

*Full Length Research Paper*

# Physical education evaluation methods

Gonçalves F\* and Aranha Á

2011

**The aim of this research study was to verify, using a confidential questionnaire, what sort of evaluation, supervisor teachers of sport's science courses in Portugal base their judgement. For a total of eighteen subjects inquired, 38,9% of the supervisors explain to their trainers the criterions, parameters, types and objectives of the evaluation. Around 66.7% of the supervisors believe that higher value to the formation in the evaluation area should be given, because it is important to know how to evaluate correctly, so as to be fairer with their students and to learn new evaluation strategies and instruments. The remaining supervisors believe that there are not enough subjects that train the future teachers, how to evaluate their students.**

**Key words:** Evaluation, supervisor, student, performance, teach.

## INTRODUCTION

In global terms, evaluation has been gradually occupying a wider and more important space in all the dominions of human being's activity, in most differentiated areas, such as: Educational, commercial, financial, artistic, etc. As it is natural, for this research work, the study is only focussed on students' evaluation in education. The topic of evaluation is currently more and widely discussed. However, it is important to bear in mind some important questions like: Who to evaluate? What to evaluate? How to evaluate? Why to evaluate? Which results?. They are complex questions, but they must be asked when it concerns to the educational system, more specifically, in the scope of physical activities.

The aim of the study was to verify which type of evaluation is carried out by the teachers' trainers of the course of Physical Education and Sport of the University of *Trás-os-Montes e Alto Douro* in Portugal, when they evaluate their teaching trainees, learning in the same institution during the seminary. It was also intended to verify which aims, parameters or success criteria are used in the evaluation of the same students, as well as verifying how their classification is processed. The answers had been absolutely confidential and the data Had been exclusively destined to allow the statistical

treatment of the information. "The evaluation refers to the gathering of the necessary information to a (more) correct performance. It is an undeniable regulator par excellence, of all the process of teach-learning. It is the conscience of the educative system itself." (Barab et al., 2007).

The formative evaluation follows all the process of teaching and learning, identifying successful learnings and also the ones which raise difficulties, so that they can overcome the last ones, taking students to proficiency and to success (McNeill and Krajcik, 2007).

The formative evaluation must be the main modality of evaluation, consisting of a permanent accompanying of the nature and quality of each student's learning, guiding the teachers' intervention in order to give them the possibility to take suitable decisions according to the students' skills and needs. Moreover, it supplies to the students elements that strengthen, correct and stimulate the learning, increasing its effectiveness, because one aims that the one who learns must have an active role in his learning process (Hudson and Ginns, 2007). The summative evaluation should not be depleted in a judgment on something or on somebody but, in turn, it should be understood as a way of knowing more about a definite reality, under the perspective of perfecting future processes. The summative evaluation must still bear in mind the general objectives, that is, the final objectives of integration, which once reached, certify student's progress. As it was formerly referenced, the formative function of

---

\*Corresponding author. E- mail: franciscojmg@gmail.com. Tel: 00351 917 668 858.

the evaluation plays an essential role in regulating teaching, but it does not answer the question "why the education methods should be evaluated?" There are authors that try to answer to this question. They claim there are four essential aims of evaluation:

To improve decisions concerning to each student's learning,  
To inform both student and parents on the progression,  
To grant the necessary certificates both to the student and society,  
To improve the quality of teaching in general.

Traditionally, evaluation had as reference standard the norm - normative - what happens when students' performances are compared between itself in relation to a norm, being evaluation guided by a set of common rules. The evaluation proposals should reflect differences between students.

The evaluation of reference to a norm is the one which describes student's performance in terms of the relative position that he/she reaches in relation to the group. On the other hand, the evaluation by reference to a criteria - is verified when one describes student's performance in a specific field of essential teaching tasks, evaluating based on the previously formulated objectives.

The evaluation is normative if it places the individual into a particular group and compares ones results with the results of that group – their peers. They also judge that the evaluation is criterial if the individual's state is compared to a pre-established criterion.

There is a distinction between evaluation and classification (McNeill and Krajcik, 2007). The first one corresponds to the analysis of the obtained learnings facing the planned ones, expressing itself as a description which informs, both teachers and students, about the reached goals and about those where difficulties were raised. On the other hand, the classification converts the information, proceeding from the evaluation, into a scale of values, allowing a comparison and seriation of results, serving as a base to decisions related to the promotion or non-promotion of the students within the school system (Johnson, 2007).

Concerning the abilities of the teachers, the biggest issue is related to the capability to evaluate the acquisition of the teaching trainees' professional ability (Lawrenz *et al.*, 2007). So there are two great "Achilles' heels":

- (1) The problem of evaluating with severity the competent performances of the teacher and, once accepted, the possibility of its evaluation,
- (2) The problem of its validation as performances with a positive effect on students' learning.

It can be said that some changes are being made, strengthening the formative function of the evaluation, the importance of retention by students, the reinforcement of students and teachers' role, as well as, the articulation between students' evaluation system and the evaluation

of the educational system. "(...) the evaluation is concerned with the education strategy, on which it depends, to a large extent, the effectiveness of teaching, especially in what concerns with the implantation of the materialized options in the planning of activities. On the other hand, two functions are conferred: Regulation and classification" (Barab *et al.*, 2007).

## METHODS

In what concerns is the characterization of the sample considered to the development of the present study, this was based on 18 teacher's trainers who orientate the works for the seminary of the course of Physical Education and Sport. One intended to know how they carry out their students' evaluation in the subject - seminary. On account of this, it was presented to these teachers a questionnaire, referring to the part of the bibliographical revision with the intention of drawing conclusions in order to reach the proposed aims. In the application of the questionnaires, the return was not of 100%, though everything was made to invert this. Result, from the 21 teacher's trainers orientating the work for the seminary in the University, only 18 answered the questionnaire, that is, a 85.7% return was accomplished.

The questionnaire, elaborated for this study, was made up by 18 questions, of which 16 were of closed reply (multiple choice) and the other 2 demanded an opened reply (development answers).

To handle the results, it was made a descriptive statistical and content analysis, comparing the obtained results with the conclusions of the researched references. This way, the first 16 questions of the questionnaire (closed questions) were submitted to a descriptive statistic but the 2 last questions (opened questions) were submitted to a content statistical analysis.

In relation to bibliographical revision, the following assumptions are drawn:

H<sub>1</sub>: There are differences concerning the type of evaluation that the teachers' trainers carry out when evaluating their teaching colleagues - their peers.

H<sub>1</sub>: The teachers' trainers, preferably, carry out a criterial type evaluation.

H<sub>1</sub>: The teachers' trainers carry out a continuous evaluation.

H<sub>1</sub>: The teachers' trainers carry out a formative evaluation.

In the present study, the object of evaluation is made up by the teachers' trainers who are orientating the works for the seminary in the course of Physical Education and Sport of the University of *Trás-os-Montes and Alto Douro*, with the intention of evaluating the students' learning of the same institution for seminary. This evaluation follows parameters, being carried out following criterion that quantify or qualify these parameters, allowing getting information to evaluate the object. This aim seemed pertinent, once all had already been, or are evaluated, countless times throughout life. The curiosity of knowing which parameters and criteria were used in evaluation, excited interest over this subject, because it was always intended to know how this problem was carried out responsibly.

A trial was then made to deepen this issue so that curiosity, on the evaluation carried out by the teachers' trainers guiding the works for the seminary, was satisfied. In addition, this problematic is (and it will be) present in topics of bigger interest to be deepened, in future works.

## RESULTS

Based on the obtained results, one can assume that 66.7%

of the teachers' trainers, by comparing the students between themselves, try to uniformize their marks, reflecting on each one's performances in those marks. Very often, an individual can have a very satisfactory performance, but if his/her performance is placed in a different context, it could not be so good. This way, everything is transferred to a definitive context and it is, in relation to it, that each one has to adjust to the situation. This normative evaluation carried out by the majority of the teachers' trainers can aim at reflecting about the differences between students, determining their position in relation to other students.

This type of evaluation, does not allow distinguishing levels of success, that is, one knows what value each student has, comparing to others, but not in relation to the pre-established criteria. Therefore, it only indicates the value of each one in relation to other students. A student can be in a group with difficulties and, consequently, be one of the best, but if he/she is included into a group with more capacities, he/she would be placed in the lower part of the rank (Barab et al., 2007).

Most of the teachers' trainers compares the results between students, but 72.2% of them do not compare these results, with the results obtained by students from other teachers' trainers.

As synthesis of the normative evaluation, most of teachers' trainers carry out a normative evaluation among their students, trying to uniformize the results, comparing them between students whom they guide. But in what concerns is the application of the normative evaluation, with students from other teachers' trainers, this is rarely carried out, because both in the second and third paragraphs the answers were negative.

In what concerns is the criterial evaluation, 100% of the teachers' trainers can perceive how distant their students are, in relation to the pre-determined standard of progress. This way, teachers' trainers as reference to the previously defined criterion and, based on these, they can organize all the process of teach-learning, bearing in mind students' success, identifying difficulties much more easily.

Through this evaluation teachers' trainers have the correct understanding of how distant their students are from the goal. By analyzing difficulties, teachers' trainers, along with students, can go round difficulties and follow the best "way" to reach the competences to which they had proposed. It is important to point out that all students must really have the exact notion of the defined parameters and of the criteria that are being used, so that the process develops itself naturally, in order to reach the competences.

As it is natural, there is not a correct evaluation, once it depends on various factors: of the targeted population, of the parameters and criteria of evaluation of the applied methodology, strategies, goals... but, in this study, it was verified that 61.1% of the teachers' trainers carry out a mixed evaluation, with characteristics both from the

criterial and normative evaluations. Consequently, the evaluation would not be right nor wrong, what it concerns is that the evaluation is correctly applied, based upon the numerous factors which surrounds it.

In relation to the diagnostic evaluation, it can be verified that a high percentage (38.9%) of the teachers' trainers does not carry out a diagnostic evaluation, so they cannot judge the pre-requisite that students have, so as to "prescribe" the best methodology of work orientation. Without this diagnostic evaluation there is not a prognosis of results, therefore it is difficult to define strategies to reach these results. Only through the diagnostic evaluation can the teachers' trainer begin his/her work, verifying their students' skills and knowledge. It is, at this moment, the initial moment of all the process of teach-learning, that the teachers' trainers verify their students' knowledge and difficulties being able, from this process onwards, to start the work by defining objectives, strategies and methodologies to be followed. So, it is through the comparison of the initial levels (diagnostic) and finals (summative), that the teachers' trainers can verify students' evolution (or regression). It is certain that the final mark does not really have anything to do with that evolution, once the students must be evaluated by their performance throughout the process (McNeill and Krajcik, 2007).

The majority of the teachers' trainers (66.7%), confirmed the idea of Barab et al. (2007), who understands that it is by means of the formative evaluation that, later, the necessary information to students' classification must be taken. Afterwards, most of the teachers uses that information to grade their students. This moment of evaluation (formative) is the one which better expresses students' performance, because it is through it that all the steps of the process are reflected, counting for students' classification all the competences/performance demonstrated throughout the process.

The teachers' trainers demonstrate having the perception that their feedback is essential so that the student knows how his/her work is being carried out, knowing what is being correctly done (continuing) and what is badly done (modifying). The formative evaluation is also, in this case, essential to recognize "where?" and "in what?" the student finds difficulty, informing him/her about his/her performance. The formative evaluation itself serves as a feedback both for student and teacher (Gómez et al., 2006). The overwhelming majority of teachers' trainers (88.9%), carries out a continuous evaluation. We cannot state if it's a correct or wrong evaluation but the continuous evaluation, if correctly applied, is the most indicated for this type of works for the seminary. Bearing in mind some authors' works Barab et al. (2007), this idea can be confirmed, because if the evaluation is continuous, throughout the formative process, the information taken for classification are the "mirror" of students' performance, showing the teachers the stages their students had overcome during the learning process

and, also, the difficulties found. This way, the teacher can show them how their work is being carried out and which obstacles they have to overcome. If the teacher's trainer did not help himself/herself from this type of evaluation and only verified, at the end of the unit, the students who had or not learned, they would have fewer possibilities to "redo the path they had walked". The smashing majority of the teachers' trainers, 88.9%, does not carry out a punctual evaluation. This evaluation is a characteristic of the examinations or competitions (not of seminary works). There might be other moments of punctual evaluation, for example, in cases where at the half of the teach-learning process there are moments of evaluation with the aim of judging the students' level, at that point. Practically all the teachers' trainers (94.4%), place questions to students with the intention to precisely judge what they know and which difficulties and doubts they have. If the teachers' trainer questions a student, he/she can understand if, what was interpreted by the student is really correct or not. The questioning can also be a way of evaluating. The teachers' trainer can question in order to evaluate, this is, to pose a question about a topic related to a content of student's work and collect information to be used in evaluation (Black, 1998). With the gathered information for this study, one verifies that there is a general agreement of all the teachers' trainers, because all of them give opinion/information about what the student must do next. With the teachers' trainers experience and information, students know what they have to do next. The formative evaluation helps the student to learn and the teachers to teach. As a consequence, there is an exchange of living experiences between them. The information supplied to students must be clear and organized, so that the teaching is guided and it promotes the success of all. The teachers' trainers' indications might avoid many errors in the students' work, there's a higher probability of the student's performance reaching the success, more quickly. The majority of the teacher's trainers (88.9%), demonstrates to prefer autonomous students, students with initiative and creative when executing work. To be autonomous does not necessarily mean that a student does not follow teachers' trainers' instructions, thus a student can be autonomous after having an indications about what to do next. It is, then, important to conciliate the two realities, to be autonomous and creative, later confronting the work done with the teachers' trainers' ideas, and/or on the opposite, to receive the information and later being autonomous to pursue the continuation of the work. Consequently, the teachers' trainer should "guide", providing the outline of the work, without "making the whole work" to the oriented student. A great majority of teachers' trainers (83.3%), makes a reflection during the process of teach-learning, with the aim of improving their performance. The evaluation must be directed towards professional development reflecting on their practice, with the intention of improving each one's performance, using

for this the professional experience which, in this case, teachers' trainers possess. This evaluation must be accomplished throughout the formative evaluation to be exact, throughout the whole process, trying to identify the errors as soon as they happen so that action might be altered and improved.

A high percentage of teachers' trainers (88.9%), demonstrates to have the perception that their professional development may be accomplished after their pedagogical practice over students. To reach the so desired pedagogical effectiveness, teachers' trainers analyze the less positive aspects of the process and try to make the necessary modifications towards success. This introspection, made at the end of the school year, can be made by verifying if the objectives had been or had not been reached, trying to identify causes of (un)success. It is important that each teacher has an introspection of his/her performance and of the applied strategies, so that future actions could be the best possible ones that are closer to effectiveness.

In the course of the analysis of the results, it is verified that the majority of the teachers' trainers (72.2%), knows how to distinguish evaluation from classification, or at least, understands that to evaluate and to classify is not the same thing. In some cases, teachers' trainers only mark students' final work, when they should be their guiders throughout the year and reward the effort of this long work. So, classify is to express into a scale of values the result of the evaluation Backhus and Thompson (2006). Most teachers' trainers know about this distinction, maybe it is because of this knowledge that the majority of the answers was negative. However, the percentage of teachers' trainers that answered affirmatively is against the ideas of McNeill and Krajcik, (2007), it refers that evaluation corresponds to the analysis of the accomplished learnings facing the planned ones, expressing itself into a description which informs both teachers and students on the accomplished aims and on those where difficulties are raised.

The effort each teachers' trainer makes to evaluate his/her students, in the best possible way, is recognized. But the obtained results show there's a lack of time, from the teachers' trainers, to guide their students. A percentage of 55.6% of teachers' trainers understands that they would better evaluate if they had more available time for each student, how it is mentioned in the consulted references. The teachers' trainers experience helps students to develop their knowledge. There is a need of teachers to be constantly in touch with students to gather the necessary information about students' performance (Clarke and Dawson, 1999).

The studied reality shows that no teachers' trainer grants more than three weekly hours to each student they supervise. This is an evidence of the lack of time they have. It is important to point out two aspects. The first one is that, in general, teachers' trainers have many students to guide, per year, so it is impossible for them to

have enough time for all of them. An aggravating aspect will be the fact that each teacher's trainer has other activities, like: teaching lessons and the orientation of thesis for graduations as doctors, Master Degrees, or PhDs. Another aspect is that teachers' trainers answered to this question by making an average of the whole year, that is to say, there are times in which they spend less time with students and, at the end of the year, closer to the conclusion of the work for seminary, they spend more time with the students they guide. Nevertheless, the majority of the answers show that little time is spent with each student. For such, it would be convenient to find some solutions in order to prevent so few contact with students: such as: the existence of many other teachers orientating the works for seminary, fewer students per teacher, or even teachers with fewer activities, who would be almost exclusively guiding works for seminary.

The results show a very high tendency by the teacher's trainers, 88.9%, to listen to their students' opinion about the work they did throughout the year. All teachers must be under a constant evaluation of their performance (Askew, 2002). For such, there is nobody better than their students to do that because they were working together side by side, all year. It is on account of this that teachers' trainers allow students to give them a feedback on their performance. All the teachers' trainers find important listening to their students' opinion, so that they can improve their performances, even more. Only by listening to their students' opinion can teachers' trainers evaluate their own work, verifying if the methodologies and decisions used are the most appropriate ones. This is an introspection, a self-assessment based on students' indications about the teachers' trainers' performance (Askew, 2002).

The biggest obstacle of the summative evaluation is that, evaluating students through its final result does not represent the work which they had developed throughout the year. Students should be graded according to what they had made during the whole year, because there are moments in which they have more work to carry out and others in which they have less to do. As it was reported throughout this work, students' should value their continuous work, not only representing their final work. Student's performance must be the most important, because the student was subjected the whole year to a learning situation and the competences he/she acquired are the ones that are necessary to value (Ellett and Teddlie, 2004).

The summative evaluation carried out by the teacher's trainers (16.7%), indicated that it carries out a summative evaluation, being this the most indicated, as already it was referred in the analyzed references. Thus, Roehrig et al. (2007), contradicts a little, the majority of the teachers' trainers who carry out summative evaluation (72.2%), helping to understand there is no subject that approaches exclusively of opposing, sufficient way ones who opt by the summative one. The author refers

that the summative evaluation intends to judge the student's carried out progress at the end of a unit of learning, in order to compare results already collected throughout the formative evaluation and to obtain indicators that allow perfecting a future process of education. The summative evaluation corresponds, then, to a final balance, allowing a wider vision of what it was the teach-learning process. It is still possible to judge which were the results from the learning, as well as, verifying which corrections can be made for future processes of teaching.

The obtained results in this study clearly shows a great tendency by the teachers' trainers in finding that students' formation of the courses related to education (future teachers), should value more the formation in the area of the evaluation, in the understanding of 66.7% of the teachers' trainers. Most of the teachers' trainers (58.3%) understands that the formation of students of courses related to education (in this case, future Physical Education or Sports teachers), should value more the formation in the area of the evaluation, because it is important to know how to evaluate students correctly. Another percentage teachers' trainers (16.7%) justified the importance of the formation in the area of the evaluation, because the more experience an evaluator has, the less errors he/she will commit, when performing evaluation. About one third of teachers' trainers (33.3%) understand that the formation of the students of courses related to education, should value more the formation in the area of the evaluation, once it causes an improvement of education. Of course, the better prepared the teachers are to evaluate, greater will be their students' success.

To 8.3% of the teachers' trainers, the students' formation (future teachers) provides them the learning of new strategies and instruments of evaluation that they will be able to apply when evaluating their students.

Finally, there are 25% of teachers' trainers who understand that there are no university subjects that really teach how to evaluate. For such, it is necessary to oppose to a gap which these teachers' trainers mention to exist in the course. This gap is the lack of subjects that the teachers were taught to evaluate. There is no subject of evaluation, since its main concern is this topic and where future teachers could learn how to evaluate. There was only a subject, called "Didactics", whose syllabus contained an approach to evaluation, but though important, is manifestly insufficient. An aggravation to all this scarcity is that this subject was removed from the course programme of study.

About 40% of the teachers' trainers understand that the formation of the courses related to education already values the formation in the area of the evaluation, in a, believing that the current model is correct, as it was seen in the previous analysis, that evaluation. On the other hand, the same percentage (40%) of the teachers' trainers understands that the formation of future teachers

does not need to focus, so much, on the evaluation once the most important (the practical experience) acquired while working. However, it is necessary to bear in mind that in the pedagogical period of the teachers' training and the first years of the teachers' teaching, teachers can commit some errors in evaluation.

## DISCUSSION AND CONCLUSIONS

A teaching practice without objectives would be a "blind" and an "accidental" teaching, and without teaching evaluation would be far from the improvement of the quality of the education. Likewise, what matters will not be to reach results – success, but it should also be, and most of the times, the processes which are carried out.

At the end of the work and based on obtained results some conclusions can be made, such as:

There are differences in the type of evaluation which teachers' trainers carry out related to their peers (teaching colleagues), not having a uniformity of criteria or evaluation parameters used.

In relation to the second hypothesis raised in the beginning of the work, it can be mentioned, based on the obtained results, that teachers' trainers carry out a criterial evaluation, however, the great majority does not explain to their students which are these criteria. Therefore, students do not have the knowledge of what they have to do, in order to reach the final objective, the pedagogical effectiveness.

In relation to the continuous evaluation, it can be referred, that practically all the teachers' trainers carry out a continuous evaluation, inferring throughout the formative process for future classification of students.

Finally, in relation to the fourth hypothesis, the evaluation carried out by teachers' trainers has characteristics of a formative evaluation, because the majority of issues corresponding to the formative evaluation were answered affirmatively. The effectiveness of teaching mentioned previously, is related to the improvement of the teaching-learning process. For such it is necessary to enhance some aspects: To define goals, To train the dexterities to reach these goals (student's task), To control, to evaluate and to guide the process (trainer's task, based on the formative evaluation), To verify, at the end of the process, which are the reached objectives, comparing them with the intended ones (trainer's task, based on the summative evaluation), To classify students, based on their performance (trainer's task, based on the formative and summative evaluations) For something to be evaluated as good, it is needed to pre-establish the criterion and to verify if the process is developed according to those criteria. This way, the evaluation criteria are norms that act as reference points to make possible the qualification of what is proposed to evaluate. Naturally, they must be known by the object of evaluation (in this case the students, that are going to be teachers

in the future). A last feature that will be referred to is the future teachers' formation on this thematic evaluation. A considerable part of the teachers' trainers understands that there are no university subjects which teach how to evaluate. An even bigger percentage of them believe that, better the formation on evaluation will be, greater success the students will have. Consequently, there will be an improvement of education. The majority of the teachers' trainers believe that it is important to know how to evaluate correctly, consequently, there is need for formation to the future teachers.

## REFERENCES

- Askew S (2002). Feedback for Learning. *J. Edu. Teach.*, 28 (1): 83-90.
- Backhus D, Thompson K (2006). Addressing the Nature of Science in Preservice Science Teacher Preparation Programs: Science Educator Perceptions. *J. Sc. Teach. Edu.*, 17: 1.
- Barab S, Zuiker S, Warren S, Hickey D, Ingram-Goble A, Kwon E, Kouper I, Herring S (2007). Situationally Embodied Curriculum: Relating Formalisms and Contexts. *Sci. Edu. – Wiley Int.Sci.*, 91(5): 750-782.
- Black P (1998). Assessment by Teachers and the Improvement of Students' Learning. In *Int. Handbook of Sci. Edu.*, 811-822. Dordrecht: Kluwer Academic Publishers.
- Clarke A, Dawson R (1999). *Eval. Res.* London: Sage Publications.
- Ellett C, Teddlie C (2004). Teacher Evaluation, Teacher Effectiveness and School Effectiveness: Perspectives from the USA. *J. Personnel Eval. Educ.– Springer Netherlands* 17:1.
- Gómez H, Benarroch A, Marín N (2006). Evaluation of the Degree of Coherence Found in Students' Conceptions Concerning the Particulate Nature of Matter. *J. Res. Sci. Teach.*, – *Wiley Periodicals*, July, 43 (6): 577-598.
- Hudson P, Ginns I (2007). Developing an Instrument to Examine Preservice Teachers' Pedagogical Development. *J. Sci. Teach. Edu.*, 18:6.
- Johnson C (2007). Effective Science Teaching, Professional Development and no Child Left Behind: Barriers, Dilemmas and Reality. *J. Sci. Teach. Edu.*, , 18(4): 2.
- Lawrenz F, Huffman D , Gravely A (2007). Impact of the Collaboratives for Excellence in Teacher Preparation Program. *J. Res. Sci. Teaching – Wiley Periodicals*, 1(2): 22.
- McNeill K, Krajcik J, (2007). Scientific Explanations: Characterizing and Evaluating the Effects of Teachers' Instructional Practices on Student Learning. *J. Res. Sci. Teaching – Wiley Periodicals*, 1-26.
- Roehrig G, Kruse R, Kern A (2007). Teacher and School Characteristics and Their Influence on Curriculum Implementation. *J. Res. Sci. Teaching – Wiley Periodicals*, September, 44 (7): 883-907.