Research on Behavior and Evaluation System of Online Learning

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Abstract. In the context of digital educational means, especially the rise of online teaching and mobile learning, how to use online teaching resources well, understand learners' learning behavior, encourage and guide learners to participate in learning, and obtain the maximum learning efficiency in a limited time is a common problem between teachers and students. In this paper, under the assumption that positive behavioral incentive helps to enhance the learning effect, we construct a learning model based on the Internet + learning platform, reconstruct the learning module and evaluation of the learning APP, and guide the learning behavior, carry out goal incentive and guide participation in learning to enhance the learning effect through big data analysis. Over the experimental test, the Internet learning platform based on the model of ability-improvement can play a role in promoting the study habits and comprehensive performance, which based on the proposal of model construction and evaluation optimization of mobile learning platform.

Keywords: e-learning · learning model · content reconstruction · evaluation system

1 Introduction

With the rapid development of information technology and the increasing popularity of smartphone communication devices, Internet-based social tools and interactive platforms are becoming increasingly mature, and have become an important means of communication for college students' life and study with their advantages of convenience, cross-platform and low cost. However, how to guide students to participate in learning and plan learning models and evaluation systems rationally is a major challenge [1–3].

Internet learning models and evaluation systems include the following:(a) Overall topological structure At the early stage of the Internet course construction, the learning website focuses on the establishment of the knowledge system and the integrity of the knowledge structure, the basis relies on the course-related textbooks or lecture notes [4], main contents are pictures, text, animation, video. Its formal composition: overall construction, chapter content, and post-class assignments are presented to the learners [5], and the evaluation system relies mainly on points of post-class assignment. In structure of traditional online courses, the courses lack interactivity, and the learning process

is relatively flat, the same as reading a book. (b) Type of Knowledge Point Penetration (APP, Subscription account) Scattered knowledge points are the learning content, which are sent point by point, the systematicity and structural integrity of knowledge points are poor, and digital learning resources such as text, pictures, audio and video files in multimedia form provide learners with very convenient conditions for independent learning [6], while the learning process lacks systematicity. (c) Internet + Learning Platform Based on a large platform, a personalized curriculum system and highly simulated virtual classroom are built, combining real-time interaction and recorded on-demand and creating virtual scenarios. The convenience and interactivity of the platform guide learners to be able to learn anytime and anywhere, while reinforcing the learning effect with visuals, sound impact, and text training [7].

Through the research of the current online teaching mode, there is no judgment and guidance from the learners' participation in learning behavior. This research innovates the traditional mode, develops the learning platform for the second time, parameterizes the students' learning behavior on the basis of statistics, guides the learning behavior through positive incentives, and improves the learning process and learning efficiency. Over the experimental test, the Internet learning platform based on the model of ability-improvement can play a role in promoting the study habits and comprehensive performance, which based on the proposal of model construction and evaluation optimization of mobile learning platform.

2 Framework Construction Based on Internet + Learning Platform

2.1 Model of Learning Framework

According to modern instructional design theory and constructivist learning theory, a student-oriented online learning platform system should generally include several subsystems, such as management system module, learning tools module, collaboration and communication module, online question and answer module, learning resources module, intelligent evaluation module, and maintenance support module [8]. There are flexible course management, tracking and analysis of learning record, class and group management, course resource management and other functional modules. Learning process resourses, learners' habits, learning activities, and learning process records, are shown in the model of user-course relationship in Fig. 1.

2.2 Strategy Model Based on Competency Improvement

Stimulate learning interest and changing learning styles through online learning, and because the form of learning organization and learning evaluation in the online learning environment are different from those in the traditional classroom, online learning should increase the learning characteristics of the online learning environment. This study takes online learning environment as a specific context to study online learning for informing students [9], and defines the internal drive of online learning as a dynamic ability system that can effectively promote the interaction of learners' cognitive ability, learning
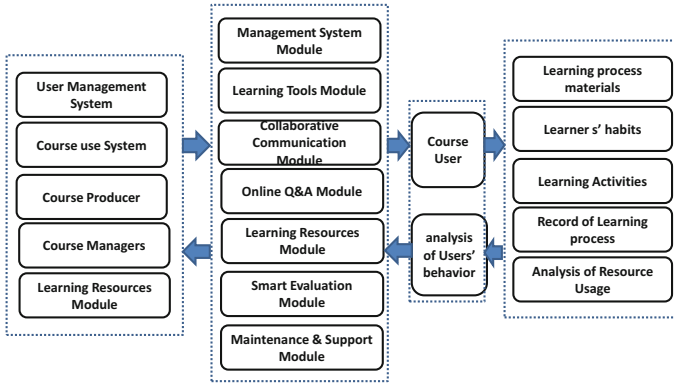
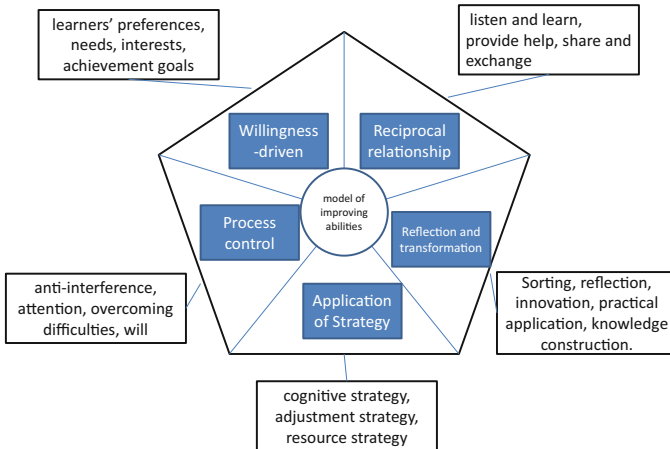**Fig. 1.** Model of the user-course relationship.

Fig. 2. The strategy model of copetency enhancement.

motivation, learning strategies, and learning outcomes during the process of adapting to the environment, making good use of technology, acquiring knowledge, and developing skills, which stimulates learners' potential, promotes learners' acquisition of knowledge and skills of development, and helps learners achieve lifelong development of individuals, and builds a model of competency enhancement, as shown in Fig. 2 for the strategy model of competency enhancement.

2.3 Build Guidance Model Learning Behavior

Building data mining based on learning behavior guidance is the process of extracting, from a large amount of incomplete, noisy, fuzzy and random practical application data, which people do not know in advance, but is potentially useful information and knowledge [10].
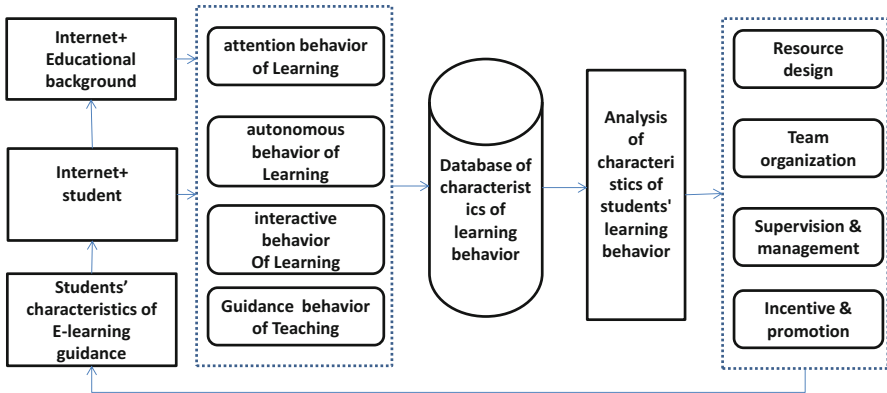
Fig. 3. Guidance model of Learning behavior

In this paper, according to the general process of data mining, the model of online learning behavior guidance is formed as shown in Fig. 3, and the design idea of the model has the following four aspects: (1) analyzing the group characteristics of vocational college students and the current situation of online learning in the context of "Internet +", and defining the pre-mining problem of online learning behavior. (2) Collecting relevant data through the database information of the learning platform and the web log information of the server. (3) Through data analysis model and data mining software, the information in the database is further mined to form valuable data infographics, and the online learning behavior is analyzed and evaluated according to the knowledge representation of the infographics. (4) On the basis of data mining of online learning behavior preferences, we study relevant countermeasures at the level of teachers' intervention, motivation and guidance, resource design, and learning organization with respect to the patterns exhibited by students in terms of attention to persistence, autonomy, interactivity, collaboration, and selectivity of learning contents.

3 Behavior-Guided Evaluation Based on Big Data Motivation

3.1 Indicators of Effective Learning Behavior of College Students in Online Learning

Take "College English" as an example, the course adopts hybrid teaching, which combines traditional classroom teaching with an online teaching platform mainly based on the Learning App, with offline teaching and online tutoring promoting each other, stimulating students' enthusiasm for independent and collaborative learning, focusing on ability development, solving practical problems, students' comprehensive learning quality will be improved. Taking the online learning of vocational English in the fall semester of Grade 2021 as the sample, the students' learning database and server's web logs of the open online course learning platform of course resources were used as the main data sources during this period, and the following 15 characteristics were used to statistically explore the four aspects of learning behavior patterns: focused behavior of the online

Table 1. The overall situation of the characteristic indicators of college students' online learning behavior.

characteristic indicators of learning behavior		Code of characteristic indicators	maximum	minimum
Learning-focus behavior	Span of learning time (days)	TZ01	15	45
	study duration (times)	TZ02	30	3
	Study frequency (times)	TZ03	60	8
	average duration of online study (hours)	TZ04	45	5
Autonomous learning behavior	Browse (times)	TZ05	85	8
	search (times)	TZ06	20	0
	subscribe (times)	TZ07	48	3
	Create resources	TZ08	5	0
interactive learning behavior	comments (items)	TZ09	7	0
	feedback (items)	TZ10	27	0
	topic (items)	TZ11	32	0
Incentive feedback behavior	Video response	TZ12	49	9
	Image and text response	TZ13	36	3
	Photo data response	TZ14	43	8
	Text response	TZ15	53	2

learning platform: the learning time span, the total time of learning, the frequency of logging in, and the distribution of the average time of stay of each online learning. Students' independent learning behaviors, including the frequency distribution of browsing, searching, creating resources, subscribing, and other learning behaviors. The frequency distribution of students' interactive learning behaviors, including commenting, replying, starting topics, etc. Motivational feedback behaviors. As shown in Table 1, the overall situation of the characteristic indicators of vocational college students' online learning behavior.

3.2 Design of Evaluation Index Based on Behavior Guidance

The teaching evaluation system of "Internet + classroom" does not only reflect the whole process of teaching online and offline, evaluate learning preferences, learning process, learning output and value-added learning, but also realize the evaluation of teaching effect in a more scientific, comprehensive and reasonable way through big data management and prediction analysis by means of information technology.

The deep learning level in the deep learning scale is the dependent variable Y, and the four main factors extracted from the effective teaching behavior scale in online English teaching (F1 is the factor of learning concern behavior, F2 is the factor of students' independent learning behavior, F3 is the factor of students' interactive learning behavior, and F4 is the factor of motivational feedback behavior) are used as independent variables for multiple regression analysis, and the validity of the regression analysis is tested first (see Table 2), F = 25.041, P = 0.000 indicates that the regression equation passed the test and the partial regression coefficient column was obtained (see Table 3).

The above results showed that the coefficient of factor F2 (factor of normative online teaching) was not significant, P = 0.690, so the method of stepwise regression was adopted to adjust the model, and F2 was removed from the results of calculation. The final model of regression equation Y = 3.664 + 0.206F1 + 0.472F3 + 0.140F4 was obtained, indicating that F1, F4, F3 (F1 is the factor of learning concern behavior, F2 is the factor of students' independent learning behavior, F3 is the factor of students' interactive learning behavior, and F4 is the factor of motivational feedback behavior) were the main factors that significantly affected students' deep learning. Behavior factor, F3 student's interactive learning behavior factor, and F4 motivational feedback behavior factor) are the main factors that significantly affect students' deep learning, with F3 (the factor of developing learning strategies and abilities) being the most critical factor that positively and significantly affects students' deep learning. Therefore, the implementation of effective teaching behaviors that promote students' learning engagement, develop learning strategies and abilities, and motivate learning in online English teaching can

Table 2. AnovaA

model	Sum of squares	Df	Mean Square	F	Sig
model 1	regression	59.905	4	25.041	.000b
	residual	123.204	206	–	–
	Total	183.109	210	–	–

Table 3. Partial regression coefficient

Model 1	Denormalization coefficient		Standardcoefficient	t	Sig	95% confidence interval of B	
	B	Standard error	Trial version			Upper limit	Lower limit
constant	3.664	0.053	–	68.811	0.000	3.559	3.768
F1	0.206	0.053	0.221	3.868	0.000	0.101	0.312
F2	-0.021	0.053	-0.022	-0.387	0.699	-0.126	0.085
F3	0.472	0.053	0.505	8.839	0.000	0.366	0.577
F4	0.140	0.053	0.150	2.632	0.009	0.035	0.246

positively and significantly affect students' deep learning, among which the implementation of effective teaching behaviors that develop learning strategies and abilities is crucial to promote students' deep learning.

3.3 Model of Learning Efficiency Evaluation

The decision tree is a common classification model of data mining with a tree structure, which is a function approximation method for classification that has been continuously developed from the field of machine learning, and the decision tree model has the advantages of fast computation, easy interpretation of results, and robustness. The ID3 algorithm is one of the basic algorithms of the decision tree model, and its basic idea is: by analyzing the information gain of attributes, finding the most discriminative partition attribute, divide the sample into the multiple subsets and continue to recursively divide each subset according to the similar method, and finally get the decision tree. The core problem of the ID3 algorithm is how to determine the optimal partitioned attributes, and the algorithm uses the entropy of the attributes before and after partitioning to compare and calculate the information gain as a measure of the discriminative power of the attributes. The relevant calculation formula is as follows.

The amount of information required for sample classification, assuming that S is a set, containing s samples with m values of different category attribute Ci, where $i = 1,2,…,m$.

Given the probabilities $p_1, p_2…, p_m, \sum_{i=0}^{m} p_i$, then the amount of information required to classify the sample is

$$H(p_1, p_2…, p_m) = -\sum_{i=0}^{m} p_i \log_2 p_i \tag{1}$$

The expected information required for sample classification, assuming that there are n different values in attribute A, i.e., a1,a2,…,an, according to the attribute A, the sample set S is divided into n different sets, i.e., $S_1, S_2,…,S_n$, with sij representing the number of samples belonging to the category C_i of s_j in the sample set, at this time, the sample size is calculated by the formula:

$$E(A) = \sum_{j=1}^{m} \frac{s_{1j} + s_{2j} + … + s_{mj}}{s} H(s_{1j} + s_{2j} + … + s_{mj}) \tag{2}$$

where, $\frac{s_{1j}+s_{2j}+…+s_{mj}}{s}$ denotes the weight of the jth subset. The smaller the value of E(A), the more thoroughly the set is divided.

4   Data Analysis of Teaching Process Behavior

4.1   Analysis of Effective Learning Participation

Time span of Study: From 2020–2022, altogether 4 semesters, the total length of each semester from the course lecture to the exam is 16 weeks. The time span of students who left study records ranged from 5 to 45 days, and the average time span was 24 days. 75% of the students reached the average level, and the most students logged in during

Table 4. Statistics of learning participation.

Term	Class period (week)	Unit study span (days)	Total logged hours (credit hours)	Login frequency (times/week)	Effective duration of a single session (minutes)	Completeness of homework answers (%)
1	16	45	8	8	5	53%
2	16	33	9.2	18	9	61%
3	16	21	11.5	39	13	73%
4	16	5	13	60	18	86%

the first week of the semester and the week of the examination. Total learning hours: The total span of learning hours is from 3 to 30 h, mainly distributed between 8 and 13 h, with an average of 12 h. 87% of the students reached the average level, and the course was taught for 15 weeks, almost 0.75 h per week was spent on the e-learning platform of the course. Frequency of learning: The frequency of logging in ranged from 8 to 60 times, with a mean value of 20 times, and 78% of the students achieved the average level. Based on the number of weeks of lectures, the average times of logging-in per week for the participating students was 1.33. Average duration of each online learning: the range of learning duration is 5–45 min, 18 min per capita, the average duration is short, only 3 micro videos can be watched, referring to the total duration and the number of logging-in, there are interruptions in learning. Table 4 Statistics of Learning participation.

4.2 Analysis of Learning Variability

In order to investigate whether there is any variability in the level of English self-directed learning among vocational college students with different English learning habits in the online learning environment, this study used a one-way ANOVA to analyze the relationship between English learning habits and the overall level and dimensions of self-directed learning among vocational college students. Table 5 Differences in study habits of English self-directed learning levels.

As shown in Table 5: There is an extremely significant difference in the overall level of English self-directed learning in the online learning environment among vocational college students with different English learning habits (Sig = .000 < .01), indicating that students with very good English learning habits (M = 3.89) have a much higher overall level of English self-directed learning in the online learning environment than those students with poor English learning habits (M = 2.98). Numerically, the magnitude of each mean for the different options of English learning habits is in the following order: very good (M = 3.89) > good (M = 3.74) > fair (M = 3.52) > poor (M = 3.35) > poor (M = 2.98). This shows that the level of self-directed learning is in a state of continuous increase.

Table 5. Differences in study habits among students of different level in self-directed learning english.

Study Habits	Sample size (N)	Mean value (M)	Standard deviation (Sd)	F-value	Sig (Bilateral)
Very poor	48	2.98	0.540	24.651	0.000
Poor	105	3.35	0.432		
Fair	229	3.52	0.423		
Good	64	3.74	0.457		
Very good	10	3.89	0.707		

4.3   Analysis of Learning Material Preferences

Analysis of the choice of learning materials. Regarding the choice of learning contents, according to the click rate of different learning materials in Fig. 4, it can be seen that students like video materials most, followed by graphic materials and picture materials, and the click rate of pure text materials is very low, only 6%. This shows that higher vocational students like direct and intuitive teaching materials and are averse to the boring text materials. The click rate of graphic materials is higher than that of picture materials, which indicates that the learning materials with text and pictures are also preferred by students, and the intuitive text with textual explanation is more suitable for the expansion part of the course tasks. Video materials are more popular with students, but they also require a short time to explain the relevant content systematically. The statistics of students' preference for learning materials are shown in Fig. 4. Video materials and graphic materials are favored by most students.
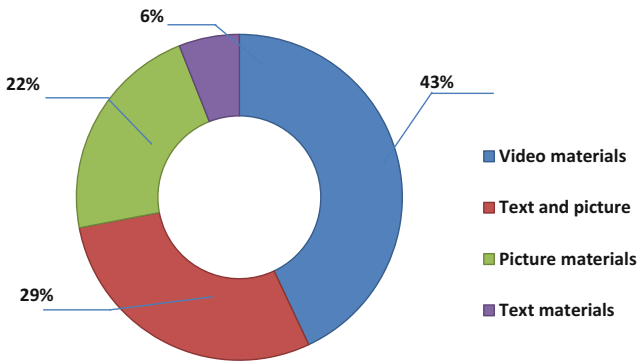

Fig. 4. The statistics of students' preference for learning materials

4.4 Analysis of Improvement of Students' Comprehensive Performance

"Internet + Classroom" highlights student-centered, and realizes mastery and improvement of knowledge and skills through online independent learning and offline collaborative learning, emphasizing students' participation and contribution in the classroom. Teaching evaluation adopts the method of "online and offline equal emphasis, qualitative and quantitative combination" to comprehensively monitor teaching and learning from the three stages of pre-class, in-class and post-class, and jointly realize the rectification of teaching quality and the improvement of talent training quality. Increase the statistics of students' learning volume, measure all learning activities that learners need to complete and the aeverage learning time that requires in order to obtain a credit, and develop self-learning ability and habits through statistics of factor F1 of learning attention behavior, factor F2 of students' independent learning behavior, factor F3 students' interactive learning behavior, and factor F4 of motivational feedback behavior, and reflect comprehensive learnong results through comprehensively counting online and offline learning performance. According to the analysis of statistical results, the comprehensive score showed an upward trend, and the motivational teaching based on Internet + could promote learners' behavior development and performance improvement. Figure 5 Comprehensive comparison of students' grades year by year, (a) grades of the second semester, (b) grades of the third semester, (c) grades of the fourth semester, (d) comprehensive comparison of three semester grades.
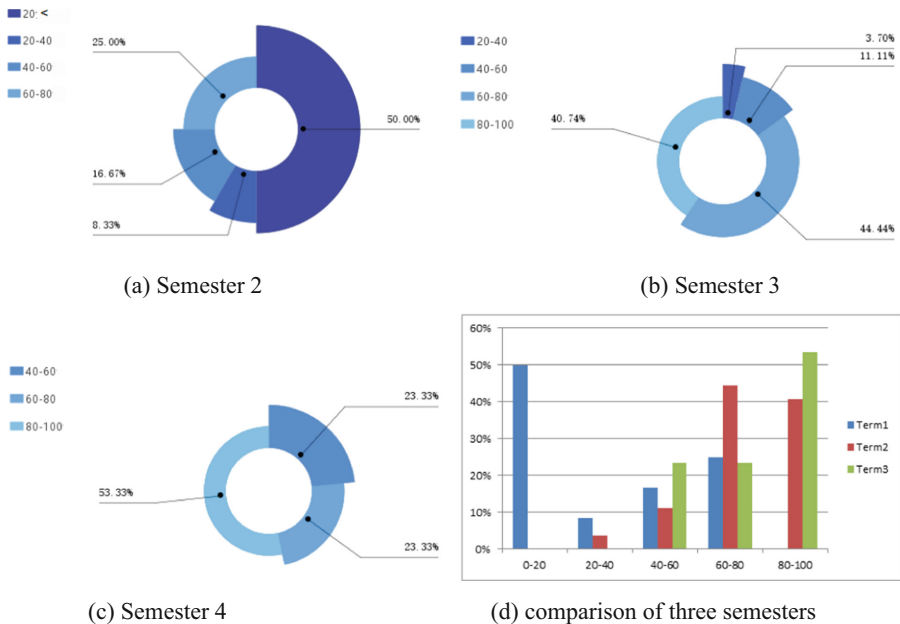

(a) Semester 2

(b) Semester 3

(c) Semester 4

(d) comparison of three semesters

Fig. 5. Comprehensive Comparison of students' grades in three semesters

5   Conclusion

The mobile Internet provides a new learning experience for online teaching, allowing students to accept knowledge at any time, making the teaching process no longer bound by time and space, and making the acquisition of knowledge more flexible and diversified. "Internet + education" is a brand-new form of education combining Internet technology with education, with the progress of society, the development of science and the update of educational concepts, and it is also an opportunity for vocational colleges and universities to take the initiative to reform teaching methods and explore teaching innovation.

"Internet + education" effectively makes up for the shortcomings of traditional education. In the process of online teaching, the unique teaching platform of computer network technology, big data technology and education technology is used to provide an effective learning path for independent learning. The teaching platform system can realize the real-time complete tracking and collection of the personality characteristics, learning process and learning stage of each student participating in online learning, so that students' learning behavior is not restricted from beginning to end, from part to all; The teaching platform system can present the process evaluation of learning behavior, the teaching guidance and learning tracking service in real time, the system can put forward effective and targeted suggestions of independent learning for different students according to the personal learning behavior and other information recorded by the system. Online teaching provides a real-time and effective way to achieve self-directed learning.

The integration of information and communication technology, Internet technology and education technology has given new characteristics to learning behavior: different groups of people can choose different subjects and start learning different courses from different chapters at different time and places. The "five differences" of "Internet + Education" are efficient, convenient and flexible, allowing students to have more choices, directly reflecting the characteristics of active learning, and fully meeting the needs of modern education and further education.

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