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Full Research Paper

An Empirical Analysis of the Effectiveness of Online Learning in the Virtual Semester Context

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Abstract: The relationship between students' learning effectiveness, satisfaction and willingness to continue learning and the influencing factors were investigated using the recent A virtual semester online course "Interesting Financial Statements" as an example. The empirical analysis based on 249 questionnaires shows that (1) four variables, including extrinsic motivation, intrinsic motivation, learning experience and knowledge fragmentation, have a positive impact on the learning effectiveness of the course, with knowledge fragmentation having the greatest impact. (2) Course learning effectiveness significantly and positively influenced learning satisfaction, and learning satisfaction further positively influenced willingness to continue learning. (3) The most significant effect of fragmentation was seen in terms of influencing factors; the tendency of "choice" in the intrinsic motivation of learners was noted in terms of learning motivation; and the learning experience emphasized the purpose of the learner and the role of the teacher as a non-learner subject. While confirming the positive effects of the reform of general education based on flexible teaching time and space and student-initiated learning, the study proposes recommendations in three aspects: giving full play to the advantages of fragmented learning, optimizing teaching design and evaluation system, and giving full play to learners' subjective initiative.

Keywords: virtual third semester, online learning effectiveness, empirical analysis

1. INTRODUCTION

The "New Engineering" has become one of the largest and most determined reforms in the field of higher education in China in recent years. The cross-fertilization of science, humanities and engineering, the cultivation goal of composite and comprehensive engineering talents and the cultivation requirements of multi-dimensional ability and global vision are its basic characteristics ^[1]. Therefore, the concept of talent cultivation and curriculum system construction of universities are facing new opportunities and challenges.

The mini-terms system is one of the effective methods for Chinese universities to integrate with international standards, improve the talent training system, and deepen teaching reform ^[2]. Many universities have creatively combined the primary term with the promotion of "New Engineering" by relying on technical means, and created the innovative mode of "virtual term" in which the students are not in school and the classes are not suspended. "This is an innovative mode of online teaching to explore a new talent cultivation path. Since the meaning and value of teaching activities are quality and efficiency, the issue of "effectiveness" of teaching must be taken into consideration ^[3]. How effective are students' online learning? How satisfied are the students with the course learning? Is there a strong willingness to continue learning? These are still the issues that need to be focused on in the reform. This paper is based on the teaching reform practice of University A's "Interesting Financial Statements", a "virtual semester" school-level general education course for the 2019-2020 academic year, discusses the learning effectiveness, satisfaction and willingness to continue learning of students and the

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factors influencing them. The study will provide an in-depth discussion on the learning effectiveness, satisfaction and willingness to continue learning of the learners and the factors influencing them, and explore the direction for the continuous improvement of the teaching mode of the course.

2. TEACHING OBJECTIVES AND DESIGN OF THE COURSE

With the basic concept of cultivating *three creative* (innovation, creativity, entrepreneurship) engineering talents, University A has innovatively designed a general education course study mode of *circular courses, independent study and unified assessment* through a deeply integrated curriculum system of *general studies + major + double creation* and virtual semester in winter and summer.

Based on this model, the course *Interesting Financial Statements* is a general education course for the whole school with different professional backgrounds and different grades. The course adapts the presentation of the material to the characteristics of the students and adapts the text and the language used in the classroom, and sets the following three levels of objectives.

- Build a financial mindset. Giving professional knowledge an interesting learning process, making academic views supported by common sense, and helping students build up a basic financial thinking;
- Open up diverse perspectives. Guiding students to view the basic activities of business operation, investment and financing from a financial perspective, and forming a financial vision;
- Lay the foundation for practice. Through the reading and analysis of financial statements, students can deepen their understanding of enterprise operations and form objective judgments on investment decisions, and help science and engineering students understand "what are financial statements", "what are financial statements for" and "how to use financial statements to help enterprise decisions". The course will help students understand the basic questions of "what is financial statement", "what is the use of financial statement" and "how to use financial statement to help enterprise decision", which will help students' future innovation, entrepreneurship and employment.

In terms of teaching arrangement, the course length is 6 weeks, the basic hours are 32 hours, and the credit requirement is 2 credits; in terms of teaching mode, the course adopts the SPOC teaching mode with mixed classroom teaching and online teaching as the basic features. The reorganization of teaching resources and the innovation of teaching mode are the main means of SPOC, and student-centeredness is the core essence of SPOC.

3. RESEARCH PROCESS

Learning outcomes are the process of learning inputs and outputs, and refer to the competencies that learners should have in terms of knowledge, skills and values after completing certain courses or training. According to the preliminary survey of the course, students are more willing to study in a virtual semester in a more autonomous way than in a formal semester with a formal schedule, fixed time and classroom. According to the theory of basic psychological needs, the higher the degree of satisfaction of basic psychological needs, such as autonomy, competence and belonging, the higher the motivation and adaptability of students; therefore, the virtual semester is more likely to strengthen students' motivation and adaptability.

In the evaluation of learning effectiveness, the study of Li Fan was used to measure learning effectiveness in terms of both quantitative indicator factor knowledge level and qualitative indicator factor overall quality^[4]. At the same time, extrinsic motivations such as time investment and intrinsic motivations such as autonomy needs and competence needs are introduced into the model to analyze the influence of personal factors on learning behaviors and effects, and satisfaction is introduced into the model as an intermediate variable between learning effects and willingness to continue learning to analyze the influence of course learning effects on

learning satisfaction, and then explore the influence of willingness to continue using.

3.1 Research hypothesis

3.1.1 Personal factors and learning outcomes

Personal factors include extrinsic and intrinsic motivation. Extrinsic motivation includes learners' time commitment and energy allocation, while intrinsic motivation includes learners' autonomy, self-perception of competence, and personal expectations of the course. In terms of extrinsic motivation, Linlin Li summarized relevant foreign studies that pointed out a positive correlation between time allocation and academic performance of college students ^[5]. In terms of intrinsic motivation, a study by Nix et al. showed that intrinsic motivation increases when people feel competent and autonomous ^[6]. Therefore, hypotheses 1 and 2 are proposed.

H1_A : Extrinsic motivation has a significant positive effect on the overall quality of learners.

H1_B : Extrinsic motivation has a significant positive effect on the improvement of learners' knowledge.

H2_A : Intrinsic motivation has a significant positive effect on the overall quality of learners.

H2_B : Intrinsic motivation has a significant positive effect on the improvement of learners' knowledge.

3.1.2 Learning experiences and learning outcomes

In addition to personal factors, factors such as the degree of outside influence, learning goal completion and the pressure of the atmosphere perceived in learning can also affect students' learning status and thus their learning outcomes ^[4], which are all related to students' learning experiences. Lu Genshu found that students' perceived goals, assessments and burdens in their course learning experiences have an impact on their learning behaviors and outcomes ^[7]. As a result, hypothesis 3 was formulated.

H3_A : Learning experience has a significant positive effect on comprehensive quality of learners.

H3_B : Learning experience has a significant positive effect on knowledge level of learners.

3.1.3 Objective factors and learning outcomes

Since the course is offered during the winter and summer virtual semesters, fragmentation becomes a learning behavior that cannot be ignored in virtual semester course learning. For the purpose of this paper, time fragmentation is defined as users using less than 30 minutes of continuous time for learning in their daily lives. Jiang Qiang et al. argue that using fragmented time can improve learners' learning efficiency, which is conducive to their self-development and their better adaptation to society ^[8]. Therefore, hypotheses 4 and 5 were proposed.

H4_A : Time fragmentation has a significant positive impact on the overall quality of learners.

H4_B : Time fragmentation has a significant positive effect on the improvement of learners' knowledge.

H5_A : Knowledge fragmentation has a significant positive impact on the overall quality of learners.

H5_B : Knowledge fragmentation has a significant positive effect on the improvement of learners' knowledge.

3.1.4 Learning outcomes, course satisfaction and willingness to continue learning

Learning satisfaction can be seen as the overall feeling or sensation of learners in the process of participating in learning activities, a feeling of satisfaction or dissatisfaction with the degree of accomplishment of learning objectives, and investigating learning satisfaction can provide better evaluation and feedback on students' learning effectiveness. At the same time, expectation confirmation theory considers satisfaction as an important factor affecting willingness to continue using, and is an important indicator to predict learners' willingness to continue using in the process of online learning. The empirical study conducted by Genfu Yang based on the continued use behavior of MOOC and mobile learning users showed that there is a positive influence relationship between satisfaction and willingness to continue learning ^[9]. Therefore, Hypothesis 6 and Hypothesis 7 were proposed.

H6_A : Comprehensive quality has a positive effect of on learning satisfaction of learners.

H6_B : Knowledge level has a positive effect of on learning satisfaction of learners.

H7 : Learning satisfaction has a significant positive effect on learners' willingness to continue learning.

Based on the above hypotheses, a model of the factors influencing students' learning effectiveness, satisfaction and willingness to continue learning in online courses in the virtual third semester was constructed as follows.

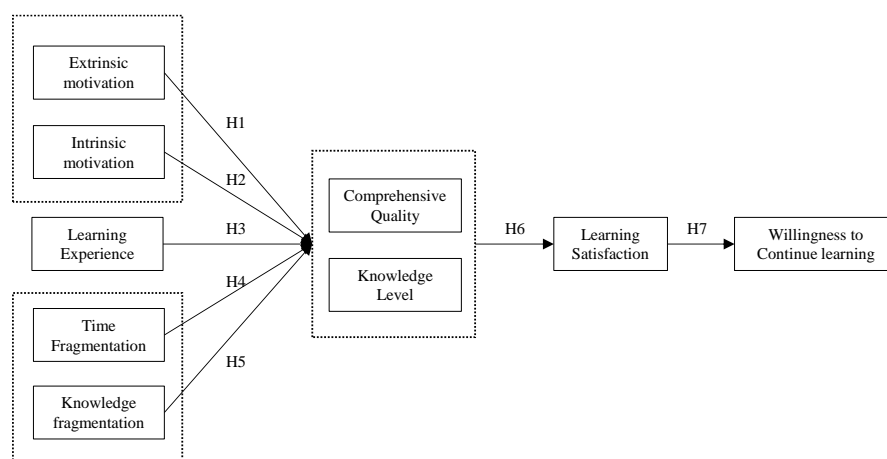


Figure 1: Model of factors influencing learning effectiveness, satisfaction and willingness to continue learning

3.2 Questionnaire design and measurement

The questionnaire of this study was divided into three parts: the first part included respondents' gender, grade level, usual study time, online study time, SPOC study experience, and type of major, with the aim of collecting basic information about the respondents. The second part includes the nine variables in the theoretical model mentioned above, and the definitions and measurement scales of each variable draw on the more established questions from Li Fan (2019) ^[4] and Lu Genshu (2013) ^[7]. The questionnaire was administered on a 7-point Likert scale ranging from 1-strongly disagree to 7-strongly agree. The third section, consisting of open-ended questions, investigated students' suggestions for further course optimization to determine other factors that influence students' satisfaction with the course and their willingness to continue studying.

For this study, 320 students who took the course at University A were selected for the study and the questionnaire was distributed online in the course's QQ group after they completed the course. The questionnaire was distributed for one week and 274 students voluntarily filled out the questionnaire, with a completion rate of 85.6%. Based on the time and completeness of the questions, 249 valid questionnaires were screened, and the questionnaire efficiency rate was 90.9%.

3.3 Descriptive statistical analysis

The survey sample showed that 67.88% of male students and 32.12% of female students chose the course, which is basically consistent with the proportion of male and female students in science and technology majors in School A. In terms of the distribution of the course selection year, students who are about to enter their sophomore year dominate, accounting for 61.68%. In terms of study periods, 63.86% of the students chose to use fragmented time periods to study the course, in line with the expectations of pre-course research on fragmented learning behavior. In terms of learning duration, 66.79% of students spent less than 40 minutes in a single online learning session, and only 9.12% of students spent more than one hour in a single session, further indicating that the course was mainly conducted in the form of fragmented learning. The online learning experience survey shows that 46.72% of the students are taking SPOC mode for the first time. In terms of the

distribution of majors, 87.23% of the students were majoring in science and technology, which is in line with the university's *New Engineering F Plan* to strengthen humanities and general education in cultivating new engineering talents.

3.4 Empirical analysis

3.4.1 Reliability and validity tests

SPSS 22.0 software was used to process the relevant data in this study. Cronbach 's alpha coefficient was chosen to test the internal consistency reliability of the questionnaire. The structural validity of the questionnaire was analyzed using factor analysis to test the KMO, the overall degree of explanation and Bartlett's value of each variable. The statistical results showed that the Cronbach's alpha coefficient of each variable was above 0.7, and the overall alpha coefficient of the scale reached 0.979, which had good internal consistency reliability. The KMO value of each variable was greater than 0.6, and the Bartlett's test sig value was less than 0.001, and the degree of explanation of each variable was at a high level, indicating the good structural validity of the scale.

3.4.2 Relevance analysis

Before regression analysis of the variables, the correlation between the variables needs to be tested. In this study, Pearson's simple correlation coefficient method was used to test the correlations of the variables. The results of the correlation analysis (Table 1) showed that there were significant correlations between the two learning effect variables, general quality and knowledge level, and the five variables, extrinsic motivation, intrinsic motivation, learning experience, time fragmentation and knowledge fragmentation, and the correlation coefficients were all at 0.65, indicating strong correlations between the variables; general quality and knowledge level were significantly correlated with learning satisfaction, with correlation coefficients of 0.791 and 0.837, which have strong correlation; learning satisfaction is significantly correlated with willingness to continue learning, with a correlation coefficient of 0.868, which has a strong correlation.

Table 1. Correlation of variables

| | Extrinsic Motivation | Intrinsic Motivation | Learning Experience | Time Fragmentation | Knowledge Fragmentation | Comprehensive Quality | Knowledge Level | Learning Satisfaction | Willingness to Continue Learning |
|----------------------------------|----------------------|----------------------|---------------------|--------------------|-------------------------|-----------------------|-----------------|-----------------------|----------------------------------|
| Extrinsic Motivation | 1 | .746 ** | .667 ** | .701 ** | .735 ** | .683 ** | .657 ** | .712 ** | .720 ** |
| Intrinsic Motivation | .746 ** | 1 | .710 ** | .764 ** | .802 ** | .723 ** | .731 ** | .751 ** | .740 ** |
| Learning Experience | .667 ** | .710 ** | 1 | .783 ** | .753 ** | .682 ** | .656 ** | .639 ** | .643 ** |
| Time Fragmentation | .701 ** | .764 ** | .783 ** | 1 | .867 ** | .739 ** | .737 ** | .747 ** | .733 ** |
| Knowledge Fragmentation | .735 ** | .802 ** | .753 ** | .867 ** | 1 | .780 ** | .789 ** | .794 ** | .776 ** |
| Comprehensive Quality | .683 ** | .723 ** | .682 ** | .739 ** | .780 ** | 1 | .834 ** | .791 ** | .778 ** |
| Knowledge Level | .657 ** | .731 ** | .656 ** | .737 ** | .789 ** | .834 ** | 1 | .837 ** | .811 ** |
| Learning Satisfaction | .712 ** | .751 ** | .639 ** | .747 ** | .794 ** | .791 ** | .837 ** | 1 | .868 ** |
| Willingness to Continue Learning | .720 ** | .740 ** | .643 ** | .733 ** | .776 ** | .778 ** | .811 ** | .868 ** | 1 |

Note: **Significantly correlated at the 0.01 level (two-sided)

3.4.3 Regression analysis

To verify whether the hypothesis is valid, regression analyses were conducted on the five antecedent variables of extrinsic motivation, intrinsic motivation, learning experience, time fragmentation, and knowledge fragmentation, the two intermediate variables of comprehensive quality and knowledge level, and the two dependent variables of learning satisfaction and willingness to continue learning, respectively, and the adjusted R of each regression model was greater than 0.6. Significance was less than 0.01, indicating that this regression model was statistically significant and The overall goodness of fit of the model is good.

As shown in Table 2 below, knowledge fragmentation has the greatest effect on overall quality ($\beta=0.432$)

and learning experience has the least effect on overall quality ($\beta=0.138$). This leads to the hypotheses H1_A, H2_A, H3_A, and H5 being Avalid and hypothesis H4 is Anot valid.

Further multiple linear regression analysis of knowledge level and its antecedent variables showed that both antecedent variables, intrinsic motivation and knowledge fragmentation, were significantly and positively correlated with knowledge level at the 99% significance level. The effect of knowledge fragmentation on knowledge level was greater ($\beta=0.568$) and the effect of intrinsic motivation on knowledge level was less ($\beta=0.276$). This leads to the hypothesis that H1_B, H5_B holds and hypothesis H2_B, H3_B, H4 does Bnot hold.

Finally, multiple linear regression analysis of learning satisfaction and learning effectiveness variables showed that both variables, general quality and knowledge level, were significantly positively correlated with learning satisfaction at a 99% significant level, with a higher effect of knowledge level on learning satisfaction ($\beta=0.581$) and a lower effect of general quality on learning satisfaction ($\beta=0.307$). Learning satisfaction is significantly and positively correlated with willingness to continue learning at a significant level of 99%, and learning satisfaction has a higher effect on willingness to continue learning ($\beta=0.868$). It follows that hypothesis H6_A, H6_B and hypothesis H7 are valid.

Table 2. Model regression coefficients

| Models | | Non-standardized Coefficient | | Standardization Factor | T | Saliency | Covariance Diagnosis | |
|----------------------------------|-------------------------|------------------------------|----------------|------------------------|--------|----------|----------------------|-------|
| | | B | Standard Error | Beta | | | Tolerances | VIF |
| Comprehensive Quality | A constant (math.) | -1.181 | .864 | | -1.367 | .173 | | |
| | Knowledge Fragmentation | .396 | .063 | .432 | 6.251 | .000 | .271 | 3.695 |
| | Intrinsic Motivation | .155 | .061 | .169 | 2.548 | .011 | .293 | 3.413 |
| | Extrinsic Motivation | .093 | .037 | .147 | 2.530 | .012 | .380 | 2.630 |
| | Learning Experience | .143 | .060 | .138 | 2.403 | .017 | .390 | 2.567 |
| Knowledge Level | A constant (math.) | 1.324 | .477 | | 2.776 | .006 | | |
| | Knowledge Fragmentation | .302 | .032 | .568 | 9.444 | .000 | .357 | 2.797 |
| | Intrinsic Motivation | .146 | .032 | .276 | 4.586 | .000 | .357 | 2.797 |
| Learning Satisfaction | A constant (math.) | 6.358 | .903 | | 7.039 | .000 | | |
| | Comprehensive Quality | .423 | .079 | .307 | 5.354 | .000 | .305 | 3.280 |
| | Knowledge Level | 1.382 | .136 | .581 | 10.129 | .000 | .305 | 3.280 |
| Willingness to Continue Learning | A Constant (math.) | 3.450 | 1.147 | | 3.009 | .003 | | |
| | Satisfaction | 1.087 | .038 | .868 | 28.778 | .000 | 1.000 | 1.000 |

4. CONCLUSIONS AND DISCUSSIONS

4.1 Research findings and discussion

The relationship between students' online learning effectiveness, satisfaction and willingness to continue learning and the factors influencing them were investigated in the A university-level general education course *Interesting Financial Statements*. Specifically, extrinsic motivation, intrinsic motivation, learning experience and knowledge fragmentation positively affect the *general quality* dimension of learning effectiveness, while

intrinsic motivation and knowledge fragmentation positively affect the *knowledge level* dimension of learning effectiveness. The most influential antecedent variable on learning effectiveness was *knowledge fragmentation*. Learning effectiveness further significantly and positively influences learner satisfaction; learning satisfaction further positively influences learners' willingness to continue learning.

4.1.1 Fragmentation: a key influencer of learning effectiveness

Fragmented knowledge means that learners acquire knowledge that is fragmented, disordered, and irrelevant, giving the impression that "it seems that they have learned everything, but they have learned nothing. If learners want to integrate the fragmented knowledge to form a new, personalized system knowledge system, the learning strategy requires learners to get rid of the stereotypical thinking and learn to *turn the whole into zero*; at the same time, fragmented knowledge also raises the requirement of managing the knowledge fragments. At the same time, fragmented knowledge also raises the requirement of managing knowledge fragments, and learners should not only dig and filter meaningful and valuable knowledge from the *knowledge warehouse*, but also delete and forget the worthless knowledge on the basis of identification ^[10].

Since fragmented knowledge may cause problems such as perceptual, attention, memory and thinking barriers, in order to break these barriers, learners are required to improve their ability to discern fragmented knowledge, enhance the purpose of the learning process and judge the value and usefulness of the learning content. The higher the degree of knowledge fragmentation, the more learners are required to "reprocess" and build a new knowledge system, and how to realize the flow of knowledge on different media carriers and resist the danger of information overload requires learners to carry out a systematic knowledge acquisition process ^[11], so the learners' knowledge level will also be improved in the process of integrating fragmented knowledge.

The two hypotheses H4a and H4b about time fragmentation in this study did not hold true. In further analysis of the study results, it was found that 36.13% of the students chose to study at regular intervals and another 33.21% studied for more than 40 minutes in a single session. This is mainly because, although the "Fun Reading Financial Statement" provides learners with the opportunity to study in fragmented time, some learners were unable to schedule large blocks of continuous time for study as in formal study, or to study in short, fragmented time as in the traditional sense, resulting in the variable of time fragmentation not having a significant effect on the learning outcomes.

4.1.2 Intrinsic motivation: the tendency to "choose" learning strategies

The hypothesis H2b about intrinsic motivation versus knowledge level in this study failed to pass the test. In further investigation, it was learned that students do not attach enough importance to general education courses, devote less time to the courses, and are not highly motivated to learn. At the same time, because intrinsic motivation presupposes the psychological characteristics of learner initiative, persistence, and ease of coping, which are an *investment behavior* of learners based on flexible learning options, multiple learning aspirations, and rich learning styles ^[12], with more emphasis on "choice", which has little to do with the level of knowledge focused on "outcomes". In this course, due to the online learning mode and the summer time, learners can hardly feel the pressure of course learning as in the formal semester, and will not put too much effort into it, and have less motivation to improve their knowledge level.

4.1.3 Learning experiences: focus on learner purpose and the role of non-learner subjects

Hypothesis H3b about the effect of learning experiences on knowledge level in this study was also not significant. One possible explanation for the small effect of learning experiences on overall quality is that, in terms of the meaning of learning, learning experiences that can influence and change the learner and lead to a lifelong social integration value can be called meaningful learning experiences ^[13]. As a general elective course, *Interesting Financial Statements* emphasizes the development of financial thinking, theoretical and practical skills, and has some shortcomings in focusing on value and meaning. In terms of learning assessment

mechanisms, good teaching and appropriate evaluation in the learning experience reflect the importance of scientifically sound assessment mechanisms to inhibit superficial learning and improve the quality of students' learning, but this focuses on the teacher's teaching methods and does not directly affect the overall quality of students.

4.2 Discussion

The above findings suggest that the innovative development of the virtual semester demonstrates the new normal characteristics of future education - the mutually beneficial symbiosis of flexible teaching and active learning^[14], that is, encouraging students to engage in flexible learning through flexible scheduling, flexible learning locations, multidimensional learning assessments, and convenient learning spaces, fully mobilizing and utilizing learners' independent learning abilities to achieve the purpose of taking some practical, entrepreneurial, and general education courses.

Firstly, effective time-fragmentation strategies in online learning have not been implemented by learners, resulting in a failure to fully exploit the positive effects of time-fragmentation in enhancing learning outcomes; secondly, there is a tendency for learners to be selective in their motivation for learning. Third, teachers play a key role in the learning experience of learners, and how to set up a scientific and reasonable evaluation mechanism to stimulate learners' enthusiasm for learning in order to achieve continuous learning is a topic that needs to be further explored. This study examines these issues from three perspectives. This study discusses these issues in three possible ways.

Taking advantage of the situation, based on the reality of fragmented learning in the *virtual semester*, the advantages of systematic learning and fragmented learning are organically combined according to the characteristics of the course. It is possible to break the thematic arrangement of the course according to the logic of knowledge, and link up the contents of the same logical thread in different chapters, so as to achieve the effect of triggering learners' active reorganization and memory; it is also possible to build a "teacher-learner" interactive platform with the help of online live streaming platforms such as Tencent Classroom and Tencent Conference, and adopt the "teacher-learner" interactive platform. The live lectures are conducted in a way that highlights the key points and practical cases, divides the complete time block into different sub-modules and sub-contents, and presents the logical thinking and content framework of the course to help students understand systematically. At the same time, the structured ability of students is strengthened through the corresponding course design, and the leading role of teachers is brought into play to inspire students to creatively reorganize the knowledge fragments through specific forms such as live plus meals, post-class discussion questions, and group assignments with the help of the online platform, to guide students to establish logical relationships between modules and knowledge nodes in their minds, so as to form a self-consistent knowledge system, and to guide students to use their fragmented time to move towards meaningful meaningful learning, associative learning, and constructive learning.

Secondly, the teaching design of SPOC online courses should be constantly optimized, with emphasis on the subjectivity and initiative of learners, changing the idea of learners *only for credits* and allowing learners to fully feel the *fun* and connotation of the general elective courses. For example, before the start of the course, students can be introduced to the content through QQ course group, combined with Tencent class, Tencent meeting and other forms, to explain to learners the teacher's teaching objectives, the overall teaching arrangements and the basic requirements, so that students can follow up flexible and independent arrangements for learning according to their own situation. At the same time, the study habit of self-monitoring is cultivated throughout the course, and the awareness and ability of individual learners in self-feedback and self-evaluation are enhanced. At the same time, we collect and selectively absorb learners' demands for course design and course assessment, and purposefully focus on designing and optimizing some practical application and

examination links through the model of teacher-student co-construction, so as to help students achieve internalization of knowledge.

Third, teachers should play a major role in the course evaluation process, establish a regular evaluation and feedback mechanism for the course, explore innovative course content, course media carriers, assessment content and forms, and regularly obtain feedback from learners on various aspects of the learning content experience, form experience and assessment experience, so as to achieve teaching for fun and growing together.

Tao Xingchi, a famous educationalist in China, once said that "teaching is to not teach". For general education, its teaching goal is not only to broaden and extend students' knowledge, but also to focus on the cultivation of students' mindset and independent learning ability. It is worthwhile to study and explore how to combine the internalization and absorption of students' knowledge outside the classroom with MOOC, SPOC and other internet classroom forms and promote the complementarity of the two, and how to highlight the cultivation of innovative thinking and critical thinking in the design of teaching contents.

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