



ELSEVIER



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

ScienceDirect

Procedia - Social and Behavioral Sciences 182 (2015) 566 – 573

Procedia  
Social and Behavioral Sciences

4th WORLD CONFERENCE ON EDUCATIONAL TECHNOLOGY RESEARCHES, WCETR-2014

## Assessment of Satisfaction with the Quality of Education: Customer Satisfaction Index

Natalia Yanova<sup>a\*</sup>

<sup>a</sup>*Faculty of Education and Psychology, Altai State University, pr.Lenina 61, Barnaul 6560049, Russia*

---

### Abstract

The paper discusses the questions of formalization about customer satisfaction index in empirical research and model building on the context of pedagogical qualimetrics, psychometrics and marketing of educational services to the feedback systems. Statement of the problem includes methodological, theoretical and instrumental-technological level analysis of model measurement techniques with illustrative examples of the experimental material due to monitoring of education service quality in the department for education.

© 2015 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of Academic World Research and Education Center.

*Keywords:* measurement, customer satisfaction index, expert test systems, modeling techniques, feedback.

---

### 1. Introduction

The analysis of approaches to Customer Satisfaction Index (CSI) formalization is justified by paradigms of education quality research from the perspective of economics, sociology, pedagogy, psychology and marketing. The article discusses the measurement of Customer Satisfaction Index in educational technology researches for analysis of satisfaction with the quality of education.

---

\* Natalia Yanova. Tel.: +7-903-910-9081;  
E-mail address: [yanova@sny-research.com](mailto:yanova@sny-research.com)

## 2. Purpose of applications in education

Customer satisfaction measurement in education is an important tool for the development of an independent evaluation of the education quality. As we know, the mission of public examination of education is the study of the subjective views of the people to translate the educational standards of quality in the results of educational institutions.

The CSI construct firmly entrenched in the paradigm of education and occupies a strong position in the mandatory public reporting of educational institutions (Demetriou, 2008). This index shows the extent to which the current level of quality education corresponds to the needs of consumers. CSI is a performance of analytical statistics in general and higher education (Zhang, Han, Gao, 2008). It is often used as a percentage value for the comparison of results obtained regardless of the approach to the measurement methods. Meanwhile, the models for calculating the CSI are the subject of scientific debate (Jiang& Jingyi, 2006; Huili, Jing, 2012).

Statement of the CSI measurement problem in the humanities (Andrich, 1999) is reduced to the meters. This approach is implemented through parametric description of a measuring object by means of indicators in compliance with the power of the homomorphism in the data structure through the choice of paradigms, tools and measurement procedures.

## 3. Analysis paradigms

In assessing the quality most often it comes to survey of public opinion as public confidence in the quality of education. But the sociology of mass survey captures only a quantitative assessment with primitive arithmetic of sample descriptive statistics. Even in the case of a representative sampling it only reflects the degree of public confidence to education that does not reveal the qualitative nature and causal relationships of such confidential assessment. Independent evaluation of the education quality research technology is not representative to technology of presidential elections on the entire population. Even on a national scale the "pros and cons" statistics or "average temperature in the hospital" calculation is an uninformative throwback. Education quality assessment is not a one-dimensional construct, retaining only the "level" of gradual evaluation. This is an experimental variable, which must satisfy the diagnostic ability and interpretive capacity for qualitative analysis. It is hardly necessary to study the "quality" only on the "quantity" of this quality, regardless of its nature.

Moreover, the "quality assessment" paradigm requires the criterion score, which requires the quality criterion. In an objective education quality assessment such a criterion is the norm of "objective" standards (e.g., for certification or accreditation) or "criteria regulatory framework» (e.g., for university rankings). Research design of the regulatory framework sheds light on the "formalization" of the origin of the "norm" for each criterion, and their ratio in the "total" calculation. Thus, in classical test theory to calculate the test score is used Gaussian function, and in non-classical (IRT) - Rasch model (Raykov, 2010). In the subjective assessment of quality education such an external "standard" is absent and there is only a "picture in the head" of the consumer. Subjective assessment is attributing of consumer attitudes to an objective standard of education quality. It's the results of the implementation of this standard in real activity. The result of such assessment is not the additive sum of the views but an emergent mental response (Strack & Deutsch, 2011).

The subject of CSI measurement is in the field of estimated relationship. It captures not the opinion of the respondent, but its attitude as latent variable (McDonald, 2011), the category of social and cognitive psychology. The theory of attitude's and their attributions measurement refers to the measurement of mental response and mental representations (Fauconnier&Turner, 2006). The questions of formalization are beyond the classical theory of measurement and statistical paradigm of multidimensional scaling. Although modern mathematical psychology offers solutions in the paradigm of nonlinear dynamics in the study of feedback, educational practice more often uses the experimental design of statistical methods for assessment.

## 4. Approaches to measurement

Economic approach measures the objective parameters that determine consumer cost of educational services. Sociological approach defines the regulatory requirements of society to the effective operation of the education

system in its social function. Pedagogical approach includes qualilogy (theory of education quality) and qualimetry (theory of measuring the quality of education). Psychological analysis uses psychometrics to study mental representation of education quality for consumers of educational services.

Customer Satisfaction Index is a multidimensional variable (Furr, 2011) and shouldn't be investigated as a one-dimensional quantity. Parametric structure of the CSI measurement includes subjective factors of mental evaluation of the content, the outcome and the educational process. In the model of experimental design they are presented by a specific indicative base. Indicators are normally given by an expert panel (experts of public examination). They reflect the interests of the various subjects of education and expert groups themselves. The problem of subjective evaluations measurement is updated so that the assessment indicators are not only a means of diagnosing the quality of education, but also a means of control to the educational policies.

Justification of the indicative unit measurement procedure for the CSI index formalization is regulated by model methodology. Most relevant in the empirical field are the methods based on the weighting indexes (coefficients). Such methods and techniques have been tested in various economic service sectors (Luo, Ratchford, Yang, 2013). They provide the ability to compare data from different studies into a single quantitative model.

Modeling techniques with "weighted coefficients" can be used to: identify target expectations of the education system; assess the level of customer satisfaction based on the factors that determine the quality of educational services; conduct a comparative analysis of CSI in different segments of education; conduct a cluster analysis of "indicative zones" to identify risks and to build ratings of educational institutions. Here is a typical example of the CSI index formalization on the municipal monitoring experimental material. We use a model of balanced assessment of indicators on 2 criteria: to assess the degree of their importance and satisfaction for the customer.

## 5. Measurement technology

Satisfaction coefficient is calculated by the formula:

$$CSI = \frac{\sum_{f=1}^n (S_f \cdot I_f)}{\sum_{f=1}^n (I_f)} \quad (1)$$

CSI - satisfaction coefficient, point;

$S_f$  - satisfaction average value by  $F_i$  factor, point;

$I_f$  - the average value of factor  $F_i$  importance, point;

$f$  - important to ensure the quality of educational services factor (from 1 to  $n$ ).

Points/percents transfer is calculated by the formula:

$$CSI(\%) = CSI \cdot 100\% / j \quad (2)$$

$j$  - maximum number of points on a measurement scale (e.g., 5, if 1 to 5 scale is used).

Average values for satisfaction and importance are defined:

$$S_f = \sum N S_{(t)} \cdot l / N, \quad t=1, \dots, j \quad (3)$$

$$I_f = \sum N I_{(t)} \cdot l / N, \quad t=1, \dots, j \quad (4)$$

$N(t)$  – the number of respondents who put  $t$  -point by  $f$ -factor (indicator) or sample size by the  $t$  – data array for the  $f$ -factor;  $N$  – sample size

Interpretation of the satisfaction coefficient value is performed by the statistical boundary of "test standards" for which the minimum threshold of satisfaction is not less than 68%.

Using weighted indexes in scale/points evaluation system is a fairly simple method of satisfaction index formalization. It is possible to use some other mathematical models to identify balanced weights for CSI indicators, used, for example, in the economic analysis of consumer assessment of commercial services (Duvuri, Gruca, 2010).

The main arguments in favor of the "weighted indexes" model are: availability for mass user, intuitive tools, statistical justification of conclusions, factors relevance verification, statistical principle of factors visual clustering and "risk zone" indicators identification (sample estimates indicator as an important, but unsatisfactory). These advantages ensure replicate of this technique for the user.

## 6. Measurement tools and statistics

Our general education system surveys monitoring (2007-2014) demonstrates the differences in the CSI statistics depending on the model of its calculation. Differences in modeling techniques are related to the formula for CSI calculation, the choice of measurement scale and the formulation of the question. The following table shows the CSI statistics, obtained in one sample (by type of educational institutions), but using various modeling techniques.

Table 1. CSI Statistics in measurement methods.

EDUCATION	Pre-school education		Secondary education		Further education	
TYPE OF INSTITUTION	Day nursery	Nursery school	School	Lyceum Gymnasium	Arts school	Sports school
Method 1	89,12	92,15	81,70	86,67	91,82	89,95
Method 2	<b>84,26</b>	<b>88,49</b>	<b>70,48</b>	<b>79,32</b>	<b>87,02</b>	<b>84,63</b>
<b>Weighted index</b>						
Method 3	89,95	92,98	78,15	85,85	91,06	89,64
Method 4	96,37	99,03	88,89	92,31	96,53	98,17
Direct index						

Higher CSI results are obtained by direct survey and lower CSI results are obtained by the weighted scales method. Modeling method based on the "importance / satisfaction" coefficients gives the lowest, but a more objective measurement result. This principle of weighted indexes for the quality assessment criteria laid in the calculation of educational rankings (IREG / ENQA, ARWU / THES-QS / KEI).

The use of "weights" to the criteria of measurement avoids artifacts associated with a direct assessment of when the content of the CSI construct stays out of formalization and cannot be "extracted from the head of the consumer." The degree of approximation to the "picture in the head" (or mental "prototype" in the terminology of Rosh) increases with the use of implicit personality theory and testing expert systems for mental evaluation formalization.

## 7. Experimental methods and results.

Scientific research attributes:

The purpose is public examination of education quality.

The subject is an evaluation of public satisfaction with the quality of educational services.

The task is a comparative analysis of education quality assessment by the kinds and types of services in the general education system.

Measuring instruments:

Criterion: satisfaction of the population with general education quality.

Index: customer satisfaction index (CSI).

Indicators: 16 and 25 variables (CSI indicators).

Methods of data collection: a questionnaire survey and an online survey.

Methods of data processing: a statistical analysis by Statistica 6.0 software.

Measurement tool: CSI evaluation interval scale on indicators system.

Measurement procedure: method of CSI calculation taking into account the weighted indexes for indicators.

Empirical base: institutions of municipal system of general education (pre-school \ school\ additional education).

Sampling: quota sample, by segments (parents / teachers).

The study is performed with the use of parallel forms surveys. This allows for quantitative and qualitative consumer response with the further comparison of the results. CSI modeling technique is implemented by the direct questionnaire on 16 one-dimensional parameters and by online survey on 25 one-dimensional parameters. Both options use scaling tools for indicators of CSI model. Detailed survey examined CSI on 50 multidimensional parameters. The article discusses the CSI experimental model on 16 and 25 indicators. This model presents a short diagnostic screening with the CSI formalization due the technology of "weighted index" method.

The method allows comparing data within data sets and between the sets. Also we can compare CSI by type of educational services, educational institutions and so forth. Easy CSI formalization allows conclusions within a single

institution and between institutions; within one sampling segment and between the segments. In each case, the data is mathematically comparable. CSI descriptive statistics has an accessible format.

Example of CSI matrix in the school educational system for the sample "parents":

Table 2. CSI statistics considering weights Sf /If.

№f	Indicators	Lyceum, Gymnasium			School		
		If	Sf	CSI	If	Sf	CSI
1	Reputation of the institution and its rating	4,60	4,31	86,20	4,22	3,69	73,77
2	Information about the services provided	4,65	4,27	85,43	3,26	3,67	73,47
3	Diversity of educational services	4,33	3,71	74,14	3,98	3,28	65,69
4	The quality of the educational result	4,87	4,23	84,51	4,72	3,92	78,44
5	The quality of the educational process	4,85	4,25	85,08	4,60	4,03	80,66
6	The cost of paid services	3,05	3,13	62,65	2,71	2,72	54,34
7	Pedagogical, administrative and support staff	4,86	4,36	87,17	4,59	4,25	85,06
8	Place of supplied services	4,18	4,33	86,59	4,38	4,23	84,65
9	Safety of stay at the institution	4,86	4,52	90,48	4,70	4,05	81,07
10	Technical equipment of the institution	4,65	3,52	70,43	4,35	2,61	52,28
11	IT- level of the educational process	4,51	3,65	72,93	4,28	3,08	61,67
12	The financial base of the institution	4,62	3,25	64,97	4,27	2,38	47,50
13	Psychological climate of the institution	4,90	4,34	86,88	4,72	4,01	80,25
14	Health-preserving environment	4,81	4,02	80,43	4,69	3,69	73,78
15	Public participation in the educational process	3,74	3,55	70,96	3,67	3,12	62,48
16	Modernization processes	4,30	3,53	70,56	4,07	3,02	60,34
	Integral	71,76	62,97	<b>79,32</b>	67,23	55,77	<b>70,48</b>

Satisfaction score is below the importance score on all the criteria. It proves the relevance of measuring instruments of the method. "Low satisfaction - high importance" statistics for the indicators reveals areas of risk in the education system. The cluster of risk by the evaluation of parents includes the parameters of the educational environment (financial, technical, information provision, health-preserving environment). The cluster of risk by the evaluation of teachers consists of indicators as conditions and content of education.

The CSI difference between internal and external evaluation is recorded annually, with the external evaluation of higher internal (Fig.1).

Comparison of the panels in a single system of indicators allows for a comparative analysis of CSI. Statistics of annual surveys shows higher customer loyalty to the pre-school and additional education than to school (Fig.2).

Charts convincingly demonstrate leadership of status institutions for quality education. The consumer is convinced that lyceums and gymnasiums guarantee a better result than comprehensive school (Fig.3).

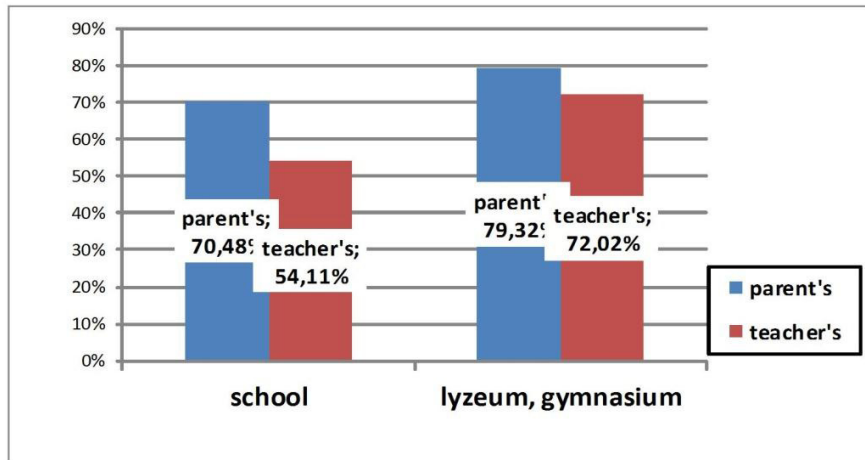


Fig.1. External (parent's) and internal (teacher's) assessment.

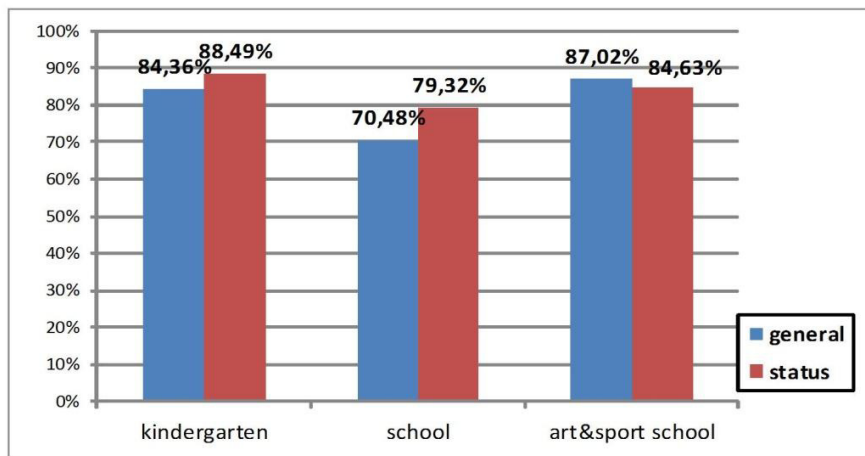


Fig.2. Comparative CSI statistics in institutions of general education.

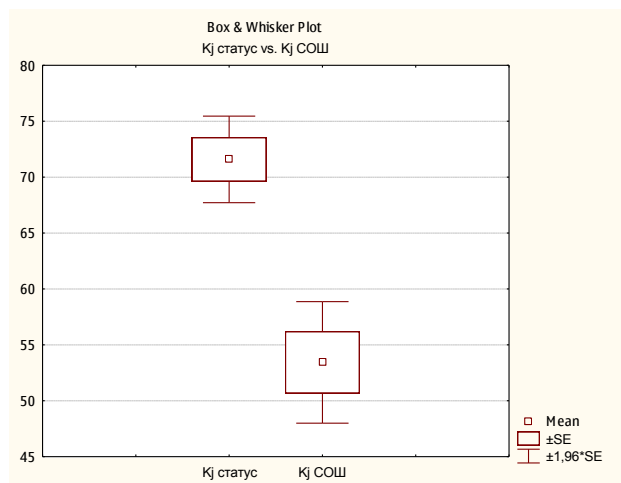


Fig. 3 Significantly different CSI of T-test: status and general school

An important outcome of education evaluation is the ratio of the "process" to the "results". Why the endless process of modernization of education does not lead to the guaranteed result? Annual monitoring records, that the evaluation of the educational process is always higher than learning outcomes. Regression analysis as reliable predictors of educational outcomes points to the role of the educational process, teachers and psychological climate. Teachers, pupils and their relationships in the educational process, according to the consumer, are the main attributes of a quality guarantee. Therefore, the personality-oriented subjective paradigm of education must improve pedagogical and psychological didactics of the lesson not less than technical gadgets. Russian saying "what the teacher is, so is the student" is banal, but relevant.

Checking the consistency of CSI measurements on types of sampling and types of institutions proves the relevance of the measurement model and confirms the semantic unity of the measurement construct indicators.

Correlation's between data sets by CSI index are the dispersion of the Pearson coefficients from 0.88 to 0.95 with an estimate of the significance level not below 0.01. The technique of parallel forms of CSI measurement allows us to compare results obtained by different measurement procedures. Thus, the express survey estimated CSI on 16 parameters, and the online survey - on 25 parameters. Survey data is fully consistent:

Table.3. CSI index statistics in different survey forms

Survey form / type of School	School	Lyceum, Gymnasium
Online survey	71,55%	80,09%
Direct survey	70,48%	79,32%

## 8. Future directions: expert test systems

Application of expert test systems can be an alternative to the statistical paradigm of CSI analysis.

Expert test systems in psychology (case-based expert system) represent psychometric diagnostic tool with "feedback - control" function. On software level they allow user to implement the task of testing and mathematical modeling in a single technological cycle. They use a methodology of nonlinear dynamical systems theory in terms of the mathematical apparatus for the study of non-additive effects associated with the system of mental representation. Expert test systems are used as a feedback tool for the study of the mental response, group behavior, social evaluation, decision making, and others (Suprun, Yanova, Nosov, 2013).

Application of feedback expert systems for education quality diagnostics allows user to simulate the "mental prototype" of quality criterion (in "feedback -control" mode) instead of setting it externally. It is a modern technique for measuring the latent nature of mental response in the form of attitude and representing its attributive schemes of perception and evaluation. New technology allows formalizing of measurement rating procedure with the construction of a mathematical rating model.

The development of psychometric theory and information technologies (Templin&Bradshaw, 2014) proves the relevance of the occurrence of measurement tools with a strong scientific verification, but intuitive interface that allows practitioners to use the achievements of modern science. The way out of the situation, in which the complex nature of the measured processes corresponds to the complex nature of the tools, is seen in the engineering test programs and raising the standard of requirements for developers and testers (Hunt, 2006). In modern conditions of science and practice integration the effectiveness of the quality assessment depends on the level of tools, developer and user.

## 9. Conclusion

Monitoring the opinions of consumers of educational services is an effective tool for management decisions to optimize the educational policy in feedback mode. Continuous improvement of public assessment measurement tools provides a more accurate and reliable feedback from consumers of educational services. The transition from personal questionnaire tools and techniques of commercial marketing to the professional technologies of

pedagogical qualimetry and psychometrics will avoid conflict between the paradigms of "quality of education" and "quality of educational services" and move from a socio-economic model of education quality assessment to humanitarian technologies of educational systems optimization.

## References

- Andrich, D. (1999). *Advanced Social and Educational Measurement*. Perth: Murdoch University.
- Demetriou, C. (2008). Arguments against Applying a Customer-Service Paradigm. *Academic Advising Journal*, September 30. Retrieved from <http://www.psu.edu/dus/mentor/080930cd.htm>
- Duvuri, S.D., Gruca, T.S. (2010). A Bayesian Multi-Level Factor Analytic Model of Consumer Price Sensitivities Across Categories. *Psychometrika*, 75 (3), 558-578.
- Fauconnier G., Turner M. (2006). Mental spaces: conceptual integration networks. In Dirk Geeraerts (Ed.) *Cognitive linguistics: basic readings*, (pp.303-371). Berlin: Walter de Gruyter GmbH &Co. KG.
- Furr, M. (2011). *Scale Construction and Psychometrics for Social and Personality Psychology*. London: SAGE Publications Ltd, Series: The SAGE Library of Methods in Social and Personality Psychology.
- Huili, Y., Jing Y. (2012). Empirical Research and Model Building about Customer Satisfaction Index on Postgraduate Education Service Quality. *Canadian Social Science*, 8 (1), 108-113.
- Hunt, E. (2006). *Mathematics of Behavior*. New York: Cambridge University Press.
- Jiang, Y. & Jingyi, M. (2006). The Estimation and Test for CSI Model. *Statistics and Decision*. 2, 12-15.
- Lan L., Ratchford, B. & Yang, B. (2013). Why We Do What We Do: A Model of Activity Consumption. *Journal of Marketing Research*, 50 (1), 24-43.
- McDonald, R. (2011). Measuring Latent Quantities. *Psychometrika*, 76 (4), 511-536.
- Raykov, T. (2010). *Marcoulides Introduction to Psychometric Theory*. NY: Routledge Academic.
- Strack, F., Deutsch, R. A. (2011). Theory of Impulse and Reflection. In P. A. M. Van Lange, A. W. Kruglanski, & E. T. Higgins (Eds), *Handbook of Theories of Social Psychology* (pp. 97-117). London: Sage.
- Suprun, A., Yanova, N., Nosov, K. (2013). *Metapsychology: Relativistic psychology. Quantum Psychology. Psychology of creativity*. Moscow: URSS.
- Templin, J., Bradshaw, L. (2014). The Use and Misuse of Psychometric Models. *Psychometrika*, 79 (2), 347-354.
- Zhang, L., Han, Z., Gao Q. (2008). Satisfaction Index in Higher Education. *International Journal of Business and Management*, 3(9), 46-51.