Construction and evaluation of a smart learning ecosystem for college English

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Abstract. This paper aims to construct a smart learning ecosystem for College English from the inorganic environment and ecological communities in order to generate the greatest energy flow and information flow among the physical environment, visual environment, resource environment and teachers, students, administrators and developers. After a two-year experiment of GUET, the findings are as follows. First, this model has significant effects on improving the passing rate of CET-4. Second, this model has obvious improvement on improving students’ writing ability, while there is no obvious improvements in students’ listening and reading ability. This paper analyzes the research results and puts forward corresponding solutions to these problems to promote a sustainable development of College English.

1. Introduction
College English is one of the most important subjects in the college curriculum, which meets the requirements of colleges and universities aiming at cultivating international talents with a high foreign language proficiency. According to some documents and administrators or scholars (Chen Bao-sheng 2016, Wu Yan2017, Cai Ji-gang2020), it is necessary to have a high-quality education for undergraduates, which lies in the first-class specialties, courses and teaching [1-3]. Therefore, the education of a foreign language is indispensable in the process of cultivating students with an international vision and an intercultural communicating ability.

However, the credit for College English shows a decreasing trend. Take GUET as an example. The credit hours of College English in GUET have also been gradually reduced from 16 to 12, corresponding with the teaching periods. In order to solve the contradiction between increasing requirements of a foreign language ability and the reduction of teaching periods, we need to expand our classroom to the second classroom for autonomous learning with the help of an information technology [4-5]. In GUET, we implement the autonomous learning with the help of Lange Platform, Smart Learning and Testing Platform, Unipus Platform, iTEST Platform etc. At present, we also make use of online courses in MOOCs, UMOOCs and so on to carry out various teaching attempts, including online and offline blended teaching mode based on SPOC. However, some problems occurred during the application of these platforms. Two outstanding problems are as follows.

Firstly, the design of online learning is not systematic and ecological. Sometimes, there are some fragments of knowledge for students to finish their online learning. Meanwhile, teachers do not get feedbacks from students’ learning, so they cannot adjust their teaching based on the latest fact. Secondly, it is difficult to implement personalized learning on the basis of individual needs. They get
the same tasks and assignments though their English proficiencies and interests are various. Therefore, in the era of a smart education, it is a practical problem and challenge of how to optimize the learning environment and contents to meet the personalized learning needs [6]. We attempt to construct a smart learning ecosystem for College English aiming to solve these problems.

2. Construction of a smart learning ecosystem model

A learning ecosystem includes the inorganic environment and biological communities. The former refers to the physical environment, visual environment and resource environment, while the latter means teachers, students, administrators and developers, which indicate producers, consumers and decomposers respectively in the learning ecosystem.

2.1. Constructing a model

Suppose the smart learning ecosystem for College English is a model with an interaction and restriction among the biological communities on the basis of the inorganic environment, which having four distinctive technical characteristics, including precise managements, personalized guidance, three-dimensional interactions and intelligent services.

In this model, students, teachers, administrators and developers rely on high-quality physical environment, virtual environment and resource environment to form a virtuous circle of an ecological learning system and generate positive energy through their interactions. On the contrary, if any link to the model has problems, information feedbacks will be formed and a negative information flow will be generated. The model of a smart learning ecosystem for College English is shown as follows.

Figure 1. The model of a smart learning ecosystem for College English.

2.1.1. The energy flow in the smart learning ecosystem. In the smart learning ecosystem, students act as the core elements, while teachers play a role as the leading factors. Virtual environment and resource environment are the key factors, and physical environment is the basic one. First, in order to achieve an effective teaching, administrators will create the best teaching environment for teachers, including providing high-speed free online services, high-end teaching facilities, abundant teaching forms, etc. Correspondingly, teachers will devote themselves to their English teaching to get the greatest energy by making use of the virtual environment to create smart learning situations, to form a virtual learning community, to provide personalized learning contents and to construct high quality learning resources, etc. The stronger the teachers’ energy is, the more likely students will be able to complete their autonomous learning or cooperative learning online by utilizing various learning platforms, resource databases, websites and Apps. Therefore, the more engagements they are in English learning, the better their learning effects will be. If students achieve good learning results,
developers will be encouraged to develop more and better learning resources and platforms, including off-campus platforms and on-campus platforms that are suitable for different students to meet their personalized learning needs.

2.1.2. The information flow in the smart learning ecosystem. The ideal learning ecosystem can generate enormous energy and every subject is in its best state. However, if any one of them has a problem, it will affect other subjects, and thus generates a powerful flow of information among them with the function of an informational transmission and feedback.

For example, if the resources are out of date, it will be less beneficial for students to make use of them. Once there was an English learning website developed independently by GUET [7-8]. However, due to the lack of a timely management and updated resources, it is now a dullest one and has long been forgotten. If there is no quality network service and high-end teaching equipment, then the teaching effect may not be satisfied. In accordance, teachers cannot fully develop their teaching potentials. Without smart visual environment and resource environment, as well as teachers who are full of energy, students’ learning effects will be discounted.

When students’ academic performance does not live up to teachers’ expectations, teachers will intervene in students’ study by setting a condition for students to pass the learning tasks. For example, according to the tests and tasks in U-Unipus Platform, the score should be higher than 80 [9-11]. Otherwise, students must do it again and again. Therefore, the ecological communities and the inorganic environment interact and restrict each other.

3. Application to the model of a smart learning ecosystem
After building the model, we implement a two-year experiment in GUET to test the effect. The physical environment in GUET has improved a lot by offering free WIFI in every corner of our campus, which gives the conditions for students to finish their autonomous learning in anytime and anywhere. More visual communities are provided for teachers and students to communicate with each other. Moreover, learning platforms have been added owning to different learning skills.

3.1. Subjects of the experiment
The subjects of this study are undergraduates of Grade 2017, 2018 and 2019, each with an appropriate number of 4500 students. With the continuous optimization of resources and environment, students of Grade 2018 keep applying U-Unipus Platform and iTEST Platform in two years, students of Grade 2019 do the same thing, generating a large amount of learning data during the application [12-14].

By taking students of Grade 2018 and 2019 as experimental groups and Grade 2017 as control groups, the internal relationship between learning data and the passing rate of CET-4 is discovered through the data generated by the platforms. In terms of listening, reading, and writing, we hope to prove that these platforms have some positive effects on the scores of CET-4.

3.2. Research process
In the near two years, we implement a blended teaching model of online and offline teaching, with a deep combination of technology and teaching. Online learning mainly focuses on students’ autonomous learning, which also serves in-class teaching. It is divided into two parts: previews and assignments or supplements for the class. Offline teaching lies emphasis on the difficulties and key points of the tasks as well as students’ discussions, aiming at improving their critical thinking and communicating ability. In this blended teaching mode, students’ learning mode is online + offline + online. In view of the reduction of class periods, we make use of the U-Unipus Platform in GUET to conduct the autonomous learning. Teachers intervene in students’ learning if necessary. They set a situation for passing the tasks before they can do the next one, for example, 85 percent. For those who fail to reach the goal, they are required to do it again until they can reach the requirement.

Table 1 shows the numbers and time durations of using U-Unipus Platform in four semesters:
Table 1. The number of Applications of U-Unipus Platform.

| Terms       | Courses | Classes | Teachers | Students | Teachers’ online hours | Students’ online hours |
|-------------|---------|---------|----------|----------|------------------------|------------------------|
| 2018 Autumn | 6       | 89      | 23       | 4578     | 424                    | 67534                  |
| 2019 Spring | 8       | 155     | 23       | 6033     | 597                    | 91394                  |
| 2019 Autumn | 10      | 160     | 60       | 9830     | 1049                   | 163274                 |
| 2020 Spring | 19      | 163     | 60       | 9216     | 1466                   | 165963                 |

As can be seen from Table 1, there is an increasing trend of applying U-Unipus Platform for a blended learning, including courses and classes as well as teachers and students. In accordingly, teachers and students spend more time on their platforms. Teachers will give more assignments, tests, resources for their students and at the same time, they also make applications of other functions of U-Unipus Platform to check in, make a poll, ask questions etc., which is shown in Table 2. Taking the term of 2019 Spring as an example, the numbers of check-in, asking questions, issuing tests and manual correction surpass 90% colleges and universities in China, among which, issuing tests exceeds 95%.

Table 2. Detailed applications of U-Unipus Platform.

| Terms       | Assignments | Tests | Check in | Poll | Manual corrections | Asking questions | Delivering resources |
|-------------|-------------|-------|----------|------|--------------------|------------------|----------------------|
| 2018 Autumn | 8           | 19    | 60       | 0    | 170                | 0                | 14                   |
| 2019 Spring | 12          | 161   | 173      | 0    | 635                | 38               | 21                   |
| 2019 Autumn | 30          | 319   | 489      | 1    | 1004               | 72               | 91                   |
| 2020 Spring | 44          | 529   | 699      | 1    | 2705               | 56               | 15                   |

At the same time, iTEST Platform is used to conduct in-class tests and vocabulary tests. There are 4 in-class tests and 10 vocabulary tests for each class in each semester. The former detects the overall learning effect, while the latter checks students’ vocabulary. In order to enrich the resources of iTEST Platform to make it become more suitable for students, teachers build a total of 7,779 terms on the basis of vocabularies of New Horizon College English, ranging from Book 1 to Book 4.

Another important reform action is making an ecological learning assessment, which consists of a process assessment and a final assessment, accounting for 50 percent respectively. The final assessment comes from final examinations, while the process assessment is a comprehensive assessment, which includes 10% of autonomous learning in U-Unipus, 10% of in class tests in iTEST Platform, 10% of vocabulary tests, 10% of the homework attendances and 10% of the oral test score. Students can lay a solid foundation in the virtual learning community through collaborative learning and autonomous learning. Moreover, students can take advantage of various platforms to constantly challenge themselves.

4. Results analysis

So far, the blended teaching mode has been practiced in GUET for 2 years. In order to verify its validity, we obtain the relevant data of CET-4 from the Educational Administration Department in GUET.

First, we compare the numbers of passing CET-4 in freshmen and sophomores of Grade 2017 and 2018, which is shown as follows.

Table 3. A comparison of CET-4 in Grade 2017 and 2018.

| Terms/Grade | 2017 | 2018 |
|-------------|------|------|
| 1           | 521  | 599  |
| 2           | 528  | 1032 |
| 3           | 441  | 542  |
| 4           | 427  | Not test |
| sum         | 1917 | 2173 |
| S’S total No.| 4343 | 4114 |
| Passing rate | 0.4414 | 0.5282 |
From Table 3, we notice that the total number of Grade 2017 is almost equal to that of Grade 2018. At present, Grade 2017 have finished 4 times of CET-4 while Grade 2018 only 3 times, with a total number of 1917 and 2173 students whose scores are more than 425 respectively. That is, the passing rate of Grade 2018 is 52.82 percent, while Grade 2017 is 44.14 percent, and the former is 8 percent higher than that of the latter. Therefore, we can summarize that it is effective to improve students’ English ability with the application of some platforms in some extent, which means that the model of a smart learning ecosystem constructed is beneficial for students’ learning.

At the same time, in order to have an overall check, we make use of the statistical software SPSS 22.0 to analyze the data of the listening comprehension, reading comprehension and writing generating from the first term of Grade 2018 and 2019. According to the results of an independent samples test, there is no significant differences of the average scores between listening and reading, as their significances (2-tailed) are 0.422 and 0.428 in listening, and their significances are 0.141 and 0.143 in reading, much larger than 5%. Therefore, it indicates that there is no significant difference between the average score of listening and reading in Grade 2018 and 2019. Maybe it is because we give more focus on vocabulary instead of doing many practices in listening and reading with the platforms. Table 4 and Table 5 are the analytical results, which are as follows.

**Table 4. An independent samples test of the listening section.**

|        | F   | Sig. | t    | df  | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |
|--------|-----|------|------|-----|----------------|------------------|----------------------|-----------------------------------------|
| listening | .224 | .636 | - .802 | 1858 | .422           | -.99661          | 1.24214               | -3.43274, 1.43952                        |
| Equal variances assumed | | | | | | | | |
| Equal variances not assumed | | | | | | | | |

**Table 5. An independent samples test of the reading section.**

|        | F   | Sig. | t    | df  | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |
|--------|-----|------|------|-----|----------------|------------------|----------------------|-----------------------------------------|
| reading | .001 | .975 | -1.473 | 1858 | .141           | -1.49987         | 1.01828               | -3.49697, .49722                       |
| Equal variances assumed | | | | | | | | |
| Equal variances not assumed | | | | | | | | |

According to Table 6, there is a significant difference of the average scores in writing, as their significances (2-tailed) are both 0.003, less than 5%. Therefore, it indicates that there is a significant difference between the average scores of writing in Grade 2018 and 2019. This is partly due to the practice of vocabulary tests in the iTEST Platform and other assignments for their autonomous learning.

**Table 6. An independent samples test of the writing section.**

|        | F   | Sig. | t    | df  | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |
|--------|-----|------|------|-----|----------------|-----------------|----------------------|-----------------------------------------|
| writing | .073 | .787 | 3.022 | 1858 | .003           | 2.14730         | .71051                | .75381, 3.54079                         |
| Equal variances assumed | | | | | | | | |
| Equal variances not assumed | | | | | | | | |

5. Problems and suggestions

According to the analytical results from the above, we notice that there are some benefits to make use of the model of a smart learning ecosystem. Students have improved their ability in their practices
with platforms, especially in writing. But as to listening and reading sections, there is no significant difference.

5.1. Problems
We try to find some problems from the elements of constructing our model, which consists of an inorganic environment and biological communities.

The first one is the environment of a smart teaching. The physical environment in GUET has been constantly improved, and the wireless network has been covered every corner on campus. However, the role of the smart classrooms has not been fully applied. In many cases, teachers just change to a more beautiful environment for classes, instead of using the smart classrooms for a data collection and analysis. Though GUET has successively provided Lange Platform, Unipus Platform, the Wisdom Platform independently developed by GUET, U-Unipus Platform, iTEST Platform, etc., as well as teachers have also supplemented some resources on the corresponding platforms, each platform is an independent system, and the data among these systems is not connected, which leads to the problem of a data gap and an informational island. This brings great difficulties to collect data in the teaching process, and it is not convenient for the administrative department to carry out a data excavation and analysis.

The second problem comes from the biological communities. As to students, they reflect a problem of insufficient learning motivations. Because of the materials from New Horizon College English for their autonomous learning, students are easy to get answers from the Internet, resulting in shorter learning hours to complete the tasks assigned by teachers. Even if teachers set a duration for their tasks, they cannot fundamentally solve the problem of learners searching for answers online. As to teachers, they usually complete the tests and assignments prescribed by the administrators, and few of them have analyzed the learning results. Moreover, some teachers have a low ability to analyze the data, so it is difficult to achieve the deep integration of College English teaching and an informational technology. As to administrators, some of them are not engaged in College English teaching, so they are not familiar with the latest characteristics of College English teaching and the characteristics of students. At the same time, they do not analyze the teaching rules from the perspective of a data analysis, so as to develop some corresponding teaching measures.

5.2. Suggestions
In order to solve these problems, there are some suggestions. First of all, the inorganic environment should be improved. GUET is striving to improve the smart teaching environment. At present, 28 smart classrooms have been put into use. However, how to give a full play to the functions of smart classrooms requires the joint efforts of teachers and administrators. In the case of a good smart teaching environment, we should develop more and better resources and improve students’ comprehensive abilities in listening, speaking, reading, writing and translation with the help of various platforms. For example, as to the speaking ability, FIF Platform will give a hand for students to do more practices. At present, some teachers also take advantage of SPOC to replace the tasks from their textbooks in the autonomous learning. The content of MOOCS is relatively new and covers a wide scope of knowledge, so students are willing to take the initiative to learn and their learning motivation will be significantly improved.

Secondly, we should make interlinks among all the platforms and educational administrative systems to make data interflows and mutual applications. On the one hand, we avoid the duplication of resources and the problem of an informational island. On the other hand, it is convenient for teachers, students and administrators to master the data generated from the teaching and learning process, giving a necessity to provide personalized learning, so we have a more accurate understanding of each student’s learning.

Third, we should strengthen the construction of talents and build a professional team of data managements and analyses. Especially in the College of Foreign Studies, a great many teachers have little idea of how to conduct a data analysis. A convenient way is to cooperate with some professionals
from other colleges or universities to carry out various trainings and guidance of a data analysis. Teachers should not only improve their ability to use various information tools, but also be familiar with students’ data and make it useful and effective in teaching. At the same time, the administrative department should pay more attention to the applications of smart equipment instead of building them only.

6. Conclusions
It is necessary for the learning system to adapt to the requirements of latest trend and promote the development of education to realize the change of learning environment with the informational technology. And it needs to support the change of learning ecological environment, which is the only way to break the barriers of traditional learning and promote the new education in the information era.

In an excellent inorganic environment, students’ ability is constantly improved with the construction of a smart ecological learning mode. Smart learning is a new learner-centered learning mode, which requires continuous improvements, optimizations and adaptations to the environment, supports and promotes the personalized, characteristic, comprehensive and innovative development of human beings in the information age. It represents the direction of human learning. Teaching administrators should be far sighted and establish service-oriented smart campus to provide technical support for College English teaching and learning. Teachers should innovate teaching modes, play a leading role in the wisdom teaching. Students should make full use of intelligent tools to carry out intelligent learning by acting as the main role. Only in this way can we create an ecological and innovative learning environment for College English, implement an innovatative teaching reform, and thus expand the influence of College English, and realize the sustainable development of College English.

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