Construction of Online Course APP Evaluation Index System

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Abstract: In recent years, on the one hand, online course APP are developing at a high speed. On the other hand, the online course APP market is uneven, and the phenomenon of homogenization is becoming more and more prominent. Therefore, the evaluation of the quality of the online course APP is important. However, there are few researches on this topic in the academic field. At present, there is no scientific and reasonable evaluation index system. Therefore, this paper uses Delphi method to determine the evaluation index of online course APP, including 4 first-level indexes, 14 second-level indexes and 37 third-level indexes, and then use AHP method to calculate the weights of each index and construct an evaluation index system which is suitable for online course APP, in order to give full play to its diagnostic function, and provide reference for the evaluation of online course APP and to guide and standardize its construction and application.

1. Introduction

Since the strategic deployment of the Education Information Decade Development Plan (2011-2020) requires the development of online courses construction, large-scale online courses have become more popular among teachers and students. At the same time, smartphone companies are developing rapidly. By 2018, the number of smartphone users in China ranked first in the world. The online course APP extends the online course from the PC side to the mobile phone side. This not only broadens the horizons of teachers and students, but also lowers the threshold for education and is conducive to achieving educational fairness. In recent years, on the one hand, online course APP are developing at a high speed, such as the Chinese University MOOC, NetEase Open Class, Tencent Classroom and so on. On the other hand, however, the public welfare of the online course APP is gradually weakened, and the problems of unevenness and homogenization are becoming more and more prominent. At present, for the online course APP has not established a recognized evaluation index system. So how to guarantee the quality of online course APP and provide users with reasonable choice basis is an urgent problem to be solved.

2. The construction of the evaluation index system

On the basis of literature analysis, combined with the characteristics of online course APP, then preliminary evaluates various evaluation indexes, the use of “back-to-back” consultation is proposed. At the next step, extensive consultation with experts is evaluated, and then screens indexes and uses the analytic hierarchy process to calculate the weight of the indexes to form an evaluation index system for the online course APP.

2.1. Determination of evaluation indexes

2.1.1. The consultations process

This study carried out two rounds of expert consultations. In the first round, the background, the purpose and the initial evaluation indexes of online course APP evaluation research were provided to experts, according to this, experts can score the approval degree of various indexes and put forward suggestions for modification. moreover, experts were invited to make self-evaluation on the influence of the judgment basis and the familiarity with the contents of the letter. In the second round, the analysis of the data was summarized, at the same time based on the statistical results and

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the revised suggestion, the correspondence forms of the second round were prepared, the Table contained the statistical results of expert reference of correspondence in the first round, at the same time, experts were invited again to rate the agreement degree of each index after screening. After the two rounds of experts' consultations, the expert opinions tend to be consistent and reliable, thus determining the evaluation indexes of the online course APP.

2.1.2. Data analysis

(a) The positive coefficient of the expert is measured by the recall rate (R)of the correspondence forms, where $R = n/\mathrm{N}$ (n represents the number of copies of the correspondence forms recovered from experts, N indicates the total number of copies of the correspondence forms). According to the purpose of online course APP evaluation research, postgraduate tutors of educational technology (14 people), educational software company technical staff (8 people), modern curriculum and pedagogy scholars (6 people) are invited to form a group of experts. Two rounds of experts' consultations issued 28 copies of the letter and 28 copies are recovered, the recall rate is 100%. This indicates that the experts are very concerned about this research and the enthusiasm for participation is high.

(b) The authority of experts(C_r) is determined by their judgment basis (C_α)and their familiarity with the contents of the letter(C_s), where $C_r = (C_\alpha + C_s)/2$. Experts usually take “practical experience” (0.5, 0.4, 0.3 according to the degree of influence, respectively), “theoretical analysis” (0.3, 0.2, 0.1), “reference to domestic and foreign data or understanding from peers” (0.1), “intuitive feeling” (0.1) as the judgment basis, besides, the range of C_α is $0.6 \leq C_\alpha \leq 1$. In this study, the experts' familiarity with the content of the letter consultations is divided into five grades: “very familiar”, “familiar”, “general”, “unfamiliar” and “very unfamiliar”, and the corresponding values were 1, 0.75, 0.5, 0.25 and 0, respectively. According to the statistics, the average authority of the experts is 0.78, which indicates that the authority of the experts is relatively high, and the result of the correspondence consultation is of high reference value.

(c) The concentration degree of expert opinions is reflected from the mean (M_j), full mark frequency (K_j) and coefficient of variation (V_j) of each index. Where $M_j = \sum_{i=1}^{m} C_{ij}$ (m_j denotes the number of experts scoring the indexes and C_{ij} denotes the exact score). And $K_j = \mathrm{m}_j{}' / \mathrm{m}_j$ ($\mathrm{m}_j{}'$indicates the number of experts who give full marks to the j index), the larger M_j and K_j, the more important the corresponding j index is. $V_j = \delta_j / M_j$ (δ_j denotes the standard deviation of the j index), the smaller the V_j, the better the experts' coordination of the index j will be. In this study, a five-point Likert scale was used, and experts were asked to rate the degree of identification of the indexes, namely “totally agree (5)”, “agree (4)”, “average (3)”, “disagree (2)” and “totally disagree (1)”. After two rounds of expert consultation, the mean of each index is greater than 3.5, the full score frequency is greater than 0.2, and the coefficient of variation is less than 0.2, which indicates that the concentration degree of expert opinions is relatively high, and the opinions tend to be consistent.

(d) The coordination coefficient of expert opinions (W) reflects the coordination degree of all experts to all indexes. Where $0 \leq W \leq 1$, the greater the W, the higher the degree of coordination. In this study, the coordination coefficient W of expert correspondence consultation was 0.596 ($df = 35, \chi^2 = 583.790, P < 0.05$) in the first round. The coordination coefficient of the second round of expert correspondence consultation was slightly higher than that of the first round, and the W of

the second round was 0.787 ($df=36, \chi^2=793.356, P<0.05$). The χ^2 test values and P value of the coordination coefficient of the two rounds were all less than 0.05, indicating that the coordination coefficient was significantly consistent after the test, that is, the coordination of expert suggestions was good and the results were accepTable under the 95% confidence.

2.1.3. Screening indexes

In this study, the threshold method was used to screen the indexes. Specifically, if the score of " M threshold = M mean - M standard deviation " is higher than the threshold, then the corresponding indexes can be include in the study; Those indexes whose score of "K threshold = K mean - K standard deviation" were higher than the threshold were selected; and those indexes whose score of "V threshold = V mean + V standard deviation" were lower than the threshold were selected. In the above measurement scale (mean, full mark frequency and coefficient of variation), the indexes with three unsatisfactory boundary values were removed and if one or two boundary values do not meet the requirements, they shall be subject to the principles of scientificity, comprehensiveness and feasibility to decide whether to remove the corresponding index. According to the results of the letter consultation and taking the suggestion of experts into full consideration, the initial evaluation indexes were adjusted, and the final evaluation indexes of online course APP were determined to include 4 first-level indexes, 14 second-level indexes and 37 third-level indexes.

2.2. Calculation of index weight

2.2.1. Hierarchy establishment

The evaluation index determined by Delphi method is regarded as a structural model of hierarchical analysis. Under this structural model, the complex problem (evaluation index system of online course APP) is decomposed into several elements (indexes). These elements form different levels (levels of indexes) according to their attributes. Elements of the same level, as criteria, play a dominant role in some elements of the next level, and at the same time, it is dominated by elements of the previous level.

2.2.2. Judgment matrix construction

The above first-level indexes are taken as the judgment criteria, and pair-wise comparison is made for the indexes of the next level according to the scale from 1 to 9 (if the ratio of the importance of i element to j element is a_{ij}, then the ratio of the importance of i element to j element is $=a_{ji}=1/a_{ij}$), and the judgment matrix is constructed as $A=1/^{(a_{ij})_{n\times n}}$ where $a_{ij}>0, a_{ji}=1/a_{ij}$.

2.2.3. Relative weights calculation

Geometric average is adopted for each column vector of A, and then normalized to obtain weight vector:

$$W_i=\frac{(\prod_{j=1}^{n}a_{ij})^{1/n}}{\sum_{x=1}^{n}(\prod_{j=1}^{n}a_{xj})^{1/n}} \qquad i=1,2,\ldots,n$$

In order to ensure the reliability of the judgment matrix, the consistency of the judgment matrix needs to be tested. First, the largest characteristic root of the matrix $\lambda_{\max}$ is calculated, where $\lambda_{\max}$

$= \frac{1}{n}\sum_{i=1}^{n}\frac{(Aw)_i}{w_i}$ and $(A_w)_i$ represents the i th component of the vector; Secondly, the consistency index $C.I.$ is calculated, where $C.I. = \frac{\lambda_{\max} - n}{n-1}$. Thirdly, the consistency ratio $C.R.$ is calculated, where $C.R. = \frac{C.I.}{R.I.}$, $R.I.$ represents the average random consistency index, whose value can be determined by searching the Table. When $C.R. = 0$, it reflects complete consistency; when $C.R. < 0.1$, it reflects satisfactory consistency; when $C.R. \geq 0.1$, it means the result does not meet the consistency requirement, so the judgment matrix needs to be adjusted.

In this study, stratified sampling method was adopted, and 14 experts were selected from 28 experts participating in the Delphi method to fill in the questionnaire on the weight of online course APP evaluation index. After calculation, all judgment matrices $C.R.$ are less than 0.1, and the weight of each index is shown in Table 1.

Table 1. APP Evaluation Index system of online Curriculum

first-level index	secondary index	three-level index	index description
Educational nature (0.44)	Curriculum resources (0.75)	Authority (0.46)	The teacher has high popularity, great influence and clear source of curriculum resources
		Richness (0.43)	There are a wide range of courses, involving different classes and disciplines
		Refresh rate (0.11)	Timely updating of curriculum resources
	Course service(0.25)	Course reminder(0.09)	Timely delivery of course notifications to learners by e-mail or telephone text messages, etc
		Learning style (0.41)	Offer a variety of ways (live courses, broadcast courses, “live + broadcast” courses) for learners to choose from
		Process record (0.23)	Be able to record learners' learning time, learning progress and learning testing, etc
		Course push (0.09)	According to big data's user behavior analysis system, learners are accurately pushed for courses that they may be interested in
		Free/ Paid (0.18)	Tips for free or paid courses are clear, and fees are in line with the level of mass consumption
Functionality(0.30)	Communicate and share (0.20)	Interactive communication(0.24)	Allow learners to initiate a dialogue between themselves on a discussion topic, be it thumb up or mutual review
		Answering questions at time (0.44)	Teachers can answer students' questions online in real time
		Resource sharing (0.32)	Support resource upload and download to promote resource recycling and circulation
	Evaluation feedback (0.20)	Learning detection(0.48)	A test of the learner's learning outcome to enable them to grasp their own learning situation
		Reward system (0.25)	Have appropriate incentives to improve learners' external motivation
		Content evaluation (0.17)	Allow evaluation of curriculum and instruction to facilitate curriculum and instruction redesign
		Data feedback (0.10)	Teachers are provided with scientific and timely teaching feedback by data analysis
	Learning management (0.60)	Learning time (0.48)	The course learning plan is provided to facilitate learners to arrange their study time independently
		Course selection (0.37)	It provides scientific course classification and comprehensive course information, which is easy to retrieve and helpful for learners to make effective decisions
		Course management (0.15)	Easily achieve the course to add, delete, classification and other operations
Ease of	Interface	Reasonable	Simple interface, strong guidance, in line with the use of learner habits

use(0.16)	(0.16)	layout (0.58)	
		Tonal and consistent(0.27)	Color scheme with appropriate levels of light and shade
		The graphic image(0.15)	Icon meaning clear, composition can touch the elements intuitive and easy to trigger
	Navigation (0.10)	Easy to identify(0.60)	Navigation is easy to recognize, and the links section shows the difference between browsed and unbrowsed
		Easy to operate (0.40)	Using spatial navigation instead of hierarchical navigation, any location can be easily returned
	Interaction(0.25)	Accuracy (0.71)	The operation can get accurate feedback
		Timeliness (0.29)	The operation can get timely feedback
	Medium (0.37)	A variety of forms(0.25)	Use multiple media to present content and avoid monotonous and boring forms
		Use appropriate(0.75)	According to the different content, choice reasonable media to achieves the best presentation effect
	Advertisement(0.04)	Advertising (1.00)	The APP does not carry spam ads
	The user manual (0.08)	Integrity (1.00)	Provide detailed APP product description and user guide to learners
Reliability(0.10)	The safe and sTable (0.23)	Link security (0.59)	Links do not have a virus, will not be a malicious attack
		Running stability(0.22)	The operation of the APP is smooth and there is no technical fault such as link interruption or error
		High concurrent access (0.19)	APP can support a large number of users simultaneously online access
	Privacy protection(0.65)	Identification (0.25)	With account binding function (such as entering mobile phone verification code to log in)
		Information confidential (0.75)	Keep the information of learners confidential and do not disclose personal privacy
	Configuration requirements(0. 12)	Memory footprint(0.29)	Small memory footprint, will not affect the normal operation of the device
		Scalability (0.15)	Support multi-terminal browsing, adapt to mobile, fragmented learning needs
		Compatibility (0.56)	Able to install and use the same machine with other common apps

3. Conclusion

This paper builds the evaluation index system of online courses APP to meet the principle of the good learning experience of learners, the integrated use of Delphi method and analytic hierarchy process (AHP) illustrates the online courses APP on the educational, functionality, ease of use and reliability of quantitative evaluation process. The system provides theoretical basis for the learners to choose the right APP, moreover, it can provide certain reference to the optimization of the APP itself. Online courses construction is a dynamic development process, therefore, the evaluation index system of online courses APP should make the corresponding adjustment according to the online course construction, so as to guide the online course for the better development. It is hoped that scholars will do more exploration and research in this field, and provide more feasible schemes for the evaluation and optimization of online course APP.

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