Quality assessment of the internet portal academic unit of the higher educational establishment with the help of the fuzzy set

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Abstract. The article focuses on the importance of education. Education is presented as an educational service regardless of the type and method of receipt. The components of the educational service are indicated as a combination of the educational component, the managerial component and the financial and economic component of the educational institution. A scheme describing the complexity of decision making by the consumer of educational services is presented. It concerns the need to expand positions in the Internet space of the higher educational institution. The components are listed and a diagram is presented containing a list of the necessary components that make up the Internet portal of a higher education institution. The approaches to the evaluation are given, the choice of the apparatus of fuzzy sets is justified, which allows one to evaluate indicators of a different nature in one numerical scale. A system of indicators has been proposed, the value of which is most significant for the consumer of educational services, but cannot be independently assessed due to the complexity of the task. The approaches to assessing the quality indicators of the educational unit of the Internet portal of the educational organization, as a tool to enhance competitiveness in the market of educational services, are considered. The choice of the type of the membership function was determined and an approach was proposed for obtaining estimated values of indicators affecting the quality of the educational unit of the Internet portal of a different nature in a single numerical scale.

1. Introduction

The significant role of education in Russia is legislatively enshrined in the National Doctrine of Education of the Russian Federation until 2025, in the Law of the Russian Federation “On Education” and the Federal Law “On Higher Education on Postgraduate Professional Education”. Let us consider education regardless of the type and form of obtaining (secondary vocational, higher, full-time education, correspondence, etc.) as an educational service rendered by the school. We define an educational service as an aggregate of the educational component, the managerial component and the financial and economic component of an educational institution, determined to meet the needs of consumers of educational services (obtaining a profession, advanced training, retraining, etc.).

2. The need for evaluation

The institution of higher education functions in the conditions of tough competition in the educational services market. The market of educational services has its own specifics, namely, a feature of educational services is that the consumer of educational services is actively involved in the process of receiving the service. Educational institutions enter the market, on the one hand, as producers of educational services in accordance with the requirements of legislation, competencies, labor market requirements, and on the other hand, as consumers of the workforce in terms of management and people directly involved in the educational process. It should be noted that students, on the one hand, are consumers of educational services, and, on the other hand, they are the result of the educational process, i.e., a product that determines the quality of the educational
process. Educational institutions, as participants in the educational services market, enter into market relations with other participants for the interaction of educational services, thus, there is competition. The product in this market is an educational service of an educational institution or vocational school, presented in the form of educational materials, tests, various programs, as well as graduates, as a result of various educational services. In addition, the market for educational services is a combination of consumer choice of a profile and type of an educational institution and the right of all citizens to receive vocational education on a competitive basis, as well as retraining and advanced training initiated by employers, employment services and their own initiative.

It should be borne in mind that the consumer of educational services, when choosing an educational service, is forced to make a decision based on the variety of alternatives provided (Figure 1). The consumer of educational services makes a decision on the choice of an educational institution, interacting with the educational market, the labor market, communicating with other consumers of educational services, determining the choice between the type of educational service, method of obtaining, security (in the form of educational content), availability of control, the ability to change educational trajectories, the presence of a way to communicate with teachers, etc. [1-5].

Educational services market

Consumers of educational services

Labor market

Type of educational services

Consumers of educational services

Monitoring the receipt of educational services

The method of obtaining educational services

Providing educational services

Building a trajectory of educational services

Fig. 1. Characteristics of the position of the consumer of educational services when deciding on the choice of an educational institution

The above emphasizes once again that the competition in the market of educational services in the field of vocational education is quite high, since related services are offered by various actors - educational institutions - and consumed by different actors - legal entities and individuals. The demand, offers and requirements for the quality of educational services on the market determine the level of competitiveness of the market educational environment. An educational institution determines its position in the educational services market with its proposals, monitors an assessment of the level of competitiveness of the environment in which it is to act, and also re-evaluates this situation in the future. The consumer of educational services also assesses the quality of the educational services provided (in various ways), primarily using information and communication technologies [6-7]. Accordingly, the university needs to identify itself in the Internet space, apply the latest methods of attracting the target audience, perform continuous monitoring of the quality of the content of the Internet portal, take into account the needs of the consumer of educational services. Figure 2 offers a fragment of the structural scheme of the Internet portal of a higher educational institution, containing components, in accordance with the requirements of today.
3. Evaluation Methodology

The Internet portal of the university, containing verified educational materials, a block of tests, free video lectures, proposals on various types of education, will improve the competitiveness of higher education institutions. This paper proposes a method of site evaluation (in particular, an Internet portal) from the training side (let us call it the learning block) and focuses on the following quality indicators of the site learning block (KS), which, from our point of view, are more significant:

\[ KS = \{PN, PY, VZS, PPO, PT, PEJ\} \]  

where PN is a normative indicator characterizing the compliance of the content of the site with state standards and regulations of the university (law on consumer protection, the charter of an educational institution of higher education, the presence of a license for educational activities, standards of directions according to which training, curricula and work programs are carried out in accordance with accepted competences);

PY is an indicator of the quality of an educational-methodical complex, which determines the quality of the materials included in the educational-methodical complex (textbooks, teaching aids, methodological recommendations for laboratory, practical classes, implementation of test, term papers, projects, degree projects);

VZS is an indicator of the quality of the speed of loading pages on the site;

PPO is an indicator of the availability of software, which includes the characteristics of the site according to the time of execution of transactions, a list of software products, in accordance with academic disciplines and courses. Each educational institution is obliged to use software products only with a license. For distance learning, it is especially important to use computers with the necessary bandwidth of data transmission channels;

PT is an indicator of the quality of tests used in training in the discipline under study (preliminary, intermediate, final);

PD is an indicator of the quality of accessibility of online teachers (availability of technical means to communicate with students in order to answer the questions received);

PEJ is an indicator of the quality of availability and maintenance of an electronic dean's system, which allows you to track student’s work schedule.

The description of the indicators clarifies that they are all of different nature, both qualitative and quantitative [8-11].

To obtain the value of the quality indicator of the site learning block (KS) in a numerical representation, we apply the apparatus of the theory of blurry sets, which allows us to estimate indicators of a different nature in a single numerical scale. In the theory of fuzzy (fuzzy) sets, there are no requirements for the appearance of
the membership function, except for the interval [0,1], to which the values of the membership function should belong.

Proceeding from this, we propose the following approach for estimating the indicator PN (indicator of normativity). In our opinion, the existing classes of membership functions (triangular, trapezoidal, s-shaped, z-shaped, etc.) are not quite acceptable, since the indicator is very specific. Namely, the basic set $X = \{\text{the law on consumer protection, the charter of an educational institution of higher education, the license to carry out educational activities, standards}\}$ is discrete and of course, all components of the basic set are necessary to determine the direction for the development of all activities of a higher educational institution. The indicator is legislative, but due to the continuous change in the direction of development of higher education (the next generation generation of education standards, respectively, changes in curricula, work programs, etc.) may not always correspond to the required value 1. Therefore, we consider that the membership function (PN) fuzzy set "good value" for the indicator PN may have the following form:

$$
\mu(PN) = \frac{\sum_{i=1}^{n} x_i}{n},
$$

(2)

where $x_i$ is an element of the base set X, only 0 (one-to-one absence), or 1 (full correspondence) can take on value; $n$ is the number of elements of the base set X.

For other indicators, for example, an assessment of the PY indicator (an indicator of the quality of an educational and methodological complex), which in turn is also complex and depends on the set of values of the indicators included in its composition (indicators of the quality of teaching and methodological manuals, guidelines for classes, etc.), suggests the following approach.

Let us suppose that you need to assess the quality of the textbook, which is extremely difficult, since assessing the quality of the textbook, making a verdict: “low quality”, “medium quality”, “high quality” is a serious task. Compliance with the discipline, volume of the presented material, timeliness, completeness and accessibility of the material, examples given, graphic material, etc., all this suggests that experts should make an opinion on this issue (individuals who can make a verdict on a given subject area) from among the staff of the department, or a group of experts appointed by the leadership of the higher educational institution. After receiving the opinions of experts in this paper, it is proposed to use the following analytical relationship.

Suppose there is a basic set of benefits $P=\{p_1, \ldots, p_n\}$, it is required to obtain an estimate in the numerical representation, the belonging to the fuzzy set A is “good quality of benefits”, using the opinions of k experts [5-8], obtained in numerical representation, functions $\eta(p)$.accessories. We propose to determine by the formula 3 an indicator of the quality of the textbook (KYP):

$$
KYP(p_j) = 1 - \prod_{j=1}^{k} (1 - \eta_{ij}),
$$

(3)

where $i$ is the index of the estimated benefit; $j$ is the index of the next expert.

In the process of online learning, situations arise that require intensive work with the site, for example, getting a page with a task, getting answers to asked questions, getting explanations of answers, etc., in this case VZS (quality indicator of the speed of loading pages) becomes significant. When approaching the assessment of the VZS indicator, it becomes clear that the base set is a numeric set and can be set to $S = [0.01..5]$ s, where the time from 0.01 s to 1.5 s can be considered a “good time” for the page to open. As an analytical representation of the membership function, we propose the following dependence:

$$
Z = \begin{cases} 
1, & 0.01 \leq t \leq a1 \\
\frac{a2-t}{a2-a1}, & a1 \leq ta2 \\
0, & t \geq a2 
\end{cases}
$$

(4)

$$
Z=\{1, 0.01\leq t<0.05
$$
where \( t \in S \), \( t \) is the opening time of the page; \( a_1 \), \( a_2 \) are the values determined by an expert. For the rest of the indicators included in the KS indicator (quality of the site learning block), a similar approach can be applied or existing membership functions are used [1,3].

4. Conclusion
In this work, some indicators are highlighted that affect the quality of the training unit that is part of the website (Internet portal) of a higher educational institution, and some approaches have been proposed to develop a system for evaluating the quality of the training unit using the fuzzy sets, which will increase the level of competitiveness of higher education institutions in the market of educational services.

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