Cognitive assessment instruments in Dental education: reflections about an experiment

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ABSTRACT

The cognitive assessment of academic performance in the dental course has been poorly standardized, without obeying a taxonomic order of educational objectives, generating a distorted perception of the competence acquired by the student. Thus, the aim of this study was to present evaluation instruments used in the dental course of School of Medical Sciences and Health of Juiz de Fora (FCMS/JF) to provoke reflections about the dynamics of evaluations. To this end, the Dentistry Assessment Center (NAO) has developed assessment tools for building structured evidence (six discursive questions at three different taxonomy levels), a checklist for verifying assessments by the NAO before being delivered to students and the goal - evaluation, where students evaluate the content of the test, its objectivity and clarity. The three instruments presented in this study form an evaluation dynamic, which are repeated twice per semester, so that there is an improvement in the students' evaluation process and consequently a meaningful learning. Thus, it is believed that these evaluation instruments, within the semiannual dynamics, can contribute to a better perception of cognitive competence acquired by dental students.

Descriptors: Teaching. Institutional Evaluation. Dentistry.

1 INTRODUCTION

The National Curricular Guidelines (NCG) of the undergraduate course in Dentistry marked a new concept about the education of dentists[1], since it came into effect in 2002. Within this context, different courses have sought proposals in which the daily practice of student would be linked to the development of professional

competences, rather than marked by the fragmentation of contents[2].

Therefore, active teaching methodologies have increasingly been integrated into the "traditional grid" of the course, and in this, the "professor" no longer has the function of offering or teaching, and becomes a facilitator of the process of acquiring knowledge; while "students" receive denominations that refer to the dynamic and constructive context, which has a positive influence on both educators and learners[3,4,5]. Among the active methodologies are Problem Based Learning (PBL), that work with activities typically divided into stages, with small groups of students. While Problematization is based on analyses of problems of a population that will later be transformed on the basis of the studies conducted. In Team Based Learning (TBL), the students are divided into Groups of five to eight participants to discuss a clinical case and reach a consensus of response that will later be analyzed together with the entire team[4].

Therefore, the professor faces the challenge of breaking paradigms, by seeking to develop the learners' capacity to learn how to learn, apply theoretical knowledge and work in a team [6-8]. However, a large portion of these teachers acquire a purely technical and specialist education[9] in their postgraduate studies. This implies a method of depositing a high level of teaching contents (in the student's head), which rapidly become obsolete by virtue of the dynamic change in reality[10]. When students are faced with the problems of this reality in professional life, they are incapable of resolving them by seeking the solution in specialties, perpetuating the paradigm of education centered on techniques and specializations of higher learning in Dentistry, going contrary to the demands of society and NCG guidelines relative to the generalist profile[9,11]. Advancement lies in methodologies that integrate the contents, centralize students in the teaching-learning process, by providing autonomy in the development of professional competences. Thus, they place the professor in the position of an intermediator, with a holistic scope, from a perspective of human understanding as a biopsychosocial being, which, after all, is the proposal of the active teaching methodologies[6]. However, to enable the professor to go through this transformation, which will consequently transform the student, some pillars are necessary: reflection, intense and profound training and motivation.

However, the use of active methods of education in Dentistry is still perceived to be juxtaposed to the traditional teaching model, constituting a hybrid model of teaching; consequence of the teacher's education, who teaches in the traditional manner. (The teacher in the center of the process, teaching a generation of students who have other dynamics in the learning process), which generates great difficulty in the evaluation procedure. After all, how does one measure the students' cognitive gain, if not by means of tests? In essence, evaluation leads to a diagnostic concept that allows verification of whether cognitive objects have been attained, whether the evaluated students revealed their merit and value, whether the object evaluated met the criteria established by the evaluators, or at least by those interested in the results of the evaluation[12].

Generally, the evaluations are composed of questions without any pattern, with questions of a technical or direct nature; which leads to mechanical or memorized learning. Therefore, in education it is fundamental to decide and define the aim of learning with the purpose of organizing and structuring the manner in which the evaluations are made, thereby making it possible to change thoughts, actions and behaviors[13].

In this scenario, the Taxonomy of Educational Objectives popularly known as the

Taxonomy of Bloom, makes it possible to prepare a test in which measurement of the results of learning obeys a progressive sequence of hierarchically ordered educational objectives, ranging from the simplest to the most advanced types. The levels of this taxonomy are knowledge, understanding, application, analysis, synthesis and evaluation[14]. Therefore, the learners' capacity to remember corresponds to the lowest taxonomic level, and the capacity to create, to the most complex level in taxonomy. Thus, educators will help their students in a structured and conscious manner to acquire specific competences through perception of the need to have command of simpler skills, to enable them to have command of more complex types later[4,13].

For this purpose, evaluation must be presented systematically, which is not an end of itself, but is the target of a continuous and regular process of improvement, so that evaluation of the evaluation - denominated meta-evaluation - is frequently necessary[15]. This represents an evaluation instrument, in which the teacher will obtain a perception from the students in relation to the tests performed. By these means, teachers who have their tests evaluated by their students will be able to mark the points that need to improve, and thereby implement changes to ensure that this improvement does in fact occur[13].

In addition to meta-evaluation, another instrument capable of recording performance, behaviors or demonstrating appropriation of the contents, is the checklist. This may be drawn up as a single list, constructed by a professor, and generally has the activity performed by the student as a reference [16, 17].

Therefore, we report the experience of the undergraduate course in Dentistry of the School of Medical Sciences and Health of Juiz de Fora (FCMS/JF), and present the three instruments used (structured test, evaluation checklist and meta-evaluation) to the dental scientific community, with the purpose of serving as a basis for discussions about the standardization of the evaluation models in Dentistry.

2 EXPERIENCE REPORT

Since 2013, FCMS/JF has been structuring the cognitive evaluations of the Course in Dentistry in accordance with the NCG and pedagogical project of the course, by elaborating discursive, criterion-referenced questions that cover the scope of all the levels of complexity of the Taxonomy of Bloom. For this purpose, the teachers underwent a series of training sessions and workshops conducted by competent professors in the field of health education, about the new system of evaluation, how to elaborate discursive and multiple-choice questions, and about the Taxonomy of Bloom. A long process began with the professors of the institution, who initially responded with denial, suspicion and fear of the new. Later, with acquisition of knowledge, they emerged in an individual manner to reflection, and after successive approximations, the majority finally reacted with acceptance. From this time onwards, the new model of evaluation was considered mandatory for all professors at this private institution.

Therefore, to ensure learning in a more consistent and faithful manner, they understood that it was important to verify the structure of the test relative to the types of questions formulated, the quality demanded, responses they expected to obtain according to the content of questions or problems that were formulated[16]. For this purpose, the "Núcleo de Avaliação da Odontologia (NAO)" Nucleus of Dental Evaluation (NAO) elaborated an instrument capable of verifying the test, denominated the evaluation checklist. The NAO is composed of previously trained professors, in a part-time or full-time working regime, who participated in other teaching activities at the institution. The approach used in the checklist ranges from the

way the teachers organize their questions, such as for example, the areas of knowledge that were used to formulate their questions, their value and whether the question was contextualized, through to the way it was written; whether it was within the taxonomic level and written in adequate language.

The checklist alone of the test performed by the professors of NAO does not guarantee quality, therefore active participation of the students is also of extreme importance in the process, favoring the joint construction of knowledge[1]. This is why the students' perception about the test is fundamental to ensure that there will be constructive feedback. Therefore, another instrument was elaborated - the meta-evaluation - to verify the test. This is filled out by the students after doing each test and has the function of helping the professors to improve their strong points and strengthen their weaknesses where elaboration of these evaluations is concerned.

For the meta-evaluation to add value to the teaching-learning process, students are trained to answer it, particularly in the first period when they are getting to know all the teaching processes of the course. Members of NAO and professors engaged in the process explain about standardized evaluation, meta-evaluation and feedback. A hard (printed) copy of the students' manual is delivered and also made available on the website of the course, with all this information. Every semester these concepts are reinforced by means of successive repetitions.

The three evaluation instruments created by NAO presented in this article are for standardized cognitive evaluation in accordance with the taxonomy of educational objectives, the evaluation checklist and meta-evaluation. The first of these, applied cognitive evaluation, follows a criterion-referenced formatting and confection pattern, based on the principles of the Taxonomy of Bloom. It is constructed with six mandatory discursive questions, of which the first has context and statement with high taxonomy, containing fifteen numbered lines for the answer. The following two questions are of medium taxonomy and have eight lines for the answer. The last three questions are considered low taxonomy, and have two lines for the answer, of a more objective nature. If the professor of the discipline considers it necessary, more questions could be added, and these would be of the multiple-choice type. The questions must contain the area of knowledge, value, template and bibliographic references.

The second instrument, the *checklist* created by NAO for verifying the evaluation prior to its application, approaches thirteen items, to which the possible answers are "yes", "no" or "partly". The taxonomies, coherent templates with the statements and references are examples of the items evaluated (Figure 1). The checklist is important for guiding the professors with regard to their evaluation and for maintaining standardization, which is of benefit to the student, because there is no surprise relative to the format of the evaluation.

Lastly, the meta-evaluation is approached in the form of four items that are answered by students as "satisfactory" or "unsatisfactory" (Figure 2). The content of the test, quantity of lines per question, objectivity and clarity are the items of this instrument. In it there is also space for particular criticisms and suggestions related to the evaluation made.

The three instruments constructed are used in a dynamic evaluation of the course, which begins by elaboration of the evaluations by the professors, respecting the standard model of the institution, and after this the NAO verifies them using the checklist and takes the opportunity to suggest changes to the professors, in the sense of making adjustments to the standard. After this, the evaluations are applied during the week of tests predefined in the school calendar. Simultaneously, the students receive the meta-evaluation, which must be filled out and returned on conclusion of the test.

CHECK LIST for ___ – ___ semester, _____ year

Professor:
Discipline:
Course: Period:

Fill out the number of the questions with reference to: Yes / No or Partly

	Yes (Questions)	No (Questions)	Partly (Questions)
The statement contains only essential data and information			
Used verbs in accordance with the taxonomy			
Presents the contents in a contextualized manner			
Has an adequate level and language			
The questions state clear commands			
It has questions that make it possible to use logical thought			
The statement is very long			
There is coherence between the template and question			
Established the value of each question			
Inserted the area of knowledge into each question			
Each question has a template			
The test has the bibliography			
It is in the model standardized by the institution			

Suggestions:

Figure 1. Checklist of evaluation delivered to professor for adjustments to standardized evaluation model of institution

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Meta-evaluation

Course: Period: Discipline:

The items of information collected in this document are confidential and will be used for evaluation and improvement of the teaching-learning process, by means of identifying the strong points and those that require improvement.

Evaluate the discipline relative to the following aspects: (Check X for the option of your choice)

	Satisfactory	Unsatisfactory
a) Relations between contents approached in the tests and disciplines		
b) If the spaces reserved for the answers were adequate		
c) Were the statements of questions easy to understand, were they clear?		
d) Was the time of evaluations sufficient?		

Commentaries: Cite the questions that had unsatisfactory results;

Figure 2 - Meta-evaluation Instrument, delivered to students at the time of performing the test per discipline

With the meta-evaluation in hand, the NAO acts once again, by analyzing the results, and then provide the professor with feedback, thus improving the quality of the evaluation and establishing patterns of correction.

As soon as the professor has corrected the tests, a time occurs in the classroom, denominated feedback about the test, when these are delivered to the students, and the template is presented, thus constituting another time of learning and reflection of the evaluation process. However, feedback is not the time of revising the test, if the students judge that the tests were not adequately corrected, they must schedule an appointment for revision, with the secretary. This cycle is repeated two times per semester, at all times in the sense of strengthening the evaluation process, because the professors have their strengths and weaknesses at hand, and can work on them with the support of NAO (Figure 3).

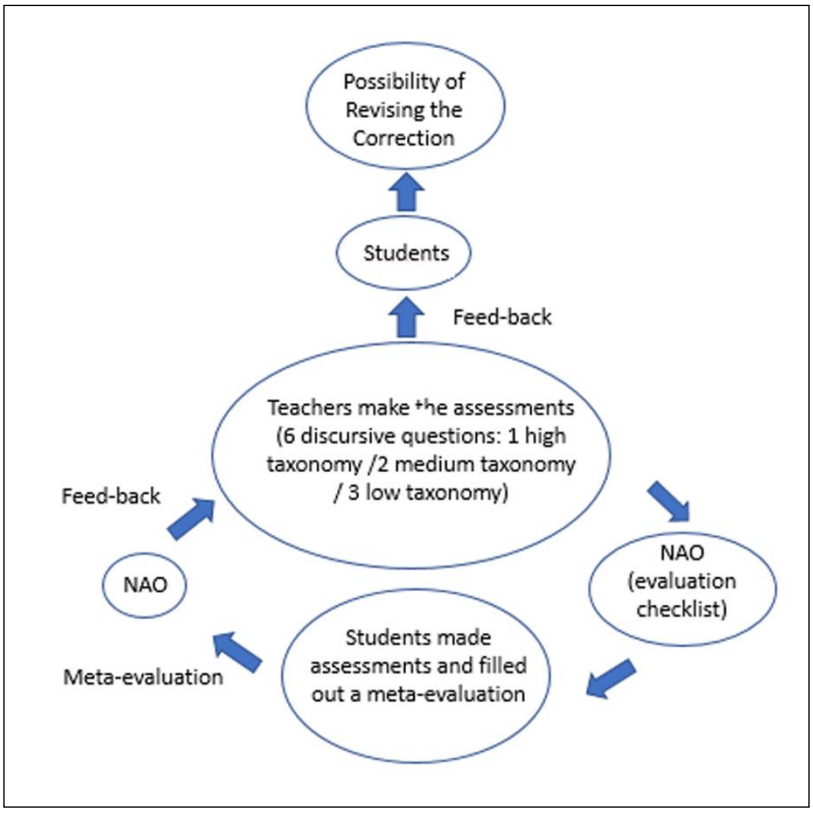

Figure 3. Evaluation Cycle Dynamics of the Course

Although studies have demonstrated that conventional evaluations are incapable of "measuring" the knowledge of learners, both teachers and students, as well as parents and society itself still find this affirmation difficult to grasp. Over the last few years, credibility related to the measures, summarized in the known grades resulting from the evaluation processes at different educational levels, appears to have attained high thresholds, whether in tests and internal disputes of the institutions, or in the form of exams, such as the entrance exams or within the scope of National assessments (Exame Nacional do Ensino Médio/Enem, Sistema Nacional de Avaliação da Educação Básica/Saeb e Exame Nacional de Desempenho

dos Estudantes/Enade). Students, professors and those responsible for them have been hostages of the measures relative to making decisions in the face of the Brazilian education system[18].

According to the Commission of the National Council of Education/Chamber of Higher Education ["Câmara de Educação Superior (CNE/CES)"] of 2002, in Resolution No.3, of the NCG of undergraduate courses, the Course in Dentistry must present a pedagogical project centered on the students as the subjects of their learning and supported by the professor as facilitator of this process. The students must have an education of a generalist, human, reflective and critical nature, to enable them to work at all levels of health care. To achieve this, it must comprise all the social, cultural, behavioral, psychological, ecological, ethical and legal determinants of the health-disease process, at both individual and collective levels[1].

These perceptions will give rise to the different proposals of evaluation; among them, the most outstanding was called "pedagogy by objectives". This pedagogy, as opposed to that of the contentist model, stole the scene and invaded the school environment, spreading its "truths" about the process of knowledge acquisition by individuals[18].

Thus, the professor becomes the fundamental subject of these dynamics, and must face many challenges, of which the first is to break loose of rigid traditional models of teaching. In Dentistry, the professionals are not trained for teaching, and are frequently restricted to techniques and specializations, reinforcing the idea that whoever knows how to do it, also knows how to teach it[3]. A change is necessary in the concept of what it means to be a teacher; that is, someone who provides students with not only specific themes and a high load of instrumentalization, and will afterwards test this knowledge with punitive tests of memorization; but rather someone who makes it possible for students to gain knowledge of their own culture and intellectual posture, which is the university mode of situating oneself in the world. Professors must constantly be asking themselves how they can contribute to the education of the student of higher education, and based on this question, seek pedagogical improvement by means of training; reflecting on their actions, and in this way, correcting routes[19].

Since 2013, the reality of the professors at FCMS/JF began to change, by training the teacher for a series of active methodologies such as problematization, denominated by the institution as interdisciplinary articulation. In this mode, the professor is the tutor and works with problems of paper, the educational aim of which is realized by means of students elaborating questions based on the taxonomy of Bloom, pertinent to the gaps in knowledge about the case and disciplines of the courses they are doing. The professors also work with questions for constructing the progress test and the *Objective Structured Clinical Examination* (OSCE), for example. However, many challenges remain, because these methodologies demand a great deal more dedication from the teacher and they work with small groups. This consequently implies the need for higher investments and strategic organization by the institution, so that the entire process can effectively continue, and not merely be implanted. In the same way as occurs with the students, the teacher must be constantly motivated and guided, because the work with active methodologies is not only to place the students in the center of their learning process and let them follow on alone, which certainly would result in insecurity and confusion. To the contrary, the professor needs to work actively on providing these students with support, so they can complete the targeted pathway. But what is observed at the institution is a change in the cultural paradigms of teaching and learning, altering the teachers' perspectives

about which the professional competences are that must be approached in teaching and how, in fact, to teach the students to acquire them in a fully independent manner.

In this process, the construction of significant learning must involve the professor and student partnership, thus it is necessary to have a potentially significant content and to adopt an attitude favorable to learning[20]. This latter concept is with respect to the students' immature posture that allows associations to be established between the new knowledge acquired and the parts already present in the students' cognitive structure, constituting the so-called process of continuity[21]. This must be presented and conducted patiently and with confidence by the trained teacher As the thinker and psychoanalyst Rubem Alves defended:

> *"The human body only learns two types of content; The first those that give pleasure. The second, the means to reach the object of pleasure. In their overwhelming majority, the curricular contents are not objects of pleasure, and are not perceived by students as being means to reach anything whatever. The fact is that students do not even know the reason why they have to learn that which they are being forced to learn"*[22].

In this scenario, the writer Paulo Freire said it was necessary for us to overcome the idea of the bank account, in which the professor deposits a certain quantity of contents and the students only memorize them[10].

If adequate planning is not made, this could lead to teachers being faced with a high level of dropouts in their disciplines, or even to personal anxiety when they note that their students are not attaining the desired level of development[13]. The problem of "how to evaluate this development?" has been the target of many scientific researches in the field of Education. This was confirmed with the study of Bloom and his team, when they demonstrated that in the same teaching conditions, not considering the variables outside of the educational environment, all the students learned, but they were differentiated relative to the level of depth and abstraction of the knowledge acquired[23]. This difference could be characterized by the strategies used and by the organization of the learning processes to stimulate cognitive development[13].

Therefore, the challenge was proposed to the professors of Dentistry at FCMS/JF, to standardize all the tests applied to the students of the 1st to 8th periods, in all the disciplines, ached on the Taxonomy of Bloom. From the literature, students are known to feel anxious and insecure relative to the tests constructed by professors individually; or that is, without the standard, because they reported on the difference in the manner in which a question is answered, depending on the professor who constructed it[23]. This is because an answer may not please two different professors in one and the same discipline, which configures a weakness in the evaluation process. Therefore, it is clearly imperative to organize and structure the institutional objectives with the purpose of directing the teaching process towards the adequate choice of strategies and methods, thereby contributing to effective and long-lasting learning[12].

Only standardizing the tests is not sufficient in the evaluation process. As this concerns a new model, the professors need to be supported and guided to enable them to perceive the students' cognitive performance in higher levels of complexity. Therefore, the role of NAO, which has the function of guiding the teachers, is important and helps them with the understanding of how to construct items. For this purpose, in addition to collective meetings to train teachers about test questions based on the taxonomy of Bloom, individual meetings are scheduled during the semester for following-up the processes.

The questions must be clear, objective, contextualized; and this context must have items that are strictly necessary for constructing the answer. The statement must allow a sequence that stimulates logical reasoning with verbs pertinent to the taxonomy of the question. To enable NAO to provide this guidance, it is necessary for the professors themselves to answer their questions in full.

When students receive the meta-evaluation together with the test, students will begin to understand the time of evaluation not only as being accumulative, but also formative as from the time they begin to participate in the construction of this evaluation. The meta-evaluation involves critical appreciation of its usefulness, feasibility, propriety, precision, validity and enables an evaluation to be conducted for reporting its strong and weak points, evaluating its quality, and providing guidance and feedback[25].

Relative to usefulness, the meta-evaluation must verify to which extent the results of the evaluation are being made use of, because the more the results are used by participants, the stronger will be the compliance with the criterion of usefulness. Therefore, it is relevant for the questions of tests to have great approximation to the reality experienced by students in their clinical practice, in addition to being useful not only in their academic life, but in their professional life as well[26,27].

Feasibility concerns the extent to which it would be cost effective and feasible to produce a meta-assessment. In this case, the meta-evaluation could be performed online, thus avoiding costs with impressions that will be digitized later for delivery to the professors, which makes them doubly unfeasible. The criterion of propriety refers to the role and responsibility of students, who must be ethical and conscientious when answering the meta-evaluation.

The items of information obtained from the commentaries in the meta-evaluation are analyzed by the NCG relative to compliance and low-class terms are removed before forwarding the documents to the professors. However, a good portion of the commentaries have been constructive and conscientious. The great difficulty with meta-evaluation has been adequate filling out of the items by students. The majority answer "satisfactory' in all the items, and few attribute scores to items that are unsatisfactory and comment about the items to which they attributed scores. This is probably owing to the insecurity about their anonymity, because they deliver the meta-evaluation directly to the professors, and also due to being tired, because they always answer immediately after the tests, which are discursive and demand a large amount of writing. Therefore, when the test is good or reasonable, they generally answer "satisfactory" in all the items without writing any commentary. When the test has differed from the standard, with questions outside of the taxonomies, or very confusing, the students do comment. In terms of scores, the students criticize the professors for personal divergences or because they have not yet adapted themselves to the content of the discipline. Strategies such as providing the meta-evaluation *online*, for example, are being worked on by the institution. However, the determinant factor for students to place value on the meta-evaluation is the *feedback* that NCG offers, because when the students do not obtain answers to the anxieties they reported, the process is compromised even further.

Whereas, precision is the reliability of the meta-evaluation results in which, if the students are familiar with the content, they can faithfully evaluate them, thereby guaranteeing the veracity of the results obtained[27]. Within this context a possible bias would be if the students do not understand what the meta-evaluation and its

importance are, and by answering in a relapsed manner, they contribute to an unsatisfactory result on conclusion of the process. Students must be motivated by the professors at a time close to the period of tests, in addition to analyzing the professors' perspective about the group, how the content was approached, whether or not there were difficulties, and about the evaluation itself. By crossing these items of information, it is possible to perceive the reality about the evaluation in a better way.

Validity concerns the relations between the conclusions presented by the students and their justifications[28]. An example would be the students' answer "unsatisfactory" relative to the content approached in the test and discipline. The fact that students marked a negative response already justifies the questioning.

Finally, the conduct is related to the legal, ethical and professional standards, and whether they have been respected by the evaluator. This criterion encompasses the obtainment of consent to participate in the evaluation, and protection of the confidentiality of data and information obtained[28]. Therefore, it is mandatory for the meta-analysis to be anonymous, so that no retaliation occurs by professors who are immature in the process. Therefore, anonymity and reliability of the meta-evaluation are inter-related.

After being processed by the NAO, the meta-evaluation is delivered to the professors for reflection about their own evaluation, considering the perspective of their students. Therefore, after meticulous correction of the tests, based on the meta-evaluation, professors provide feedback about the tests.

Thus, thinking of education as a form of liberating the individual, leading to a political, reflective, and critical practice that allows a new logic in the understanding of the world, FCMS/JF closes the evaluation cycle in the expectation that by means of these dynamics, the student may be evaluated in a better manner by their professors, thereby making this process less subjective and more just as far as possible.

3 FINAL CONSIDERATIONS

We believe that the elaboration of the instruments presented provided an evaluation of a formative and accumulative nature. This process still needs investments in training teachers about what evaluation is, its objectives in educating the students and how to construct items for evaluation. Furthermore, it demands a change of paradigms in the teaching-learning process, from teachers, patience with and reflection about the changes, engagement to transform the students and the professors themselves.

RESUMO

A avaliação cognitiva do desempenho acadêmico no curso de Odontologia tem sido feita de forma pouco padronizada, sem obedecer a uma ordem taxonômica de objetivos educacionais, gerando uma percepção distorcida da competência adquirida pelo aluno. Assim, apresentam-se os instrumentos de avaliação utilizados no curso de Odontologia da Faculdade de Ciências Médicas e da Saúde de Juiz de Fora (FCMS/JF) para provocar reflexões acerca da dinâmica das avaliações. Para tanto, o Núcleo de Avaliação da Odontologia (NAO) elaborou instrumentos avaliativos para construção de provas estruturadas (seis questões discursivas, em três diferentes níveis de taxonomia), um *checklist* para verificação das avaliações pelo NAO antes de ser entregue aos estudantes e a meta-avaliação, quando os discentes avaliam o conteúdo da prova, sua objetividade e clareza. Os três instrumentos, apresentados neste estudo, formam entre si uma dinâmica avaliativa que se repete duas vezes por semestre letivo, visando à melhoria do processo avaliativo dos educandos e, consequentemente, uma aprendizagem significativa. Desta forma, acredita-se que esses instrumentos avaliativos, dentro da dinâmica semestral, podem contribuir para uma melhor percepção da competência cognitiva adquirida pelos acadêmicos de Odontologia.

Descritores: Ensino. Avaliação Institucional. Odontologia.

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