Tuijin Jishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 45 No. 2 (2024)

# The Development of a Blended Learning Model by Using a Production-Oriented Approach to Improve the Self-Directed Learning Ability for Faculty of Chinese Language and Literature Undergraduate Students in China

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***Abstract:-*** This study aims to develop a POA and blended learning model to improve self-directed learning among college students. The study method was divided into three phases, and the research objectives were as follows: 1) to study the conditions and requirements of a blended learning model; 2) to develop a blended learning model by using a production-oriented approach to improve self-directed learning ability; and 3) to study the effectiveness of a blended learning model developed by using a production-oriented approach to improve self-directed learning ability. In phase I, the population was 96 second year of Chinese Language and Literature Undergraduate Students; in phase II, the sample was five model experts; and in phase III, the sample was 48 second year of Chinese Language and Literature Undergraduate Students were students selected by using cluster random sampling. Research instrument included a needs questionnaire about the learning status of college students, interview form for content experts, blended learning model, lesson plans, an archived test, Xue Xi Tong learning platform, and "self-directed learning ability" questionnaire form. Data were analyzed by using PNI, Mean, S.D, and dependent t-tests.

From the results, the instructional learning model named D-FEELLT were three processes: 1) D: drive, 2) F: facilitate, and 3) E: evaluate, and had four components: 1) E: evaluation and feedback, 2) L: learning platform, 3) L: learning environment and resources, 4) T: teacher and students. For self-directed learning, the results showed that after learning with D-FEELLT model , the students had a higher level of self-directed learning ability and achieved learning goals better than before learning, with statistical significance ($p<0.05$).

***Keywords****: Production-oriented approach, Blended learning, Self-directed learning ability.*

## 1. Introduction

Blended learning has become more and more popular among educators and students [1]. Blended learning combines online and offline learning [2], which forms a continuous, flexible and convenient personal learning space for learners, enhances learners' sense of control over learning, and improves their interest in learning. In this situation, choosing the right learning method can not only help students improve their learning efficiency, but also promote personalization and all-round development. Students should not passively rely on the learning and activities planned by schools and teachers, but should take the initiative to build knowledge development ability according to their own actual needs, that is, self-directed learning [3]. The steps of self-directed learning

include planning, strategy, motivation, monitoring, evaluation, and summary [4]. In the blended learning environment, students' pretest and post-test scores are quite different. The learning style in which learners perform classroom activities through self-directed learning is a key factor in successful learning [5]. Students who have adopted blended learning have demonstrated higher levels of self-directed learning ability and achieved better learning outcomes [6].

The production-oriented approach (POA) involves making specific lesson plans, setting up different levels of teaching tasks, and cultivating students' subjective initiative [7]; the teaching system guided by the production-oriented approach mainly covers the following three processes: drive, facilitate, and evaluate [8]. Students are required to conduct selective learning according to their learning objectives and their own learning characteristics and needs, while teachers are required to pay attention to cultivating students' learning initiative and subjective initiative.

After the outbreak of COVID-19, online self-directed learning officially became the new normal of college students' learning methods [9]. However, the effect of college students online self-directed learning is not ideal, and the deep reason is that students' self-directed learning ability is seriously insufficient. Exploring innovative modes and methods of college students' self-directed learning to improve the ability of self-directed learning is an important issue worth studying. In this research, a research and development method was used. This study had the following three specific objectives:

1. To study the conditions and requirements of a blended learning model to be developed by using a production-oriented approach to improve self-directed learning ability;
2. To develop a blended learning model by using a production-oriented approach to improve self-directed learning ability;
3. To study the effectiveness of the blended learning model developed by using a production-oriented approach to improve self-directed learning ability.

The results of this study provide valuable information and references with regard to online learning and self-directed learning; at the same time, they can be used to improve the academic performance of college students.

## 2. Literature Review

### Blended learning

Blended learning is a combination of traditional learning methods and networked learning [10]. Blended learning is based on a planned design approach, can combine the advantages of face-to-face teaching and online teaching, and can realize educational value [11]. Blended learning has become a suitable model of education in the post-COVID-19 era, by combining face-to-face teaching with technology, and creating an environment that can improve students' learning potential [12].

Blended learning is not a fixed model and includes a mixture of multiple learning modes [13]. The blended learning model refers to a description method used to clearly show teaching and learning links [14]. With its development, blended learning has become the dominant teaching method in colleges and universities. Blended learning allows students to actively manage their own self-learning rhythm and can cultivate students' self-directed learning [15].

### Self-directed learning

Self-directed learning is the process of taking students as the main body of learning, under the inspiration, guidance and help of teachers, through independent analysis, exploration, practice, questioning and creation, thus solving problems and learning the process of learning [16]. Self-directed learning emphasizes that learners should exert their own subjective initiative [17], combine their own learning needs, clarify learning goals, formulate learning strategies, and evaluate learning results. Self-directed learning is not completely independent learning, and learners can still learn in a self-directed way in group activities [18]. The flexibility of the time and space of blended learning, the richness of learning resources and the diversification of activity organization [19]

has ensured the realization of self-directed learning [20]. Compared with traditional learning, the self-directed learning of blended learning is more likely to occur and continue, and is more effective [21].

Self-directed learning is both an attitude and an ability [22]. Self-directed learning includes self-management ability, self-adjustment ability and self-control ability. Students are able to manage and control their learning activities at any time and place [23]; adjust, select and implement learning strategies according to teacher learning requirements; and evaluate learning outcomes [24]. Self-directed learning means that students take responsibility for their own learning. In the implementation of self-directed learning, students should use self-management ability, self-adjustment ability and self-control ability to solve problems, and show continuous improvement in this process [25].

**Production-oriented approach (POA)**

The production-oriented approach (POA) is an educational method with Chinese characteristics. Taking output as the starting point and goal [26], it aims to solve the long-standing problem of "separating learning from application" for learners [27]. POA completely breaks the traditional teaching method of relying on textbooks and paying attention to investment [28]. The POA involves specific teaching plans, creating a diversified teaching environment, and cultivating students' subjective initiative [29]. Teachers promote students to develop in the direction of active and self-directed personalized learning [30], stimulate students' enthusiasm for learning, encourage students to think and explore the learning content so as to promote their internal information processing process, and finally transform knowledge into ability.

The teaching process of the POA is divided into three steps: drive, facilitate, and evaluate. "Facilitate" is the main link in the education process under the guidance of the production-oriented approach, and plays a decisive role in the output quality [31]. The POA starts with output and ends with output [32]. The POA teaching process follows the order of "output" - "input" - "output", allowing students to perceive the difficulties and challenges of "output" in the situation, and then carry out targeted input and practice, finally realizing the "output" after improvement [33].

## 3. Materials and Methods

**Design of the study**

A research and development method was used in this research titled "The Development of a Blended Learning Model by Using a Production-Oriented Approach to Improve the Self-Directed Learning Ability for faculty of Chinese Language and Literature Undergraduate students in China".

The research design was divided into three phases:

Phase I: Study the conditions and requirements of a blended learning model;

Phase II: Develop a blended learning model by using a production-oriented approach to improve self-directed learning ability; and

Phase III: Study the effectiveness of the blended learning model developed by using a production-oriented approach to improve self-directed learning ability.

**Research instrument tools**

Phase I:

Instrument 1: Needs Questionnaire about the learning status of college students

Instrument 2: Interview form for content experts

Phase II:

Instrument 3: The POA and blended learning model

Instrument 4: Lesson plans

Instrument 5: Archived Test

Instrument6: "Self-directed learning ability"

questionnaire form

Phase III:

Instrument 7: Confirmation model form

**Participants**

Phase I: The sample consisted of 96 Chinese Language and Literature Undergraduate Students and three content experts who completed the interview form.

Phase II: Five model experts

Phase III: The sample consisted of 48 Chinese Language and Literature Undergraduate Students chosen by using specific selection.

**Data collection and analysis**

Phase I:

1) The needs questionnaires were analyzed by using PNI. The formula calculation, which made use of Nonglak Wiratchai and Suwimon Vongvanit's (2007) algorithm, was as follows:

$$\text{PNI}_{\text{modified}} = \frac{I-D}{D}$$

I = Score of needs self-directed learning ability

D = Score of self-directed learning ability actual

2) The interview forms were analyzed by finding the key concepts.

PhaseII:

1) After the results from phase I were analyzed, the researcher designed the POA and blended learning model, including lesson plans.

2) The model evaluation form was evaluated by using the mean (median) and S.D.

Phase III:

1) The model confirmation form was given to five experts.

2) The self-directed learning test was analyzed by using the following statistics: mean (median), and S.D.

**Methodology**

Phase I: Research

1) The researcher created a needs questionnaire about the learning status of students and an interview form for the content experts.
2) The IOC experts were given the opportunity to decide whether the model was reasonable or not.
3) Data was collected from 96 Students.
4) A comprehensive analysis of relevant data was performed.

In this phase, we mainly put together the required components of the model, drafted the model and prepared for the second stage.

PhaseII: Development

1) The results from phase I were used to develop the POA and blended learning model.

2) The quality of the instrument tools was approved by IOC experts.

3) The collected data was given to five model experts.

4) Collocation of the model was performed for implementation in the next phase.

This phase was mainly carried out to get the model, prepare for the practical application of the POA and blended learning model, ensure the quality and process of each link, and make reasonable lesson plans.

Phase III: Implementation

1) The POA and blended learning model was implemented with 48 students for 6 weeks.

2) Data was collected by using a pretest and post-test.

This phase was mainly carried out to get test scores and self-directed learning ability measurement results, and get the POA and blended learning model persistence scores.

## 4. Results and Discussion

### Results of the needs assessment

Phase I: Study the conditions and requirements of a blended learning model.

Results of the needs questionnaire about the learning status of the college students

**Table 1. Results of the self-directed learning ability of college students**

| Self-directed learning ability | Actual | | Meaning | Needs | | Meaning | PNI | Rank of PNI |
|---|---|---|---|---|---|---|---|---|
| | $\bar{x}$ | S.D | | $\bar{x}$ | S.D | | | |
| Self-adjustment | 2.61 | 0.67 | Rarely | 4.20 | 0.80 | Often | 0.6092 | 2 |
| Self-management | 2.40 | 0.87 | Rarely | 4.48 | 0.98 | Often | 0.8667 | 1 |
| Self-control | 2.53 | 0.62 | Rarely | 3.80 | 0.76 | Often | 0.5020 | 3 |
| Overall average | 2.51 | 0.72 | Rarely | 4.16 | 0.85 | Often | 0.6552 | |

In Table 1, it can be seen that the overall average needs score (mean = 4.16, S.D = 0.85), with regard to self-directed learning ability, was higher than the actual score (mean = 2.51, S.D = 0.72). Regarding the PNI ranking displayed, self-management ability(PNI = 0.8667)was ranked first, self-adjustment ability (PNI = 0.6092)was ranked second, and self-control ability (PNI = 0.5020) was ranked third.

**Table 2. Results of self-adjustment ability**

| Self-adjustment ability | Actual | | Meaning | Needs | | Meaning | PNI | Rank of PNI |
|---|---|---|---|---|---|---|---|---|
| | $\bar{x}$ | S.D | | $\bar{x}$ | S.D | | | |
| Through classroom teaching, I can learn complete and systematic knowledge. | 2.35 | 1.02 | Rarely | 4.55 | 1.19 | Always | 0.9362 | 1 |
| Through online learning, I can learn complete and systematic knowledge. | 2.40 | 0.98 | Rarely | 4.31 | 1.13 | Often | 0.7958 | 3 |

| Self-adjustment ability | Actual | | Meaning | Needs | | Meaning | PNI | Rank of PNI |
|---|---|---|---|---|---|---|---|---|
| | $\bar{x}$ | S.D | | $\bar{x}$ | S.D | | | |
| Through blended learning, I can improve my learning motivation. | 2.48 | 1.17 | Rarely | 4.01 | 1.42 | Often | 0.6169 | 5 |
| Through blended learning, I can make a reasonable study plan. | 2.42 | 1.09 | Rarely | 4.20 | 1.29 | Often | 0.7355 | 4 |
| Through blended learning, I think that learning is much easier. | 2.46 | 1.07 | Rarely | 4.50 | 1.18 | Always | 0.8293 | 2 |
| I often feel that the learning process is hard work. | 2.56 | 1.01 | Sometimes | 3.87 | 1.19 | Often | 0.5117 | 6 |
| Overall average | 2.45 | 1.06 | Rarely | 4.24 | 1.23 | Often | 0.7342 | |

In Table 2, it can be seen that the overall average needs score (mean = 4.24, S.D. = 1.23) was higher than the actual score (mean = 2.45, S.D. = 1.06). Regarding the PNI ranking displayed,"Through classroom teaching, I can learn a complete and systematic knowledge." (PNI = 0.9362) was ranked first;"Through blended learning, I think that learning is much easier."(PNI = 0.8293) was ranked second; and "Through online learning, I can learn a complete and systematic knowledge."(PNI = 0.7958) was ranked third.

**Table 3. Results of self-management ability**

| Self-management ability | Actual | | Meaning | Needs | | Meaning | PNI | Rank of PNI |
|---|---|---|---|---|---|---|---|---|
| | $\bar{x}$ | S.D | | $\bar{x}$ | S.D | | | |
| In group collaboration, I can work very well with others. | 2.29 | 1.05 | Rarely | 3.73 | 1.33 | Often | 0.6288 | 6 |
| I can actively participate in the learning activities arranged by the teacher, such as teamwork, achievement display, practice, etc. | 2.50 | 1.03 | Sometimes | 4.25 | 1.18 | Often | 0.7000 | 4 |
| I am willing to learn certain courses through the Internet. | 2.38 | 1.08 | Rarely | 3.92 | 1.28 | Often | 0.6471 | 5 |
| I am willing to perform study tasks online. | 2.40 | 1.13 | Rarely | 4.31 | 1.26 | Often | 0.7958 | 3 |
| I can learn according to the learning materials provided by the teacher. | 2.42 | 1.09 | Rarely | 4.35 | 1.19 | Often | 0.7975 | 2 |
| I can determine my own learning goals and learning activities. | 2.44 | 1.03 | Rarely | 4.42 | 1.07 | Often | 0.8115 | 1 |
| Overall average | 2.41 | 1.07 | Rarely | 4.16 | 1.22 | Often | 0.7311 | |

In Table 3, it can be seen that the overall average needs score (mean = 4.16, S.D. = 1.22) was higher than the actual score (mean = 2.41, S.D. = 1.07). Regarding the PNI ranking displayed,"I can determine my own learning goals and learning activities." (PNI = 0.8115 ) was ranked first;"I can learn according to the learning materials provided by the teacher." (PNI = 0.7975) was ranked second; and "I am willing to take the study task to study online." (PNI = 0.7958) was ranked third.

**Table 4. Results of self-control ability**

| Self-control ability | Actual | | Meaning | Needs | | Meaning | PNI | Rank of PNI |
|---|---|---|---|---|---|---|---|---|
| | $\bar{x}$ | S.D | | $\bar{x}$ | S.D | | | |
| I can control my learning behavior. | 2.33 | 1.08 | Rarely | 3.79 | 1.30 | Often | 0.6266 | 4 |
| I can study according to my own study plan. | 2.23 | 1.04 | Rarely | 4.10 | 1.23 | Often | 0.8386 | 2 |
| I can resist all kinds of temptations and concentrate on my study. | 2.21 | 0.90 | Rarely | 4.40 | 1.08 | Often | 0.9910 | 1 |
| I can get rid of my bad study habits. | 2.29 | 0.97 | Rarely | 3.87 | 1.17 | Often | 0.6900 | 3 |
| I do not study according to the teacher's arrangement, and I study according to my plan. | 2.56 | 1.03 | Sometimes | 3.62 | 1.33 | Often | 0.4141 | 5 |
| Overall average | 2.32 | 1.004 | Rarely | 3.96 | 1.222 | Often | 0.7069 | |

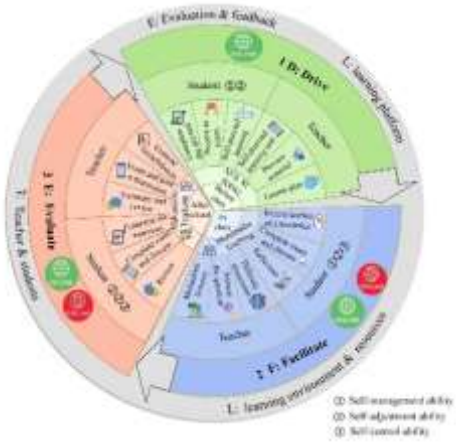
In Table 4, it can be seen that the overall average needs score (mean = 3.96, S.D. = 1.222) was higher than the actual score (mean = 2.32, S.D. = 1.004). Regarding the PNI ranking displayed,"I can resist all kinds of temptations and concentrate on my study." (PNI = 0.9910 ) was ranked first;"I can study according to my own study plan." (PNI = 0.8386 ) was ranked second; and"I can get rid of my bad study habits." (PNI = 0.6900 ) was ranked third.

Phase II: The results of the blended learning model

The blended learning model was developed by using a production-oriented approach to improve self-directed learning ability.

The development results from the first phase were as follows:

1. A POA and blended learning model was formed.



D-FEELLT

According to the results of the POA and blended learning model were three processes: 1) drive, 2) facilitate, and 3) evaluate.

1) Drive (preparation and preview before class): Both teachers and students completed the corresponding tasks before class, released the received tasks before class through learning communication channels, and communicated online or offline.
2) Facilitate (internalization of knowledge in class): Teachers explained the questions studied before class, asked students the questions one by one and discussed the answers in class, using a variety of ways to complete the teaching task.
3) Evaluate (after-class review evaluation): Teachers and students reflected on each class and consolidated knowledge after class, and evaluated the effect of each class.

The POA and blended learning model had four components: 1) evaluation and feedback, 2) learning platform, 3) learning environment and resources, and 4) teacher and students.

**1) Evaluation and feedback**

The teacher effectively evaluated the students' previews, learning activities, learning processes, test questions and homework. The teacher wrote study reports to provide summaries and feedback and wrote good reflection records and logs. Students self-evaluated and reflected on their own learning content.

**2) Learning platform**

It mainly combined online and offline learning, mainly through learning tasks and learning discussions, and auxiliary platforms, including WeChat and QQ, to answer questions. Offline learning was mainly done in the classroom, with the help of multimedia and multi-functional classrooms.

**3) Learning environment and resources**

Regarding learning environment and resources, the main requirements were the two aspects of hardware and software:

Hardware: a computer or tablet, network connections, sound, and visual devices

Software: Online learning platforms, such as Xue Xi Tong; collaboration tools, such as Ding Ding, Tencent conference software, WeChat, etc.; and multimedia resources, such as interactive content, PPTs, and a projector

**4) Teacher and students**

Teacher: The Teacher made detailed course plans and course progress plans before class, arranged reasonable teaching tools, designed clear teaching activities and student activities, coordinated the overall rhythm of the classroom in class, and made timely adjustments according to the actual situation of students. The teacher also performed a reasonable after-class evaluation and reflection after class.

Students: Before class, the students received and completed the learning tasks through the learning platform, and communicated with the teachers through the learning platform. In the class, the students mastered and digested the knowledge according to the teacher's explanation. After class, the students completed the review and evaluation, and summarized the class content.

2. For all components and processes, the level of agreement was ‘strongly agree’.

Phase III: Study the effectiveness by using D-FEELLT model to improve self-directed learning ability.

The results from phase III show the effectiveness of the model with regard to students’ knowledge and understanding (N = 48).

**Table 5. The post-test results of students (total score = 100 points)**

| Archived test | $\bar{x}$ | S.D | Criteria | T-test | p |
|---|---|---|---|---|---|
| Knowledge (K) | 71.69 | 4.06 | 60 | 122.357* | -12.69 |
| Understanding (U) | 85.61 | 6.31 | 60 | 93.945* | |

*p < 0.05

Scoring standard: 100 points = full marks; more than 60% = pass.

Table 5 shows the post-test results of students. The average post-test scores of knowledge (mean = 71.69, S.D. = 4.06) and understanding (mean = 85.61, S.D. = 6.31) were significant at p<0.05.

**Table 6. Results of the "self-directed learning ability" questionnaire form**

| Self-directed learning ability | Pretest score | | Post-test score | | Meaning |
|---|---|---|---|---|---|
| | $\bar{x}$ | S.D | $\bar{x}$ | S.D | |
| Self-adjustment ability | 2.61 | 0.67 | 3.94 | 0.92 | Often |
| Self-management ability | 2.40 | 0.87 | 3.89 | 0.80 | Often |
| Self-control ability | 2.53 | 0.62 | 3.73 | 0.73 | Often |
| Overall average | 2.51 | 0.72 | 4.32 | 0.82 | Often |

According to Table 6, the overall average of the post-test score (mean = 4.32, S.D. = 0.82) was higher than pretest score (mean = 2.51, S.D. = 0.72). The overall self-directed learning ability was often.

**Table 7. Results of the self-adjustment ability**

| Self-adjustment ability | $\bar{x}$ | S.D | Meaning |
|---|---|---|---|
| I try to learn what I want to learn. | 4.51 | 1.18 | Always |
| When I study, I know what to learn. | 4.57 | 1.09 | Always |
| I firmly believe that I can study hard. | 4.42 | 1.29 | Often |
| I can know if I'm learning well or not. | 3.85 | 1.27 | Often |
| I can get the information I need for myself. | 4.44 | 1.12 | Often |
| I can stick to my study plan. | 4.38 | 1.13 | Often |
| I prefer to determine the criteria to follow in evaluating my own performance. | 3.99 | 1.22 | Often |
| I often actively regulate my motivation and behavior to participate in learning activities. | 4.42 | 1.17 | Often |
| I can repeat the learning content in order to keep the information. | 3.73 | 1.18 | Often |
| I can integrate the knowledge to form a new knowledge structure, such as an outline. | 4.35 | 1.20 | Often |
| Overall average | 4.27 | 1.185 | Often |

According to Table 7, the overall average score of self-adjustment ability was often (mean = 4.27, S.D. = 1.185). The top four items of self-adjustment ability, ranked from highest to lowest score, were as follows: The first item was "When I study, I know what to learn." (mean = 4.57, S.D. = 1.09). The joint second items were "I try to learn what I want to learn." (mean = 4.51, S.D. = 1.18). The third item was "I can get the information I need for myself." (mean = 4.44, S.D. = 1.12).

**Table 8. Results of the self-management ability**

| Self-management ability | $\bar{x}$ | S.D | Meaning |
|---|---|---|---|
| I can set up a specific study plan. | 3.58 | 1.22 | Often |
| I can motivate myself in my studies. | 3.72 | 1.29 | Often |
| I was able to solve those problems that I had already planned for. | 3.27 | 1.22 | Often |
| I take the initiative to communicate with my classmates and discuss the problems arising in my studies. | 3.63 | 1.16 | Often |
| I arrange my studies according to the order of events. | 4.31 | 0.98 | Often |
| I often set periodic learning goals according to my own learning needs. | 4.22 | 1.02 | Often |
| I am a disciplined and organized person. | 3.92 | 1.26 | Often |
| I have a tight schedule for my studies. | 4.65 | 1.01 | Always |
| I like to study alone. | 4.58 | 1.24 | Always |
| I have great confidence in my time management skills. | 4.65 | 1.20 | Always |
| Overall average | 4.05 | 1.16 | Often |

According to Table 8, the overall average score of self-management ability was often (mean = 4.05, S.D. = 1.16).

The top three items of self-management ability, ranked from highest to lowest score, were as follows: The first item was “I have great confidence in my time management skills.” (mean = 4.65, S.D. = 1.20) and “I have a tight schedule for my study.” (mean = 4.65, S.D. = 1.01) . The third item was “I have a tight schedule for my studies” (mean = 4.58, S.D. = 1.24). The third fourth was “I will arrange my study according to the order of events.” (mean = 4.31, S.D. = 0.98).

**Table 9. Results of the self-control ability**

| Self-control ability | $\bar{x}$ | S.D | Meaning |
|---|---|---|---|
| I can study according to my own study plan. | 3.64 | 1.26 | Often |
| I can complete the teacher's tasks. | 3.78 | 1.41 | Often |
| I can control my study time. | 4.58 | 1.10 | Always |
| I can handle the study time and game time well. | 4.66 | 1.26 | Always |
| I can develop good study habits. | 3.86 | 0.98 | Often |
| The teacher supervises me so that I can study hard. | 2.15 | 0.98 | Sometimes |
| My study is always controlled by a fixed plan. | 2.00 | 0.71 | Sometimes |
| I can study reasonably every day. | 4.48 | 1.06 | Often |
| Overall average | 3.64 | 1.095 | Often |

According to Table 9, the overall average score of self-control ability was often (mean = 3.64, S.D. = 1.095). The top three items of self-control ability, ranked from highest to lowest score, were as follows: The first item was “I can handle the time of study and game well” (mean = 4.66, S.D. = 1.26). The second item was “I can control my study time” (mean = 4.58, S.D. = 1.10). The third item was “I prefer to set my own learning goals.” (mean = 4.48, S.D. = 1.06).

**Table 10. Results of the model confirmation by model experts**

Part 1

| The overall model | $\bar{x}$ | S.D | Meaning |
|---|---|---|---|
| The model elements are complete. | 4.60 | 1.03 | Strongly agree |
| Model tools are properly selected. | 4.62 | 1.03 | Strongly agree |
| The model was evaluated reasonably. | 4.60 | 1.00 | Strongly agree |
| There was reasonable modification to the model. | 4.49 | 1.00 | Agree |
| The model achieves the expected goal. | 4.63 | 1.00 | Strongly agree |
| Overall average | 4.588 | 1.012 | Strongly agree |

According to Table 10, the overall average score of the overall model was strongly agree (mean = 4.588, S.D. = 1.012). The top three items of the overall model, ranked from highest to lowest score, were as follows: The first item was “The model achieves the expected goal” (mean = 4.63, S.D. = 1.00). The second item was “Model tools are properly selected” (mean = 4.62, S.D. = 1.03). The joint third items were “The model elements are complete.” (mean = 4.60, S.D. = 1.03) and “The model was evaluated reasonably” (mean = 4.60, S.D. = 1.00).

Table 11. Results of the model confirmation regarding the components, process, and learning environment of the model

Part 2

| | $\bar{x}$ | S.D | Meaning |
|---|---|---|---|
| **The components of the model** | | | |
| Auxiliary learning materials are detailed and proper. | 4.74 | 0.94 | Strongly agree |
| The model is rich in content and activities. | 4.74 | 0.92 | Strongly agree |
| The evaluation process is reasonable. | 4.76 | 0.91 | Strongly agree |
| Teachers and students interact well. | 4.72 | 0.84 | Strongly agree |
| The learning process is interesting and vivid. | 4.78 | 0.85 | Strongly agree |
| **The process of the model** | | | |
| The draft design is reasonable, and the process is clear and concise. | 4.49 | 0.86 | Agree |
| The assessment meets the expert requirements. | 4.49 | 0.80 | Agree |
| The improvement conforms to the teaching. | 4.67 | 0.80 | Strongly agree |
| The practice meets the experimental requirements. | 4.65 | 0.75 | Strongly agree |
| **The learning environment of the model** | | | |
| Online: learning through e-learning | 4.77 | 0.85 | Strongly agree |
| Offline: classroom | 4.67 | 0.80 | Strongly agree |
| Overall average | 4.68 | 0.85 | Strongly agree |

According to Table 11, the overall average score of the components, process and learning environment of the model was strongly agree（mean = 4.68, S.D. = 0.85). The top three items of the components, process and learning environment of the model, ranked from highest to lowest score, were as follows: The first item was "The learning process is interesting and vivid" (mean = 4.78, S.D. = 0.85). The second item was "Online: learning through, e-learning" (mean = 4.77, S.D. = 0.85). The third item was "The evaluation process is reasonable." (mean = 4.76, S.D. = 0.91).

Overall, the results of interviews with students and lecturers showed that using D-FEELLT model significantly improved students' self-directed learning ability. Improving self-directed learning ability can be a good way to improve learning efficiency and the attractiveness of the subject.

**Discussion**

After in-depth research, strict expert review, precise experimental verification, and detailed test analysis, we finally obtained this innovative D-FEELLT model. To ensure that this model provided an excellent experience, we conducted multiple rounds of research and continuous improvement. We listened to the students, focused on their needs and feedback, and constantly optimized the design and function of the model. At the same time, we also invited a number of excellent national education experts from Thailand and China to review and give guidance to ensure the scientific and effectiveness of the model. Ultimately, our results showed that students using D-FEELLT model showed a significant improvement in learning outcomes.

1. In this study, it was found that there were three processes for establishing D-FEELLT model: 1) drive, 2) facilitate, and 3) evaluate. The POA and blended learning model comprised four key components: 1)evaluation and feedback, 2) learning platform, 3) learning environment and resources, and 4) teacher and students.

In the D-FEELLT model, teachers in the "drive" stage set clear learning goals and tasks, provide diversified learning resources and learning methods, meet the learning needs and styles of different students, stimulate students' interest and motivation in learning, and form a "big online drive" [34]. Students can clarify their learning goals and learning paths through their self-assessment and needs analysis [35]. This process helps to cultivate students' self-directed learning ability and goal-oriented consciousness.

In the "facilitate" stage, teachers can provide a variety of learning resources and environments through online platforms, such as online videos, e-books, forums, etc., so that students can learn anytime and anywhere, and communicate and discuss with others. In the offline classroom, face-to-face communication and interaction are conducted to realize the internalization and application of knowledge [36]. This process helps to cultivate students' self-adjustment ability, self-management ability and self-control ability.

In the "evaluate" stage, through online and offline evaluation methods, teachers can understand students' learning situations and problems, and provide timely feedback and guidance [37]. Students can also reflect on and summarize their own learning to better adjust their learning strategies and improve their learning effects. Teachers can collect the students' learning data through the online platform, analyze the students' learning situations and progress, and better adjust their teaching strategies and provide personalized learning support [38]. This process helps develop students' self-control ability and promotes lifelong learning.

The beneficiaries of D-FEELLT model are not only students but also teachers and schools. For students, D-FEELLT model provide a more flexible and diverse learning style. Meanwhile, teachers should pay more attention to students' learning needs and problems so as to better adjust teaching strategies and methods. For the school, these models can improve the teaching quality and level of the school, and cultivate more excellent talents.

2. The results of the blended learning model developed by using a production-oriented approach to e-learning enhancement to improve the self-directed learning ability are as follows.

The results show that students often feel that learning is hard, are unwilling to follow teacher arrangements, prefer Internet and team activities, and tend to blend learning to improve motivation. How to create a flexible, interactive and personalized learning environment to meet the needs of these modern students has become the focus of the researchers in this study. Other researchers also hold this concern [39].

The results of the post-test showed that D-FEELLT model improved student performance. Compared with the pretest, students showed higher knowledge and understanding ability in learning the post-test content. In addition, the blended learning model also has significant advantages in improving students' academic performance, practical ability and self-directed learning ability [40].

The results showed that the students demonstrated a high level of self-adjustment. By introducing D-FEELLT model, students are able to obtain the required information, maintain learning motivation, and proactively adjust learning motivation and behavior. Diversified learning methods, such as online learning, group discussion and practical operation, stimulate students' interest and motivation in learning, and cultivate independent self-directed learning [41]. This fits with the "drive" concept in D-FEELLT model. However, students have deficiencies in assessing their own learning effectiveness and testing learning outcomes, and need to further improve their relevant abilities.

The results show that students have a high level of self-management ability, and in D-FEELLT model, they can set learning goals according to learning needs, effectively organize learning, and improve time management skills. High levels of self-management skills have been shown to have a positive impact on students' classroom activity participation, time management, and strategic planning skills development [42].

The results show that students have the ability to control their study time and develop good study habits. Through continuous and reasonable learning every day, they can stabilize their learning state. By mastering the allocation and adjustment of learning time, students can maintain focus and motivation in the process of learning, and thus improve the learning effect [43].

In conclusion, D-FEELLT model have positive effects in improving college students' academic performance and self-directed learning ability. In this mode, teachers can design more abundant and diversified teaching activities and learning tasks according to students' learning characteristics and needs so as to provide students with more personalized and accurate teaching services.

## 5. Conclusion

Through convincing experimental data, this research shows that using the POA and blended learning model is an effective way to improve the self-directed learning ability of Chinese college students. D-FEELLT model was divided into three processes: drive (before class), facilitation (in class), and evaluation (after class). The POA and blended learning model had four components:1)evaluation and feedback, 2) learning platform, 3) learning environment and resources, and 4) teacher and students.After adopting D-FEELLT model, the academic performance of Chinese college students was found to have been significantly improved, and their "self-adjustment ability", "self-management ability" and "self-control ability" was also found to have been significantly improved.

Therefore, colleges and universities should vigorously promote this learning mode; provide flexible, diversified and personalized learning methods; and help students develop in an all-round way. At the same time, colleges and universities should also strengthen the development and application of D-FEELLT model,and constantly optimize its functions and performance to meet the changing learning needs of students.

## Conflict of Interest

The authors declare no conflict of interest.

## Author Contributions

Han Junyan was responsible for the experimental study, analyzed the data, and wrote the paper, while Jaemjan Sriarunrasmee and Khwanying Sriprasertpap proposed revisions. All of the authors have approved the final version.

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