

How to evaluate Industrial Engineering undergraduate teachers?

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Abstract

In Brazil, teacher evaluation is required by the National Higher System Evaluation System (INEP, 2011). At UFAM, it is done through the student portal, which is considered ineffective, compromising the process of continuous improvement of teaching and learning. The article evaluates the students' level of satisfaction with the quality of the services provided by the teachers who taught discipline for the FT/UFAM Industrial Engineering course, to propose suggestions for improvements. To this end, the UFAM evaluation portal was studied, then a review of performance evaluation articles allowed the development of a questionnaire (Appendix 1) that was applied in 2011 to 112 (70%) students enrolled in the 2nd, 4th, 6th and 8th periods of this course. After analyzing the data, it was concluded that: a) the UFAM website to evaluate teachers was considered negative by more than 1/3 of the respondents, and the obligation to answer, the excessive amount of questions, the lack of feedback and improvement actions discourage students from responding; b) On the other hand, the application of the questionnaire revealed that the best-evaluated subjects were Special Topics of Industrial Engineering I and II, Management of Technological Innovation, Sanitation Applied to Production, Calculus II, Linear Algebra, Transport Phenomena, and Digital Electronics, most of which were taught by teachers of 2nd and 4th period. For improvement, it is recommended to identify the good teaching and learning practices of these teachers to apply seminars and disseminate them through FT/UFAM.

Keywords: Teacher evaluation; Performance; Satisfaction;

1. Introduction

The Federal University of Amazonas (UFAM) is located in Amazonas and in 2011 offered 96 undergraduate courses divided into 21 academic units, including the Faculty of Technology (FT) located in the city of Manaus, consisting of five departments (Graphic Design and Expression; Construction; Electronics and Telecommunications; Electricity; Hydraulics and Sanitation; Geotechnics and Transportation) serving 1633 students enrolled in the second semester of 2011, which offered 10 undergraduate courses: Architecture and Urbanism = 79 students; Graphic Design and Expression = 286 students; Civil Engineering = 255 students; Computer Engineering = 186 students; Gas and Oil Engineering = 85 students; Electrical Engineering = 257 students; Materials Engineering = 93 students; Mechanics = 101 students; Industrial Engineering = 218 students; Chemical Engineering = 73 students.

To evaluate and improve the quality of the courses, it is necessary to have an effective (efficient and

effective) system of teacher performance evaluation, having students as evaluators, since they are the clients served by the teaching community.

According to Ramos (1999), a teacher evaluation system made by the students is a decisive instrument in the perspective of betting on the teacher's personal and professional development and, simultaneously, on the student's responsibility, clearly aiming at a logic that sees the evaluation of the discipline and professional performance.

In this sense, for teacher evaluation, UFAM uses an online portal for the end of the period when the student evaluates all teachers of the subjects in which he was enrolled.

However, this evaluation has the following problems:

First) the evaluation system was not developed with the support of the students, not considering their perception of what is relevant in the teaching-learning process;

Second) as occurs only at the end of the period there is no possibility of immediate intervention when there is any non-compliance in the evaluated services;

Third) assessment results are not systematically used by students, managers and service providers in order to develop corrective and proactive actions over time. These problems lead to a) the repetition of errors by service providers; b) discontent student with the quality of services provided; c) the discrediting of students and teachers regarding the efficiency and effectiveness of the University's electronic evaluation system.

Given these problems, the general objective of this article is to evaluate the students' level of satisfaction with the quality of the services provided by the teachers of the Industrial Engineering course at the UFAM's Faculty of Technology to propose suggestions for improvements.

To this end, the specific objectives are:

- (1) to know UFAM's teacher evaluation system and experiences of other Brazilian universities;
- (2) develop and test an evaluation questionnaire that will periodically measure students' satisfaction with the services provided by FT/UFAM Industrial Engineering teachers;
- (3) propose suggestions for improvements to FT/UFAM Managers.

The main question of this research is "How to evaluate Industrial Engineering undergraduate teachers?"

The study is relevant because:

- 1) it may increase student motivation;
- 2) will provide information for teacher improvement, allowing the professional to know their strengths and points that require improvement;
- 3) will serve to improve the teaching evaluation system of the FT/UFAM;
- 4) provide information that will enable managers to develop a policy of training and appraising the teachers evaluated;
- 5) In the medium and long term, it will help the course to achieve academic excellence;
- 6) can be benchmarked and reapplied in other UFAM courses.

2. Theoretical reference

2.1 Reasons to measure and principles for measuring customer satisfaction

Evaluate means value, determine the importance of something. For Barros (2010), at all times the human

evaluates the elements of the reality that surrounds him. The evaluation process is a current requirement of society and is a way of monitoring programs to ensure effectiveness in organizations. From the perspective of quality of service, performance measurement provides, through the results obtained, the continuous improvement of processes. In general, something is measured to analyze strengths and weaknesses and propose improvements, not just to evaluate by evaluating.

There are seven good principles to follow when performing customer satisfaction measurement: a) what is the measuring reason; b) let customers report which ends results they want to be measured; c) search about the performance and competitors; d) follow-up on internal procedures that should produce the results that customers want; e) perform the measurements and verify the results; f) inform the staff about discoveries; g) verify what actions will be taken to standardize and disseminate good practices, as well as to correct what needs to be improved (adapted from WHITELEY, 1995 apud SILVA, 2011).

2.2 Key Performance Indicators

According to Mello (2002), the use of indicators is one way to measure and evaluate the quality of products, processes, and customers. However, the use of an indicator system requires the structuring of indicators, the form of collection, processing and analysis, the labor and the use of results. According to Schröder (2005), the measurement of organizational results is an essential strategic issue, since only through an adequate estimation of organizational performance can attest how much the organization is “approaching” or “moving away” from its own goals.

According to Neely et al. (1995) apud Corrêa (2009), performance measurement can be understood as the technique used to quantify the efficiency and effectiveness of business activities. Efficiency will discuss waste-free resource utilization, the relationship between economic resource utilization, taking into account a certain level of satisfaction. In turn, effectiveness evaluates the achievement of the goal, the result of a process where the expectations of various customers are satisfied or not.

Rezende (2003) adds that a performance measurement system not only provides data necessary for management to control the various activities of organizations but also influences decisions and organizational behavior. A balanced measurement should be understood as a dialectical process that leads to the continual discovery of focuses and sources of improvement in the organization's existing intangible assets, rather than a simple comparison of predictions and achievements over a period.

There are several studies focused on organizational performance indicators, such as Van Bellen (2002), Fernandes (2005), Merchant (2006), Machado, Machado and Holanda (2007), Callado, Callado, and Almeida (2008), Menezes, Guimarães and Sellitto (2008), etc. A broad study of the characteristics of performance indicators used in research conducted in the fields of Administration, Accounting and Tourism from 2000 to 2008 revealed 24 terminologies (p. 381) used involving performance indicators as well as 21 concepts (page 382) extracted from the authors researched by Nascimento et al. (2011).

In this research, the indicators are considered flags that seek to express and demonstrate the reality in a way that is possible to observe and obtain more concrete data to improve the evaluation (COELHO, 2004), are considered supportive tools to evaluate processes (FREIRE; CHRISÓSTOME; CASTRO, 2007) and performance indicators are qualitative or quantitative elements used to detail the scope to which objectives or goals have been achieved, observing the timeframe and resources used.

The development of performance indicators is not an end in itself, the creation and use are only justified as reference points, should be used as tools for questioning, critical and evaluative analysis of problem-solving management guidelines and practices.

In addition, there are aspects (Figure 1) that must be observed when creating a system of performance indicators, such as context analysis, organizational purposes (mission, vision, and values) and goals; the norms, communication and learning, assessment system, the correct amount of indicators per manager, training, strategic and operational alignment.

It is recommended that performance indicators are inseparable from the organization's vision, values and objectives. Thus, the choice of performance indicators follows normative principles, assuming a political, oriented decision to action based on goals nature, from the creation of a coherent information system that allows learning and assists in decision making (adapted from COUTO, 2005).

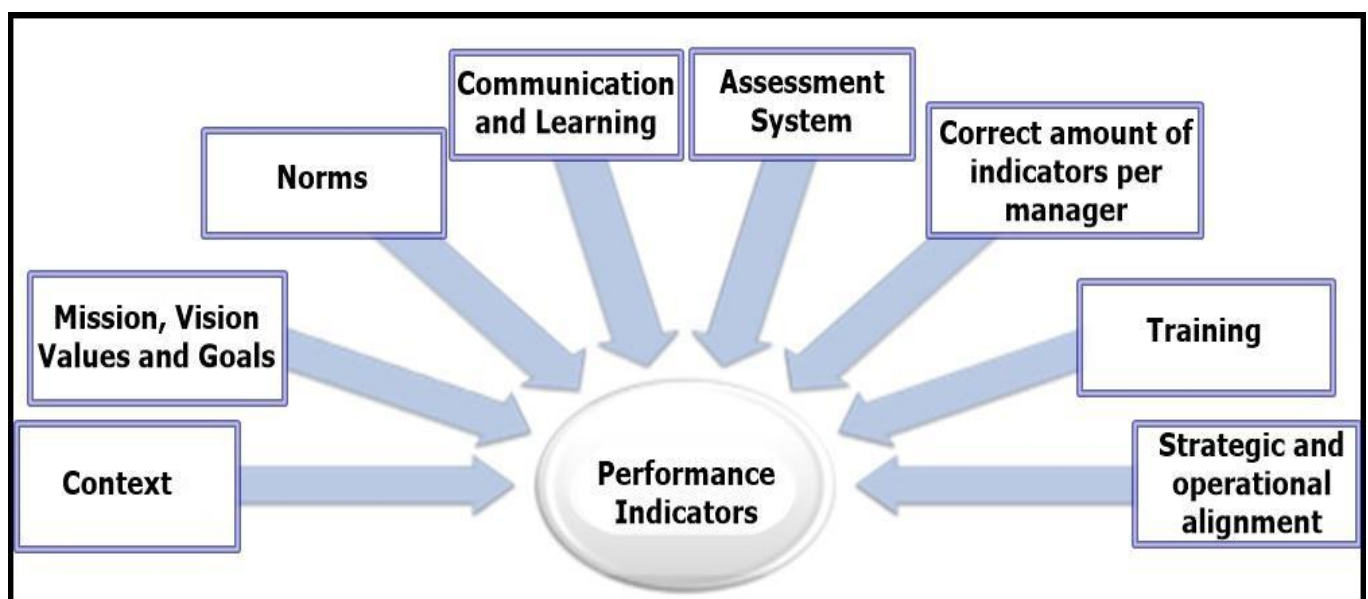


Figure 1 – Aspects to be considered during the development of a Performance Indicator System

Source: adapted from Couto (2005)

2.3 Quality in Higher Education Institutions

According to Mansur (2001), assessing quality in service means estimating how satisfied the customer is regarding the service through its various aspects such as efficiency, speed, and friendliness of the attendants, comfort, etc. The problem of valuing quality in services is to check the client's psychological aspects (what he thinks of the service) and this gives the problem a very subjective character. Educational institutions, as well as other service providers find it difficult to get consensus on how to measure quality, depending on the intangible nature of the services.

Given this, Giansesi and Corrêa (1994) point out that services are different from manufacturing, have characteristics such as product intangibility, customer presence, and participation and, generally, services are produced and consumed simultaneously. Thus, the services provided by higher education institutions are characterized by the essentially qualitative nature of the university. These institutions usually have a departmental structure, divided into different areas, with decentralized decision-making power based on

collegiate bodies, obeying the autonomy of the academic units and the academic freedom that the teacher enjoys as a professional and main production agent.

Marchesan (2006) points out that the practice of quality in university management is done through the harmonious articulation of the board with its teachers, employees, and students committed to the interests and objectives of the educational institution. This is the best way to seek and solidify recognition of the standard of teaching excellence and to prove the social responsibility of the educational task at all levels. According to Rupolo (2003), the pedagogical guidelines guide the establishment of its mission, its objectives, its goals and actions for teaching that should be idealized with a view to a quality formation that can be measured for a permanent qualification of its function.

Macedo (2001) also emphasizes that the measurement of the teaching and learning process is fundamental so that universities fulfill their role as promoters and socializers of knowledge, capable of compromising reality. To this end, the evaluation provides a global view in qualitative and quantitative terms, facilitating the resizing of policy and action plans.

Therefore, the evaluation process is not an isolated moment, but a public action for the school community to improve their administrative, technical and pedagogical practices in a critical and committed way (NAUJORKS, 2002).

For Strassburg and Moreira (2002), higher education institutions adopted an evaluate teacher performance system, and it is effective when it results in an improvement in teaching through self-critical teacher reflection.

2.4 Teachers' work in Higher Education Institutions (HEI)

There are challenges to higher education teachers in Brazil related to the information and knowledge society, perceived both through references to the practice of professions, as well as the legal guidelines announced by LDB 9394/96 and resulting curricular guidelines for undergraduate courses (CNE / MEC), which now require new skills for the restructuring of courses and pedagogical projects that enable the exercise of teaching as a reflexive, critical, transformative and emancipating act, resizing the academic life.

For Macedo (2001), teaching in higher education supposes the understanding of dimensions that characterize the structuring of an undergraduate course and the implementation of new training practices, with due clarity on the definition of each constituent element and the articulation between them.

The perception of this reality enables the inventive, entrepreneurial and productive potential of the teaching community in face of the daily possibilities of recreating the environment, instruments and work processes, stimulating the search for innovative solutions for the accomplishment of the required initiatives in face of the institutional questions that determine the scenario administrative-academic-pedagogical of undergraduate courses.

Thus, Zalbaza (2004) recommends some guiding principles: the study of the professional profile, the area of expertise, as well as the analysis of pedagogical strategies to be implemented so that teaching action is consistent with its objectives, based on a good curricular integration, with competent human resources and adequate materials, conducted by a careful evaluation system, elements that must be present in the Pedagogical Project that needs to be well explained in the paper and well understood, implemented and

managed by the teachers and students.

2.5 Teacher Evaluation

The relevance of teacher evaluation concerning teaching functions is unquestionable but the great challenge is to build an evaluation system with shared procedures, articulated, contextualized to the local reality that helps improve service delivery while still considering, respecting and valuing teachers.

According to Strassburg and Moreira (2002), one should not restrict the evaluation of teaching quality only to the teacher's performance but should evaluate considering the overall dimension of the institution.

In this context, educators should consider evaluation as feedback and one of the components of the institutional evaluation process is the survey of students' opinions about the didactic-pedagogical activities of their teachers. This is a complex task since it is up to the teacher to define which wills of the academics that are necessary (MACHADO, 1997 apud MEYER, 2006).

2.6 Evaluation of the teaching performance of teachers according to SINAES

The pedagogical performance evaluation of the teachers of a higher education course is really important to reach academic excellence. In Brazil, Law No. 10,861 (April 14, 2004) establishes the National Higher Education Evaluation System (SINAES), which must be applied by all Brazilian higher education institutions (INEP, 2011).

This evaluation process takes into consideration aspects such as teaching, research, extension, social responsibility, institution management, and faculty, aiming to improve the quality of higher education, guiding the expansion of its offer, the permanent increase of its institutional, academic, and social effectiveness. This system has three main components: the evaluation of institutions, courses, and student performance.

The information obtained by SINAES is used by Higher Education Institutions (HEI) to verify their institutional, academic, and social effectiveness; It is also used by government agencies to guide public policies, as well as by the general public to guide their decisions about the reality of courses and institutions. Thus, HEIs need to evaluate faculty through a more scientific and participatory evaluation system.

2.7 Teacher assessment cases practiced in some HEIs in Brazil

The eight cases presented were used to understand how some universities perform their teachers' performance evaluation, as well as contribute to the development of the data collection instrument.

The survey was conducted in 2010 by the students of the Industrial Engineering course of FT/UFAM, during the classes of the Quality Management course, taught by the author (SILVA, 2011), aiming to identify how HEIs with well-regarded courses evaluated their teachers, result of the study of the following Higher Education Institutions: Alves Faria College (Alfa), Physical Education College of Gravataí Ulbra, Anhanguera Educational, Federal University of Rio de Janeiro, Federal University of Minas Gerais, Pontifical Catholic University of Rio de Janeiro (PUC-RIO) and Federal Technological University of Paraná.

Usually, these are practices applied by HEIs with Industrial Engineering courses with good evaluation in the National Student Performance Exam (ENADE) of 2008.

2.7.1 Alves Faria College (Alfa)

According to Silva (2010), Alfa is located in Goiânia (State of Goiás-Brazil), even before any determination by the Ministry of Education (MEC), Alfa was already evaluating teachers. A methodology for applying data collection questionnaires and the N-Vivo 8 software for data processing is adopted. Silva (2010) also emphasizes that the information obtained is the result of decisions made after obtaining the data from the institutional evaluation of teachers. At Alfa, the academic community becomes the subject of the appraisal, committing itself to the transformations and changes in the quality level.

2.7.2 Physical Education College of Gravataí Ulbra

According to Dornelles (2009), the teacher assessment is applied through a structured questionnaire, consisting of 10 questions, where the student assigns one of the following levels of satisfaction: 1- Weak, 2- Fair, 3 - Good, 4 - Very good and 5 - Excellent.

The collected data are analyzed using descriptive statistics, using tables and graphs. Statistical treatment is performed by the SPSS software for Windows version 10.0.

2.7.3 Anhanguera Educational

In 2010, Anhanguera Educacional had 25 colleges, 2 university centers, and 1 university, located in the states of São Paulo, Rio Grande do Sul, Goiás and Mato Grosso do Sul. The organization had an institutional self-assessment program established since 1997, which contributed to the anticipation of the precepts contained in SINAES.

According to Casbonari (2007), among the 3 assessment instruments is the Teacher Performance Assessment (ADDA), where the student evaluates the teacher by giving grades from 1 to 5 (1 - Very weak, 2 - Weak, 3 - Regular, 4 - Good and 5 - Very good).

The results are statistically treated and published as teacher performance percentage indices, which are called Student Satisfaction Index (ISD) and High-Grade Percentage (PNA), a percentage in which students ranked teachers with high grades.

2.7.4 Federal University of Rio de Janeiro (UFRJ)

According to Porto (2010), the Federal University of Rio de Janeiro (UFRJ) implemented on November 20, 2010, the Evaluation of Disciplines and Teachers by Students. Through a tool available in the Integrated Academic Management System (SIGA), students can evaluate, on a non-mandatory basis, all subjects taken in the semester.

Among other subjects, the questions include the degree of compliance with the menus, the effectiveness of the teaching method and the infrastructure.

The “Evaluation of Disciplines and Teachers by Students” was still available on an experimental basis at the Polytechnic/UFRJ and was inspired by a previous evaluation system employed at the Center for Technology and the Center for Mathematical and Natural Sciences of the University.

2.7.5 Federal University of Minas Gerais (UFMG)

According to the UFMG website (2011), the student evaluation of the subjects studied during a semester

is a procedure implemented at the University since 1996. It is done by completing, at the end of the semester, a questionnaire about each undergraduate subject in which the student was enrolled.

For each subject, an evaluation questionnaire is also completed for each teacher who taught it. The filling is done through the internet and occurs along with the registration process for the subsequent semester. The student can decide whether or not to complete the assessment questionnaires by going to the assessment page on the internet to make their decision explicit. Also, this semester's graduating students are presented with a questionnaire to evaluate the course.

2.7.6 Pontifical Catholic University of Rio de Janeiro (PUC-RIO)

The PUC-RIO evaluation system has been in use since 2002 and was redefined in 2005.

Undergraduate students evaluate teachers in that period at the end of each semester. Teachers and students can consult the results in the Teacher Assessment System using the online PUC login and password. The dissemination of these results has the following purposes:

First) to serve as a consultation tool for the student at enrollment, providing a conscious and transparent choice of subjects and classes;

Second) provide information for teacher improvement, allowing the professional to know their strengths and points that require growth;

Third) serve as a complementary tool for academic planning, generating historical data for the analysis of the progress of subjects and teaching performance;

Fourth) serve as a subsidy to the Institutional Evaluation process (PUC-RIO, 2011).

2.7.7 Federal University of Rio Grande do Sul (UFRGS)

Since 2006, following the reformulation of the teacher's assessment by the student, the Institutional Assessment Secretariat (SAI) has provided to all UFRGS courses an online questionnaire to collect student feedback about the subject development as well as teacher performance.

In this questionnaire the student answers 10 questions, using a scale from 1 to 5, according to their agreement with the question, 1 to disagree and 5 to agree.

At the end of the questionnaire, the student may also explain the grade for each subject and teacher, and the student's name is kept confidential. Results reports are dynamically generated and made available to each unit if requested (MOTTA, 2009).

2.7.8 Federal Technological University of Paraná.

The evaluation of the teacher by the student occurs in two moments: in the first and second semester of each year, through electronic form.

The evaluations remain in the database and are processed by the Information Technology Management Direction (DIRGTI). The results are released to the Academic Departments and Course Coordinators after the end of the semester so that students are not repressed when evaluating their current teachers.

It is worth remembering that the evaluations are performed through electronic forms, available on the intranet and internet so that students can complement them according to their preference and availability.

3. Methodology

The research has an applied nature since the knowledge generated can be applied by the managers of UFAM. Regarding the objectives, the research is descriptive, since it will use descriptive statistics to analyze the results without changing the values of the variables involved.

Data was collected and analyzed with a combined approach (qualitative and quantitative), through a case study, use of survey and bibliographic research, which was performed by reading articles that approached performance evaluation, including cases performed in Brazilian universities.

As few articles were identified it was considered the experiences described on websites of universities whose Industrial Engineering courses were well evaluated by the 2008 ENADE.

Given this, from reading of articles (STRASSBURG, U.; MOREIRA, DA, 2002; MACEDO, S. A, 2001; SILVA, 2011) and the analysis of the teacher evaluation instrument used by UFAM and the eight universities described in section 2.7, a questionnaire (Appendix 1) was developed to collect the data, containing 3 sections:

Section 1 has a question that evaluates from 0 to 10 the student's level of satisfaction with each teacher who taught the course over the period. The Scale used was Likert where 1 means very dissatisfied and 10 very satisfied. To this end, 11 items were placed to be evaluated, which were chosen from the literature review and also in consultation with students of the Industrial Engineering course who studied disciplines with the author in 2010. The selected items were: the quality of material presented in class; evaluation methodology; subject domain; available to answer question; dynamic classes; meets teaching plan; exposes the subjects clearly; demonstrates ability to motivate students; assiduousness; presents the partial scores and frequencies before the test; presents real cases of knowledge application.

Section 2 is an open-ended question about student opinion regarding the teacher's assessment by the UFAM portal. Section 3 is another open-ended question about what other indicators the student considers relevant to evaluate teacher services.

The target audience was 161 students enrolled in the 2nd, 4th, 6th and 8th semesters of the second semester of 2011, and the students of the 10th semesters were not consulted because they are not frequently in college because of Supervised Internship II or Final Project of Course.

The questionnaire was applied in the classroom, the pilot test was performed with 12 randomly selected students in the second half of October 2011 to verify the comprehensibility level of the questionnaire. As there was no need to make changes, the questionnaire applied to the other students from the end of October until the first half of November 2011.

Then, the data were collected, typed in a spreadsheet CALC for the development of Figures and Tables, aiming at the discussion of the results and the construction of an article that was defended in December 2011 for an examination board of the Industrial Engineering course at FT/UFAM.

4. Results

In total (Chart 1), 112 students answered the questionnaire correctly, which represented almost 70% of students enrolled in the 2nd, 4th, 6th and 8th periods or 51.4% of all students in the Industrial Engineering

course enrolled in the second semester of 2011.

| STUDENTS/PERIODS | 2th | 4th | 6th | 8th | Total |
|----------------------|------------|------------|----------|------------|-------------|
| Enrolled Students | 47 | 41 | 35 | 38 | 161 |
| Interviewed Students | 28 (59.6%) | 28 (68,3%) | 28 (80%) | 28 (73,7%) | 112 (69.6%) |

Chart 1 – Number and percentage of respondents (October and November, 2011)

Source: Author

For the analysis, the general mean and standard deviation were observed. The sections present the analysis by period and for ethical reasons, the names of teachers will not be cited, using only the designation of subjects, as well as highlighting the level of satisfaction of the underperforming subjects.

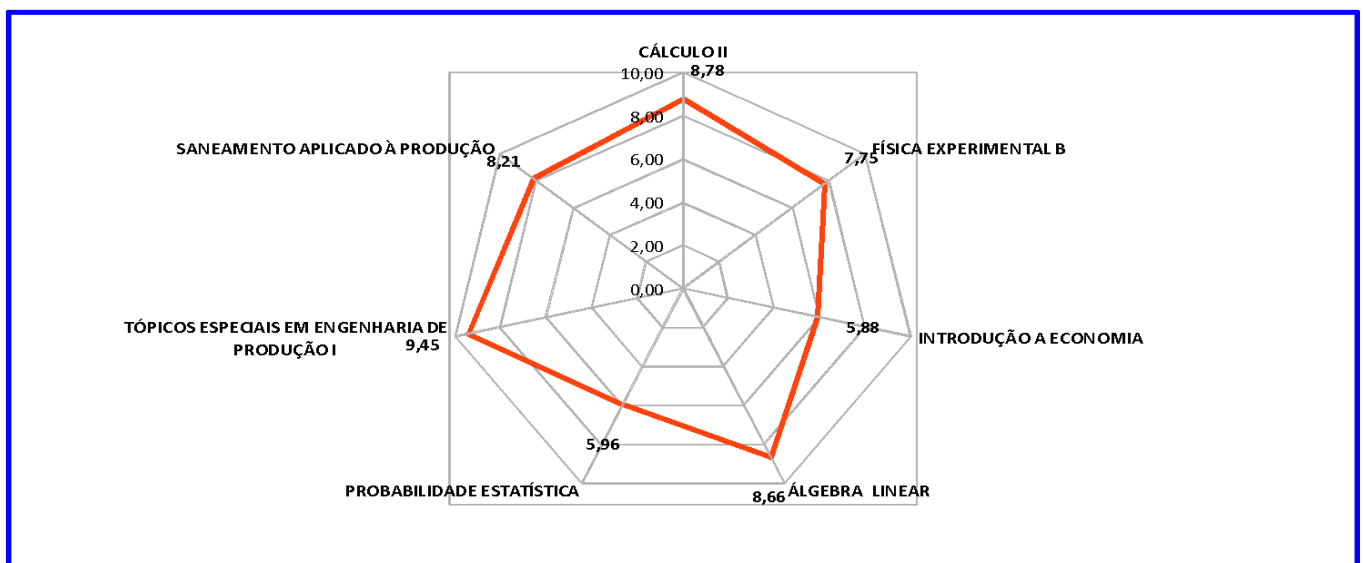


Figure 2 – Students` level of satisfaction with subjects taught in the second period of 2011

Source: Author

4.1 Analysis of student satisfaction with the 2nd period subjects

Seven subjects were offered in this period (Figure 2): Calculus II (Cálculo II), Experimental Physics B (Física Experimental B), Introduction to Economics (Introdução a Economia), Linear Algebra (Álgebra Linear), Probability & Statistics (Probabilidade e Estatística), Special Topics of Industrial Engineering I (Tópicos Especiais em Engenharia de Produção I) and Sanitation Applied to Industrial Engineering (Saneamento aplicado a Engenharia de Produção). In the second semester there were 47 students enrolled, of which 28 (59.6%) answered the questionnaire correctly. Analyzing the results of Figure 2, it is observed that in general the teachers of the Special Industrial Engineering Topics I ($X = 9.45$; $S = 1.38$), Calculus II ($X = 8.78$; $S = 1.33$), Linear Algebra II ($X = 8.66$; $S = 1.64$), Sanitation Applied to Production ($X = 8.21$; $S = 1.13$) and Experimental Physics B ($X = 7.75$; $S = 1.96$) were the best evaluated by the students, while the teachers of Introduction to Economics ($X = 5.88$; $S = 2.41$) and Probability & Statistics ($X = 5.96$; $S = 2.61$) were considered regular.



Figure 3 – Performance of teacher that taught Economy Introduction

Source: Author

Regarding the Introduction to Economics discipline (See Figure 3), the main points that were considered below regular and need to be improved are: demonstrates ability to motivate students ($X = 3.64$; $S = 2.36$); teaches dynamic classes ($X = 3.89$; $S = 2.72$); available at the institution to answer questions ($X = 4.20$; $S = 2.29$); Exposes matter clearly ($X = 4.61$; $S = 2.51$); Evaluation Methodology ($X = 4.79$; $S = 2.88$) and Has mastery of the subject ($X = 4.96$; $S = 2.70$).



Figure 4 - Performance of teacher that taught Probability & Statistic

Source: Author

On the other hand, the strengths were: (1) It is assiduousness ($X = 9.25$; $S = 1.14$); Complies with the teaching plan ($X = 7.75$; $S = 3.52$); Quality of material (slides and handouts) presented to students ($X = 7.64$; $S = 1.70$); Reveals partial grades/frequências prior to Final Exam ($X = 7.14$; $S = 2.12$).

When analyzing the Probability and Statistics discipline (Figure 4), the points the teacher needs to improve on are: Assiduousness ($X = 3.85$; $S = 3.35$); Presentation of partial notes and frequencies before the Final Exam ($X = 4.52$; $S = 3.33$); Availability at the institution to answer questions ($X = 4.59$; $S = 2.22$); Ability

to motivate students ($X = 4.67$; $S = 2.57$); Comply with the teaching plan ($X = 5.85$; $S = 2.30$).

On the other hand, the subject's teacher presented as strengths: Evaluation methodology ($X = 8.07$; $S = 2.24$) and mastery of the subject ($X = 7.44$; $S = 2.68$).

4.2 Analysis of student satisfaction with 4th grade subjects

Six subjects were offered to students from this period (Figure 5), namely: Sanitation Applied to Production, Special Topics in Industrial Engineering I, Special Topics in Industrial Engineering II, Transport Phenomena, Analog Electronics, Sociology of Labor and Ethics.

In the second semester there were 41 students enrolled, of which 28 (68.3%) answered the questionnaire correctly.

Analyzing the results of Figure 5, it is observed that in general the students are satisfied with all the subjects taught. Sanitation Applied to Production ($X = 9.18$; $S = 1.16$), Special Topics in Industrial Engineering II ($X = 9.14$; $S = 0.19$), Special Topics in Industrial Engineering I ($X = 9.05$; $S = 1.07$), Transport Phenomena ($X = 8.26$; $S = 2.05$), Analog Electronics ($X = 8.24$; $S = 1.64$) were the best evaluated by students, while Sociology of Labor and Ethics ($X = 7.90$; $S = 1.63$) was which presented lower performance.

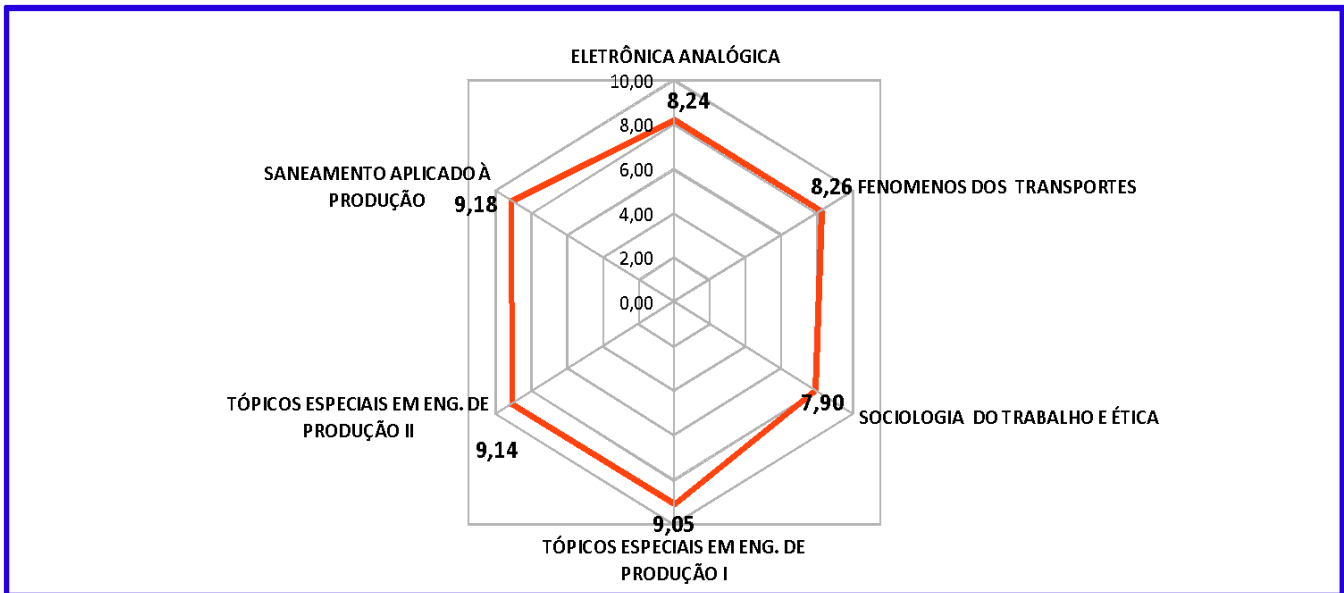


Figure 5 - Students` level of satisfaction with subjects taught in the fourth period of 2011

Source: Author

Regarding the discipline of Sociology of Labor and Ethics (Figure 6), the points that need to be improved are: Presenting partial grades and frequencies before the Final Exam ($X = 7.00$; $S = 2.94$) and Presenting more real cases of knowledge application ($X = 7.52$; $S = 1.67$).

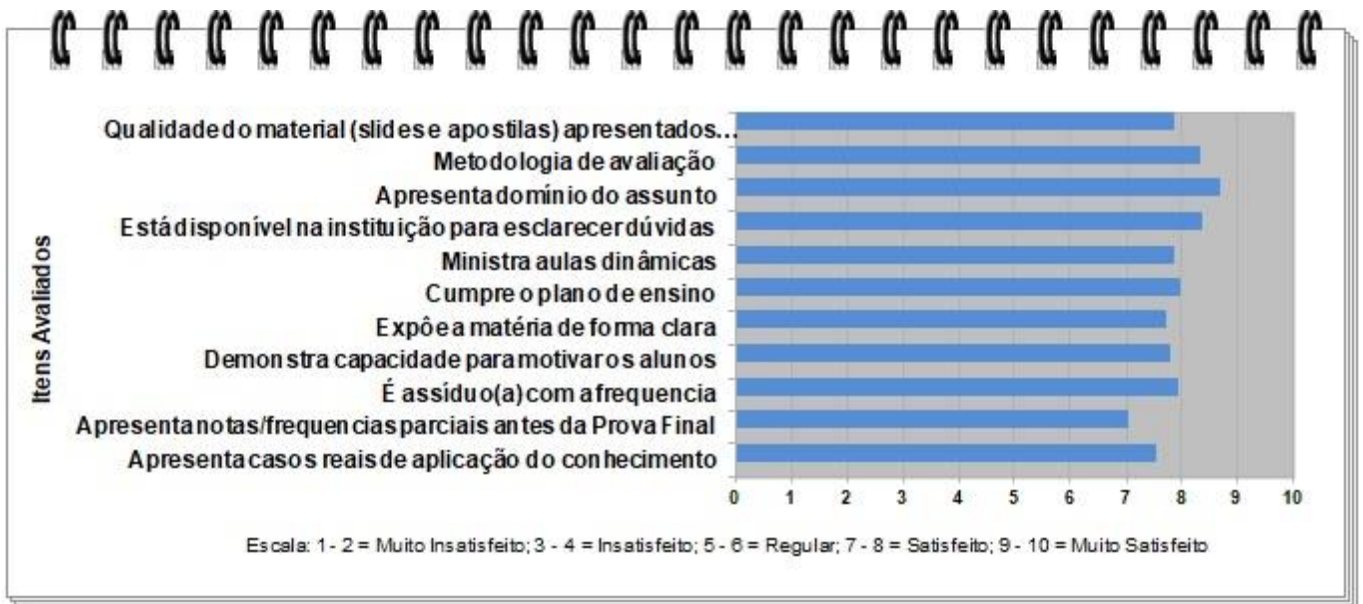


Figure 6 - Performance of teacher that taught Work Sociology and Ethic

Source: Author

4.3 Analysis of student satisfaction with 6th semester subjects

About 35 students were enrolled to study 6th grade subjects, of which 28 (80%) answered the questionnaire. Regularly, students in the sixth period studied six subjects, two of which (Special Topics in EP I and II) did not enter the analysis because both are special and less than 8 students answered the question, which could influence the overall results of the period. Analyzing the respondent data, there is a high level of dissatisfaction with teachers from the Fundamentals of Industrial Automation, Metrology & Standardization, Industrial Electrical Installations, and Materials.

Analyzing the results of Figure 7, it is observed that the teachers of the Materials (X = 5.48; S = 2.10); Industrial Electrical Installations (X = 5.69; S = 1.90) and Metrology & Standardization (X = 5.84; S = 2.46) achieved regular performance, while Fundamentals of Industrial Automation (X = 6.45; S = 1.96) was better evaluated, but staying between regular and satisfied.

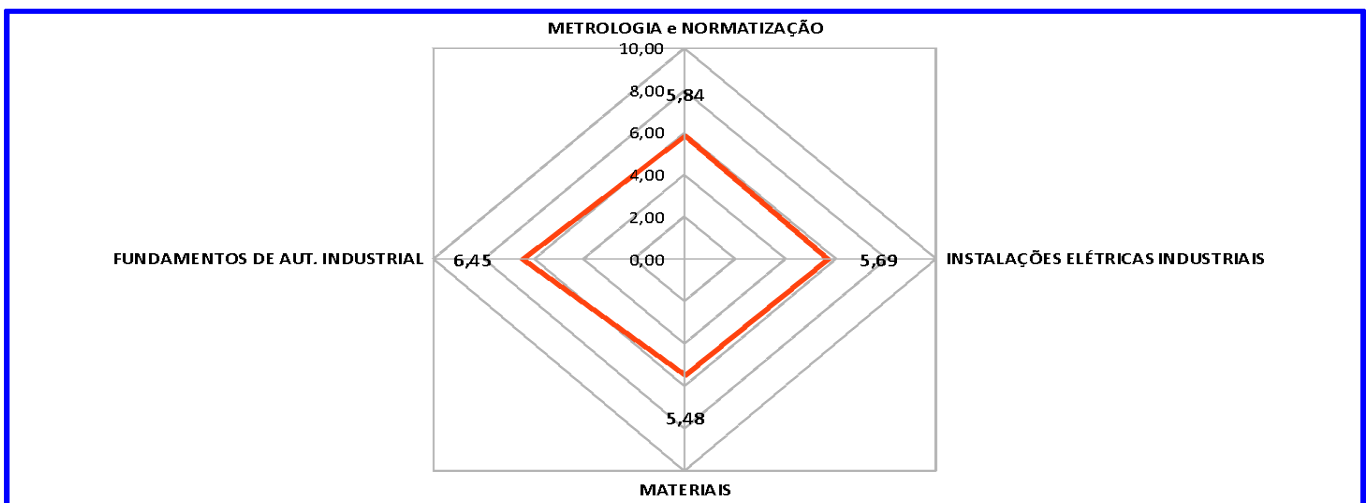


Figure 7 – Students` level of satisfaction with subjects taught in the sixth period of 2011

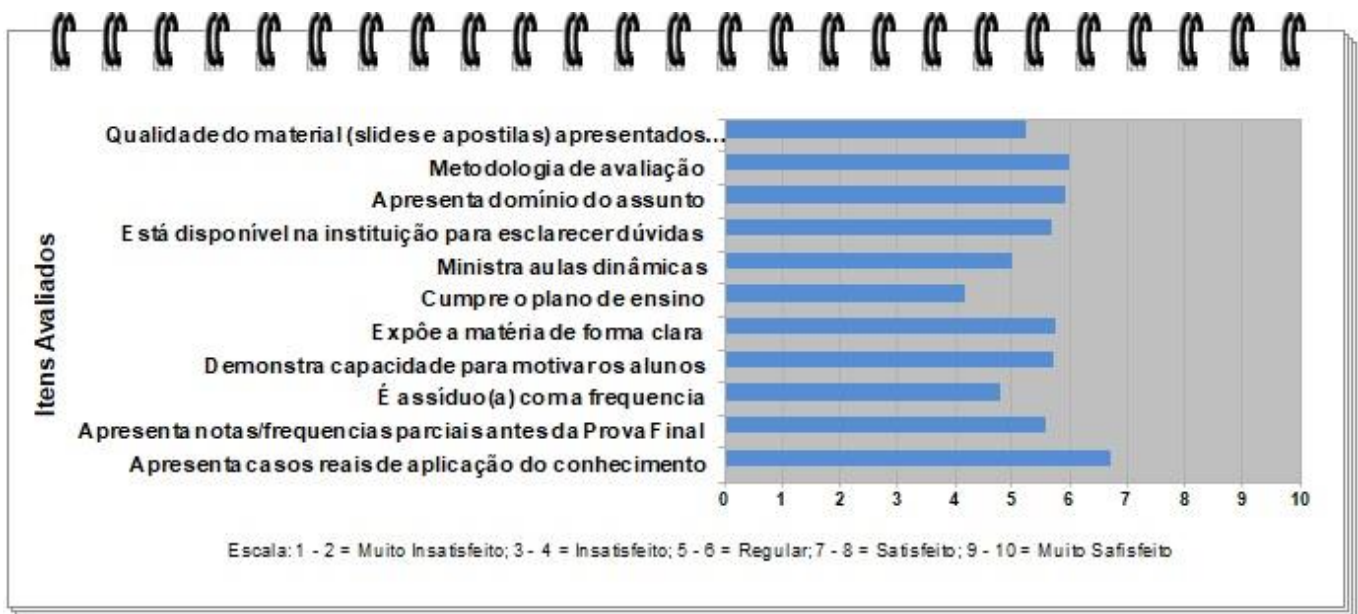


Figure 8 – Performance of teacher that taught Material

Source: Author

The worst performing subject was Materials (Figure 8) and the points with the highest level of dissatisfaction were: Does not comply with the teaching plan ($X = 4.15$; $S = 2.46$); Low attendance with frequency ($X = 4.77$; $S = 2.61$); Class dynamics ($X = 4.96$; $S = 1.98$); Poor quality of material (slides and handouts) presented to students ($X = 5.23$; $S = 2.23$); Failure to present partial grades and frequencies before the Final Exam ($X = 5.56$; $S = 1.73$); Unavailability at the institution to answer questions ($X = 5.65$; $S = 2.20$); Ability to motivate students ($X = 5.69$; $S = 1.71$); Exposure of matter clearly ($X = 5.73$; $S = 1.95$); Subject domain ($X = 5.92$; $S = 2.27$) and Evaluation Methodology ($X = 5.96$; $S = 2.52$). On the other hand, the presentation of real cases of knowledge application ($X = 6.69$; $S = 1.40$) was the only item with a certain student satisfaction index.

Regarding the Industrial Electrical Installations (Figure 9), most of the evaluated items are below the regular level of student satisfaction, except for the subject domain item ($X = 6.81$; $S = 1.71$).



Figure 9 - Performance of teacher that taught Electric Installations

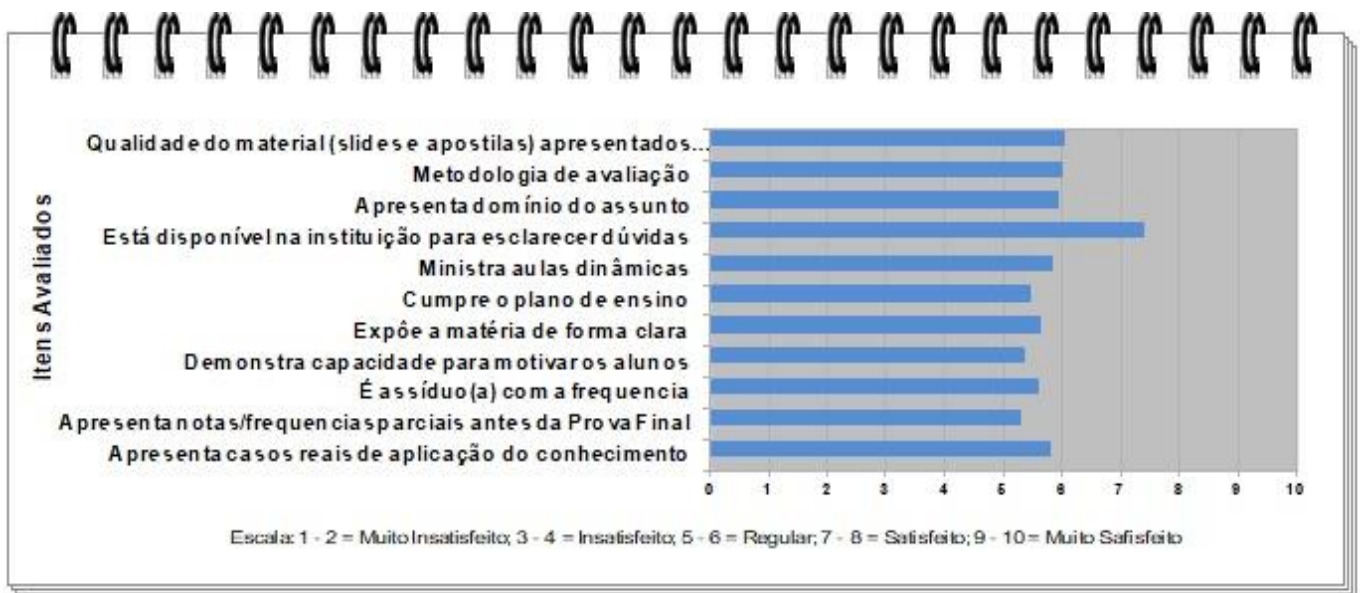


Fig. 10 - Performance of teacher that taught Metrology and Standardization

Source: Author

About Metrology & Standardization (Figure 10), it is clear that although the teacher is available at the institution to answer questions ($X = 7.37$; $S = 2.20$), most of the evaluated items had equal performance or below regular.

Although the discipline of Fundamentals of Industrial Automation (Figure 11) presented a better performance concerning the other three evaluated, most of the teacher's items were between regular and satisfactory, highlighting only the mastery of the subject by the teacher ($X = 7.47$; $S = 1.58$).

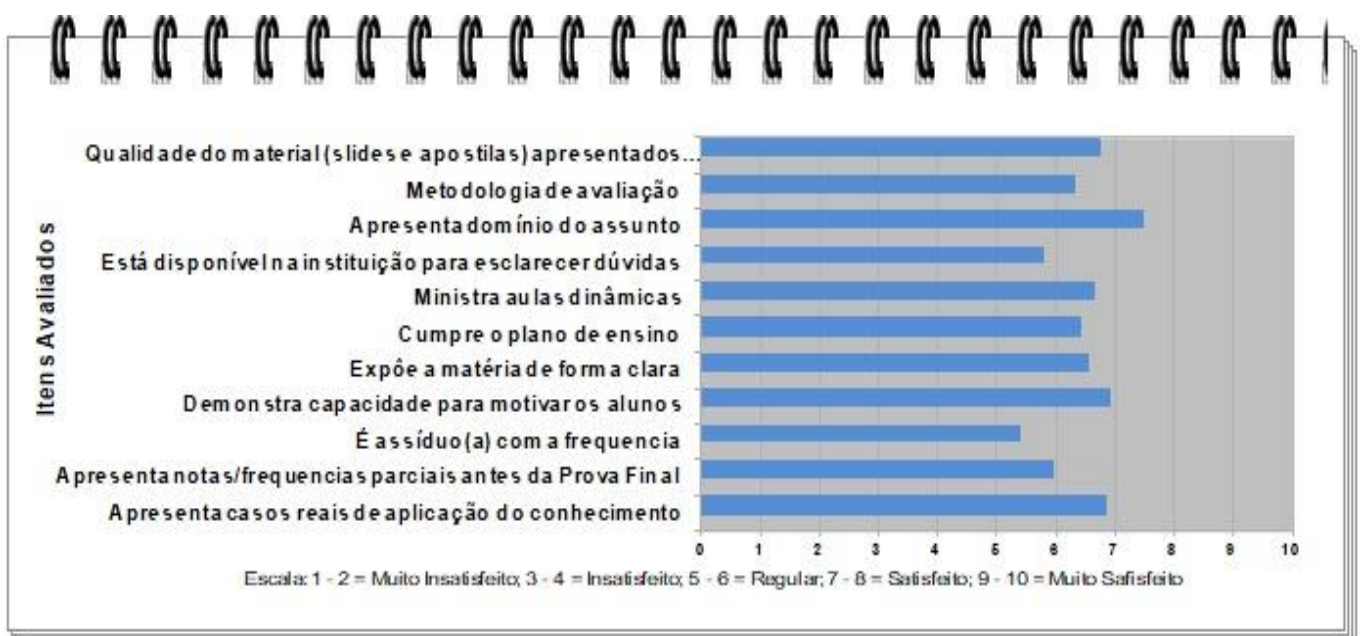


Figure 11 – Performance of teacher that taught Industrial Automation Fundamentals

Source: Author

4.4 Analysis of student satisfaction with 8th grade subjects

About 38 students enrolled in the subjects offered for the eighth period, 28 (73.7%) answered the

questionnaire correctly.

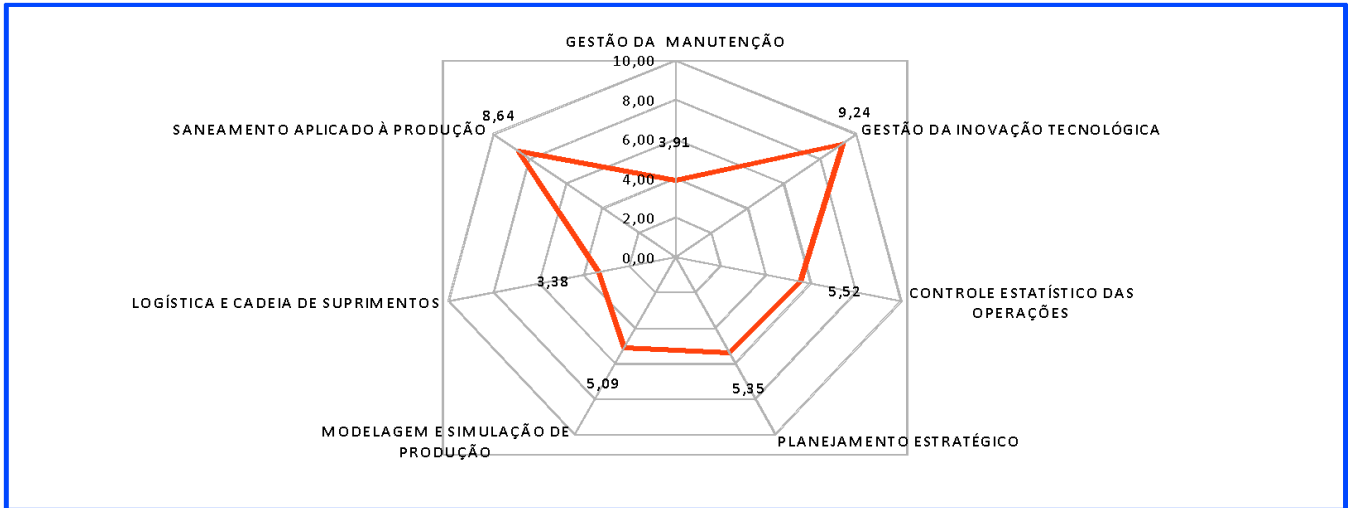


Figure 12 – Students` level of satisfaction with subjects taught in the eighth period of 2011

Source: Author

Seven subjects were evaluated in this period (Figure 12). Technological Innovation Management ($X = 9.24$; $S = 0.90$) and Sanitation Applied to Production ($X = 8.64$; $S = 1.19$) obtained good satisfaction level, while Logistics and Supply Chain ($X = 3.38$; $S = 2.16$), Maintenance Management ($X = 3.91$; $S = 2.59$), Production Modeling and Simulation ($X = 5.09$; $S = 2.43$), Strategic Planning ($X = 5.35$; $S = 2.13$) and Statistical Control of Operations ($X = 5.52$; $S = 2.16$) achieved a level equal to or below to regulate.



Figure 13 - Performance of teacher that taught Logistic and Supply Chain

Source: Author

The underperforming discipline was Logistics and Supply Chain (Figure 13). It was observed that all items had below-regular satisfaction indices: Assiduousness ($X = 2.67$; $S = 1.78$); Presentation of partial grades and frequencies before the Final Exam ($X = 2.85$; $S = 1.83$); Quality of material (slides and handouts) presented to students ($X = 2.89$; $S = 2.06$); Class dynamics ($X = 3.19$; $S = 2.13$); Ability to motivate students

($X = 3.33$ $S = 2.29$); Exposure of matter clearly ($X = 3.33$; $S = 2.18$); Availability at the institution to answer questions ($X = 3.33$; $S = 1.93$); Evaluation Methodology ($X = 3.89$; $S = 2.26$); It presents real cases of knowledge application ($X = 3.93$; $S = 2.50$); and Subject domain ($X = 4.52$; $S = 2.68$).

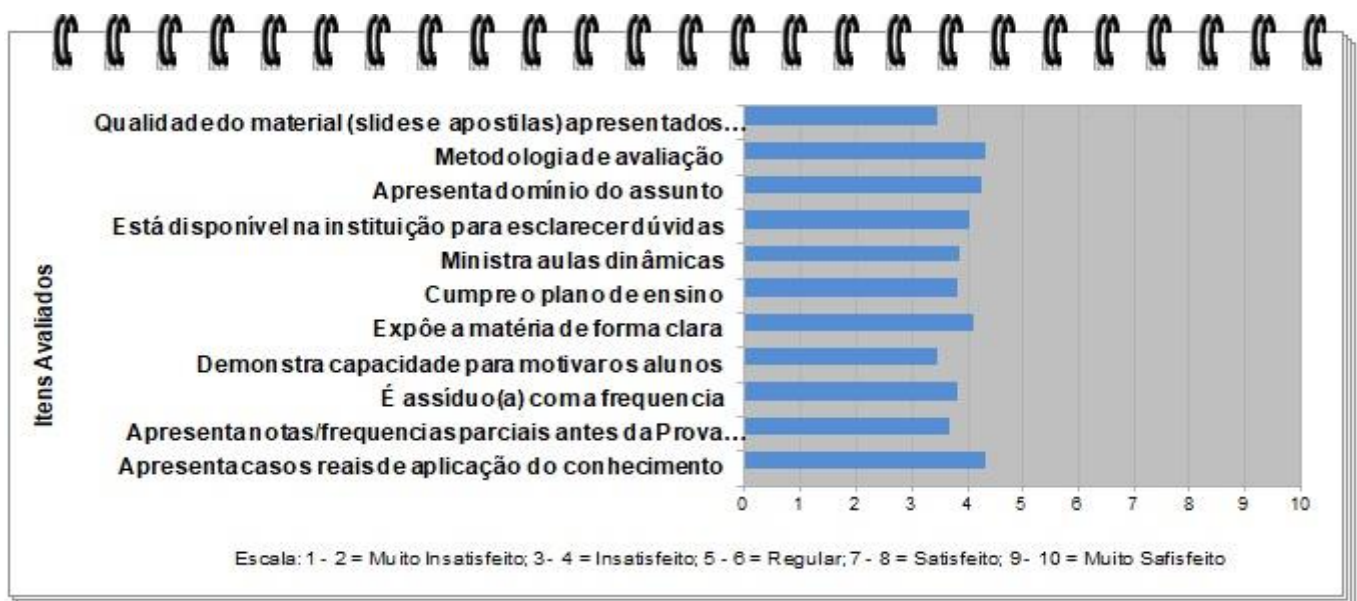


Figure 14 - Performance of teacher that taught Maintenance Management

Source: Author

Regarding the Maintenance Management discipline (Figure 14), all items need to be improved as they are below the regular level of satisfaction: Quality of material (slides and handouts) presented to students ($X = 3.45$; $S = 2.52$); Ability to motivate students ($X = 3.47$; $S = 2.34$); Presentation of partial grades and frequencies before the Final Exam ($X = 3.67$; $S = 2.82$); Assiduousness ($X = 3.80$; $S = 2.74$); Compliance with the teaching plan ($X = 3.80$; $S = 2.50$); Dynamic classes ($X = 3.84$; $S = 2.43$); Availability at the institution to answer questions ($X = 4.00$; $S = 2.35$); Exposure of matter clearly ($X = 4.10$; $S = 2.75$); Subject domain ($X = 4.25$; $S = 2.73$); Evaluation Methodology ($X = 4.30$; $S = 2.90$); and Presentation of real cases of knowledge application ($X = 4.30$; $S = 2.34$).

About Production Modeling and Simulation (Figure 15), all items are at or below the regular satisfaction level: Exposure of the subject clearly ($X = 4.24$; $S = 2.02$); Ability to motivate students ($X = 4.62$; $S = 2.22$); Presentation of real cases of knowledge application ($X = 4.86$; $S = 2.73$); Presentation of partial grades and frequencies before the Final Exam ($X = 5.00$; $S = 2.81$); Subject domain ($X = 5.05$; $S = 2.54$); assiduousness ($X = 5.10$; $S = 2.55$); Quality of material (slides and handouts) presented to students ($X = 5.10$; $S = 2.28$); Dynamic classes ($X = 5.43$; $S = 2.40$); Evaluation Methodology ($X = 5.52$; $S = 2.62$); Compliance with the teaching plan ($X = 5.71$; $S = 2.72$), Availability at the institution to answer questions ($X = 5.95$; $S = 2.39$).

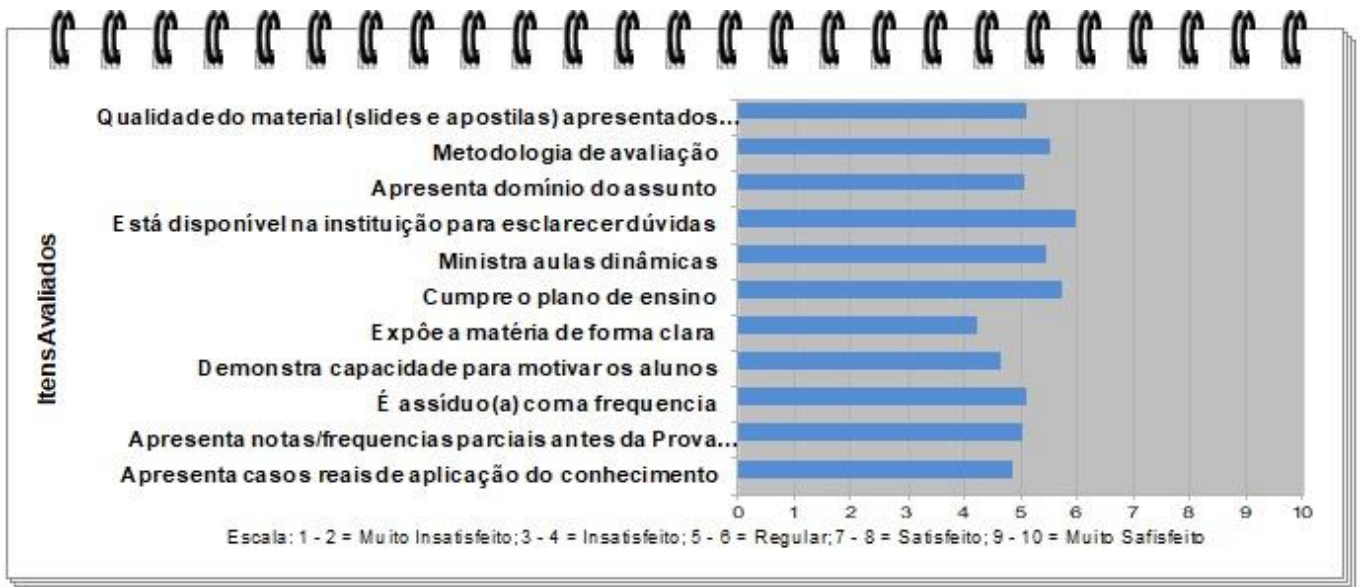


Figure 15 - Performance of teacher that taught Modeling and Simulation

Source: Author

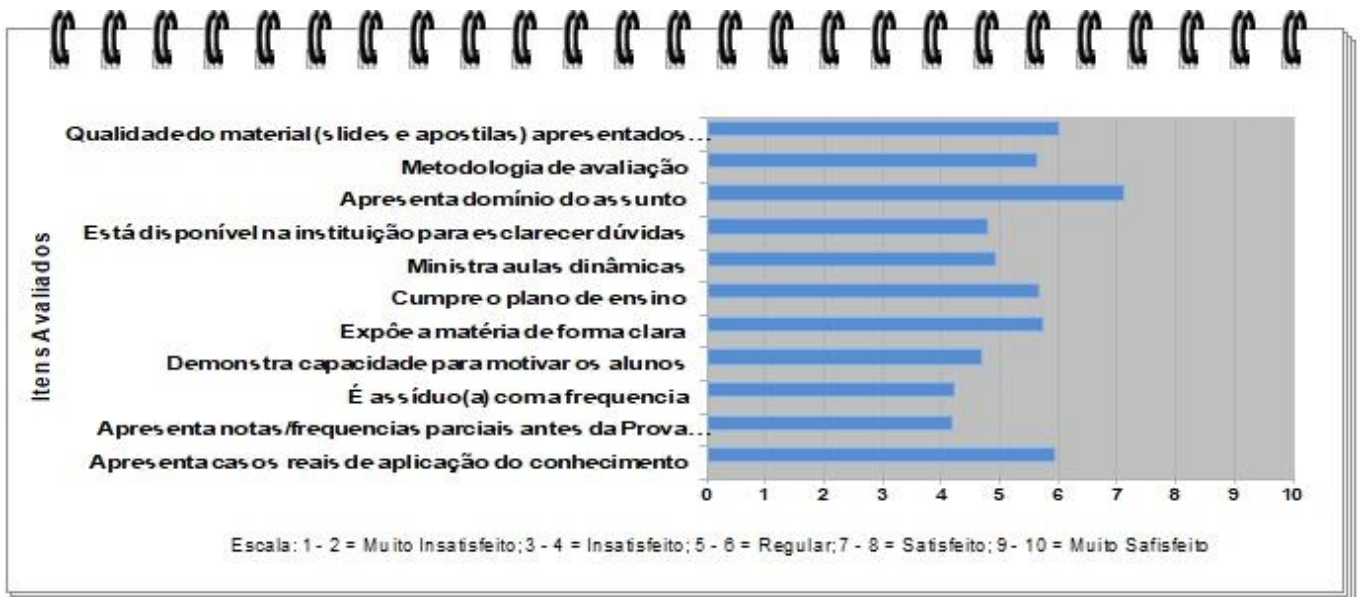


Figure 16 - Performance of teacher that taught Strategic Planning

Source: Author

Concerning Strategic Planning (Figure 16), most of the evaluated items were between dissatisfied and regular. The teacher's best assessment was his mastery of the subject ($X = 7.13$; $S = 1.54$).

Finally, the results in Figure 17 show that most of the evaluated items of the professor who teaches the discipline Statistical Control of Operations were between dissatisfied and regular. The teacher's best evaluation was the Mastery of the subject ($X = 7.23$; $S = 1.57$).



Figure 17 - Performance of teacher that taught Operations Statistic Control

Source: Author

4.5 Student satisfaction analysis with UFAM teacher evaluation portal

At the end of the interview, each student was asked to answer an open-ended question “What do you think of the teacher assessment made on the student portal?”.

Of the 112 students interviewed, 33 (29%) declined to respond but 34% evaluated as negative, another 27% considered it positive, while only 10% considered the site as positive but with aspects to improve.

Regarding students who expressed NEGATIVE opinion, the following arguments were identified: first) students do not see practical results, no improvement over time; second) there is no feedback and no action plan for improvement is presented; third) it is not possible to evaluate teachers correctly because it is a mandatory option; fourth) the quiz is tiring and it is not clear if anyone really evaluates that.

4.6 Student suggestions for other performance indicators

Finally, the interview ended with the question "What other indicator do you consider relevant to measure the quality of teacher service?"

After systematizing the responses, it was observed (Figure 18) that half of the students did not respond to the request. Respondents expressed their concern (12%) to develop some indicators that would allow real-time monitoring of the teacher's presence at the university to help find them more efficiently over time, as shown by a portion of the teachers presented a lower than the expected index concerning its availability at the university.

Next, it was suggested to create an indicator related to the student approval rate (11%) to measure the success of the professor teaching the discipline.

Some indicators focus on their ability to approve (Student Approval Rate) and Managing Research Projects (5%), Number of Monthly Meetings between students and FT/UFAM managers to solve student problems, as well as an indicator of Self-assessment to be made by the teacher.

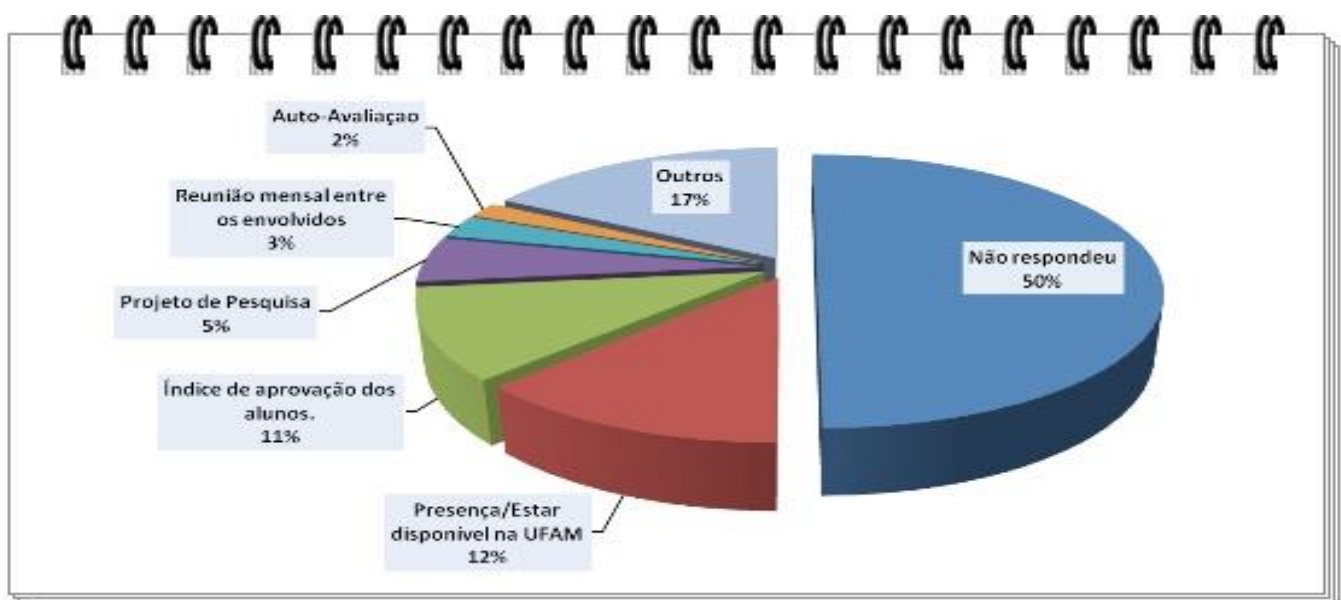


Figure 18: Other relevant indicators proposed by the respondents

Source: Author

5. Conclusions

This article aimed to evaluate the level of satisfaction of students from the 2nd to 8th period of the Industrial Engineering course at FT-UFAM, in order to propose improvements for the university.

To this end, a questionnaire consisting of 11 evaluative items and two open-ended questions was applied to 112 students during October and November 2011.

After analyzing the data, the following conclusions and suggestions for improvements were made:

First, the UFAM portal for students to rate teachers was considered negative by just over a third of respondents, with obligatory, too many questions, lack of feedback and improvement actions being the main reasons whereby a good proportion of students are not motivated to express their opinions seriously. As a suggestion for improvement, UFAM managers are recommended to a) make the assessment a voluntary act; b) students and teachers have online access to the actions being taken to disseminate the good teaching and learning methods of the best teachers, as well as to improve the weaknesses of those teachers identified in the assessment; c) as with Anhanguera University, the results could be statistically treated and published in the form of teacher performance percentage indices, called the Student Satisfaction Level (NSD); d) designate a team composed of the course coordinator, class representatives, and teachers to perform bimonthly improvement actions identified in the evaluations of the previous semester; e) recognize and reward the best performing teachers over time;

Second) The evaluation questionnaire performed well concerning the closed questions, but about the open questions, the students found it difficult to position themselves critically to what was asked. Through this data collection instrument, it was found that the best-evaluated teachers were responsible for the disciplines Special Topics of EP I and II, Management of Technological Innovation, Sanitation Applied to Production, Calculus II, Linear Algebra, Transport Phenomena, and Digital Electronics. As a suggestion for improvement, a benchmark study could be done to identify in more detail the methodologies developed by these teachers to hold seminars to discuss and disseminate best teaching practices;

Third) In general, about the 11 proposed items, it was observed that the non-presentation of grades and

frequencies before the final exam, the low ability to motivate students, the low attendance, the availability of teachers to answer questions and poor classroom dynamics are the top five items that need to be improved with the teaching community. As a suggestion, it is necessary to conduct periodic training for teachers, improve communication and coordination performance with those who teach classes in the Industrial Engineering course;

Fourth) For a successful teacher evaluation process to be implemented, a change of culture must be made among all involved, as for the faculty teachers, the objective of the evaluation should be viewed as a process of continuous improvement and not a punishment, whereas for students, this process should voluntarily reflect their interest in contributing to making their teaching and learning process as effective as possible, which is why their efforts together with the teacher help them achieve the goals of the Pedagogical Project of the course;

Fifth) There is a need to update this research to compare with the results obtained eight years ago. Besides, it is advisable to make assessments more periodically involving course coordination, student representatives and teachers. As a suggestion, it is proposed that this questionnaire be applied twice throughout the semester and that meetings be held between teachers and student representatives to analyze the results and perform improvement actions, thus contributing to the course grade reaching 5 in the year 2021.

6. Acknowledgement

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Appendix 1. Questionnaire to evaluate teachers who taught in the UFAM/Industrial Engineering Course

| Pesquisa para avaliar o nível de satisfação dos alunos com os serviços prestados pelos professores que ensinaram disciplinas para o curso engenharia de produção da FT/UFAM – Segundo semestre de 2011 | | | | | |
|---|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| 1) Para cada item, informe de 0 a 10, o seu nível de satisfação com os serviços prestados pelos professores Escala: 1 a 2 – Muito insatisfeito; 3 a 4 – Insatisfeito; 5 a 6 – Regular; 7 a 8 – Bom; 9 a 10 – Excelente | | | | | |
| ITENS AVALIATIVOS | Professor e Disciplina | Professor e Disciplina | Professor e Disciplina | Professor e Disciplina | Professor e Disciplina |
| A qualidade do material apresentado nas aulas | | | | | |
| Metodologia de avaliação | | | | | |
| Apresenta domínio do assunto | | | | | |
| Está disponível na UFAM para esclarecer dúvidas | | | | | |
| Ministra aulas dinâmicas | | | | | |
| Cumpre o plano de ensino | | | | | |
| Expõe a matéria de forma clara | | | | | |
| Demonstra capacidade para motivar os alunos | | | | | |
| É assíduo com a frequência | | | | | |
| Apresenta as notas e frequências parciais antes da prova | | | | | |
| Apresenta casos reais de aplicação dos conhecimentos | | | | | |
| 2) O que você acha da avaliação do professor feita pelo portal da UFAM? | | | | | |
| | | | | | |
| 3) Que outro indicador você considera revelante para avaliar os professores? | | | | | |
| | | | | | |

Source: Author (2011)

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