 34 turn data. Get the Kappa coefficient is 0.858.

Results:

Analysis of the overall evolution process of different types of Emergent Roles:

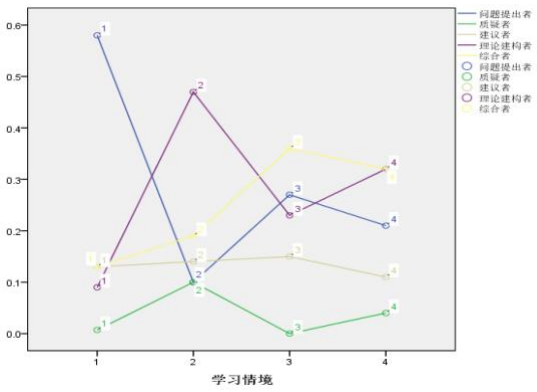
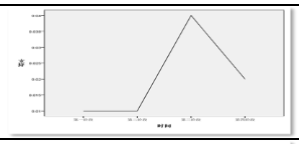
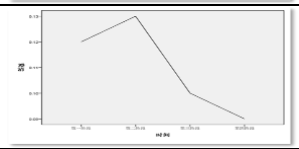
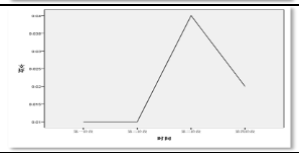
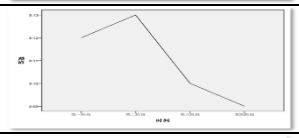
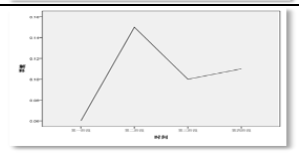
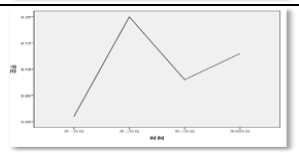


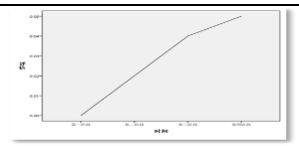
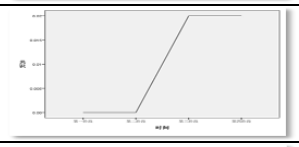
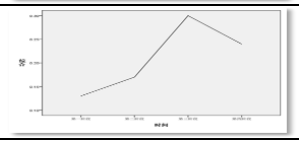
Figure 1 Overall Time Series Diagram of Emergent Roles of Different Categories

It can be seen from Figure 1 that different types of emergent roles change differently with time. On the whole, the problem proposers, skeptics and proponents show a downward trend with time, while the theory-builders and synthesizers show an upward trend with time.

Analysis of Local Evolution Process of Different Categories of Emergent Roles:

Table 3: Local Evolution Process Table of Emergent Roles of Different Categories

Class 1 category	**Class 2 category**	**Time Series Diagram**	**Non-standardization coefficient**		**t**	**Sig.**
			B	**standard error**		
question proposer	**Elaboration**		1.015	.018	56.065	.000
	Question		.995	.022	45.700	.000
proponent	**Support**		1.429	.004	230.316	.000
	clarification		1.114	.017	58.624	.000
theory-builder	**Explanation**		1.398	.150	9.331	.000
	Quote		1.046	.126	8.291	.000

synthesizer	**Assessment**		1.001	.004	234.534	.000
	consensus		0.974	.007	153.252	.000
	synthesis		1.001	.027	35.815	.000

It can be seen from Table 3:

Question Proposer: The two dimensions of "Elaboration" and "Question" all showed a downward trend, and both of them increased in the third stage of teaching. In the KB instruction, the two kinds of conversational behaviors have an impact on the changes of the "Question Proposer", and the degree of importance is equivalent.

Proponent: The "support" dimension shows an overall upward trend, which is the highest in the third stage and decreases at the end of teaching; the "clarification" dimension shows a downward trend as a whole, and it has increased in the second stage of teaching. In the KB instruction, both of them have an impact on the "Proponents", and the "clarification" dimension has a greater impact than the "support" dimension.

Theory-builder: The "Theory-builder" is mainly influenced by the "interpretation" and "quotation" behaviors. Two dimensions of "interpretation" and "quotation" all showed an overall upward trend, and have declined in the third stage of teaching. The "interpretation" dimension has a greater impact than the "quotation" dimension, and the "defense" behavior is negligible to the "theory-builder".

Synthesizer: The "assessment" dimension shows a continuous upward trend; the "consensus" dimension shows an overall upward trend, and there is no change in the second and fourth stages; the "synthesis" dimension shows an overall upward trend and declines at the end of teaching. In the KB instruction, these three kinds of conversational behaviors have an impact on "Synthesizer". The two dimensions of "assessment" and "synthesis" are the same, slightly larger than "consensus" dimension.

Conclusion and Discussion

Conclusion:

There are five kinds of emergent roles are automatically generated in the KB instruction.

The number of question proposer, skeptic and proponent has gradually declined, the number of theory-builder and synthesizer has gradually increased.

As time changes, teachers should adopt different teaching strategies to help students to change from the initial question proposer, skeptic, proponent to the final theory - builder and synthesizer.

Discussion:

Teaching strategies:

Authoritative information should be Introduced at the right time.
the conflicts of students' diverse cognition should be triggered.
students' consensus on issues should be promoted.
students' ability to comment and reflect should be cultivated.
the discussion of knowledge building class circle should be organized regularly.

Existing Limitations:

The sample is insufficient that has only one class and for one semester.

there are some missions in the records of students' teaching discourse, especially in the process of group discussion.

References

Scardamalia, M., & Bereiter, C. (2003). *Knowledge building*. J.W. Guthrie (Eds.), Encyclopedia of education (2nd ed.) (pp. 1370-1373). New York, NY: Macmillan Reference.

R. Keith Sawyer. (2014). *Cambridge Handbook of the Learning Sciences*. New York, NY: Cambridge University Press.

Johann W. Sarmiento, Wesley Shumar. (2009). *Boundaries and roles: positioning and social location in the Virtual Math Teams (VMT) online community*. Computers in Human Behavior.

Kollae I, Fischer F, Hesse F. (2006). *Collaboration Scripts-A Conceptual Analysis*. (pp. 159-185). Educational psychology Review.

张义兵(2018).*知识建构：新教育公平视野下教与学的变革*.南京：南京师范大学出版社.

Zhang, J., Tao, T., Chen, M-H. (2018). *Co-Organizing the Collective Journey of Inquiry with Idea Thread Mapper*. (pp. 1-62). Journal of the Learning Sciences.

Jianwei Zhang, Marlene Scardamalia, Richard Reeve, et al. (2009). *Designs for Collective Cognitive Responsibility in Knowledge-Building Communities*. (pp. 7-44). Journal of the Learning Sciences.

刘虹. (2004).*会话结构分析*.北京：北京大学出版社.

Chuy, M., Zhang, J., Resendes, M., Scardamalia, M., & Bereiter, C. (2011). *Does contributing to a knowledge building dialogue lead to individual advancement of knowledge? In H. Spada, G. Stahl, N. Miyake, & N. Law (eds.), Connecting computer-supported collaborative learning to policy and practice: CSCL2011conference proceedings. volume i - long papers* (pp. 57–63). International Society of the Learning Sciences.

Gay G, pena-Shaff J, Martin W. (2001). *An Epistemological Framework for Analyzing Student Interactions in Computer-Mediated Communication Environments* (pp. 41-68). Journal of Interactive Learning Research.

Jianwei Zhang, Marlene Scardamalia, Mary Lamon, Richard Messina, Richard Reeve. (2007). *Socio-cognitive dynamics of knowledge building in the work of 9-and10-year-olds* (pp. 117–145). Education Tech Research.