

# Methodology of Digital Search of Target Audience and Data Analysis for Distance Learning Quality Assessment

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**Abstract:** In the study, the authors raise the problem of distance and online learning quality assessment as a new format of interaction of target audience of the educational process. The authors believe that a solution to the problem is to be found in in-depth analysis of distance learning indicators that could be generated from the higher educational environment in the form of an assessment of students' achievements and derived on the basis of analysis of messages from the relevant communities of the target audience. The authors propose a methodological approach of a digital search of target audience with further extraction of relevant messages to form a data sample. An integrated sample of subjective and objective data is used in analysis of comprehensive assessment of distance learning indicators through the application of the developed algorithm, so it allows to assess the quality of the online educational services. Distance learning quality assessment allows to display the degree of compliance of the achieved educational results with the expectations of students and professors, social needs and regulatory requirements. In this study quality assessment of distance learning means quality assessment of educational activities organization in the format of online educational services.

## 1 INTRODUCTION


Distance and online learnings are the components of education system almost in every education institutions. Professor Orlova, Doctor of Science, Economics, thinks that it is impossible to detach from distance learning and its further development within the context of the everyday world is impossible without applying new methods (Orlova, 2013). She highlights the problems that exist in modern distance learning. In our view, the most important are the quality assessment of distance learning and the lack of methods for the effective implementation of distance learning.


Generally, quality assessment and methods of implementation of distance learning are based on an analysis of educational data from the internal environment of the education institution. This leads to a subjective assessment and does not always reflect true assessment of the qualitative and quantitative parameters of the content and organization of distance and online learning.

Therefore, the main problem of the study is determined. It is aimed to obtain an objective quality assessment of distance learning based on opinions and judgments that are shared in social networks and other online communities. For this purpose, it is necessary to determine a methodological approach of a digital search of target audience, whose opinion will be perceived as expert one in quality assessment of distance learning.

The importance of the topic is dictated by several factors, including theoretical, methodological and practical ones. Firstly, these are the transformation processes of education. The main form changes, it is a global transition to distance and online learning (Hodges, 2020). Secondly, the burning issue of modern society is reduction of the social distance and the level of social tension. Numerous factors act on this problematic background, from the economic and financial field to the issues of culture and education (Akhmadullin, 2020). The optimal organization of the education system definitely contributes to the normalization of this aspect of social reality. Third, strengthening of the transition due to COVID-19.

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Fourth, the need for streamlining processes of distance and online learning based on relevant and reliable data. Nowadays, the following tasks are becoming urgent:

- creation of an up-to-date and reliable base of judgments and assessments of distance and online learning,
- creation of a database automation for making informed decisions on the transformation of the education system

The presented study combines several areas of scientific problems that formed a single transdisciplinary concept.

The first direction is pedagogical. It represents researches aimed at identifying the advantages and disadvantages of distance and online learning, its methods and current forms. This topic was especially relevant during the COVID-19 pandemic (Favale, 2020), when there was a rapid transition from classic to distance and online education form (Surma, 2020). Some researchers mark the particular utilization efficiency of social networks (Gurjar, 2020), since they are able to promptly provide feedback in the educational process (Filius, 2019).

The second direction is associated with an active discussion in the sciences of distance learning procedure, its technology and tools, effective assistant tools (Stárková, 2019). It is important to note that many researchers express the need to use ICT tools in the educational process, and they make a strong evidence-based case to justify their choice. The wide use of ICT in the educational process has sharply raised the need to improve digital literacy of participants in the educational process. This field has not only educational roots but also social one, it is expected the need for mastering digital skills (Lowell, 2020). The need appears in society at the current stage of its development. In addition, it is believed that by using distance learning tools, in addition to digital skills, students obtain skills they need in the twenty-first century: teamwork, project management, various forms of communication (James, 2020). Some researchers mark that high level of information literacy will allow citizens to effectively address the challenges (García, 2017) inherent in modern society, in particular, form specialized virtual (communities) spaces (Lock, 2020) and function in them.

The third direction of developing is associated with the search for the necessary information and the formation of a relevant database. The purpose of the search is students' opinions, assessments and judgments regarding the transition to distance and online learning during the COVID-19 pandemic. Social media are the most effective feedback platforms (Lazonder, 2000). Thus, academia is in discussions with the information search algorithm

(Zheng, 2020) in the social network. Researchers consider and compare the features of various active search engines, develop original agent protocols and authorized social search systems, propose multicast routing algorithms for queries (Du, 2020) and neurocomputing applications for web-searching (Serrano, 2018), and conduct the analysis of the possibilities of visualization of its results (Rashid, 2016). Important topic of research and discussion in modern scientific discourse is the efficiency of social search (Chae, 2018) that is based on tracking the relevance of obtained data (Wang, 2020). Researchers pay great attention to the process of social search optimization: work is underway with query phrasing and search criteria (Sun, 2012), Metaheuristic learning algorithms (Kumar, 2020) are proposed to improve efficiency even in multi-element queries. In addition, semi-learning search engines and algorithms for their training (Yao, 2018), interactive information search systems (Calumby, 2016), intelligent and random (Serrano, 2020) search programs are in development.

Accordingly, the issue of developing a methodological approach to assess target audience opinions about distance learning is both theoretically and practically relevant. Due to the complexity and multidimensionality of the stated problem, the degree of its scrutiny seems to be rather low, it affects certain, scattered aspects of the topic. There are no examples of a complex and systematic study of this topic in scientific discourse.

In this context, we will consider in the study the description of the digital search methodology in target audience data sample for its later use in distance learning quality assessment. An algorithm based on the developed mathematical model will be proposed for the assessment.

## 2 METHODOLOGY OF THE STUDY

In this study, the target audience (TA) referred to university students and professors that are posting about the problems of higher education, online learning and learning in the face of pandemic.

The authors define the target audience search methodology as a general approach to the choice of methods and strategies of information search in relation to the relevant selection problem of the required data. For example, an information search request is focused on finding university professors, as part of the target audience, according to the following algorithm:

1) select a group of subscribers with last place of work in a university (institute, university, etc.);

2) in the obtained sample identify people that have teaching positions;

3) select those group subscriptions that are active and meet the following criteria:

- there are no prohibitions to comment on posts;
- one of the main directions of the group is the discussion of higher education problems;
- posts are associated with learning at university and/or learning in the face of pandemic.

Based on the presented algorithm, we propose to develop a target audience search methodology through a description of its criteria and stages of its implementation.

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The following methods were used to conduct the study:

- Selective method. It made it possible to identify the target audience that meets the informational search request. As a result of the application of this method, the target audience was selected. The problems of higher education, online learning and learning in the face of pandemic were actively discussed in their subscriptions.
- Intuitive method. It allowed to form a list of keywords that form the basis of the information request for the target audience search using abstract-logical analysis. Due to the application of this method, key search parameters (of posts) were identified, including a set of context: learning, distance, online, university, student, lecturer, bachelor, master, exam, credit, professor, associate professor, lecture, department, faculty, institute, classbook, schedule, dormitory, scholarship, coronavirus, COVID-19, quarantine, pandemic, etc. (as well as different variations of abbreviations and morphological forms of highlighted keywords)., Only relevant target audience subscriptions were selected using the indicated search parameters.
- Prescribed method. It allows to create search task model that can define the subscribers of social networks communities that meet the criteria for an information search request. As a brief summary, this method identifies the target audience. The search task model includes: target specific nature, duration, amount of research. Target specific nature of information search is determined by the target audience and

the criteria. Target audience search should be obvious and atomic. A search request model was created as a result of the application of this method. It allows to find the target audience meaning relevant subscribers.

- Inductive method of information search allows to form a certain pattern of keywords search. An array of keywords was determined as a result of application of this method. For example: online learning, distance learning, pandemic, etc., Specific for relevant subscriptions of social networks communities linguistic markers were formed.
- Deductive method of information search helped to identify communities that have target audience as subscribers and meet the criteria of the information search request. As a result of the application of this method, target audience posts were selected, that involve university education issues, both classical and in the face of pandemic one.

Thus, the main criteria of the target audience search methodology were determined including a description of the choice of methods and methods of the conducted research in relation to the task of the relevant selection of target audience posts.

The study identified quality assessment of distance learning as quality assessment of organization of educational activities in online environments. This assessment will be considered as an integral indicator of the objective data of the students (received educational activities) and subjective data that are based on the analysis of the target audience opinions and judgments that were conducted on the basis of the relevant messages of digital search.

An integral quality indicator characterizes distance learning (DL). This indicator cannot be simply derived and composed from the individual activity indicators that form it. The integral quality of DL is not found as the amount of its elements qualities, but is ranked as an integral amount:

$$q_i = \sum_{j=1}^m x'_{ij} H_j \quad (1)$$

where  $q_i$  is an integral assessment of the activity element  $i$ ;  $x'_{ij}$  is the value of the standard quality indicator (standard assessment) of the object  $i$  according to the indicator  $j$ ;  $H_j$  is a certain coefficient that depends on the degree of influence of each educational factor and thus is not subjective, but objective. This certain coefficient was obtained from statistical dependencies by the coefficient of significance of each characteristic at this stage of the functioning of the educational system;  $m$  is the

number of indicators for distance learning assessment.

The matrix of distance learning assessments can be represented as follows:

$$Q = \{q_{ij}; i = 1, M; j = 1, d^0\} \quad (2)$$

where  $q_{ij}$  is the integral assessment of the distance learning activity  $j$  of the educational cluster  $i$ ;  $d^0$  is the amount of educational elements in the educational cluster  $i$ ;  $M$  is the number of educational clusters.

General mathematical model of a comprehensive assessment of the distance learning quality indicators can be presented as follows:

$$Q(x') = \sum_{i=1}^n \left( \sum_{j=1}^m \frac{k_j}{K} \ln \left( \frac{K}{k_j} \right) \right) x'_{ij} \quad (3)$$

where  $K$  is the total number of messages and educational results of the education subject ( $K = m$ );  $k_j$  is the number of favorable occurrence of event  $X$  (positive assessment or positive feedback on the distance learning system);  $x'_{ij}$  is the value of standard quality indicator;  $n$  is the number of relevant communities;  $m$  is the number of quality indicators.

The proposed model of distance learning quality indicators assessment can be used as the basis for an algorithm for conducting comprehensive assessment of the distance learning quality (Fig. 1). The developed algorithm includes a sequence of the following stages:

- to define the purpose of education quality assessment,
- to collect data in terms of the purpose,
- to calculate comprehensive assessment of the quality indicators based on the developed mathematical model of the distance learning integral indicators quality,
- to analyze the information to make educational process model based on both objective and subjective indicators.

Built on the basis of developed mathematical model the proposed algorithm for a comprehensive assessment of distance learning quality makes it possible to present in an integrated form the entire system of distance learning both in an individual educational institution and as a whole.

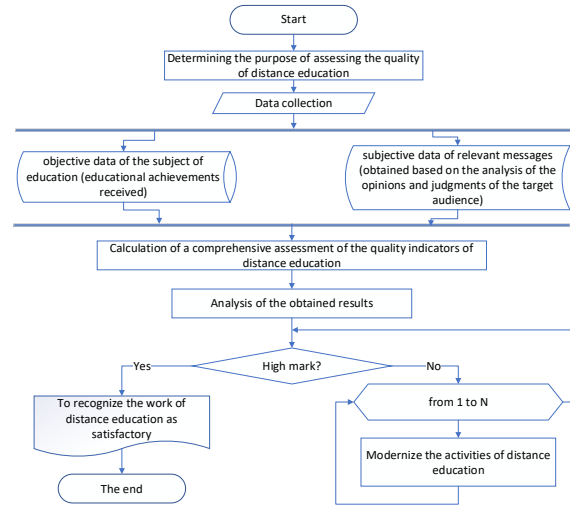


Figure 1: Algorithm for comprehensive assessment of distance learning quality.

### 3 RESULTS OF THE STUDY

17057 target audience messages were analyzed in the course of the study. The messages address problems of online learning and classic education that became distance in the face of pandemic. 2,731 teachers of various positions in universities were part of quantitative representation of target audience.

All found messages were divided into relevant, that is, relevant and irrelevant to educational topics. The number of relevant posts is different. In different regions and universities the problem of distance learning was discussed in different ways, especially when it was caused by the epidemiological situation in the country and the world.

Before moving to distance learning, students did not often bring up the topic of education in their communities. However, the analysis showed that this topic has become much more often discussed in the communities of both teachers and students with the forced massive transition to online learning.

The next block of analysis was the topic and tone of relevant messages. Data from these indicators are presented in Table 1. The topic of statements in messages are mainly related to organizational and methodological issues. In two of the three communities the share of such statements is 66-77%, 16% of which are negative messages and 84% are neutral. The second most relevant issue is the issue of living conditions. In two out of three communities the share of such statements is 13-18%, 3% of which are positive messages, 17% are negative and 80% are neutral. Socio-financial topic is in the third place among students. In two out of three communities the

share of such statements among relevant ones is 5-12%, 24% of which are negative messages and 76% are neutral. The next topic is technical support. The share of such statements among relevant in communities is 9%, 28% of which are negative and 72% are neutral. Students are concerned about well-being and other topics to a lesser degree.

Table 1: Topic and sentiment of relevant messages (example of three universities).

	University 1	University 2	University 3
Quantitative concept of topics			
Organizational and methodological issues	133	17	0
Technical support of educational process	18	0	0
Well-being and personal skills	15	1	0
Socio-financial issues	24	1	0
Living conditions	26	4	0
Other	1	0	0
Percentage of topics (percent)			
Organizational and methodological issues	0.662	0.773	0,500
Technical support of educational process	0.090	0.000	0,167
Well-being and personal skills	0.075	0.045	0.000
Socio-financial issues	0.119	0.045	0,333
Living conditions	0.129	0.182	0,083
Other	0.005	0.000	0.000
Tone of topics (positive/negative/neutral) (number)			
Organizational and methodological issues	0 / 112 / 21	0 / 14 / 3	0 / 0 / 0
Technical support of educational process	0 / 13 / 5	0 / 0 / 0	0 / 0 / 0
Well-being and personal skills	1 / 1 / 13	0 / 0 / 1	0 / 0 / 0
Socio-financial issues	0 / 18 / 6	0 / 1 / 0	0 / 0 / 0

Living conditions	1 / 21 / 4	0 / 3 / 1	0 / 0 / 0
Other	0 / 1 / 0	0 / 0 / 0	0 / 0 / 0

Table 2 shows examples of posts on various topics in relevant communities.

Table 2: Examples of messages.

Topics of relevant messages	Analytics of received messages
Organizational and methodological issues	<p>Most of the students faced the problem of lack of information on the educational process:</p> <ul style="list-style-type: none"> <li>▪ how thesis statement and state exam will be held,</li> <li>▪ how will they pass and retake tests and exams; practice and dates of the session;</li> <li>▪ how entrance exams will be held;</li> <li>▪ how will be the access to the university and return to full-time study realized.</li> </ul> <p>Students also discuss offers for canceling the state exam, a large amount of homework and technical support for distance learning (lack of a single service).</p> <p>There are posts with gratitudes to teachers that were able to teach their subjects in a high-quality way in the conditions of distance learning, but there are also complaints about teachers.</p> <p>Most of the students faced the problem of lack of information.</p> <p>Although there were messages from students that, in their opinion, online education has its advantages and is simpler than full-time mode of study.</p>
Technical support of educational process	<p>The topic of technical support comes up in the form of questions whether one need a webcam or one can use the front camera of phone in classes and exams.</p> <p>There are questions about the ways and forms of interaction with teachers.</p> <p>Questions of a technical nature are most often caused by problems with the electronic information education system:</p> <ul style="list-style-type: none"> <li>▪ how to use the system,</li> <li>▪ how to get login and password,</li> <li>▪ why information about the courses is not saved,</li> </ul>

	<ul style="list-style-type: none"> <li>▪ how to view previously passed information,</li> <li>▪ how to view missed lectures.</li> </ul>
Well-being and personal skills	Students discuss their self-isolation condition. There are posts that they do not understand online lectures, begin to miss the face-to-face communication with both coursemates and teachers.

In general, organizational messages are more specific to universities. The most publicized topic is the lack of clear information about the educational process, such as how to pass tests and exams, how to interact with teachers, how to change exam results, etc.

The analysis of the actions carried out by students in the e-learning system, and evaluated the attitude of students to the learning process to determine the level of their impact on the resulting learning effect.

Analysis and visualization of educational data (the presence of a clear learning goal or its absence, as well as the presence of a training plan or not, etc.) allowed to reflect the subjective initiative of students (Papamitsiou, 2015) and their educational behavior in the e-learning system, which contributed to the analysis of e-learning interference factors and increase its effectiveness (Fig. 2).

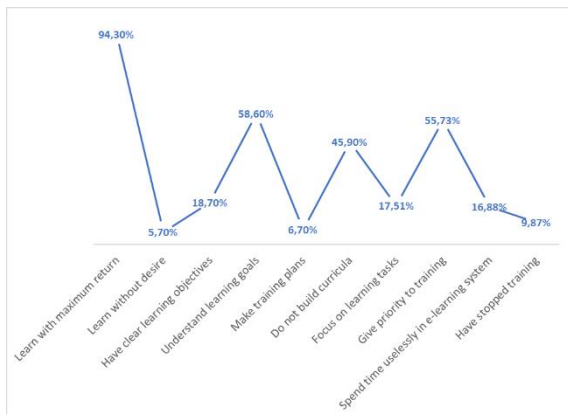


Figure 2: Analysis of attitudes to learning.

The analysis showed that about 94.3% of students believe that distant learning is beneficial for them. 18.7% have clear learning goals and 58.6% accept learning goals and understand the need for education. These indicators clearly demonstrate that among students there are those who have a clear idea of the final results of training. However, among the students there are those who do not pay attention to the process of studying educational materials: 45.9% - do not build the path of the educational route of the training plan, 16.88% - in the process of learning are engaged

in secondary matters. According to Fig.2, it can be concluded that effective learning using distant learning technologies requires specific goals, internal motivation, synchronous feedback and the ability of students to plan the educational process.

## 4 DISCUSSION OF THE RESULTS

The results obtained allow us to assert that the proposed methodology of digital search of the target audience and the analysis of the data obtained can be used to assess the quality of distance learning. The methodology includes a detailed algorithm for finding information. But at this stage, this algorithm has not been translated into a programming language. That is why the automation of the methodology of digital search and data analysis is the next step in the development of this topic.

In addition, a conceptual model for studying and evaluating the quality of the research object needs careful development. The article provides an example of using the digital search methodology in relation to distance education. It is quite clear that it is not possible to build a universal conceptual model. This is the task of each specific study, because the properties, characteristics, conditions and reasons for the functioning of an object can vary significantly. And there may also be completely different goals and objectives of a particular study.

## 4 CONCLUSIONS

Distance learning quality assessment is a major challenge that educational institutions face when the classic form of learning have been replaced by a distance and online learning. It allows to display the degree of compliance of the achieved educational results with the expectations of students and university professors, social needs and regulatory requirements. At the same time, distance learning quality assessment uses various indicators: from individual learning achievements assessment to judgments and opinions data identified in the analysis of target audience messages.

In the course of the study, there was an information search of indicators that are necessary for a comprehensive assessment. If individual learning achievements data are stored in an education institution, then it was necessary to formulate basic queries for subjective data so that the data sample

would be relevant for decision making in distance learning quality assessment.

Thus, in the course of the study, a methodology of digital search of target audience was determined including the choice of methods, methods and strategies for information search and the relevant selection of the required data. It made it possible to form a set of indicators that were later used for comprehensive quality assessment of distance learning.

An algorithm was used for distance learning quality assessment. This algorithm is based on the developed mathematical model of comprehensive assessment of integrated indicators of education subject objective data and subjective data that was integrated on the basis of target audience' opinions and judgments in terms of the digital searches for relevant messages.

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