Hindawi
Scientific Programming
Volume 2022, Article ID 9307770, 12 pages
https://doi.org/10.1155/2022/9307770

Research Article

Construction of an Improved English Teaching Model Based on Cellular Automata

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Received 7 December 2021; Revised 24 December 2021; Accepted 28 December 2021; Published 18 January 2022

Academic Editor: Tongguang Ni

In order to improve the effect of college English teaching reform, this paper puts cellular automata English into English teaching simulation and uses the cellular automata model to study the behavior of complex teaching systems. Moreover, this article uses the method of man-machine combination to establish the corresponding dynamic evolution model and design the local evolution rules of the complex system to simulate the English teaching process, including the movement of students and teachers, the interaction of the teaching process, the development of teaching activities, and the processing of teaching resources. In addition, this paper constructs the functional structure of the system and conducts system verification through experimental research. The experimental research results show that the English classroom teaching evaluation system based on the cellular automaton proposed in this article is very effective, and it has a certain role in promoting English teaching.

1. Introduction

In the process of higher education reform and development, teaching has always been regarded as the core link of higher education, and the quality of teaching can directly reflect the level of teaching in the school. The overall teaching level of national colleges and universities can prove from the side whether the national education guidelines, policies, and systems are correct, thereby further promoting the reform and development of education. For the evaluation of teaching quality, while satisfying the satisfaction of the government and society, all colleges and universities pay more attention to the level of satisfying students. Since the 1980s and 1990s, constructivist learning theories and constructivist teaching theories have become increasingly popular in the West. They all advocate student-centeredness and emphasize that students are processors of information and active constructors of the meaning of knowledge, and the role of teachers is to guide and help. This has brought a great impact on the traditional teacher-centered "filling and filling" teaching view and the learning view of students passively accepting knowledge.

In recent years, with the breakthrough development of software and hardware such as virtual engines, texture rendering, computers, and VR equipment, virtual reality has once again become a hot spot for research and development. Virtual reality technology is an important direction of simulation technology; that is, through computer science technology, the physical and digital data in the physical environment are converted into visual or even touchable 3D virtual scenes, and the combination of computers and peripheral devices allows users to enter the 3D space created by the computer model for perception and interaction [1]. In virtual reality, through diversified interactions such as vision, sound, touch, and operation, users can apply perception experience and cognitive processing capabilities to interact with objects in virtual reality just like in the real world and observe natural changes in the world. Virtual reality uses three elements to construct a virtual reality context [2]: (1) immersion, allowing users to have an "immersive" feeling and blending into the simulated virtual world; (2) interactivity, users passing sensory stimulation and reaction interact with and give feedback to the virtual situation; the system responds to the user in the shortest time and allows the user to feel the response in a simulated situation; (3) conceptual, virtual reality is a fictitious simulated situation. In addition to feeling the sound and light stimulation, you can also conceive of situational design and object attributes and express intangible abstract concepts in concrete forms. Virtual reality has strong flexibility, repetition, and adaptability. People can create the real world from scratch in the computer at a low cost, can repeatedly use virtual reality for training in the same situation, and can quickly learn to use and interact with virtual reality, can realize some areas that cannot be visualized in reality (brain, whole body structure, etc.) and virtual operations, and can obtain reliable information equivalent to the real environment from virtual reality. Another important advantage of virtual reality is safety. Users can make virtual errors and make virtual collisions without harming anyone or themselves. Therefore, virtual reality is widely used in the fields of spatial cognitive assessment, rehabilitation, and psychological research, training, and education. Especially in the field of training and education, because low-cost and high-efficiency virtual reality brings learners an immersive learning environment, enhances the learning experience, bridges the gap between learners and educators in terms of teaching, and makes virtual reality technology, this can help students learn better [3].

Based on the above analysis, this article applies cellular automata to the improvement of English teaching and uses the cellular automata model to study the behavior of complex teaching systems. Moreover, this article uses the method of man-machine combination to establish the corresponding dynamic evolution model and design the local evolution rules of the complex system to improve the teaching effect of colleges and universities.

2. Related Work

Cellular automata simulation is an important method for studying complex systems, and it has been widely used in natural sciences and social sciences. Literature [4] established a cellular automata model for classroom teaching based on the principles of sociology and psychology, and literature [5] simplified the cellular automata model. However, all of its model establishments only looked at the teaching process as the process of knowledge imparting and believed that the amount of knowledge of students should not exceed that of teachers. This is inconsistent with reality, and it is also contrary to the idea of analyzing and researching teaching activities with the viewpoints and methods of complexity science. Literature [5] uses the cellular automata evolution rule of lattice point trend to produce more complicated evolution patterns with fewer evolution rules. Literature [6] believes that a system with a variable evolution rule can better reflect the adaptation of the actual system to environmental changes and studies the chaotic edge effect of a cellular automaton with a variable evolution rule. Inspired by the new cellular automata model, based on the study of the complexity of the university teaching process, based on the driving effect of herd mentality and emotional satisfaction, quality training goals, and education and teaching strategies, the elementary cellular automata and random cellular combining automata establish a cellular automata model of the university teaching process [7].

Literature [8] uses a series of cellular automata models to simulate certain situations and analyze the characteristics of each situation. According to the characteristics of cellular automata, it can be applied to the fields of fluid mechanics and solid mechanics. Literature [9] proposed a method of combining finite element and cellular automata and analyzed the related problems of the fluid-solid interface in composite materials. The movable cellular automata make it possible to simulate complex mechanical systems. Some cellular automata research work has been extended to mechanics, but it should be pointed out that it is compatible with traditional calculation methods (such as finite element method and boundary element method). In comparison, there are few written text introductions related to cellular automata in solid mechanics [10]. As a new exploratory application of cellular automata, literature [11] proposed a simple cellular automata method, which can be combined with finite elements. It should be pointed out that the cellular automata model established above is based on randomly generated free nodes instead of traditional regular grids, and the local rules of cellular automata are based on physical concepts rather than differential equations [12].

There are some results in the research on the evolution law of complex systems based on cellular automata. Literature [13] uses the cellular automata model to develop an intelligent simulation program, which has the ability to simulate the evolution of a complex system. The essence is to simulate the evolution process of simple two-dimensional cellular automata. It allows people to fully realize that simple rules can make cellular automata produce complex evolutionary behaviors. Literature [14] carried out in-depth research on elementary cellular automata through a large number of computer experiments and qualitatively divided the evolutionary behavior of all rules of the cellular automata into four categories from the perspective of dynamic behavior. The method of formal language proves that some rule-evolving languages are formal languages, which explains the complexity of the cellular automata-evolving languages of these rules. Literature [15] proposed the parameter λ to describe the evolution of cellular automata. Through a lot of research, the internal evolution mechanism of cellular automata was revealed, and the concept of "the edge of chaos" was proposed. This concept refers to the bizarre phase transition from "order" to "chaos" in the evolution of cellular automata. Literature [16] divides cellular automata into 6 types, reclassifies stationary cellular automata into zero configuration and fixed type, and divides partial periodic cellular automata into local chaotic types. Literature [17] proposed a power spectrum method to quantitatively describe the evolutionary behavior of cellular automata and found that the evolutionary graph of cellular automata has spatial drift characteristics. Literature [18] studies the evolution properties of certain finite element cellular automata.

3. Establishment of English Teaching Model of Cellular Automata

This model is based on the cellular automata model. The cell space is used to represent the classroom where classroom teaching occurs, the cells are used to represent students, and the various states of cells are used to represent the different effects of students' meaning construction. Each cell has its own meaning construction value through calculation, and there is a mutual influence among cells.

(1) *Cell Space*. A 12×8 matrix is used to represent a classroom. Because in colleges and universities, the interior design of ordinary classrooms is not square but rectangular, so the ordinary model of $m \times m$ is not adopted, but the model of $n \times m$ is adopted, $n \neq m$. Normal classrooms in colleges and universities can generally accommodate about 100 students, so the classroom seats designed in the model are $12 \times 8 = 96$.

(2) *Cells*. A cell represents an individual learner, and an ordered pair (i, j) is used to represent the position of a learner in the cell space, $1 \leq i \leq 8, 1 \leq j \leq 12$. The model assumes that the classroom is full of students, so there are 96 cells in total [19].

(3) *Neighbors*. The neighbor mode of the model refers to the Moore model, that is, the neighbor cell set of the central cell composed of 8 surrounding cells. However, in the model, since the cell space describes a classroom, the form of neighbors will be determined according to the position of the center cell. As shown in Figure 1, the brown cell represents the central cell, and the light gray cell represents the neighbor cell. When the central cell is located at a nonboundary position (such as cell a_{55}), the mode of its neighbor cells is consistent with Moore's neighbor mode. However, when the center cell is located at the boundary of the classroom, the number of neighbor cells will be less than 8. There are two types of boundary positions for the central cell. One is where the cells a_{11}, a_{19}, a_{91}, and a_{99} are located; that is, at the four corners, these cells have only 3 neighbor cells. The other is where the a_{11}, a_{51}, a_{59}, and a_{95} cells are located; that is, at the center point of the boundary, these cells have 5 neighbor cells.

(4) When the cell state set K is selected, $K = \{-1,0,1\}$ represents the cell state set of the model, and the meaning of each state is shown in Table 1. [20].

In the simulation process, the five links of situational teaching are divided into two major links. One is the self-learning link, which includes three links: creating affection, determining problems, and self-learning. Because in these three links, the process of collaborative learning with surrounding students is not involved, the other is the collaborative learning link, which includes two links: collaborative learning and effect evaluation. Because these two links involve the process of discussion and communication, they are the focus of experimental research.

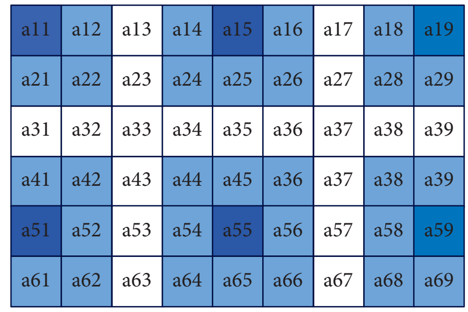

Figure 1: Neighbor mode.

Human behavior is determined by internal eds and external environment. The learner's meaning construction behavior is no exception. It is also affected by internal factors and the external environment. The functional expression of meaning construction is

$$F(t) = F_I(t) + F_O(t). \quad (1)$$

In formula (1), $F_I(t)$ represents the internal factor function thaffects the learner's meaning construction, and $F_O(t)$ represents the environmental factor function that affects the learner's meaning construction, also known as external factors.

The self-learning link focuses on the teacher's guidance and the process of students' self-study. Therefore, the meaning construction effect produced by the students through this link is affected by internal factors, namely, their own knowledge level, and external factors, namely, the teacher's context setting. The following formula can be used to express the meaning construction effect of students in the autonomous learning process.

$$F(t) = F_L(t) + F_S(t). \quad (2)$$

Formula (2) indicates that ignoring other complex factors, the learner's meaning construction function $F(t)$ at time t is the result of the interaction between the student's own knowledge background function $F_L(t)$ and the teacher's context setting function $F_S(t)$.

$F_L(t)$ represents the learner's own knowledge background, also known as the basic level, and represents the knowledge base, knowledge structure, and amount of knowledge that the learner has related to the current content to be learned. Each student has different types of knowledge related to this course, so the value of the learner's own knowledge background function $F_L(t)$ is represented by l, and l is evenly distributed in [0,1]. Each learner has a constant l value during the experiment. The larger the l value, the thicker the learner's knowledge background, which is more conducive to the construction of their own meaning, and vice versa.

Students' meaning-making effects at any moment are the result of a combination of internal and external factors. In free mode collaborative learning without teacher participation, the meaning construction effect of student (i, j) at moment t is related to the student's own meaning construction effect at moment $t-1$ (internal factors) and the

Table 1: The meaning of each state of the cell.

Condition	Implication
$K_{i,j} = -1$	Meaning construction does not meet the standard, and the learning quality of learners in this state does not meet the minimum requirements of the teacher
$K_{i,j} = 0$	Meaning construction meets the standard, and the learning quality of learners is average, between substandard and excellent
$K_{i,j} = 1$	Meaning construction is excellent, the learner's learning quality is very good, and it can meet the teacher's teaching expectations

meaning construction effect of surrounding students at moment $t-1$ (external factors).

$$F_{i,j}(t) = \alpha \times F_{i,j}(t-1) + \beta \times \sum_{n=1}^{n=n^*} F_n(t-1) \div n^*. \quad (3)$$

As shown in formula (3), $F_{i,j}(t)$ represents the meaning construction effect of students (i, j) at time $t-1$, and $F_{i,j}(t-1)$ represents the meaning construction situation of students (i, j) at time $t-1$. The formula $\sum_{n=1}^{n=n^*} F_n(t-1) \div n^*$ indicates that the students (i, j) are affected by the meaning construction effect of surrounding students at time $t-1$, which is represented by the average influence of neighbor cells on the central cell in the model. Among them, n represents the n-th neighbor cell of the central cell (i, j), and n^* represents the number of neighbor cells. Depending on the position of the central cell, the number of neighbor cells may be 3, 5, or 8, so there are three possible values for n^*. $F_n(t-1)$ represents the meaning construction of the n-th neighbor cell.

α and β are, respectively, the weights of internal factors and external factors on the meaning construction of learners, and they are all the weights of first-level indicators. The first-level indicator system of this evaluation is $\{W_e | e = 1, 2\}$, and its corresponding weight system is $\{V_e | e = 1, 2\}$, $0 < V_e \leq 1$, and it satisfies $V_I + V_2 = 1$. Among them, W_1 represents the effect of internal factors, V_I represents its weight, and $\alpha = V_I$; W_2 represents the influence of external factors, V_2 represents its weight, and $\beta = V_2$. Through the subjective experience method, it can be known that when students have poor meaning construction effects, they are more susceptible to environmental factors; when students have good meaning construction effects, they are not easy to be affected by environmental factors. Therefore, the value of the weight system is changed according to the state of the cell.

When $K_{ij} = -1$, it means that the learner's meaning construction is not up to the standard, and he is more susceptible to external factors, so $\alpha = 0.3, \beta = 0.7$. [21].

When $K_{i,j} = 1$, it means that the learner has a good sense-building effect, and he is more susceptible to internal factors and not easy to be affected by the external environment, so $\alpha = 0.7, \beta = 0.3$.

When $K_{i,j} = 0$, it means that the learner's meaning construction effect is average, and it is affected by internal and external factors with equal strength, so $\alpha = 0.5, \beta = 0.5$.

The formula after finishing is as follows:

$$\begin{cases} F_{i,j}(t) = 0.3 \times F_{i,j}(t-1) + 0.7 \times \sum_{n=1}^{n=n^*} F_n(t-1) \div n^*, & K_{i,j}^{t-1} = -1, \\ F_{i,j}(t) = 0.5 \times F_{i,j}(t-1) + 0.5 \times \sum_{n=1}^{n=n^*} F_n(t-1) \div n^*, & K_{i,j}^{t-1} = 0, \\ F_{i,j}(t) = 0.7 \times F_{i,j}(t-1) + 0.3 \times \sum_{n=1}^{n=n^*} F_n(t-1) \div n^*, & K_{i,j}^{t-1} = 1. \end{cases} \quad (4)$$

In the process of collaborative learning, it is impossible for every student to have the opportunity to communicate with the teacher. Therefore, most students are still in a situation where they have not communicated with the teacher. When students cannot get the guidance of teachers in the process of collaborative learning, the expression of the meaning construction effect is consistent with formula (4). When students get the opportunity to communicate with teachers in the process of collaborative learning, the student's meaning construction effect function is shown in

$$F_{i,j}(t) = \alpha \times F_{i,j}(t-1) + \beta \times \sum_{n=1}^{n=n^*} F_n(t-1) \div n^* + \lambda. \quad (5)$$

The state of the central cell still determines the value of the first-level weights α and β, and the value method is consistent with the value method without teacher participation. After sorting, the expression of the student meaning construction function with teacher participation is shown in

$$\begin{cases} F_{i,j}(t) = 0.3 \times F_{i,j}(t-1) + 0.7 \times \sum_{n=1}^{n=n^*} F_n(t-1) \div n^* + \lambda, & K_{i,j}^{t-1} = -1, \\ F_{i,j}(t) = 0.5 \times F_{i,j}(t-1) + 0.5 \times \sum_{n=1}^{n=n^*} F_n(t-1) \div n^* + \lambda, & K_{i,j}^{t-1} = 0, \\ F_{i,j}(t) = 0.7 \times F_{i,j}(t-1) + 0.3 \times \sum_{n=1}^{n=n^*} F_n(t-1) \div n^* + \lambda, & K_{i,j}^{t-1} = 1. \end{cases} \tag{6}$$

Unlike the free model of collaborative learning, the group model of collaborative learning has a very clear collaborative learning group, that is, group members. In the collaborative learning group, the leader of the group—the group leader—is arranged, and the group leader plays a leadership role, and he plays a key role in the collaborative learning of the whole group. Under the leadership of the group leader, the group members will have an orderly discussion. In fact, dividing the group is to divide the whole class, a large collective, into smaller groups that are almost identical to its model, in which the group leader acts as the teacher in the larger group.

In the actual teaching process, when teachers use the subgroup mode for collaborative learning, each group generally has 4 to 6 members. This experiment will choose the 6-person group mode. Because there are 96 students in the class, the class is divided into 16 groups.

As shown in Figure 2(a), the 6 students in the dark gray area are a group, and the 6 students in the light gray area are another group, a total of 16 groups. The diagonal line in each group represents the group leader. Each team has two types of members, and one is the leader and the other is the member.

For the group leader (i, j), the internal factor affecting his meaning construction at moment t is the group leader's meaning construction at moment $t-1$, and the external factor is the average meaning construction effect of the five group members at moment $t-1$, as shown in Figure 2(b). Therefore, the meaning construction function at moment t is shown in

$$F_{i,j}^{g}(t) = \alpha \times F_{i,j}(t-1) + \beta \times \sum_{n=1}^{n=n^*} F_n(t-1) \div n^*. \tag{7}$$

In formula (7), $F_{i,j}^{g}(t)$ means that the student (i, j) is the group leader, and the value of n^* can be determined here. Because each group leader has 5 group members, $n^* = 5$, the weight value of the group leader's internal and external factors is still affected by his own state, and the value is consistent with the value method in the no-group mode. After finishing, formula (8) is obtained.

$$\begin{cases} F_{i,j}^{g}(t) = 0.3 \times F_{i,j}(t-1) + 0.7 \times \sum_{n=1}^{n=5} F_n(t-1) \div 5, & K_{i,j}^{t-1} = -1, \\ F_{i,j}^{g}(t) = 0.5 \times F_{i,j}(t-1) + 0.5 \times \sum_{n=1}^{n=5} F_n(t-1) \div 5, & K_{i,j}^{t-1} = 0, \\ F_{i,j}^{g}(t) = 0.7 \times F_{i,j}(t-1) + 0.3 \times \sum_{n=1}^{n=5} F_n(t-1) \div 5, & K_{i,j}^{t-1} = 1. \end{cases} \tag{8}$$

For a group member (i, j), the internal factor that affects the meaning construction of the group member at time t is the group member's meaning construction situation at time $t-1$. There are two external factors here. One is the meaning construction effect of the team leader at time $t-1$, and the other is the average meaning construction effect of the remaining 4 team members at time $t-1$. As shown in Figure 2(c), the gray squares represent group members (i, j). Since the team leader is at the core of the team, the team leader's influence on the team members is greater than the other four team members' influence on the team members in terms of external factors. Here, a secondary weight will be introduced to describe the influence of the two external factors on the meaning construction of group members, as shown in

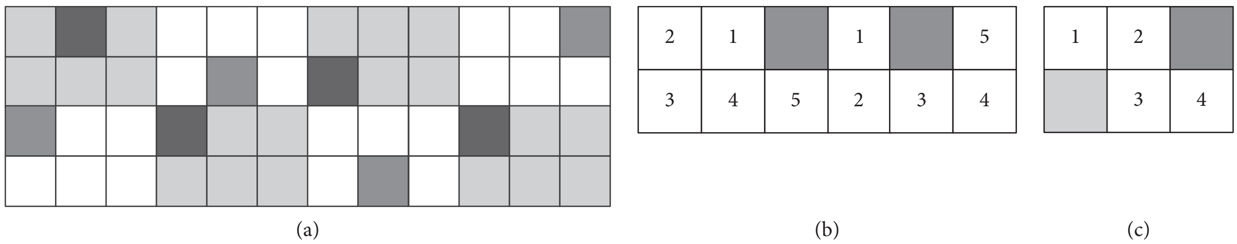

Figure 2: Schematic diagram of the cell. (a) Grouping diagram. (b) Schematic diagram of the external factors of the team leader. (c) Schematic diagram of the external factors of the team members.

$$F_{i,j}(t) = \alpha \times F_{i,j}(t-1) + \beta \times \left(\gamma \times F_{i,j}^{g^*}(t-1) + \delta \times \sum_{n=1}^{n=n^*} F_n(t-1) \div n^* \right). \quad (9)$$

In formula (9), the function $F_{i,j}^{g}(t-1)$ represents the meaning construction effect of the group leader in the group to which the group members (i, j) belong at the time t–1. The formula $\sum_{n=1}^{n=n^*} F_n(t-1) \div n^*$ represents the influence of the average meaning construction of other group members in the group to which the group member (i, j) belongs. It is certain that $n^* = 4$ here.

In formula (9), γ and δ, respectively, represent the weight value of the influence of the group leader's meaning construction situation and the group member's meaning construction situation on the group member's (i, j) meaning construction in the external factors. In equation (9), α and β belong to the first-level weight, γ and δ belong to the second-level weight, and they satisfy

$$\alpha \times \beta \times (\gamma + \delta) = 1. \quad (10)$$

In formula (10), α and β still represent the weight values of internal factors and external factors, and their values are still affected by the cell state, and their values are consistent with the previous text. In order to highlight the core role of the team leader, by referring to the values of α and β in the previous article, we set $\gamma = 0.7$ and $\delta = 0.3$. Formula (11) is obtained by sorting.

$$\begin{cases} F_{i,j}(t) = 0.3 \times F_{i,j}(t-1) + 0.7 \times \left(0.7 \times F_{i,j}^{g*}(t-1) + 0.3 \times \sum_{n=1}^{n=4} F_n(t-1) \div 4 \right), & K_{i,j}^{t-1} = -1, \\ F_{i,j}(t) = 0.5 \times F_{i,j}(t-1) + 0.5 \times \left(0.7 \times F_{i,j}^{g*}(t-1) + 0.3 \times \sum_{n=1}^{n=4} F_n(t-1) \div 4 \right), & K_{i,j}^{t-1} = 0, \\ F_{i,j}(t) = 0.7 \times F_{i,j}(t-1) + 0.3 \times \left(0.7 \times F_{i,j}^{g*}(t-1) + 0.3 \times \sum_{n=1}^{n=4} F_n(t-1) \div 4 \right), & K_{i,j}^{t-1} = 1. \end{cases} \quad (11)$$

The evolution starts with the initialization of all metacells so that each metacell has its own state. For an average class in reality, there are always basic good, average, and poor students in the class, and the number of good, average, and poor students in an average class has a distribution pattern of small at the end and large in the middle. A study of the student structure of a class in this college showed that the ratio of the number of good, average, and poor students was 2 : 5 : 2. Before the lecture started, that is, at $t = -0$, learners possessed their respective knowledge background levels, and students with good, medium, and poor knowledge background levels were defaulted to students with good, medium, and poor levels of meaning construction in the experiment during initialization. At $t = 0$, the system randomly assigned l values, $l \in [0, 1]$, to each tuple to distinguish students' basic levels. In order to express the proportion of the three types of students in the general class more accurately, the three types of students can be identified according to the range of values l, and the ratio of the number of the three types of students is 2 : 5 : 2, as shown in Table 2.

In the process of evolution, the state of the cell is determined by judging the meaning of each cell to construct the function value $F_{i,j}(t)$. The specific situation is shown in Table 3. The results in Table 3 are derived from the reasoning and calculations in Tables 4 and 5.

The conversion conditions were determined based on the students' own knowledge background function $F_L(t)$ and the values of the teacher's context setting function $F_S(t)$. Because both functions take values in the range [0, 1], in the initialization, students with $l < 0.22$ are classified as students with poor knowledge background, students with $l > 0.78$ are classified as students with good knowledge background, and

Table 2: Judgment criteria for three types of students in initialization.

	Poor students $K_{i,j} = -1$	Ordinary student $K_{i,j} = 0$	Excellent student $K_{i,j} = 1$
The value of l	$l < 0.22$	$0.78 \geq 1 \geq 0.22$	$l > 0.78$
Student number	22	52	22

Table 3: State transition rules.

The state of the cell (i, j) at time t-1	$K_{i,j}^{t-1} = -1$ or $K_{i,j}^{t-1} = 0$ or $K_{i,j}^{t-1} = 1$		
Transition condition	$F_{i,j}(t) < 0.72$	$1.28 \geq F_{i,j}(t) \geq 0.72$	$F_{i,j}(t) > 1.28$
The state of the cell (i, j) at time t	$K_{i,j}^{t} = -1$	$K_{i,j}^{t} = 0$	$K_{i,j}^{t} = 1$

Table 4: Breakdown table of student types and context setting effects obtained.

Level	Poor	Ordinary		Good
		Less good	Higher good	
Knowledge background	$l < 0.220$	$0.5 \geq l \geq 0.220$	$0.78 \geq l > 0.50$	$l > 0.780$
Situational setting effect obtained	$s < 0.220$	$0.5 \geq s \geq 0.220$	$0.78 \geq s > 0.50$	$s > 0.780$

Table 5: The value range of the meaning construction function.

$f(l_{i,j}, s_{i,j})$	$K_{i,j}$	$F_{i,j}(t)$'s value range	Total range of values of $F_{i,j}(t)$
F (poor, poor)	−1.0	[0.0,0.440)	[0,0.720)
F (poor, worse)	−1.0	[0.220,0.720)	
F (worse, poor)	−1.0	[0.220,0.720)	
F (poor, good)	0.0	(0.780,1.220)	[0.72,1.280]
F (worse, better)	0.0	(0.720,1.280]	
F (better, worse)	0.0	(0.72,1.280]	
F (good, poor)	0.0	(0.780,1.220)	
F (better, good)	1.0	(1.280,1.780]	(1.28,2.0]
F (good, better)	1.0	(1.280,1.780]	
F (good, good)	1.0	(1.560,2.0]	

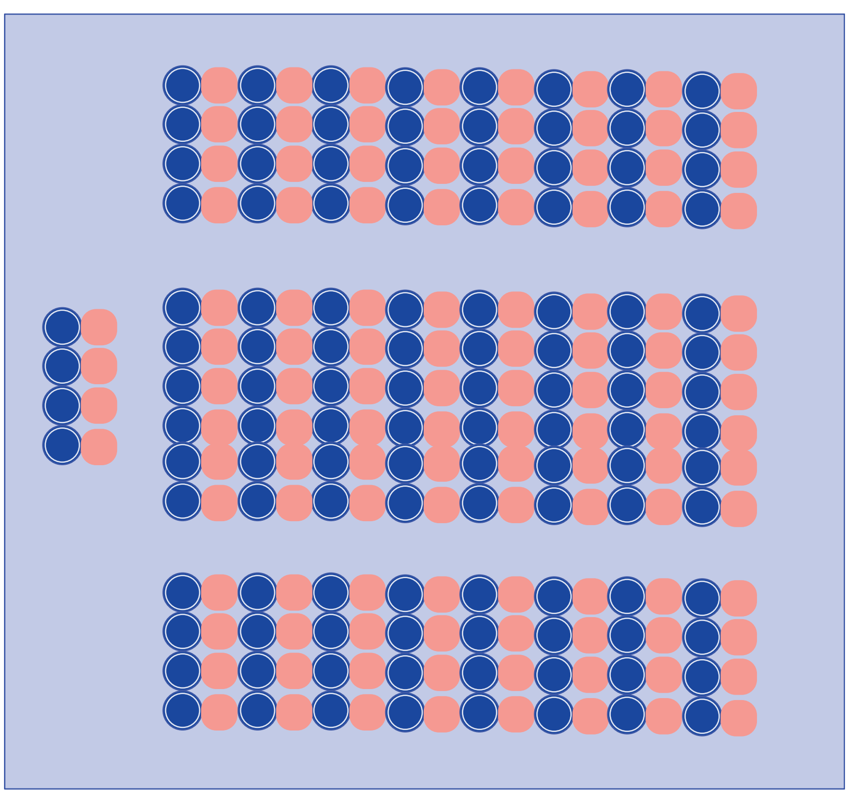

Figure 3: The initial distribution of people in the classroom.

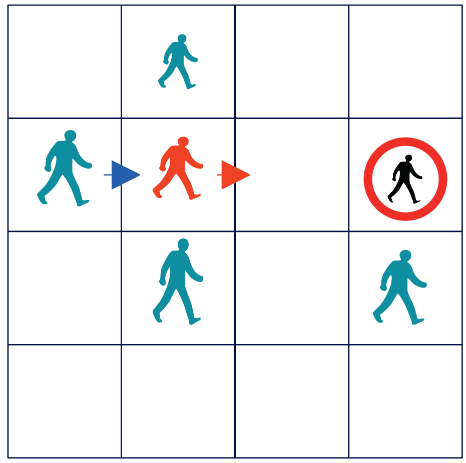

Figure 4: Interaction between pedestrians.

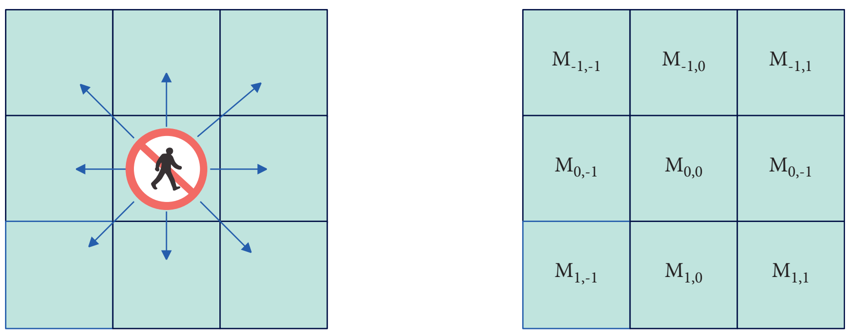

Figure 5: Pedestrian particle movement matrix.

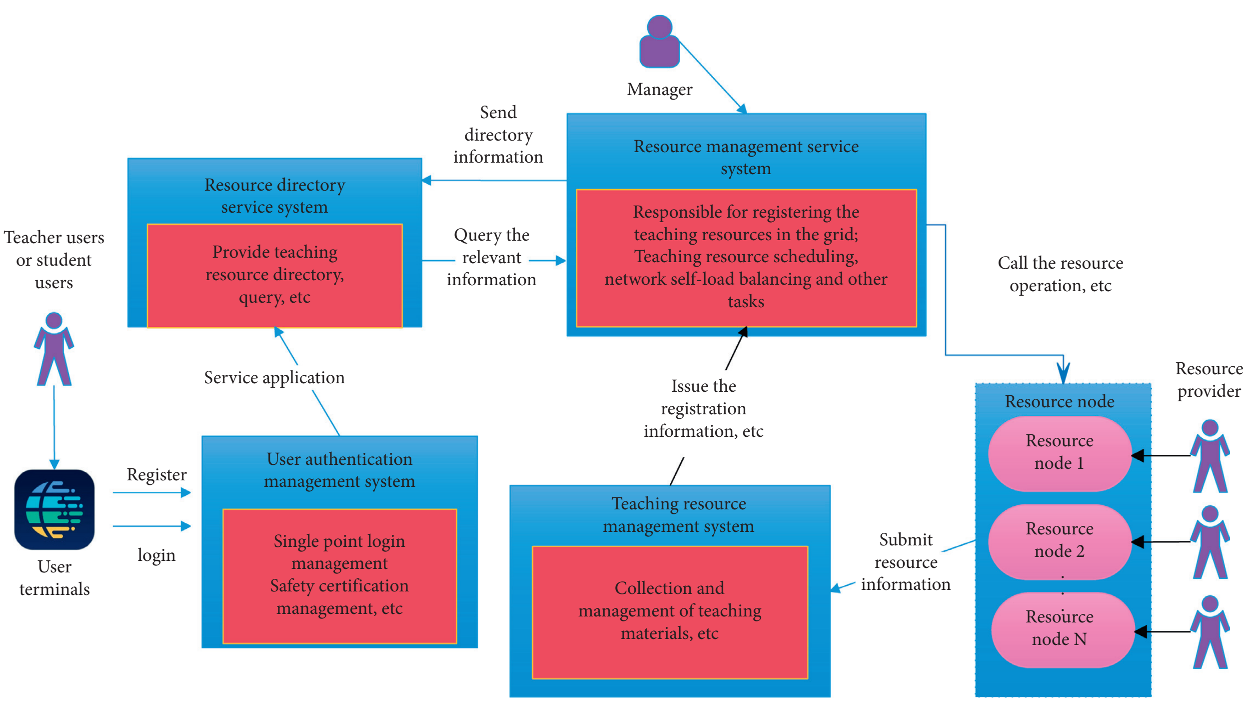

Figure 6: English teaching system model based on cellular automata.

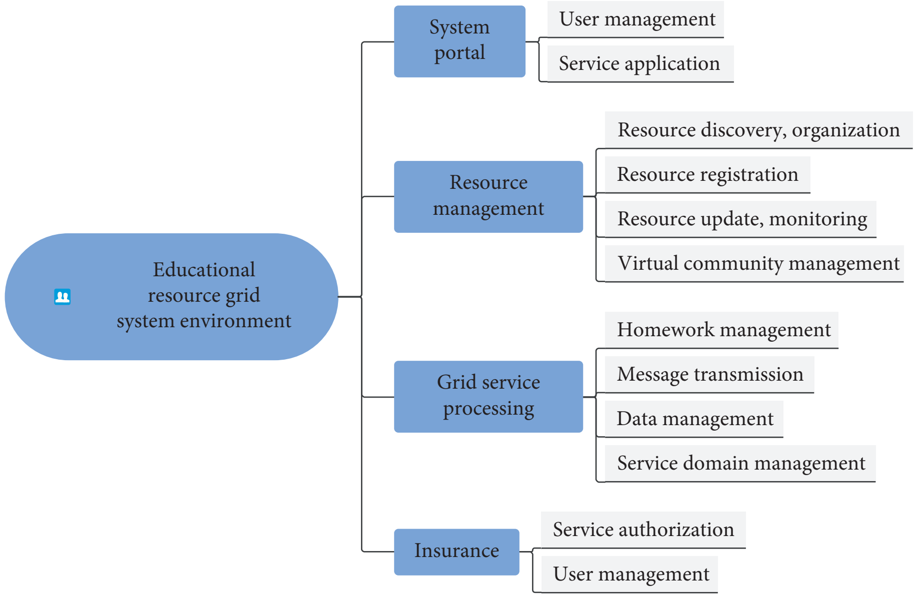

Figure 7: Logical function of English education resource sharing service based on cellular automata.

Table 6: Teaching simulation evaluation of English classroom teaching evaluation system based on cellular automata.

No	Simulation evaluation
1	87.92
2	88.52
3	77.87
4	86.06
5	81.82
6	85.11
7	80.04
8	85.73
9	85.35
10	86.92
11	88.54
12	80.90
13	79.96
14	89.21
15	90.38
16	77.49
17	81.85
18	83.39
19	89.25
20	79.84
21	78.08
22	77.95
23	80.25
24	89.48
25	84.41
26	80.09
27	77.83
28	84.17
29	81.25
30	89.73
31	86.18
32	78.58
33	90.25
34	83.59
35	88.34
36	80.72
37	89.54
38	88.39
39	86.78
40	87.31
41	81.38
42	89.35
43	85.82
44	80.58
45	81.06
46	79.40
47	88.56
48	90.45
49	89.61
50	83.50

students with $0.78 \geq l \geq 0.22$ are classified as students with average knowledge background. Referring to the practice of classifying students into three categories by the value of l, students were also classified into three levels in the experiment with respect to the value of s at which they obtained the effect of contextualization. Similarly, students with $S < 0.22$ were classified as students with poor contextualization, students with $s > 0.78$ were classified as students with good contextualization, and students with $0.78 \geq S \geq 0.22$ were classified as students with average contextualization. In order to investigate the effects of these two functions on students' meaning construction effects in detail, it is necessary to further subdivide the students with average knowledge background and those who obtained average context setting effects, as shown in Table 4.

Before the collaborative learning, the student's meaning construction function is determined by the student's own knowledge background function $F_L(t)$ and the teacher's context setting function $F_S(t)$, and the value of the meaning construction function determines the student's state. Therefore, the status of the student is determined by the

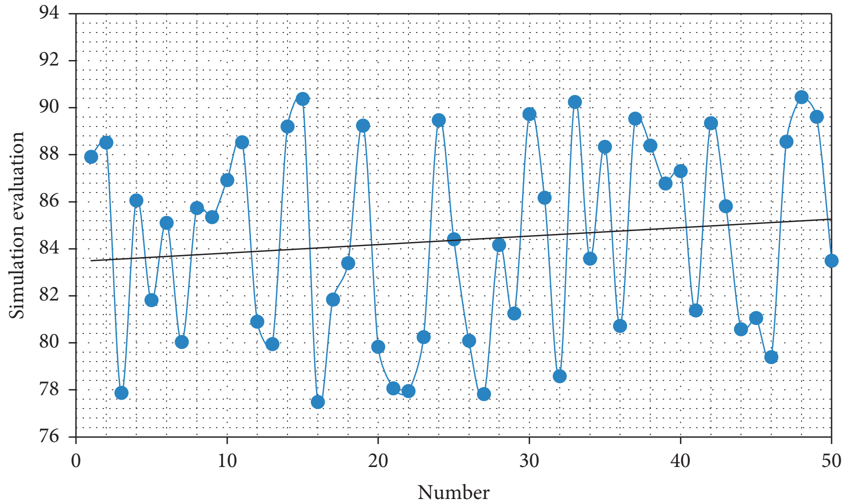

Figure 8: The simulation effect of the English classroom teaching evaluation system based on cellular automata.

Table 7: The teaching effect evaluation of the English classroom teaching evaluation system.

No	Teaching effect
1	92.35
2	82.35
3	82.39
4	85.14
5	91.16
6	86.59
7	81.75
8	91.76
9	86.76
10	91.95
11	88.18
12	91.98
13	85.19
14	89.75
15	84.62
16	90.60
17	83.17
18	90.26
19	89.96
20	88.02
21	87.61
22	88.28
23	92.03
24	90.38
25	85.33
26	85.15
27	82.43
28	85.69
29	86.54
30	86.05
31	87.12
32	86.79
33	81.18
34	91.02
35	87.42
36	81.86
37	89.25
38	85.71
39	88.74
40	87.84
41	92.36
42	82.99
43	81.76
44	81.46
45	82.06
46	85.44
47	92.26
48	83.84
49	89.09
50	88.85

student's own knowledge background and the effect of the teacher's situation setting. The relationship between the student's status and the student's own knowledge background and the effect of the teacher's context setting is shown in

$$K_{i,j} = f\left(l_{i,j}, s_{i,j}\right). \tag{12}$$

Formula (12) indicates that the state of the student can be determined according to the student's own knowledge background and the effect of the teacher's context setting.

Because l can represent students with 4 kinds of knowledge backgrounds, and s can represent students with 4 kinds of context setting effects, so the combination of l and s has $4 \times 4 = 16$ situations. The regulations are as follows:

(i) f (poor, poor) = −1;

(ii) f (poor, worse) = −1;

(iii) f (poor, better) = uncertain;

(iv) f (poor, good) = 0;

(v) f (worse, poor) = −1.

(vi) f (worse, worse) = uncertain.

(vii) f (worse, better) = 0.

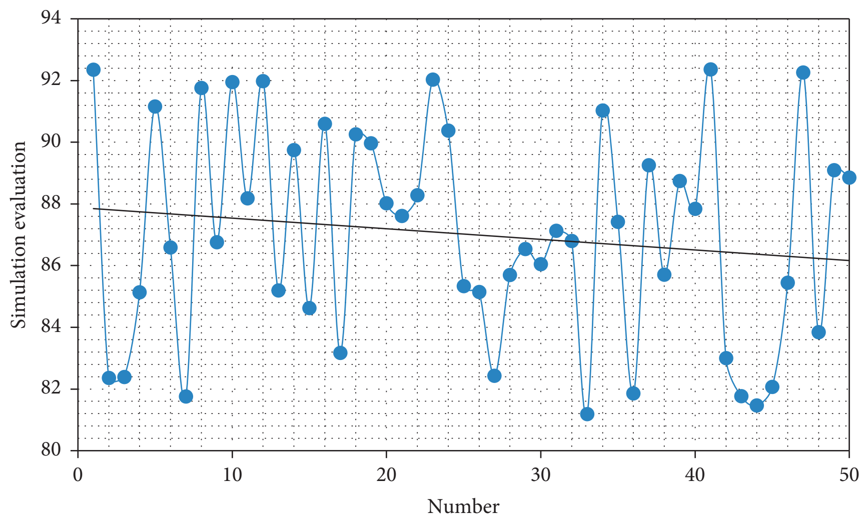

FIGURE 9: Statistical diagram of the teaching effect of the English classroom teaching evaluation system.

(viii) f (worse, better) = uncertain.

(ix) f (better, worse) = uncertain.

(x) f (better, worse) = 0.

(xi) f (better, better) = uncertain.

(xii) f (better, good) = 1.

(xiii) f (good, poor) = 0.

(xiv) f (good, worse) = uncertain.

(xv) f (good, better) −1.

(xvi) f (good, good) = 1.

For the 10 cases in which the state can be determined among the 16 cases, the range of values of the meaning construct function can be calculated by equation (1), as shown in Table 5.

Through the display in Table 5, the state transition rules in Table 3 can be summarized.

4. Construction of an Improved English Teaching Model Based on Cellular Automata

After the grid information is recorded, it is necessary to set the grids occupied by different areas, and the typical areas are classrooms, corridors, and stairs. Different areas and grids can be used to initialize the distribution of people, and at the same time, the distribution of people can be counted to analyze and evaluate the evacuation process. The teaching building is used as a place for students to attend classes, and the personnel can be initialized and distributed based on the classroom curriculum. Each classroom contains information about desks and chairs (as shown in Figure 3). The number of desks and chairs is the maximum capacity of the classroom, and people can be distributed behind the desks and chairs to simulate a real situation.

In Figure 4, the circle represents the pedestrian, the square represents the obstacle, and the arrow represents the direction of the pedestrian's moving speed. We use the red pedestrian as an example. Since he is at the opposite speed from the pedestrians on both sides, he will be subject to the friction of the two pedestrians against him, which will hinder his movement. Moreover, the pedestrians behind him move in the same direction as him, and he will be pushed by the pedestrians behind him.

To sum up, after abstracting pedestrians into particles, each pedestrian particle has a moving direction in the mobile mode. According to the direction, a 3×3 matrix M can be constructed for each particle. The elements in the matrix represent the size of the expected velocity value in the direction (i, j) of the particle, as shown in Figure 5.

As shown in Figure 6, the English teaching system model based on cellular automata consists of six parts: client, resource node, user authentication management service system, teaching resource management system, resource catalog service system, and resource management service system.

The construction of the cellular automata-based English teaching model educational resource grid configuration information platform can not only manage various resources uniformly but also provide users with safe and transparent grid services more conveniently, as shown in Figure 7.

After constructing the above model system structure, the performance of the system is verified. The system in this paper can be used to simulate the English teaching process, including the movement of students and teachers, the interaction of the teaching process, the development of teaching activities, and the processing of teaching resources. Therefore, this article combines the actual situation to deal with it systematically and, from the actual situation, design experiments to study the simulation effect of this system on English classroom teaching and obtain the results shown in Table 6 and Figure 8.

From the above test evaluation, it can be seen that the teaching effect of the English classroom teaching evaluation system based on the cellular automaton proposed in this paper is good. On this basis, the teaching effect of this system is evaluated, and the results shown in Table 7 and Figure 9 are obtained.

From the above research, we can see that the English classroom teaching evaluation system proposed in this article has a very good teaching effect and has a certain role in promoting English teaching.

5. Conclusion

The teacher evaluation system designed by colleges and universities for students, the establishment of rich elective courses, and the opening of "green channels" for students to reflect the various teaching problems of the school all reflect the main status of students, and colleges and universities gradually treat students as an object for service. Similar to the pursuit of customer satisfaction by businesses, the school also considers student satisfaction as a core indicator to reflect on its own performance. Moreover, English teaching needs to be improved through the use of intelligent methods to assist teaching and to change the traditional teaching mode. This article applies cellular automata to the improvement of English teaching and uses the cellular automata model to study the behavior of complex teaching systems. In addition, this paper uses the method of man-machine combination to establish the corresponding dynamic evolution model. Finally, this paper constructs an intelligent simulation system and then designs experiments to conduct system evaluation. The experimental research results show that the teaching effect of the English classroom teaching evaluation system based on the cellular automaton proposed in this article is very good, and it has a certain role in promoting English teaching.

Data Availability

The labeled dataset used to support the findings of this study is available from the author upon request.

Conflicts of Interest

The author declares no conflicts of interest.

Acknowledgments

This study was sponsored by Fuyang Normal University.

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