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Idea Evolution in Knowledge Building Community in a College Classroom

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Abstract: Ideas advancement is the center in KB process which is also a kind of evolution procedure. This study explored how to follow the trajectory and how to analysis the internal mechanism of the evolution. Participants were a class of 33 junior students who undertook the course of research methods in educational technology, lasted for a semester (18 weeks). Based on design-based research, this study focused on ideas evolution through three iterations including theme selection, literature review and research findings. Data resources were collected from 509 ideas in Shuke forum as well as classroom observation and students interview. The quantitative and qualitative analysis indicated that students' knowledge building activities were conducive to the development of the number and depth of ideas. The results showed that the dynamic mechanism of ideas evolution include: ideas division, ideas fusion, idea variation, self-growth of ideas, disappearance, and death.

Introduction

Idea advancement was the center in KB process which was also a kind of evolution procedure (Scardamalia,2002). From the perspective of philosophy, knowledge was saw as possessed within an individual's mind-as-a-container and was treated as conceptual objects/artifacts for further collective improvement (Bereiter, 2002; Popper, 1972). From the perspective of psychology, learning was regarded as means to progressive problem solving & finding/ defining (Bereiter, 1993). From the perspective of epistemology, idea-centered learning of knowledge building was creative learning (PAAVOLA, 2002).

Knowledge Forum (KF) provided Vocabulary Analyzer, Social Network Tool, a Semantic Overlap Tool and so on to facilitate idea improvement. There have been a lot of papers applying these tools, such as H Y Hong, Leanne Ma (Hong H Y, 2015; Leanne Ma, 2016) and so on.

Some researchers developed other tools to help advance ideas. Zhang J. (2007) developed tools of ITM to promote perspective improvement. Oshima team (2012) developed KBDeX to filter keywords to dynamically draw each node according to the progress of the conversation. Man Q (2014) used keyword tagging to promote students' idea improvement. Chen B. (2014) developed a "Promising Ideas" Tool to explore students' intuitive understanding of promising and to enhance promising judgments.

There were only a few researches of idea improvement. For example, from the view of evolutionary, Hong (2015)drew an improved evolutionary map from two dimensions——breadth and depth. Karsten Krauskopf (2012) proposed a conceptual framework to understand ideas as memes by following the survival paths (fitness) of memes.

So far, most of the current researches have only focused on the visual description of idea development with regards to the external network. The research on idea evolution process and the internal development mechanism is worthy of being studied.

Therefore, in the study there are two research questions:

RQ1: What is the development trajectory of idea evolution?

RQ2: What are the internal mechanism of idea evolution?

Methods

The participants in this study were thirty three undergraduate students (32 females, 1 male))of educational technology from Henan Institute of Science and Technology, whose age ranged from 18 to 20. They had received Knowledge Building instruction for one semester. They were active and interested in projects and designs and can apply and operate platform of Shuke skillfully. The instructor have mastered 12 principles of Knowledge Building.

Instruction environment

The platform of ShuKe was applied which was similar to Knowledge Forum. The experiment was implemented in the research method course in educational technology, lasting for one semester.

Data was mainly collected from shuke Platform, 509 notes. Continuously improved ideas were analyzed with the Knowledge Building coding scheme of Yibing Zhang (2018). Kappa was 0.83.

Pedagogical Design

According to the research of Hans Lossman (2010), the pedagogy was divided into four phases: (1) idea generation, (2) idea connection, (3) idea improvement, (4) rise above.

Firstly, students chose real Ideas, authentic Problems, and gradually applied the educational technology research methods to inquiry. Then, scaffolds were provided to students, for example, What are the most important problems in your learning? Which research methods can be used to your further study? Based on the discussion, students proposed their individual ideas. Through word clouds, the big idea was proposed, which was online learning. Every student proposed his/her individual ideas or hypothesis on Shuke platform.

Students were required to fulfill the tasks in KB activities in corresponding phase: theme selection, Research Plans, literature review and research findings.

Individual ideas

Figure 1 was about individual ideas in Shuke platform about the topic of block chain, including background, definition, characteristics, disadvantages, block chain + education, core technology, and influence on education (see figure 1).

Figure 1. Individual ideas of block chain.

Students recorded their ideas and inquiry process. Individual ideas were summarized and developed to group ideas. Here was an example of “Internet learning resources”, including situation analysis, quality assurance and evaluation criterion, excellent resources selection ……

Emergent groups

Students with similar ideas and opportunism formed one group. Each group draw posters and discussed with their group members in the classroom. Finally, six groups were formed. Each group selected suitable research methods. (see Table 1)

Each group presented their ideas in Shuke platform. Other students read, supported, refuted, and gave suggestions. G6 was stopped because they found they always had the same thought with other group and there were no characteristic research points.

Table 1: Emergent groups and research methods.

Group	Theme	Literature review	Content analysis	Case study	Interview	Questionnaire	Action research
G1	Block-chain+education	√	√	√			
G2	Live broadcast &virtual reality	√	√		√		
G3	Learning style	√	√				
G4	Learning platform assessment criterion	√			√	√	
G5	Micro-lesson evaluation system	√			√		√
G6	Learning resource	√		√			

Continuous idea improvement

Every group was required to review the literature. They searched and utilized authoritative materials constructively. Here were some authoritative papers provided by the teachers about content analysis, case study, Courses of SPSS, Learning website and so on. Every group made research plans.

Every group improved their ideas through several rounds. In the process, they discussed intragroup and intergroup. Artifact were formed and knowledge were created gradually. Figure 2 was the Artifacts of group 1 Block-chain+education (see figure 2). The first picture was literature review. In the second picture, the existing literature was further divided into three categories. The third picture focused on the curriculum setting of Block chain education from 8 aspects and selected a few cases for content analysis.

a b c

Figure 2. Group 4 Learning platform assessment criterion.

Research finding

At last, every group reported their findings in different forms, papers or reports. The research results of G2 were two design products of interface of online instruction and interface of online chatting room. Interestingly, the group was always refuted by other students: can only the design result become the research results? G2 persisted in finishing the plan.

Results

Quantity of ideas

Table 2 showed the results of coding (see table 2). In the coding scheme, ideas included three categories (Sharing conversation, Negotiation conversation, rising-above conversation) and 9 subcategories.

Table 2: Quantity development of ideas.

category	sub-category	quantity	percentage（%）
Sharing	Questions-	176	34.58

conversation	answers		
	interpretation	223	43.81
Negotiation conversation	conflict	42	8.25
	support	18	3.54
	debate	27	5.30
	consensus	3	0.59
rising-above conversation	synthesis	3	0.59
	comment	13	2.56
	reflection	4	0.78

From the quantity and percentage, sharing conversation accounted for the highest proportion, as high as 78.39%. The emergence of brainstorming produced a large number of ideas, some of which were similar or intersecting, which provided sufficient preparation for the continuous revision and refinement.

Negotiation conversation accounted for 17.68%. On the basis of cognitive conflicts and meaning negotiation, ideas continued to develop, similar ideas merged, false propositions died, some new ideas generated and so on. During this process, students' ideas had been constantly developed and revised.

Rising-above conversation accounted only for 3.93%. Students mainly summarized and sublimate the fragmented and simple ideas so that the knowledge building reached a higher level.

The category changes in different phase of ideas were shown in figure 3 (see figure 3).

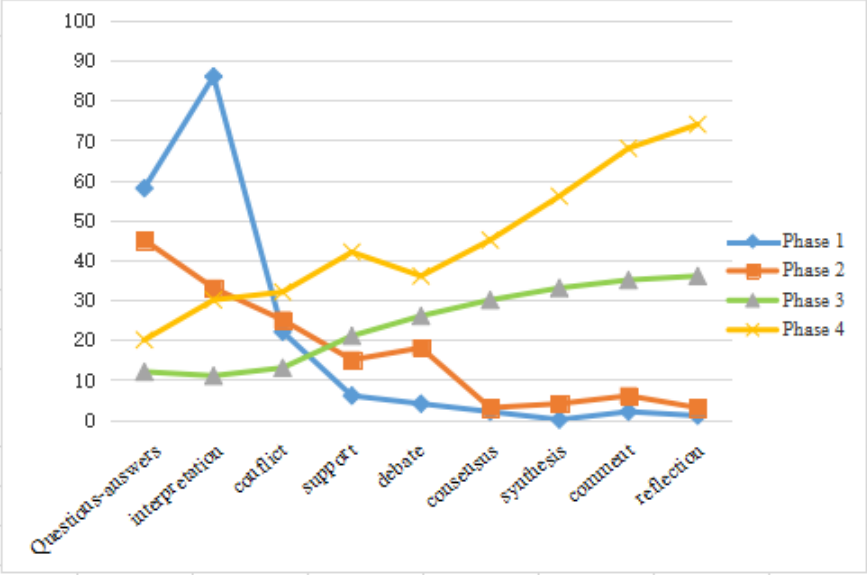

Figure 3. Idea categories

Phase I: A large number of ideas were generated because many novel even whimsical ideas were proposed that lead to more creativity and inspiration. But the depth stayed the two lower levels of question-answer and explanation.

Phase 2: The trend of idea improvement was the same as phase 1, but ideas were revised and integrated. For example, several similar ideas were combined into one idea, or some ideas were gradually replaced even abandoned.

Phase 3: The development trend was generally the same with phase 2. But with the further advance, some clear ideas gradually developed deeply.

Phase 4: Ideas were summarized and sublimated mainly on the basis of the former thought. The phase reflected a more visible reorganization but less new ideas. The transformation of ideas from quantitative change to qualitative change had been realized, and the depth of ideas had been gradually improved

Depth of ideas

The depth distribution of students' ideas was shown in figure 4 (see figure 4). In the coding scheme, idea depth was divided into nine levels. In terms of quantity distribution, most scores were between 5~7. In the whole class, the average depth was 5.9, the maximum was 7.6 and the minimum was 4. Students above and below the average accounted for half each. The result was the same with the research of Xuhui Yang (2017)， in which 33 of 38 students' ideas were above the "baseline".

In terms of quality, the depth of the ideas reached a certain level and improved gradually with the advancement of phases.

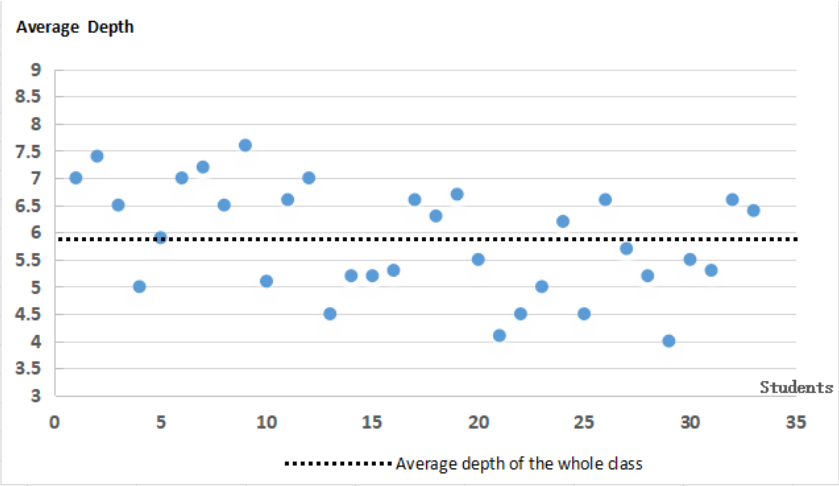

Figure 4. Idea depth scatter diagram

Conclusion and Discussion

The idea statics in the four phases of knowledge building were shown in the table 3(see table 3). "increase" reflected idea division, and "decrease" reflected idea fusion. "transform" reflected idea variation, "recombine" reflected idea self-growth, "replace" reflected idea disappear, "abandon" reflected idea death. Number referred to the total number of ideas in each phase, and frequency referred to the number of idea changes. For example, if an idea was divided into 4, the number was 4 and the frequency was 1. n represents the number of ideas, such as 1→n represented 1 idea spited into n ideas. There were different changes in different phases.

Table 3: Idea statistics of four phases in KB instruction.

category	Idea generation		Idea connection		Idea improvement		Rise above	
	number	frequency	number	frequency	number	frequency	number	frequency
increase（1→n）	465	254	83	19	62	15	14	6
decrease（n→1）	5	1	260	46	141	38	39	18
transform（1→1）	121	21	255	205	164	164	26	26
recombine（1→1）	0	0	23	23	127	127	364	364
replace（1→0）	2	2	90	90	32	32	25	25
abandon（1→0）	0	0	87	87	23	23	31	31

Evolutionary mechanism of idea improvement

According to the whole life of each idea, it was found that they experienced different development paths. The number and depth development of ideas reflected the different types of idea evolution. The quantity reflected the different development types and the depth reflected the vitality of

ideas. In terms of idea improvement life cycle, it presented multidimensional changes and can be categorized into six types. Figure 5 illustrated the development of the life cycle (see figure 5).

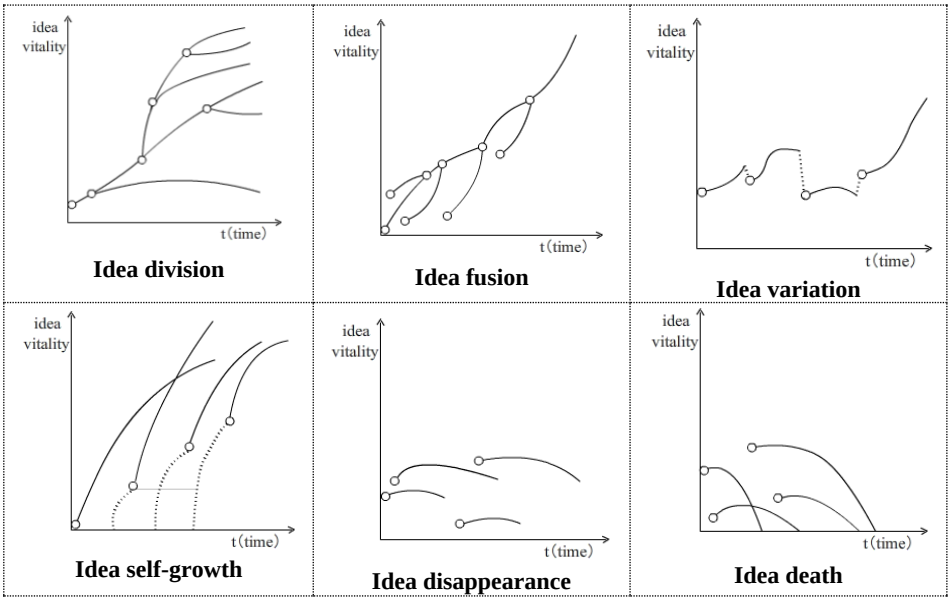

Figure 5. Idea evolution trajectory

Taking the idea division for example, at a certain time the idea split into two ideas, and then one of them continued to split. Idea disappearance meant the idea paused or suspended. But idea death meant the idea was abandoned because of no research value or no vitality.

The study has some implications. The ideas were lively. We could analyze them from five dimensions.

Time dimension: from "static" to"dynamic" (idea division, fusion, variation, self-growth, disappearance and death)

Content dimension: from "right or wrong" to "continuously improvable"

Communication dimension: from the traditional "knowledge telling" to complex "knowledge creation"

Interaction dimension: from "individual " to "interactive"

Presentation dimension: from traditional "individual input" (individual knowledge) to "collective output" (community knowledge construction)

Recommendations for further research

The research on the idea improvement trajectory could be more detailed in different levels and phases. For example, after the first division, how could the subideas be divided again? What are the reasons for idea development and the relationships among the six types of trajectory?

What is node ideas? How to find node ideas? What are the functions of node ideas? How to promote the generation of node ideas?

Is there any significant relationship between idea improvement and knowledge improvement?

Is there any ways of machine coding?

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