

Research on Quantitative Index of MOOC Quality Based on Data

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Abstract. With the rapid development of MOOC, how to evaluate the effectiveness of the curriculum has gradually become the focus of attention of educational scholars. Based on the data provided by Icourse, this paper explores a set of quantitative index system for evaluating the quality of MOOC from two aspects of curriculum content and teaching effect by combining data analysis and theoretical research. We compare and analyze the index data of 20 boutique MOOCs, summarize the construction experience of these courses, propose suggestions for curriculum construction improvement, and promote the development of MOOC.

Keywords: MOOC; Curriculum quality; Quantitative indicators; Data analysis.

1. Introduction

MOOC (massive open online courses), which is a new product of the education industry in the context of the Internet era. Since 2012, MOOC has attracted many institutions and educational institutions to participate in the construction of the platform with its novel teaching methods, great practical value and revolutionary educational significance. Take Icourse as an example, as of April 2018, the platform has 201 cooperative universities and educational institutions, and opened 1,462 courses involving various subjects.

A large number of curriculum resources have challenged MOOC education researchers while promoting the development of MOOC. One of the challenges is how to guide learners to choose a course. When the learner chooses a course, it is difficult to make choices in the face of many courses recommended by the platform. Another challenge is how to guide the curriculum. For many teachers, there is no experience in making online courses. Some teachers only recorded the lectures in the offline classroom and screened them online. Whether these courses are suitable for students to study online, they are not clear.

In order to meet these two challenges, we need to establish a comprehensive evaluation system to evaluate the curriculum. By analyzing the MOOC evolution process, Cathy Sandeen pointed out that an effective evaluation of the MOOC course can better benefit students [1]. In order to make the evaluation results more persuasive, this paper does not use the traditional online teaching platform to evaluate the standard compilation system, but to analyze the objective data, select the basic indicators with value, and integrate a number of basic indicators to construct new indicators to evaluate the curriculum.

2. Related Work

With the development of MOOC, many scholars have researched on the evaluation of MOOC quality and proposed a corresponding evaluation system. Yusuf et al. moved the evaluation norms of online courses to the MOOC field, and built a set of MOOC design quality assurance standards based on the survey of learners and professionals [2]. Based on the practical considerations of MOOC, Margaryan et al. analyzed the quality of teaching using the Merrill's primary teaching principles for the 76 open MOOC courses [3]. Lin used fuzzy AHP to evaluate the quality of online course websites [4]. Han Xibin et al. compared and analyzed the MOOC platform and the typical network teaching platform at home and abroad, and supplemented and optimized the system technical characteristics of the Edu-tools evaluation system, and then built a new evaluation system [5]. Because the research perspective and the focus of attention are different, the evaluation framework formed is very

inconsistent, but few scholars use the data analysis as the basis to extract the curriculum evaluation indicators through objective data.

Based on data analysis, this paper combines MOOC course teaching theory and comprehensive basic course evaluation indicators, and hoping to put forward more representative indicators. These indicators can help learners choose courses that suit their learning characteristics, and also provide some guidance for improving curriculum construction.

3. Evaluation Index

The evaluation index system proposed in this paper is divided into two parts: basic indicators and comprehensive indicators. The basic indicators are derived from the statistics of the data, and the reflected content is relatively simple and direct. The comprehensive index is obtained from the basic indicator structure and can reflect some aspects of the course effect, which is a comprehensive evaluation.

3.1 Basic Indicator

(1) Course span

Because learners have a higher degree of freedom in online learning, learning continuity is easily interfered by various factors, so we recommend that teachers refine the course content to make it easier to complete the course. The average number of weeks of course in the 20 quality courses is 12.1 weeks, and the duration of the course does not exceed this value.

(2) Length of study

The length of study refers to the time that the instructor advises the learner to participate in the course every week. The length of study should not be too short to prevent the learning time from being too discretized. According to the length of study given by the 20 quality courses, the learner should spend about 3 hours in the course.

(3) Total duration of video

Total duration of video reflects the size of the course content. For a course, the knowledge structure covered by it requires a certain length of video to carry. At the same time, the volume of the course content is also an important manifestation of the time and energy invested by the course builder.

(4) Average video duration

The average video duration is the average length of all instructional videos published in the course, reflecting the extent to which the course content is fragmented. Philip J. Guo et al. pointed out that for the average video, the median time of the learner's input is no more than 6 minutes. If the video time exceeds 9 minutes, the median time of the learner's input will decrease [6]. Similarly, the Coursera platform recommends making short tutorials for 4 to 9 minutes [7]. The average length of video for the 20 courses studied generally exceeded this value.

(5) Number of tests and pass rate

The test is an important way for the learner to self-test, and it is also the main means for the teacher to understand the learner's learning effect. The test is too simple or too difficult to achieve the purpose of testing the learning level. Too many tests can easily make learners feel tired. Therefore, the number of tests, the difficulty and number of questions need to be carefully designed.

(6) Number of registered persons

MOOCs of different disciplines have large differences in the number of enrollments, which has a certain relationship with the knowledge covered in the curriculum. This indicator can reflect which content is a learning hotspot and which course is more attractive in similar courses.

(7) Number of real learners

Some learners are only interested in signing up for a course, but they don't have any learning behavior. Then, the number of registered people cannot reflect the true characteristics of the learner group. We define learners as real learners if they have viewing behavior or quiz behavior. The number of real learners is a portrayal of the effectiveness of the course.

(8) Rating and number of people

Learners can evaluate the course after the course, with a score between 0 and 5, reflecting the learner's preference for the course. The average score of the 20 courses was 4.73, the variance was 0.19, the average number of evaluations was 99.8, and the variance was 198.6. Obviously, both indicators have certain defects.

(9) Number of testers

Participation in the test is an important part of MOOC learning. The number of participants in the test can reflect the learning intensity of the current chapter.

(10) Rate of completion

Generally, the weighted sum of the learner's usual score and the final exam score is taken as the final score of the learner. If the pass is passed, the certificate of completion is obtained. The completion rate is an important manifestation of the course teaching results.

(11) Number of discussants

The activity level of the discussion area is an important manifestation of the learner's initiative, which in turn reflects the teacher's teaching skills, communication skills with the learners, and the level of energy invested in the teaching process. The Number of people involved in the discussion is an important indicator of activity.

3.2 Comprehensive Indicator

(1) Mean of video viewing ratio \tilde{C}

In MOOC, learners mainly acquire knowledge by watching course videos. In general, the more people watching the course video V_i and the longer it is, the more attractive the video content is. However, the number of video viewers and watch time is affected by the order in which the course videos are published and the length of the video. Between the course videos, there is generally a strict logical order in the knowledge content. The learners need to learn according to the video publishing order, which is an important reason for the number of video viewers to gradually decrease the trend characteristics with the increase of the video serial number. In order to eliminate the interference of video release order and video duration, we propose to capture the appeal of video by the proportion of video viewing completion. For video V_i , the viewing completion ratio is recorded as \tilde{V}_i , with $\tilde{V}_i = \frac{t_i}{l_i N_i^V}$, where t_i is the total length of video playback, l_i is the duration of the video, and N_i^V is the number of video viewers.

Similarly, we propose to use the average video viewing degree of the course to characterize the video content of the course. For course C , the mean value of the viewing completion is recorded as \tilde{C} , with $\tilde{C} = \frac{\sum_{i=1}^{n_v} \tilde{V}_i}{n_v}$, where n_v is the total number of videos. Thus, the viewing completion ratio and the average viewing ratio of different videos of the eight courses are calculated (Fig.1).

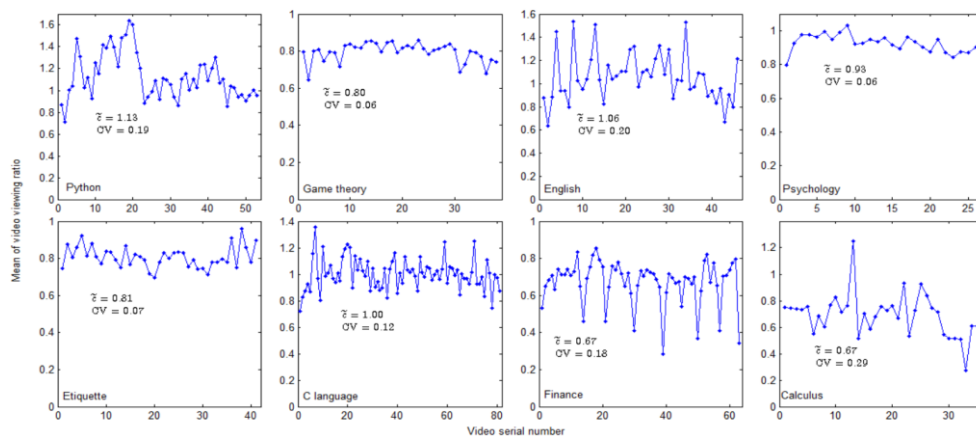


Fig. 1 Fluctuation and mean of the ratio of viewing completion of the course video

(2) Discrete degree CV

It can be seen from the figure that there are differences in the \bar{V}_i for different videos of the same course. In order to compare the stability of the attractiveness of video content between courses, we use the coefficient of variation CV to characterize the degree of dispersion of $\{\bar{V}_i\}$, with

$$CV = \sqrt{\frac{\sum_i^{n_v} (\bar{V}_i - \bar{\bar{C}})^2}{n_v \bar{\bar{C}}^2}} = \sqrt{\frac{\sum_i^{n_v} (\frac{\bar{V}_i}{\bar{\bar{C}}} - 1)^2}{n_v}}$$

It can be seen that the video content of the courses such as "game theory" and "psychology" is relatively stable, while the video content of "English" and "calculus" courses fluctuate greatly.

In addition, we found that the average watch completion percentage of the course video was inversely related to the average length of the course video (Fig.2). In fact, the time for human concentration is limited, and long videos are difficult to attract learners' attention from beginning to end. This inspires the MOOC course creators to further decompose the knowledge and shorten the duration of the video to make it easier for learners to watch the study. If the length of the long video cannot be shortened, you should pay attention to its content arrangement and increase the interest.

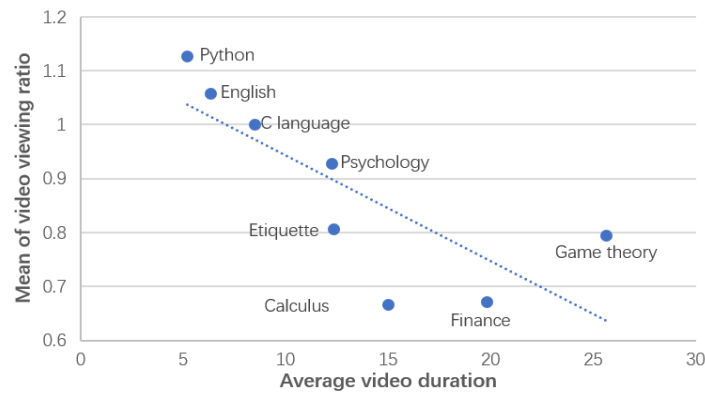


Fig. 2 Trend between average video duration and Mean of video viewing ratio

(3) H -index

The H -index was proposed by physicist Jorge Hirsch of the University of California, USA, to assess a mixture of academic output and academic output levels. The H -index of a researcher is h , which means that the number of citations of h papers published in the H_p papers is no less than h times, and the number of papers with more than $h + 1$ citations is less than $h + 1$. Drawing on this mixed quantitative thinking, we propose an H -index that portrays the appeal of MOOC course videos. For course C , the H -index of the video appeal is the value h means that the learner who has $h\%$ has less than $h\%$ of the course video content, and the learner who watches the content exceeds the course video content $(h + 1)\%$. The ratio is lower than $(h + 1)\%$.

For the MOOC course, we use the total number of course videos and the number of videos watched by the learners to indicate the course video content and the learner's content. Calculating the H -index of the eight-door data, as shown in Figure 3, it can be seen that the H -index of the courses such as "Python language programming" and "modern etiquette" is higher, indicating that the video is more attractive.

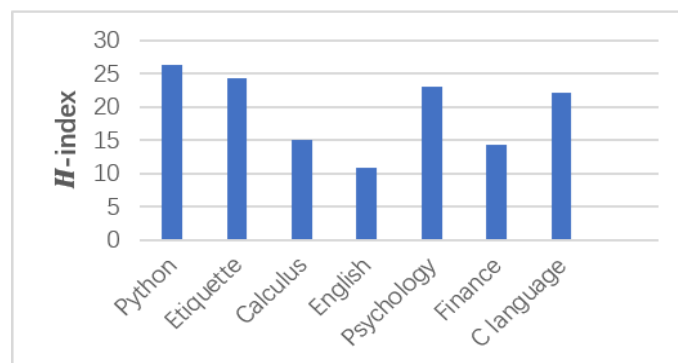


Fig. 3 H -index value for some courses

(4) Learner evaluation \tilde{E}

In the basic indicators, we introduced that a single score indicator does not reflect the difference in learner evaluation of the curriculum. Therefore, we comprehensively score and evaluate the number of indicators to construct a new learner evaluation index \tilde{E} . The specific construction formula is $\tilde{E} = \tilde{S}^2 \cdot \lg(\tilde{N})$, where \tilde{S} is scored and \tilde{N} is the number of evaluators. In this way, the learner's evaluation is related to the number of evaluations. The more the number of evaluations, the wider the scope of the curriculum, and the higher the \tilde{E} .

4. Summary

This paper uses data analysis to propose an index system for evaluating the quality of MOOC courses from the aspects of curriculum content and teaching effects. We provide course builders with suggestions for teaching improvement by comparing indicator data.

The quantitative index system proposed in this paper has the following three advantages. The first point is simple and fast. The calculation of quantitative indicators is very convenient. For any MOOC, the relevant indicator values can be calculated after inputting the data. There is no need to issue a questionnaire and no expert review is required. The second point is real-time. Since the MOOC platform stores the learner behavior data and the course attribute data in real time, it can be directly exported to help the teacher understand the current teaching state and discover problems in time, and does not have to wait for the course to end. Third, the statistical characteristics guide the course construction. By calculating the indicators of excellent MOOC, we can summarize the curriculum construction experience, and then give the course builders corresponding improvement suggestions.

The indicator system proposed in this paper is different from the previous course quality evaluation system, and does not give the course a comprehensive score, nor is it to grade the course. We hope that these explorations will give some guidance to learners when they choose courses, help MOOC build teams to build courses, improve the quality of courses, and promote the globalization of education and the globalization of resources.

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