

Morphogenetic Pyramid Model of Learning Community and its Application

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Abstract: The construction of learning community essentially belongs to the application and practice of learning community. As classroom teaching is the core link of talent training, it is necessary to solve the problem of the construction of learning community in classroom teaching. Based on the micro perspective, taking the construction of learning community in classroom teaching as the research object, the Morphogenetic Pyramid Model of Learning Community is proposed. Firstly, by using the definition method of species difference plus genus, the abstract of learning community is given and the operational definition of learning community is given to measure it by using the index description method. Secondly, the Morphogenetic Pyramid Model of Learning Community is constructed with the level of learners' development as the morphological index. Finally, the construction process and its application effect are described in details. With the help of the morphological changes of the learning community based on students' GPA (Grade Point Average) as the morphological index, the application effect of learning community can be easily quantified, which can lay a foundation for training students with precision. It is helpful to perfect the theory of learning community and contribute to the high-quality development of education, because the function of evaluation, supervision and improvement of curriculum assessment can be carried out by analyzing the performance of the Morphogenetic Pyramid Model of Learning Community.

Keywords: Classroom Teaching; Learning

Community; Pyramid Model; Morphogenesis; Morphological Resonance

1. Introduction

It's necessary to solve the problem about improving the quality of higher education as higher education is the core link of talent training. Since classroom teaching is the battle position of talent training, the construction of learning community, which essentially belongs to the application and practice of learning community, is needed to be discussed in classroom teaching. Pei discussed the basic constitution of 'learner community' [1]. Qu pointed out that it is necessary to build a lively and motivated learning community for teachers and students to improve teaching quality [2]. Yu et al. discussed the reconstruction and practice of the college teacher and student community in the new era [3]. The characteristics of the existing research on the construction of learning community are as follows: (1) Explore the construction of learning community based on application, including classroom learning community, teacher professional learning community, network learning community, etc. (2) Discuss the construction of learning community according to the practical needs, such as the Internet + background, the intelligent learning environment, the integration of industry and education background, etc. The shortcomings includes: (1) the theoretical exploration of learning community construction is not systematic; (2) the construction effect of the learning community is mainly evaluated qualitatively and lacks quantitative analysis; (3) there is insufficient research on the construction of learning community at the

micro level. All these are not conducive to the long-term development of learning community theory. The difference of this paper is that, based on the micro perspective, taking the construction of learning community in classroom teaching as the research object, the Morphogenetic Pyramid Model of Learning Community is proposed, the morphological characteristics of learning community are analyzed, and the foundation is laid for the quantitative evaluation of the effect of learning community.

2. The Definition and Characteristics of Learning Community

How to define learning community is a basic problem, and existing studies have shown that there is no unified definition of learning community [4]. By using the definition method of species difference plus genus, the abstract definition of learning community is proposed to describe its essential characteristics, and then the operational definition of learning community is given to measure it by using the index description method.

Definition 1: A learning community is a group that is bound together by a learning task. (Abstract definition)

In this definition, 'group' is its generic concept, which refers to the whole of homogeneous people or things. Groups have their own characteristics: members have a common goal; members have a sense of identity and belonging to the group; groups have structure, shared values, etc. 'Being connected together based on the learning task' is the species difference of learning community, which means the personality characteristic and essential characteristic.

Definition 2: A learning community refers to a dynamic and effective non-traditional social group to realize learning tasks, which takes learning as its core concept and main practical activities, and takes common vision, common learning, common sharing, common growth and common creation as its basic characteristics. (Operational definition)

In this definition, 'social group' is its generic concept, and 'common vision, common learning, common sharing, common growth, and common creation' is the species difference of learning community, which means its essential characteristics. Based on the relevant literature, an effective learning community

should have the following characteristics:

First, have a common vision. From the perspective of morphogenesis, a common vision is equivalent to an "attractor" that guides the learning community to develop towards a morphological goal. A shared vision can be effectively articulated through a well-crafted mission statement. Second, common learning means that the learning community advocates social learning in the era of Education 3.0 [5], focusing on 'Learning to cooperate, connecting, and creating a community of values and actions'. Third, common sharing means that a learning field is created by a learning community, in which learners can deepen their understanding of specific learning tasks and realize knowledge construction by sharing experience and views based on Kurt Lewin's field theory of behavior [6]. Fourth, common growth means that a learning community achieves common progress by strengthening communication. Fifth, common creation means that a learning community is good at produce unprecedented new results with social value by synthesizing all aspects of information, forming a certain goal, and controlling or regulating the object.

3. Morphogenetic Pyramid Model of Learning Community

Morphogenetic phenomenon is the phenomenon that objective things develop from the initial form to the final form with specific morphological characteristics [7]. From the perspective of morphogenesis, it's necessary to discuss the process of the learning community from the initial form to the final form. By integrating the theory of zone of proximal development [8], Edgar Dale's Cone of Learning [9] and the morphogenetic system theory [10], the Morphogenetic Pyramid Model of Learning Community is constructed with the level of learners' development as the morphological index, as shown in Figure 1.

Interpret Figure 1 as follows:

(1) The morphological index of learning community is expressed by the level of learners' development, and learners are divided into 9 levels. According to Alfred Rupert Sheldrake's the hypothesis of formative causation [11], morphological resonance will happen among learners with different levels.

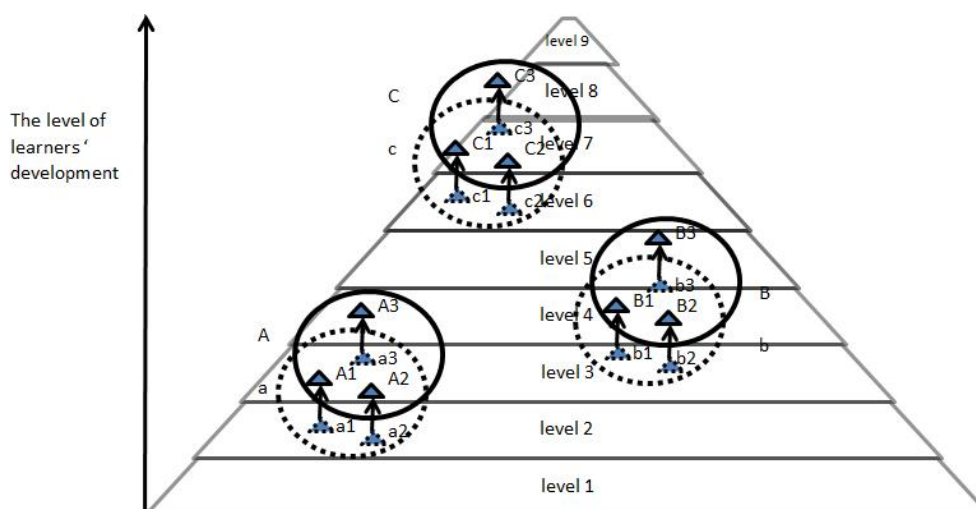


Figure 1. Morphogenetic Pyramid Model of Learning Community

(2) The learning community is divided into teacher learning community, teacher-student learning community and student learning community. Each learning community consists of 3 or more learners. Assume that there are only 3 learners in each learning community. The morphogenetic process of student learning community is expressed as the development from initial form a to final form A. For example, learner 1 progresses from a1 to A1. Similarly, the morphogenetic process of the teacher-student learning community is expressed by developing from b to B, and the morphogenetic process of the teacher learning community is expressed by developing from c to C. All similar systems will have morphological resonance effects, for example, C will act on c, B, b, a, A, etc.

(3) Morphogenetic pyramid model explains the disadvantages of traditional teaching and highlights the role of learning community. Traditional teaching is a one-to-many mode with limited interaction, and morphological resonance effects between the teacher and students are not obvious. For example, the development level of teachers is level six, and the development level of students is level one to level three. Normally, it's difficult to empathize among students and teachers which will cause lots of conflicts. The learning community is a bridge to connect teachers and students because they are new learners with the common vision. Morphological resonance effects are obvious among different learning communities while the teacher-student learning community is the main one. Traditional one-to-many mode is transformed into one-to-one mode, one-to-many mode, and

many-to-many mode. There are less conflicts, more morphological resonance effects, and deep learning can be realized easily.

4. Case Application

Classroom teaching is the battle position of talent training, updating traditional teaching with learning community teaching is conducive to creating high quality classroom. Taking the course 'Economic Laws and Engineering Construction Regulations' in applied undergraduate colleges as an example, its application will be introduced.

(1) Construct the Morphogenetic Pyramid Model of Learning Community

Construct three kinds of learning community. The teacher learning community is a high-level learning community composed of the teacher, related course teachers and the counselor. There are two types of teacher-student learning communities. The first is a middle-level learning community composed of teachers and some student representatives, which is a teacher-student learning community focused on construction. In this case, the teacher, the principal and team leaders form an assessment committee of the course, which is the teacher-student learning community. The other is made up of the teacher and each student. The student learning community consists of students, who can be team members, roommates or classmates. The main student learning community is formed by team members. For example, there are 39 students in class 1, and the students are divided into 6 student learning communities with the scope of 6-7 people. The students' morphological index is set by reference to students' GPA (Grade Point

Average). The initial form is the original GPA and the final form is the course grade point.

(2) Conduct classroom teaching based on the Morphogenetic Pyramid Model of Learning Community

The characteristics of learning community are “common vision, common learning, common sharing, common growth, and common creation”, which needs in-depth implementation in classroom teaching. Mission statement is a useful tool to form a common vision. The teaching content is divided into two parts: economic laws and engineering construction regulations and the course assessment adopts 3+3+4 mode (Usual performance 30%, oral exam 30%, and final exam 40%). The oral exam is divided into team oral exam and individual oral exam. Taking the most distinctive moot court as an example, four steps including preliminary preparation, formal teaching, summary evaluation and material filing [12] are executed in the whole process. In the preliminary preparation stage, the ‘Moot Court Assignment’ is proposed by the teacher learning community and the teacher-student learning community to guide the whole process, and common learning can be easily realized in the student learning community through strengthening cooperation and rehearsing many times. In the formal teaching stage, the collegial panel, the plaintiff and the defendant cooperate to reproduce the trial scene, which form a good ‘learning field’ to strengthen the morphological resonance effect. Another ‘learning field’ is formed by mutual comments and expert comments. Both the summary evaluation stage and material filing stage are very important. Outcome-based Education (OBE) can be easily implemented and the growth process of learning community can be recorded by various reports such as students’ experience in moot court and the final report about the moot court teaching. Multiple rounds of teaching practice show that building a learning community significantly improves the effect of classroom teaching.

(3) Quantitative analysis of the implementation effect of the learning community, summing up experience and lessons

The continuous improvement of the learning community can be realized by analyzing the morphological changes of the community. Figure 2 shows the morphological changes of

the learning community system.

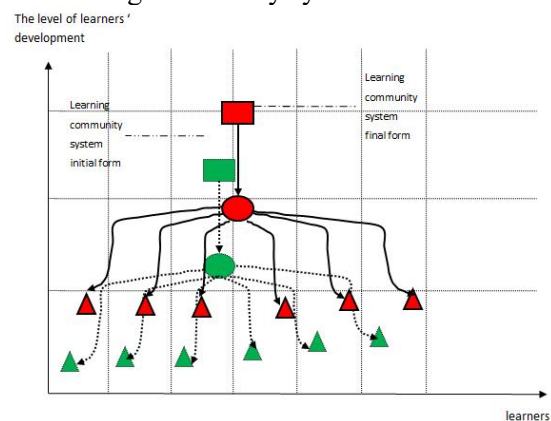


Figure 2. Morphological Changes of Learning Community System

(1) The morphogenetic process of learning community system is the development process of learning community system from initial form to final form, as shown in Figure 2. The initial form is represented by dotted lines, and the final form is represented by solid lines. The morphological change showed an upward trend which shows that the effect of the learning community was good. The morphological comparison table of the students’ learning community is given in Table 1. For example, the form value of the Team 1 increased from 2.47 to 3.57, with a deviation of 1.10, that is, the average score of the Team 1 increased by 11 points. The form value of the Class 1 increased from 2.93 to 3.52 with a deviation of 0.59, that is, the average score of the Class 1 increased by 6 points, from medium grade to good grade.

(2) A learning field is formed by stimulating the initiative of teachers and students through the construction of learning community. In the initial form, Teams 1, 2, 3 and 4 were medium grade, and Teams 5 and 6 were good grade. In the final form, all the 6 teams become good grade, and the morphological resonance effect is very obvious, which means that there are lots of interactions among teachers and students.

Table 1. Comparison of Forms of Students’ Learning Community

Value	T1	T2	T3	T4	T5	T6	C1
I	2.47	2.68	2.88	2.93	3.23	3.37	2.93
F	3.57	3.55	3.51	3.37	3.56	3.56	3.52
D	1.10	0.87	0.63	0.44	0.33	0.19	0.59

Note: The form index value represents by students’ GPA (Grade Point Average). I means Initial form index value, F means Final form

index value, D means deviation which equals F minus I. T1 means Team 1, Team 2 means T2, and so on. C1 means Class 1.

(3) The Morphogenetic Pyramid Model of the Learning Community can implement the evaluation, supervision and improvement functions of curriculum assessment based on data, which is conducive to the realization of high-quality development of education. Take the average index value of the Class 1 as the evaluation criterion, the performance of learning community can be divided into unqualified learning community and qualified learning community. If a team's index value is less than the average value, it's an unqualified learning community; otherwise it is a qualified learning community. By comparing the initial form index value, Teams 1, 2, and 3 are unqualified, and Teams 4, 5, and 6 are qualified. By comparing the final form index value, Teams 3 and 4 are unqualified, and Teams 1, 2, 5 and 6 are all qualified. So Teams 5 and 6 are high-level learning communities that have been maintained at a qualifying level. Team 1 and Team 2 are developed from the unqualified one to the qualified one, which means that the team members make big progress during the learning process. And it's necessary to pay attention to Teams 3 and 4, since they make less progress. Through targeted heart-to-heart talks with each team, advanced experience and lessons of learning community construction can be summarized and improved in the subsequent courses. The precise training of each student can also be achieved based on their morphological data.

5. Conclusion

In order to solve the problem of the construction of learning community in classroom teaching, this paper puts forward the Morphogenetic Pyramid Model of Learning Community, and discusses the construction and application of learning community from the perspective of system generation.

(1) The construction of learning community essentially belongs to the application and practice of learning community. By using the definition method of species difference plus genus, the abstract definition of learning community is proposed to describe its essential characteristics, and then the operational definition of learning community is given to measure it by using the index description

method. 'Common vision, common learning, common sharing, common growth, and common creation' is the species difference of learning community, which means its essential characteristics.

(2) The Morphogenetic Pyramid Model of Learning Community is constructed with the level of learner development as the morphological index.

(3) The application and effect of the Morphogenetic Pyramid Model of Learning Community are introduced. The data show that the construction of learning community has a good effect, which is conducive to the formation of a learning field, the implementation of the evaluation, supervision and improvement functions of curriculum assessment based on data, and the realization of high-quality development of education.

In general, the Morphogenetic Pyramid Model of Learning Community is helpful to explore the morphological characteristics of learning community, explore the formation mechanism of learning community, and lay a foundation for quantitative analysis of learning community effect. Then the research on the selection and quantification of the learning community's morphological index can be carried out further.

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References

- [1] Pei Xinning. Teaching design and research of 'learner community'--one of the practices of constructivism in integrated science teaching. *Global Education*, 2001, (03): 10-15.
- [2] Qu Zhenyuan. Focus on classroom teaching and improve the quality of teaching. *China Higher Education Research*, 2016, (12): 1-5.
- [3] Yu Hua, Li Chuanyong, Liu Yubin. Reconstruction and practice of college

- teachers and students community in the new era. *China University Teaching*, 2021, 376(12): 82-87.
- [4] Ye Zhong-hai. On some basic problems in learning community. *Contemporary Continuing Education*, 2013, 31(01): 9-10.
- [5] Gu Yuan, Zhou Xian. *Education 3.0*. China Textile Press, 2022.
- [6] Kurt Lewin. Field theory and experiment in social psychology: concept and methods. *American Journal of Sociology*, 1939, 44(6): 868-896.
- [7] Tian Jing. Morphogenetic estimation and its application in updating probabilistic risk. Doctor of Science in Natural Disaster in Beijing Normal University, 2012, 14-28.
- [8] Zhong Qiquan. The zone of proximal development: theoretical basis of classroom transformation. *Global Education*, 2018, 47 (01): 11-20+34.
- [9] Edgar Dale. *Audio-visual methods in teaching* (3rd Edition). NY: Dryden Press, 1969.
- [10] Tian Jing, Germano Resconi. Morphogenetic updating algorithm and its application in updating probabilistic risk. *International Journal of Pattern Recognition and Artificial Intelligence*, 2019, 33(7): 1950008 (30 pages).
- [11] Sheldrake R. *A new science of life: the hypothesis of formative causation*. Los Angeles: JP Tarcher, 1981.
- [12] Tian Jing. Application of the teaching method of simulated court in legal platform courses of engineering management major. *Ability and Wisdom*, 2020, 25: 121-122.