

Knowledge management: Postgraduate Alternative Evaluation Model (MAPA) in Brazil

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ABSTRACT

The Brazilian stricto sensu postgraduate programs that include master and / or doctorate courses are evaluated by Coordination for the Improvement of Higher Education Personnel (CAPES - Coordenação de Aperfeiçoamento de Pessoal de Nível Superior). The evaluation method used by CAPES is recognized in national and international context. However, several elements of the evaluation method can be improved. For example: to consider programs diversity, heterogeneity and specificities; to reduce subjectivity and to explain how indicators are grouped into different dimensions to generate a final result, which is scoring level reached by a program. This study aims to analyze the evaluation process by CAPES, presenting questions, difficulties and objections raised by researchers. From the analysis, the study proposes an alternative evaluation model for postgraduate (MAPA - Modelo de Avaliação para Pós graduação Alternativo) which incorporates fuzzy logic in result analysis to minimize limitations identified. The MAPA was applied in three postgraduate programs, allowing: (1) better understanding of procedures used for the evaluation, (2) identifying elements that need regulation, (3) characterization of indicators that generate local evaluation, (4) support in medium and long term planning.

Key words: Brazil postgraduate programs, Evaluation, Management of the programs

1 Introduction

The evaluation of education programs generates informational support that aid to improve the quality of institutions, courses, professors, students and society as a whole (Andrich, 2002; Cahan, Elbaz, 2000; Reboloso, Ramírez, Cantón, 2005). This support embraces the elements that should be observed in the evaluation process or the actions generated, directed at performance improvement and knowledge management (Bititci, Carrie, McDevitt, 1997; Galabawa, Obeleagu, Miyazawa, 2002).

A range of methods can be used to undertake this evaluation. Since this study focuses effectively on the evaluation of postgraduate programs (master and doctoral courses) used in Brazil, there is a specific evaluation method for *stricto sensu* postgraduate programs, which focuses master and doctoral courses. This evaluation distinguishes the programs that are “capable” for operation or those considered “not capable”, by the external evaluation viewpoint. The Coordination for the Improvement of Higher Education Personnel (CAPES – Coordenação de Aperfeiçoamento de Pessoal de Nível Superior), a Brazillian government agency, conducts such evaluation of postgraduate programs and courses, and compiles the results in triennial period.

The evaluation process is well structured and has a long tradition of application. However, there are many difficulties in the applying of the evaluation process of Brazilian postgraduate courses and programs. Some authors criticize the evaluation process used by CAPES. For example, Fonseca (2001) affirms that the program that comes closest to the desired performance receives the highest classification, without considering the situation of programs that present specificities in operation, whether temporary or not.

Simões (2004) argues that the CAPES evaluation is not able to consider diversity and heterogeneity of programs. Miranda and Almeida (2004) criticize the process subjectivity and observe that non-established criteria are considered without being made explicit. Hortale (2003) affirms that the evaluation method is subjective because of the lack of information about the way as the quality indicators, analyzed in different dimensions, generate a result expressed by a single score at the end of the process. In addition to better understand the evaluation process, exists demand for a tool that helps the programs to manage their knowledge and practices.

To reduce the limitations observed and invest in continuous improvement, this study proposes an postgraduate alternative evaluation model (MAPA – Modelo de Avaliação para Pós graduação Alternativo). In this way, the article describe the evaluation process of the postgraduate programs used in Brazil, and presents questionings, difficulties and objectives formulated in relation to this process.

In the next section is presented the theoretical support for the proposed model. The paper then describes the effective utilization of the current evaluation models. Based on practical findings, and with the support of the theoretical references identified, the paper proposes a reorganization of the CAPES model and then describes a proposal for a new model. The paper concludes with considerations and recommendations for future work.

2 Theoretical Support– the evaluation process

This section presents elements related to the theoretical support for the proposed model.

2.1 Description of the evaluation process – historical summary

The evaluation process conducted by CAPES began to be consolidated in 1982. In 1996-97 the process had one change but not significant. With the restructuring that occurred from 2001 to 2004, trends were observed for the adoption of more rigorous criteria. In this period was defined that the evaluation would not be considered a form of punishment or reward, but should first be understood as a way to provide feedback to postgraduate programs an couers and generate opportunities for improvement. This understanding would lead CAPES to promote information about evaluation process and its results (evaluation criteria, annual reports, triennial reports). As a consequence, programs are becoming increasingly concerned about information quality presented to CAPES (Santana, 2002). This was the first step of CAPES towards encouraging interaction with the programs in the restructuring process of evaluation. Several meetings were accomplished between area representatives (CAPES members) and program coordinators. This interaction allowed discussing criteria and made the evaluation process less obscure (Batista, 2002), and need for improvements in evaluation process have been identified.

The actual evaluation process considers the following elements: guidelines by area, explicit criteria, general indicators, specific parameters, program profiles, the classification scale used (excellent (MB), good (B), regular (R), weak (F) or failing (D)) and general orientations from CAPES.

The analyses on triennial evaluation criteria indicate that 67% of areas adopt a five group of similar items: (1) the program proposal, (2) teaching staff, (3) Students, (4) intellectual production and (5) social insertion. The program proposal is evaluated qualitatively (excellent, good, regular, weak or failing). As social insertion has a weight of 10%, the weight of the other items may vary in range of 25% - 35%, in which the sum of items must total 90%. The five items more adopted by CAPES (67%) were adopted in this research.

The CAPES evaluation process for postgraduate programs has undergone continuous change, and this study is part of effort of continuous improvement, in agreement with reality of postgraduate programs.

3 The effective use of the current evaluation models

The bibliographical references of evaluation process conducted by CAPES, as well as, part of research conducted in practical reallity of post-graduate courses, provide knowledge to support this study. Given the nature of this study, this knowledge was grouped into seven categories: (a) general factors, (b) participation of the academic community, (c) diversity and heterogeneity in the process in use by CAPES, (d) contribution to society, (e) publications and their effective contributions, (f) regional, institutional, social and financial diversities and (g)

subjectivity of the process. The knowledge obtained in the theoretical and practical analyses is shown in Table 1.

The elements described in Table 1 do not reject the perception that the process of CAPES is exemplary, recognized by other countries (Leite, Tutikian, Holz; 2000), as well as no similar evaluation process was found in other countries, which generate, for example, annual performance reports, with annual accreditation and reaccreditation every three years.

Table 1: Theoretical and practical knowledge about CAPES evaluation process

(a) <i>Concerning general factors:</i> In both the programs and among the evaluation agents, it is noted that knowledge is restricted to the elements linked to their own evaluation area. In part, this occurs because the analysis and reading of the evaluation criteria for a group area does not generate sufficient knowledge for understanding the entire evaluation process. For this reason, upon analyzing only one of the group areas, there are positions consolidated throughout the area. But upon expanding the perspective of analysis, it is found that the issues observed do not refer to the evaluation process as a whole, but only to a particular area.
(b) <i>Concerning participation of the academic community:</i> The academic community participates in the construction of the evaluation process in use by CAPES. This participation reaffirms the perception that the evaluation is not seen as a form of punishment or reward, but as a way to generate feedback. To assist in this process, CAPES presents the evaluation results, with the expectation that the programs are increasingly concerned with the quality of the information provided. The evaluation process is the result of collective work, which reflects the national academic reality. For this reason, the questions of the academic community are perceived as elements to be observed in the evolution of the evaluation process.
(c) <i>Concerning the diversity and heterogeneity of the process:</i> The information used in the evaluation are provided by the programs themselves, by means of an information collection system called Pró-coleta. In this system, the programs inform, by completing on-line forms, information about the activities conducted, specificities of the operations or elements they consider relevant. In the evaluation process, each area can opt to attribute more or less weight to the elements that are the object of analysis. It is thus found that the evaluation process gathers data, produces information, informs on weaknesses, offers suggestions for improvement and reveals to what point each program has achieved its objectives. At the end of the process, a performance classification is presented. The annual and triennial reports are made available for public consultation. These reports present suggestions for each element evaluated and indicate the perception about the performance of the program. Thus, it is up to the programs to analyze and make use of the elements presented.
(d) <i>Concerning the social contribution:</i> The analysis of the evaluation process revealed that the issue "program's insertion in society" considers the scientific, technological, economic, and educational impacts and the social integration and solidarity activities of the program. This item also considers the training of professionals, the postgraduate insertion, consultancies, extension projects, scientific promotion, organization of extension programs or specialization courses aimed at and aligned to social needs, as well as participation in scientific societies, and the organization of events. It is thus noted that the evaluation is quite broad.
(e) <i>Concerning the publications and their effective contributions:</i> The awards and distinctions conferred to the theses and dissertations and or to related publications, as well as the research and or supplementary publications, are evaluated and contribute to the final evaluation of the item, adding additional points.
(f) <i>Regional, institutional, social and financial diversities:</i> The evaluation process considers both the contribution to the development of the regions in which the programs are inserted as well as local difficulties and characteristics. Programs located in regions with lower levels of development can conduct partnerships with programs from other regions, which are stronger in terms of training and qualification of the personnel, and establish exchange programs and other activities that favor the advance of postgraduate programs in regions that have, for example, few doctors.
(g) <i>Process subjectivity:</i> According to the current position of many programs studied, the evaluation is conducted in a subjective manner. In some cases, they argue, criteria that are not established are used and considered in the process without being explained. It is evident that this possible subjectivity generates insecurity to those evaluated in terms of the score level and specificities attributed. This generates polemics about the process in use and the possibility of seeking new forms of evaluation. The analysis of the criteria used by CAPES reveals that subjectivity can occur because the scores for the items considered in the evaluation are not effectively presented when the final classification of the program is presented. Thus, doubts remain about the elements considered when issuing a score of 3 instead of 4. This subjectivity allows identification of parameters for the search for excellence in the process in the different knowledge areas.

Sources: Carvalho, 2001; Fonseca, 2001; Castro, 2000; Neves, 2002; Santana, 2002; Santos, 2002; Hortale 2003; Axt, 2004; Arantes, Lobo, Fonseca, 2004; Miranda, Almeida, 2004; Simões, 2004; Horta, Moraes, 2005; Kuenzer, Moraes, 2005; Ramalho, Madeira, 2005; Steiner 2005

In synthesis, the correlation between the theoretical research and the evaluation criteria adopted by CAPES reveal difficulties about specific issues, among which stand out (a) the consideration of elements linked to the social welfare; (b) the program specificities; (c) the criteria adopted in the process of homogenization of the scores issued and (d) subjectivity in the evaluation process.

A careful analysis of the questioning conducted allows concluding that many programs do not agree their scores for not understanding the evaluation process, or without adopting procedures that serve to justify the doubts raised (Fonseca, 2001; Axt, 2004). The reason of this situation is the difficulty in analyzing information available in CAPES evaluation process, in order to drive improvement actions internally.

The model proposed here generates dialog between internal (conducted by a program) and external (conducted by CAPES) evaluations, in response to questions raised for authors as Simões (2004) and Galabawa, Obeleagu, Miyazawa (2002). Practical studies show that internal and external evaluations are distinguished by perspective of the person that conducts the evaluation (Pletinckx, Segers, 2001; Kyriakides, Campbell, 2004; Rodgers, 2005; Alashloo, Castka, Sharp, 2005; Rumberger, Palardy, 2005). In the internal dimension, an evaluation is conducted by the institution members, while, in an external evaluation, the evaluation is conducted by specialists from different areas, who are not linked with institution evaluated (Lousada, Martins, 2005). The process does not mention the need for distinct procedures, but emphasizes the difference of internal and external perspectives.

This study contributes to improvement of evaluation process by minimizing some restrictions presented by postgraduate courses and programs, as well as subjective factors of evaluation process and its use a mechanism to drive improvements for postgraduate programs. These restrictions, and the need of create communication between external and internal evaluation process, have been identified by practical studies and theoretical studies conducted by several authors (Santos, 2002; Andrich, 2002; Pletinckx, Segers, 2001, Galabawa, Obeleagu, Miyazawa, 2002; Figueiredo, et al., 2005; Skinner, 2004; Rumberger, Palardy, 2005; Popham, 1997; Nevo, 2001).

The interaction between two dimensions begins with analysis of external elements (objective indicators, information about expected results, variations that took place and reasons for them; evaluation of actions). It seeks to allow program coordinators to implement measures to improve management actions, based on CAPES' evaluation process. The proposed MAPA can help postgraduate program coordinators to plan and take measures that integrates two perceptions (external and internal) and represents a strategy to identify characteristics intrinsic to programs, indicated by information collection mechanisms, which can be valued in evaluation process.

4 A reorganization of the CAPES model - MAPA

According to Leite, Tutikian, Holz (2000), Fonseca (2001) e Axt (2004) the distinction between two contexts of evaluation (internal and external) is due to positioning and perspective of those involved. That is, external evaluator has conditions needed to conduct performance analyses only as a consultant, without being involved with situations related to program daily activities, while internal evaluator is more susceptible to these situations.

From this perspective, the CAPES evaluation process is aligned to theoretical concepts that guide an external evaluation process. Nevertheless, some issues should be considered to offer uniformity to analyses, so that evaluators can obtain similar results, even if from different perspectives. Thus, it is necessary minimized elements that can generate different understandings.

For construction of the MAPA was conducted an analysis of the process used by CAPES, and aimed to identify if the elements considered have characterized indicators, are well understood and are not ambiguous. That is, the mechanisms adopted by CAPES (evaluation criteria) were carefully analyzed and identified the elements considered as evaluation object (evaluation reports). These elements of CAPES evaluation were incorporated to the MAPA as indicators adopting quality perspective.

The structure of indicator involves three basic components (element, factor and measure) and the set of characteristics that define them (objective, justification, environment and standards) (Fortuin, 1988; Grady, 1991). This phase identified the indicators related to each one of five issues group evaluated by CAPES (program proposal, teachers, students, intellectual production and social insertion). The indicators linked to these items were categorized in one of three environments of action (on-line, off-line or in-line) in the quality perspective, based on observation of characteristics and specificities of each environment, in which respective actions are undertaken (Pletinckx, Segers, 2001).

It is also noted that the process proposed here consists in the reorganization of the model used by CAPES. It is the categorization of indicators linked to each one of the evaluation groups (CAPES), according to three environments of action, which allow to drive actions of enhance performance of postgraduate programs. This is possible because the categorization allows an analysis of strategies adopted in management process, and determines strategic points considered and which bring greater distinction (quality) to postgraduate programs.

To conduct this analysis it is necessary to observe the program performance in each indicator. Goals can be established based on performance obtained in evaluation process, in order to enhance result (Baron, Bruillard, 2003; Bititci, Carrie, McDevitt, 1997). Therefore, it is necessary to define a standard, which compares results obtained with goals established, and also evaluates improvements produced by actions taken from previous evaluation.

The indicators are classified according to actions and environment, and observing performance of program for each indicator, it is possible to initiate the second step of proposed model. This step focuses on application of fuzzy logic, where indicators used in local evaluation are grouped to global level, in order to take the final performance of program. Fuzzy logic is employed to provide theoretical support to the proposed model by decreasing degree of subjectivity and generating differentiation among score levels (Friedlob, Schleifer, 1999; Syau, Hsieh, Lee, 2001; Lin, Hwang, Becker, 2003; Serguieva, Hunter, 2004).

By applying fuzzy logic, it is possible to demonstrate procedures that generate differentiation between one program and another in the attribution of score, to inform the degree of membership to which is assigned the score. Thus, it becomes possible to respond the questions raised (Steiner, 2005), concerning, for example, the high number of programs which were assigned score level 3.

Fuzzy logic gradually makes explicit the gradual transition of postgraduate course from "membership of a score class" to "non-membership of a score class". Another factor that justifies the use of fuzzy logic by the MAPA is the transition point between one score level and another defined by system user, for example, by area coordinators. In this case, it is up to CAPES to specify and report the score that determines transition between one score and another. This practice could reduce questioning about the subjectivity of evaluation, and suggests strategic (administrative) actions that allow a program to migrate from one score level to another (Figure 1).

For the system user, the fuzzy logic is totally transparent, the user does not need to understand fuzzy logic (Ribeiro, 1996; Zadeh, 1973; Zadeh, 1975), it is necessary only supply the data related to postgraduate program and the MAPA processes and generates the results.

5 The proposed MAPA

The motivation for developing of the MAPA was to implement improvements in the evaluation system used by CAPES, considering questions formulated by system users, a better understanding of criteria adopted and fill gaps that generate disagreement on the parameters used, caused by the lack of explanation about.

With these adaptations is possible to increase credibility of the current evaluation process. In addition, one of the goals of the MAPA is to support management of postgraduate programs, which will be organized according to external score level assigned by CAPES.

Thus, internal actions will consider external indicators. This determines, for example, actions in aspects that require immediate improvements. In this way, this information can be used as an input so that a program develop an internal evaluation process, which allows promoting improvements aimed at leveraging their performance.

The evaluation process in the MAPA begins with the configuration of indicators (local level). Weights were attributed to various elements of groupings. Thus to achieve the level of the "items evaluated by the CAPES," it is necessary to correlate the performance obtained at each hierarchical level with the respective weight. The weights are determined by CAPES. The MAPA also makes adaptations in the grouping of indicators, in order to obtain the global evaluation (where fuzzy logic elements were inserted). This insertion occurs on the issues evaluated and allows to analyze the degree of membership in the score level assigned to a program.

To apply the MAPA must be observed the following steps: (1) elements identification; (2) elements ordering; (3) performance evaluation; (4) elements grouping; (5) performance management. The management process based on the MAPA can be flexible, continuous and adjusted or modified according to internal demand of programs.

5.1 Implementation

This section presents the results and elements considered to apply the MAPA, in three departments at a public university in Paraná, Brazil. For privacy reason the postgraduate programs will not be identified. The programs, identified as CCSA-courseA, CCSA-courseB and CCET, are in two broad areas: (1) applied social sciences and (2) earth and hard sciences.

Similar methodologies were used in the three programs. First, the MAPA objective was explained to coordinators. After the initial interaction, in order to observe potential and limits of the MAPA, it was decided to conduct an evaluation related to a previous period. That is, the evaluation refers to information provided by the postgraduate programs of previous triennial periods.

The following instruments were used to obtain data: **(a) Professors and students curricula.** The Lattes platform is a curriculum database, used as a reference by universities and research and financial support institutes in Brazil; **(b) Recent annual evaluation reports provided by CAPES.** These reports provide more information about programs; **(c) Triennial evaluation reports.** These are official CAPES documents about the evaluation process for given period; **(d) Open interviews.** The purpose of interviews, which are open and non-structured, was to obtain information that was not found in previous documents. The target public of these interviews was the coordinators and secretaries of the postgraduate programs. All of this information is fed to the MAPA, as indicated in figure 1, which describes the profile of three postgraduate programs.

Based on the annual and triennial evaluation reports, interviews and resumes the indicators were organized and placed in the MAPA, as presented in figure 1 (a – indicators).

The Figure 1 illustrates the results obtained by the programs analyzed in the intellectual production item. Based on the local evaluation (a – indicator) a performance profile is generated (lines traced on the lower part of Figure 1). These indicators allow the programs to identify at which points their performances are below of “regular” level.

In the case of the programs evaluated, indicators linked to the element “4.4 Artistic product and quality and visibility of production” were not evaluated, because this item is not an object of evaluation in Applied Social Sciences (CCSA-courseA and CCSA- CourseB) and Earth and Hard Sciences (CCET).

Once the programs performance was identified in local level, the scores obtained were grouped using weights attributed to each item (f - weights). For example, the first grouping occurs at level “4.3.1.1 Encourage the existence of work with professors from other institutions” and “4.3.1.2 Analyze the organization of event with the participation of professors, students” for the level “4.3.1 In-line.” This process considers the weights 40% and 60% attributed to the objectives “4.3.1.1” and “4.3.1.2” respectively. To carry out the grouping is considered the relation between weights and scores obtained locally. For example, in objectives “4.3.1.1” and “4.3.1.2 the CCSA-courseA, obtained a “failing” score which is indicated by a score level “1.” The score obtained related to the weight attributed, in order to achieve the immediately following performance levels, or that is, “4.3.1 In-line” ($40\% \times 1 + 60\% \times 1 = \text{score of } 1$). The same procedure was accomplished for all groups until the upper levels.

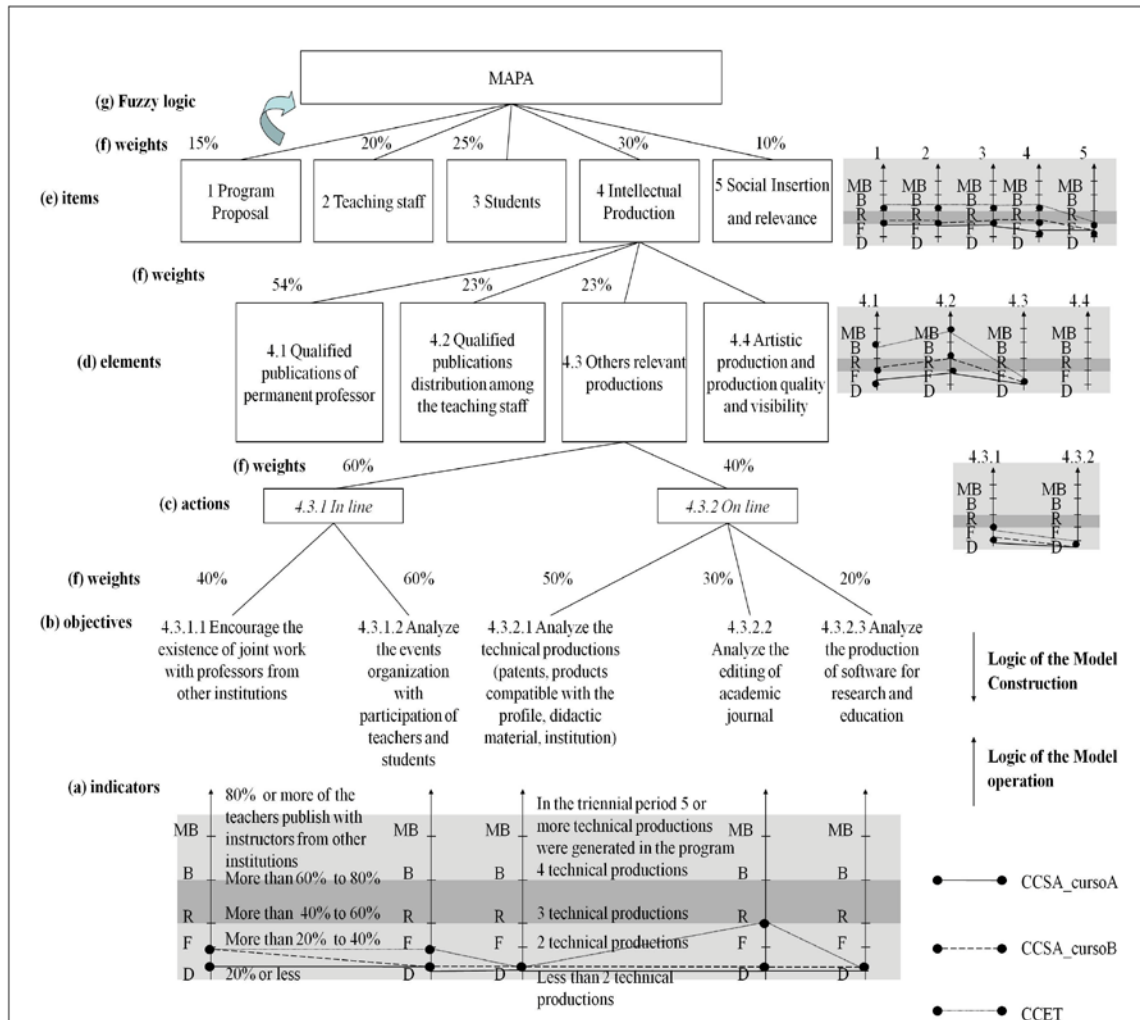


Figure 1. MAPA after operation.
Source: Primary data (performance profile).

A spreadsheet, containing the mathematical formulas for groups, was used to assist in the process. Thus, by informing a value (D, F, R, B, MB) in an indicator (local evaluation), which are in gray in figure 2, the spreadsheet automatically generated the score linked to item (1, 2, 3, 4 and 5 points), and proceeded to the grouping for the immediately following level, by correlating score and weight.

Items, Elements, Actions, Objectives	Weights	CCSA_Curso_A		CCSA_Curso_B		CCET	
Final score obtained by the Program			2.11		2.70		3.66
1 Program Proposal	15%		2.11		2.72		3.81
....							
2 Teaching staff	20%		2.46		3.10		3.74
....							
3 Students	25%		2.37		2.89		3.72
....							
4 Intellectual Production	30%		1.72		2.46		3.76
4.1 Qualified publications of permanent professors	54%		1.90		2.75		4.05
....							
4.2 Qualified publications distribution among the teaching staff	23%		2.00		3.00		5.00
....							
4.3 Other relevant productions	23%		1.00		1.24		1.84
4.3.1 In line	60%		1.00		1.40		2.00
4.3.1.1 I Encourage the existence of joint work with professors from ...	40%	F	1.00	W	2.00	W	2.00
4.3.1.2 Analyze the events organization with participation of teachers ...	60%	F	1.00	F	1.00	W	2.00
4.3.1 On line	40%		1.00		1.00		1.60
4.3.2.1 Analyze the technical productions ...	50%	F	1.00	F	1.00	F	1.00
4.3.2.2 Analyze the editing of academic journal	30%	F	1.00	F	1.00	R	3.00
4.3.2.3 Analyze the software production for ...	20%	F	1.00	F	1.00	F	1.00
4.4 Artistic production, quality and visibility			-		-		-
....							
5 Social Insertion and relevance	10%		1.92		1.97		2.84
....							

Figure 2. Illustration of the electronic spreadsheet structure before applying fuzzy logic in the MAPA.

The result of local score, multiplied by weight, automatically generates the score in the groupings. For example, the score of in-line grouping of CCSA-course-B is $2 \times 40\% + 2 \times 60\% = 1.40$. This procedure was conducted up to the level of the items in electronic spreadsheets. This was done, is necessary to verify if the model generated with the application of fuzzy logic can get a similar score level to obtained by CAPES.

Based on the MAPA tests, first, without considering the insertion of fuzzy logic, it was found that the results obtained were similar to those presented by CAPES, because the following scores were obtained: 2.11; 2.70; and 3.66; which refer respectively to the course CCSA-course-A; CCSA-course-B; and CCET. To obtain the final score, the same approach was used of multiplying weight by score obtained at respective score level, as indicated in figure 2. For example, the final score obtained by CCET considered the scores and weights of five items that were evaluated in the MAPA ($3.81 \times 15\% + 3.74 \times 20\% + 3.72 \times 25\% + 3.76 \times 30\% + 2.84 \times 10\% = 3.66$).

In these courses the triennial evaluation conducted by CAPES issued scores of 2, 3 and 4 respectively, and CCSA-course-A was discredited by CAPES (its authorization to operate was suspended).

5.2 Fuzzy logic application

Once the MAPA was put in operation, and results similar to those presented by CAPES were obtained at items level, the fuzzy logic was used in evaluation process. It was applied to the items evaluated, and is one of the results presented in figure 3.

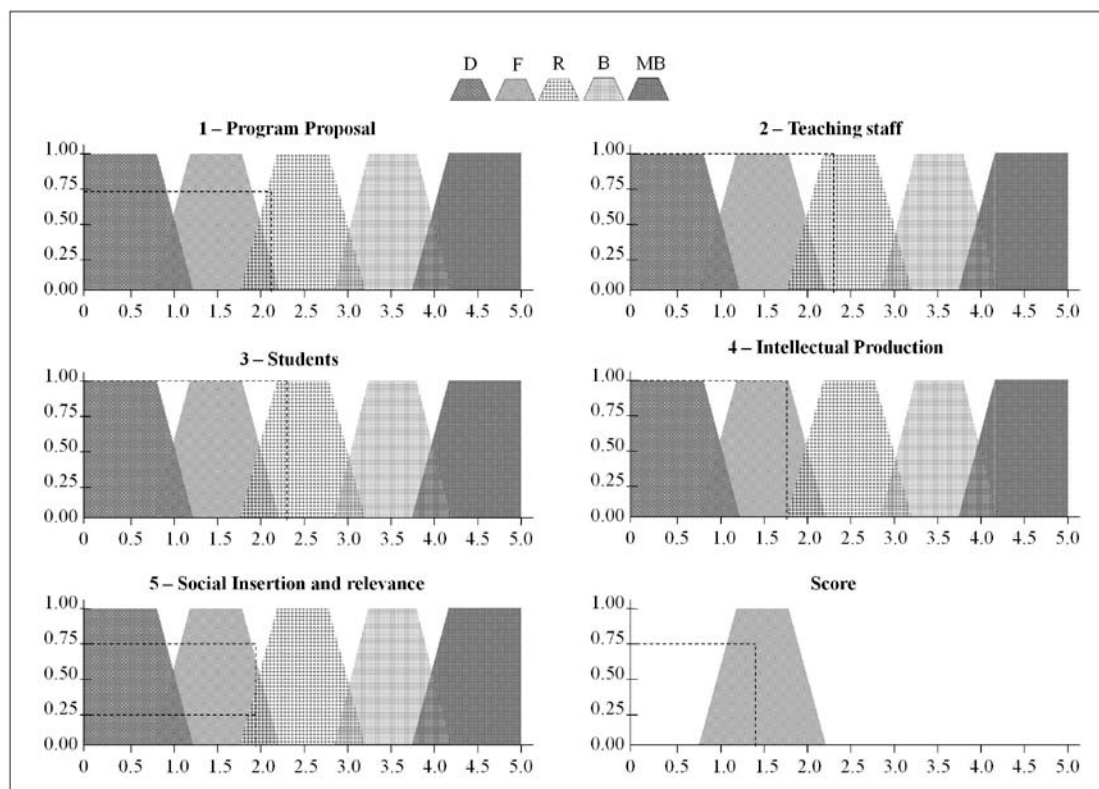


Figure 3. Score by CCSA_curso_A course after apply fuzzy logic in the MAPA.

The Figure 3 refers to CCSA-course-A, which in the triennial period in study obtained a score of “2” in the CAPES evaluation and lost its accreditation. When the MAPA was applied with the fuzzy logic, the items “teaching staff” and “students” the course had a performance with a score level “3”. However, in the items “program proposal” and “social insertion” the course is found in a transition area between a score level from “2” to “3” and “1” to “2”, respectively. In the item “intellectual production” the course had a score level “2”.

The course CCSA-course-A had, on a global level, 75% of degree of membership in the score of “2”, which means that this program would be going from score level “1” to “2”, that is from a score level from “failing” to “weak.”

Therefore, upon applying fuzzy logic, this course would be classified as “failing” because it did not totally reach the score needed to be classified as “weak”.

In the application of the MAPA to CCSA-course-B, with the fuzzy logic, to the items “teaching staff” and “students” the course is found in transition area going from score level “3” to “4”. To the item “social insertion” it is found in transition going from score level “2” to “3”. In the items “program proposal” and “intellectual production” the course CCSA-course-B has levels of performance classified at “3”.

The software classified the course with 75% of degree of membership in the score level “3”, which means that it would be migrating from “2” to “3” or that is, going from a score level “weak” to “regular”. Therefore, upon applying fuzzy logic, this course would be classified as “weak” because it did not totally achieve the score needed to be classified as “regular”. In this case, this course would no longer be considered as a program recommended by CAPES, or that is, it would lose its accreditation.

Upon applying fuzzy logic with the MAPA to the course CCET, which has a score of “4” according to CAPES, it can be seen that the items: “program proposal”, “teaching staff”, “students” and “intellectual production” have performances of “4”. Only the item “social insertion” had a score of “3”. However, the course is found close to an area of transition to the score of “4” which means that this program would be migrating from a score of “3” to

that of “4”. Or that is, from “regular” to “good”. This differentiation between the score level issued by CAPES and that obtained through the applying of the model with the application of fuzzy logic, is due to the rule generated in the period of transition from one performance score to another.

In the proposed model, it was decided to accept the change of score level only when the performance was greater than 0.90. That is the score of 3.90 points in this model will be classified as “3”, and a score of “4” only considered if the program obtains 3.91 points or more. This criteria was used for all periods of transition of the score levels. This situation can be redefined if the programs understand this to be necessary.

5.3 Management process illustration

To illustrate the management process in the MAPA, the sub-area “4.3 Other productions considered relevant” was chosen, in relation to CCSA-Course-A, as seen in figure 1.

The course had a performance “below acceptable” in all elements evaluated in sub-area “4.3”. In this study, it was considered that elements evaluated with performance “below acceptable” are factors that deserve improvement actions. This improvement action reveals the management character of the MAPA.

Figure 4 demonstrates some possible actions in management process, which were based on the application of the MAPA. In this sense, the fundamental support to the management of postgraduate program comes precisely from the indicators, linked to each evaluation objective.

Factors with performance at level “below acceptable”	Current Situation	Suggested Action	New Situation
4.3.1 Encourage the existence of joint work with professors at other institutions	D	Identify research demands in which there can be partnerships with professors from other institutions (articles, advising, projects) with annual results	R
4.3.1.2. Analyze the event organization with participation of professors, students and undergraduates	D	Encourage the organization of annual event with participation of professors, students and undergraduates	R
4.3.2.1 Analyze the technical productions (patents, products compatible with the profile, didactic material, institution)	D	Make professors aware of the importance that the program presents its technical production triennially	R
4.3.2.2. Analyze the editing of academic journal	D	Stimulate editing activities in academic journal.	R
4.3.2.3 Analyze the software production for research and teaching	D	Stimulate awareness among professors about the importance of presenting software production linked with research area and teaching of program	R

Figure 4. Improvement actions suggested to leverage the objectives with performance below a regular level.

From the exposed it is important to emphasize the beneficial effect resulting from the indicators construction (figure 1) for each evaluation line. At first, the nature of specific actions to be taken is clear, in order to perfect the program as a whole, given that the program impact level at each objective is evident. It is possible to propose improvement actions. The MAPA then offers to the coordinators support in the three levels of management – operational, tactical and strategic.

The construction of indicators (factor and measure) was based on the information presented during the triennial evaluation criteria and on the annual evaluation reports (2007). This process allowed identifying the elements that generate indicators categorization at levels of failing, weak, regular, good and excellent (D, F, R, B, MB), indicated by CAPES. In addition, the indicators classification following the management levels allows delineating action plans aligned to their respective profiles (in-line, on-line, off-line), or that is, in the short, medium or long term.

The construction of indicators in this form aggregates a distinction of the proposed model, because it establishes a dialog between the internal and external evaluation. In this sense, the MAPA encourages continuous learning or alterations in the perceptions drawn by CAPES should be incorporated to the model, to maintain dialog between the two evaluations contexts.

6 Conclusions and recommendations

The construction and applying of the MAPA provided to the postgraduate programs involved in the study better understanding of procedures adopted by CAPES (external evaluation). Among the elements that support this process, the indicators that generate local evaluation stand out. By identifying indicators, it was possible to know which courses had performance “below acceptable,” “acceptable” or “better than acceptable,” according to the CAPES criteria.

The indicators with “below acceptable” performance (lower than “regular” or score level 3), refer to elements that require immediate improvement actions. That is, the programs should make efforts to improve their performance in items related to these indicators, in order to maintain accreditation. Meanwhile, in the context of indicators with “acceptable” or “above acceptable” performance, there is also a need for improvement actions. In this case, the actions are aimed at obtaining a score of “4” or higher and, seek expansion and an action aimed at opening a doctoral program, if this is the goal. In both situations, the MAPA assists in the management of programs.

In addition to identifying indicators, their grouping in the quality perspective environments in-line, on-line and off-line offers the characterization of items that are related to the planning programs, mainly in medium and long term. The insertion of quality perspective helps to verify actions needed for the developing of programs, beyond triennial periods. The MAPA with the inclusion of quality management concepts and methods offers support to administrators in relation to the items currently proposed by CAPES, or to the other items incorporated as a function of possible alterations in the criteria used by CAPES, or because of coordinators needs.

In addition to the elements mentioned (indicators for local evaluation and grouping of these by the quality perspective), the MAPA has incorporated to management process the possibility of identifying, in a local or global mode, the score issued to postgraduate programs. For such situation, the process uses fuzzy logic. The incorporation of fuzzy logic to the MAPA allowed to generate graphical visualization of performances obtained by programs in each of the items (figure 3), as well as the degree of membership assigned to score level. The aggregation of several criteria in a simple score can also be obtained.

It is considered that is possible to support the postgraduate programs management with the insertion of elements that compose the MAPA, and to minimize limitations caused by separation of the internal and external evaluation perspectives. The MAPA also attends to concerns raised by Fonseca (2001), Hortale (2003), Simões (2004), Axt (2004), Ramalho and Madeira (2005), and Horta and Moraes (2005), concerning the more active participation of postgraduate programs in the evaluation process; as well as the concerns of Lousada and Martins (2005) on the inclusion of internal and external evaluation modalities, and still the concerns of Nevo (2001) in support of a dialog between the internal and external evaluation.

Based on the realization of this study, some recommendations can be made for future research, which can contribute to the expansion and improvement of elements related to the issue. New studies are needed to: (a) expand theoretical bases related with communication process about internal and external evaluation and observe how they influence the process used by CAPES in later triennial periods; (b) analyze the indicators presented, to identify those that are synergetic, and give to programs the possibility to make a chain improvements to their performances.

The MAPA does not conclude the investigation on improvement of postgraduate programs in Brazil. First, this study is one more contribution to the CAPES evaluation process that has become a global reference, but due to their size and complexity requires continuous improvements. Second, the study identified the need for research on postgraduate process management, using concepts and tools of quality management, focusing on indicators that provide consistency and possibility of growth to programs in the postgraduate Brazilian model.

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