A IMPORTÂNCIA DA AVALIAÇÃO FORMATIVA EM FEIRAS DE CIÊNCIAS

LA IMPORTANCIA DE LA EVALUACIÓN FORMATIVA EN FERIAS DE CIENCIAS

THE IMPORTANCE OF FORMATIVE EVALUATION IN SCIENCE FAIRS

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RESUMO: A Avaliação Formativa [AF] é decorrente da pedagogia formativa e busca abrir novos caminhos para a educação, sendo uma concepção de ensino a qual considera que o aprender é um processo longo onde o aluno reestrutura seu conhecimento a partir das atividades que realiza. As Feiras de Ciências [FC] podem ser aliadas da AF nas escolas por serem consideradas atividades de educação não formal, com a finalidade de promover o desenvolvimento da cultura científica. O presente estudo procurou analisar os efeitos da AF em uma FC com alunos do Ensino Fundamental nos anos finais. Partiu-se de uma análise documental sobre o percurso dos alunos durante o projeto intitulado como FC. A AF fica evidenciada em várias etapas do processo. O projeto pesquisado foi formativo, pois ajudou os alunos a aprenderem a se desenvolver, participando das regulações das aprendizagens e do desenvolvimento no sentido de um projeto educativo dentro da escola.

PALAVRAS-CHAVE: Divulgação científica. Ensino fundamental. Mostra de ciências. Trabalho em equipe. Autonomia do aluno.

RESUMEN: *La Evaluación Formativa [EF] es producto de la pedagogía formativa y busca abrir nuevos horizontes para la educación, siendo una concepción de enseñanza que considera aprender como un proceso largo en el cual el alumno reestructura su conocimiento a partir de las actividades que realiza. Las Ferias de Ciencias [FC] pueden ser una aliada en la EF de las escuelas por ser consideradas actividades de educación en el ámbito formal, con la finalidad de promover el desarrollo de la cultura científica. El presente estudio procuró analizar los efectos de la EF en una FC con alumnos de los últimos años de la Enseñanza Primaria. Se partió de un análisis documental sobre el recorrido de los alumnos durante el proyecto intitulado como FC. La EF Queda en evidencia en varias etapas del proceso. El proyecto pesquisado fue formativo, pues ayudó a los alumnos a aprender a desarrollarse, participando de las regulaciones de los aprendizajes y del desarrollo en el sentido de un proyecto educativo dentro de la Escuela.*

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PALABRAS CLAVE*: Divulgación científica. Enseñanza fundamental. Show de ciencias. Trabajo en equipo. Autonomía estudiantil.*

ABSTRACT*: The Formative Assessment (FA) is a result of formative pedagogy and intends to open new paths for education, being a teaching conception, which considers that learning is a long process where the student restructures their knowledge from the activities they perform. Science Fairs (SF) can be an ally in FA in schools because they are considered non-formal educational activities with the purpose of promoting development of scientific culture. The present study aimed to analyze the effects of FA on a SF with elementary school students in the final years. It started from a documented analysis about the students' path during the project entitled as SF. The FA is evident through many steps of the process. The researched project was formative as it helped students learn how to develop themselves by participating in the learning regulations and development towards an educational project within the school.*

KEYWORDS*: Scientific dissemination. Elementary school. Science fair. Team work. Student autonomy.*

Introduction

Basic education is formed by Early Childhood Education (up to five years old), Elementary Education (from six to fourteen years old) and High School (from fifteen to seventeen years old). Elementary education lasts for nine years, the first five years of which (Elementary Education I - EFI) are taught mostly by multipurpose teachers, who interact throughout an academic year with the same group of students. In the final years of Elementary Education (Elementary Education II - EFII) students are exposed to new experiences in their daily school life, such as the increase in the number of teachers (now specialists) in the teaching curriculum, with totally different levels of demands and styles of social and didactic organization of classes; demanding greater responsibilities from students, increasing the complexity with which the contents are approached, thus approaching the school structure employed in high school.

There are many criticisms related to the fragmentation of disciplines and the interaction of students with new teachers in the transition from the 5th year [EFI] to the 6th [EFII] year of Elementary School. Many teachers are more concerned with following the schedule and claim that students are immature, undisciplined and baseless, and emphasize the full responsibility of students in organizing studies and lessons. Others ignore the revision of the contents worked in the initial years, disregard the students' knowledge about the proposed contents, minimize their cultural baggage, their school habits and their attitudes (DIAS-DA-SILVA, 1997). As each teacher accompanies the student only in the discipline he teaches, the actions directed to the

students end up being little planned. As a result, the school's operating structure for the final grades of elementary school does not allow for the necessary articulations in the planning and execution of effective forms of teaching.

In addition, the concept prevails that traditional education is interested in the pass and fail percentages and, in view of this issue, schools end up adopting an exam pedagogy, losing the characteristic of teaching and learning pedagogy (GREGO, 2013). Parents or guardians, school, education professionals, teachers and students, all have their attention centered on promoting, or not, the student from one grade to another (LUCKESI, 2011). The appropriation or non-appropriation of learning by students is a consequence of the requirements adopted by teachers or other external assessments that adhere to the structured teaching (PERRENOUD, 1999).

The assessment of learning aims to assist the student in their growth, in their integration with themselves, helping them to appropriate significant content. Evaluation presents itself as a constant way of providing support to the students in their process of assimilation of contents and construction of themselves as existential subjects and citizens (LUCKESI, 2011).

From one cycle of studies to the next, even between school years, the function of traditional assessment is to certify acquisitions. A certification provides few details of the knowledge and skills acquired and the level of mastery achieved in each field covered by the student. What certifies the teacher, who receives students from the previous level or cycle, that he can work as usual (PERRENOUD, 1999). Formative evaluation provides teachers with more assertive and qualitative information about students' teaching and learning processes.

Formative evaluation is a result of formative pedagogy and seeks to open new paths for education, being a teaching concept, which considers that learning is a long process in which the student restructures knowledge from the performed activities. The term formative evaluation, introduced in 1967 by M. Scriven, refers to the procedures used by teachers in order to adapt their didactic process to the progress and learning needs of the observed student (GARUTTI, 2010). Therefore, the formative evaluation covers all the practices developed by teachers and their students, with the purpose of giving references to be used as a retroactive effect in order to restructure the pedagogical work. This feedback is the main element in the formative assessment, it refers to the construction of knowledge, due to the commitment and success in the work developed by the student himself (VILLAS BOAS, 2008). The purpose of the pedagogical work is to assist the transition from feedback to self-monitoring, thus developing the student's intellectual autonomy.

Science Fairs, also called Science Exhibits, can be an ally in formative assessment in schools. They are non-formal education activities, which can take place in both formal and non-formal spaces, with the purpose of promoting the development of scientific culture. These are social, scientific and cultural events held in schools or in the community with the intention of, during the presentation of the students, provide a dialogue with visitors, providing an opportunity to discuss the knowledge, research methodologies and creativity of students in all aspects related to the exhibition of works (SANTOS, 2012).

Beginning in the country in the 1960s, the fairs were products from science centers, whose objective was to review all foreign content and capacitate schools in the country on science teaching, allowing for numerous activities aimed at teaching practice, among others the Science Fairs and Clubs, the first ones took place in São Paulo at the installations of Prestes Maia Gallery (BRASIL, 2006). Since its beginning, it has aimed to disseminate scientific knowledge, making students dialogue with the public on subjects that they have dedicated interest, time, curiosity to, so that they finally develop the resourcefulness to express their vision of this knowledge. In this way, the student starts to see science with his gaze, making knowledge dynamic and allowing his listeners to also have the opportunity to create their own vision of science, that is, to disseminate and popularize science.

In this context, the present study sought to analyze the effects of formative assessment at a science fair with elementary school students in their final years.

Methodology

The research is classified as exploratory, having a qualitative and quantitative nature, with data collection through documentary research and content analysis.

Document analysis, according to BARDIN (1977), is a set of operations that aims to represent the content of a document in a different form from the original, in order to facilitate later its consultation and referencing. It aims to give a convenient form and to represent that information in another way, through transformation procedures. The purpose to be achieved is: storage in a variable form; and facilitating access to the observer, in such a way that he obtains maximum information (quantitative aspect) with maximum pertinence (qualitative aspect). Content analysis is presented as a method of carrying out the total and objective exploration of documents.

It started from a documentary analysis on the path of Elementary School students of the Final Years during the project entitled as Science Fair year 2017. The analyzed documents were:

- Timeline of the Fair: it was analyzed on what dates the paths that the students went during the process took place.
- Group Formation Table: clarifies the number of students participating in the fair and how the groups were formed.
- Table of themes and advisors: demonstrates which themes were chosen and the number of teachers who did the orientation process.
- Evaluation form of the written work: describes the form and the evaluation criteria used in the process.
- Evaluation form for presentation of work in class and presentation at the event: describes the form and what criteria were used for presentation in class and on the day of the event, these criteria being different from those used in the written work.
- Table of group grades in the evaluations: these tables were used to create parameters of the results obtained by the students at each stage of the process.
- Student bonus tables: this table represents a final result on how much the fair evaluation can contribute with each group to compose the grades of the 2nd and 3rd quarter of the school year.

From the analysis and survey of these data it was possible to create a panorama of the object of study that will be discussed later.

Results and discussion

The school in this study is part of the private education network in Holambra, São Paulo. It started in 1949, in a rural school that started to attend children of Dutch immigrants who arrived in the country after the Second World War. The school became official in December 1951, with the Immigrant Cooperative as the school maintainer, serving only elementary school children, today Elementary I. Over the years, there was the implementation of Elementary Education II, the Cooperative was dismissed, the formation of an Association and a Commission to work with the Parents' Commission in the implantation of High School and subsequent implantation of the Didactic System.

Today, the school serves not only the local community, but also several surrounding municipalities. The building has different classrooms, a science laboratory, a robotics laboratory, a music room, an art studio, several rooms (management, coordination, secretariat, infirmary, teachers), library, cafeteria and two sports courts. The school serves 51 students in Early Childhood Education [EI], 148 students in Elementary Education I [EFI], 130 students in Elementary Education II [EFII], 86 students in *Ensino Médio*[4] [EM] and 10 students in High School [HS]. EI and EFI have a pedagogical coordinator, nine teachers and three monitors for EI, twelve teachers and one monitor for EFI. EFII has a pedagogical coordinator and fourteen teachers. The EM has a pedagogical coordinator, an educational advisor and seventeen teachers. The school also has a librarian, an educational counselor, administrative staff, computer staff, maintenance assistant, cleaning staff, kitchen staff and outsourced cafeteria service.

The science fair started in 2006 and has undergone changes over the years. It went from a sample of experiments with themes divided by rooms to the current model.

In 2017, the science fair had a total of 129 participating students, comprising 26 work groups with guidance from 10 teachers. During the month of February students should form teams of 4 to 5 students, depending on the class, and define the theme of the work. The deadline for the definition of the teams and the initial choice of topics was at the end of February. The number of teams per class was established by those responsible for the organization and fixed according to the number of students per class. 6th grade A and 6th grade B were divided into 2 teams of 5 students and 2 teams of 4 students, totaling 18 students each class. The 7th year had 5 teams of 5 students each, totaling 25 students. The 8th year had 3 teams of 5 and 1 team of 4 students, totaling 19 students. The 9th year A had 24 students divided into 4 teams, 3 teams of 5 and 1 team of 4 students. The 9th year B featured 5 teams of 5 students each, totaling 25 students. The teams followed an activity schedule (Figure 1) indicating the month, day and deadline for the delivery of the activity to be worked on.

Figure 1 - Fair Schedule[5]

[4] The term "Ensino Médio" was used here to make difference from a particular stage describe to this is school as High School. Since *Ensino Médio* translates exactly to High School, to translation and comprehension purposes we will keep the term in Portuguese.

[5] We read on the image: First line – February – Definition of groups and work themes; Second line – March – Evaluation of themes (safety)/ - Exchange of themes/ - Evaluation of the new themes/ - Closure of themes; Third line – May – Verification – Logbook and Work diary/ - Orientation on the references/ - Return of orientations; Fourth line – June – Return of text for possible corrections/ - Evaluation of Written work (1st grade – bonus 1); Fifth line – August – Presentation in Class (2nd grade – bonus 2); Last line – September – Presentation in the Sciences Fair (3rd grade – bonus 3).

Source: Devised by the authors.

The choice of the themes of the works was made freely by the students, within the term of 5 days in the month of March, with subsequent analysis of the evaluating teachers regarding the relevance and the degree of dangerousness. Therefore, themes involving demonstration videos of experiments without scientific content were excluded, as well as those that required individual adult monitoring, due to the risk caused by the experiment. The works that presented these characteristics had another 5 days for the exchange and readjustment of the theme. After that, the new themes were reassessed. The general closing of the topics occurred at the end of March with the impossibility of exchange. It should be noted that real projects are built towards an authority negotiated in the substantial construction of students' autonomy, resulting from a real responsibility given to them (PERRENOUD, 1999).

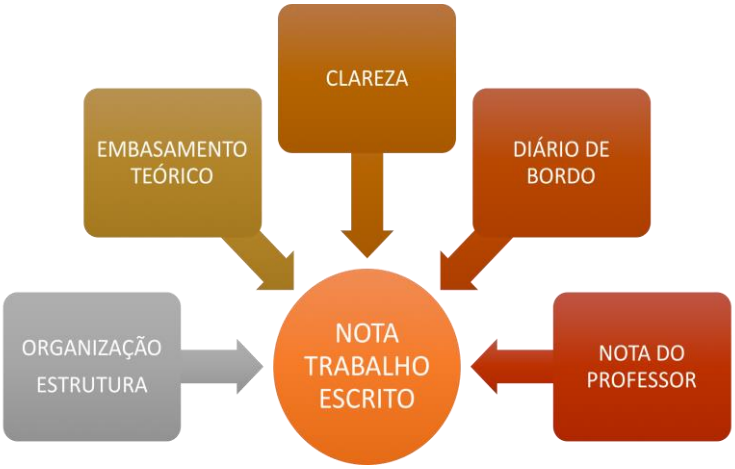
The choice of advisors was defined through the theme that generates each work and distributed to 10 teachers from the respective disciplines related to the proposed themes. Each supervisor had the responsibility to lead students in improving the development of written work, whether or not there were advances, which aspects could be improved, thus passing through possible corrections proposed in dates prior to the evaluation, indicating the possible ways to improve the structure of the project. During the month of May, the teams met with their respective advisors for the development of the written work and the logbook, which described all the meetings of the group members and the step by step of what was done for the progress of the research. The supervisors helped to improve the writing of the written work with the search and indication of complementary texts. According to Perrenoud (1999), in the pedagogy of written expression, in a formative evaluation, the production of texts must be inserted in a

coherent didactic procedure, with precise hypotheses about the way competences are built and about the nature of the students' probable errors.

In June, the teams returned the texts to the respective supervisors and they analyzed them and reported the latest corrections to be made. The deadline for the delivery of the written work was at the end of this month, this being the first assessment and the first bonus grade that would serve for the second quarter. Villas Boas (2008) points out that this response is the main element of formative assessment, serves the teacher and the student, the first deliberates actions on initiative, diagnosis and recovery, the second uses it to monitor their competences, skills and perceptions in their performance in order to achieve recognized success, as well as modify or improve unsatisfactory results.

The written work was evaluated by the teachers responsible for organizing the fair and followed criteria such as: organization and structure of the text (model to be followed by the groups), theoretical basis (reliable texts and websites), clarity, and the making of the logbook (detailing the meetings and what was produced by the group and participation of the members) and, finally, received the grade from the teacher responsible for the project (Figure 2). This last grade was given by the supervising teacher, who supervised all activities developed from the beginning with his students, in order to verify if the information and feedbacks were used for the reorganization of the pedagogical work, that is, if the students followed the teacher guidance. The quality of the work is determined by qualitative judgment. According to Villas Boas (2008), formative assessment occurs in the student's interactions with the teacher and with the other students, enabling continuous adaptations while learning is developed.

Figure 2 – Criteria for grading written works[6]



Source: Devised by the authors.

[6] We read on the image from left to right: Organization and Structure; Theoretical basis; Clarity; Loogbook; Teacher grade. And on the circle on the middle: Written Work Grade.

In the second semester, during the month of August, the teams presented the work in class to the teachers responsible for organizing the fair and to the rest of the class, thus generating an assessment and the first part of the bonus grades for the third quarter. This presentation took place during class time, with a time limit of 10 minutes. The speeches should be divided among all members of the team, following organizational criteria and using all the resources that would be necessary and used in the final presentation on the day of the fair. The evaluated criteria were: organization, oral presentation, mastery of the topic, group interaction and also the grade received by the team in the written work (Figure 3). In this process, peer evaluation and self-evaluation stand out. According to Villas Boas (2008), evaluation by colleagues in the same group is an important component in the evaluation process and can be the first step towards self-evaluation. This type of assessment allows students to participate and increases communication between them and the teacher about their learning.

Figure 3 - Criteria evaluated in the presentations in class and at the fair[7]

Source: Devised by the authors.

The last presentation with the adjustments suggested in the previous step took place in early September, with a second assessment being carried out that would complete the bonus grade for the third quarter. It took place on the school's multisport court during the time from 8:00 am to 12:30 pm. The place was previously presented to the teams to organize themselves in this space limit. Two tables were made available for each team, in addition to sockets for those who used electronic devices. Several resources were used that day, such as experiments,

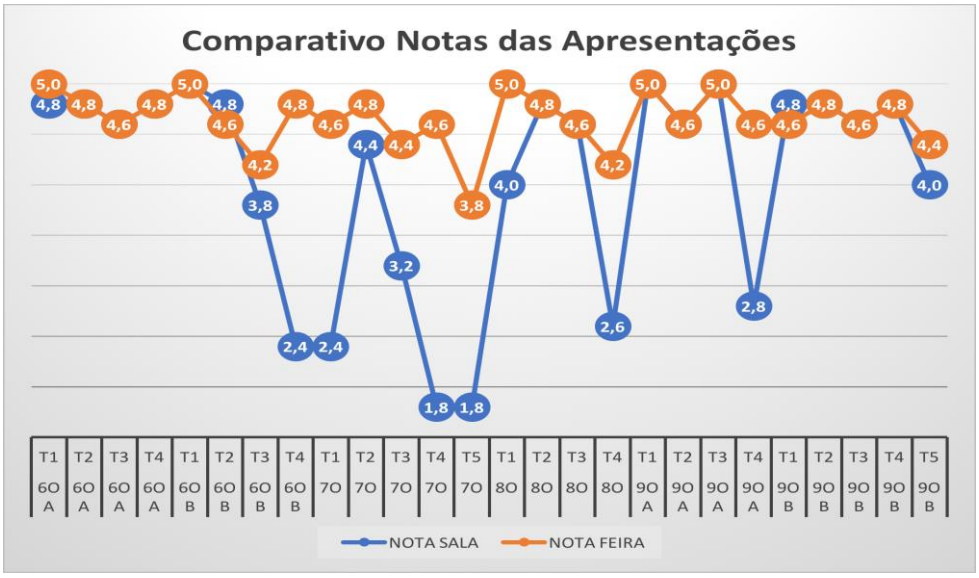
[7] We read on the image from left to right: Mastery of the theme; Interaction of the group; Organization; Oral presentation; Written work grade. And on the circle in the middle: Grade of presentation in class and in the fair.

banners, games, applications. The public at the fair was varied, with the presence of students from [EI], [EFI], [EM] and family members of school students. For Santos (2012), such scientific events enable dialogues between visitors and students, motivating them, being an opportunity for students to expose their scientific knowledge, develop their creativity and consequently their intellectual autonomy. The works were again presented to the professors responsible for organizing the fair, who followed the same criteria evaluated in the classroom, previously indicated in Figure 3.

At the end of the two programmed stages, three evaluations were generated: written work, presentation in class and presentation at the fair. For each criterion analyzed, a score of 1 to 5 points was assigned, 5 for excellent, 4 for great, 3 for good, 2 for regular and 1 for weak. At the end, the criteria 'scores were averaged, generating a grade, that grade was transformed into a bonus, in the first stage this grade was made up only of the written work, in the second stage the grade was constructed from the two presentations (in class and on the day of the fair), so students had bonuses in two of the three quarters of the school year. Each student distributed the points earned in activities developed in the second and third quarters, in the different subjects, with a minimum score of 0.5 and a maximum score of 1.0 for each activity and subject. This bonus is a way of valuing the participation and commitment of the student in the development of all stages of the work, through a formative assessment in addition to considering several aspects, such as research, writing, communication, teamwork, thus making a global assessment of the student. In the first stage the average bonus for the groups was 3.8, in the second stage it was 4.3.

Figure 4 makes a comparison of performance in the presentation in class and in the presentation at the fair by working group, in their respective years. All classes had a significant increase. The 6th year showed an average increase of 0.4 points, the 7th year 1.7 points, the 8th year 1.3 points and the 9th year 0.8 points. These results demonstrate that the simulation of the presentation in the classroom was important for the improvement of the results in the presentation day and corroborate with the entire path covered by the formative evaluation. Considering that the rounding of grades gives each student on the team the right to increase, at least, 0.5 points in classroom activities per subject, this increase improves the possibility that other subjects may be included in the process, this adds 1 more subject in the 6th year, which had the lowest increase, to up to 4 in the 7th year, the class that had the greatest increase.

Figure 4 – Comparison of performance in the two presentations: class and fair[8]



Source: Devised by the authors.

The formative evaluation is evidenced in several parts of the process, the first of which occurs in the role of the advisor, who through the indication of materials for construction of the work teaches how and where to look for references to support the writing, also in the corrections that happen during the monitoring of writing, verifying, directing a path to be followed so that the objective is achieved. Only after all this process, this structuring and monitoring, the student is evaluated objectively.

The second evidence appears when students presents it in the classroom, where they simulate the presentation they will make at the fair, the teachers point out the positive and negative points for them to improve their results, there is also a simulation with the audience of the classroom, making the student experience what will happen on the day of the event.

Through the exchange developed between students, teachers, community and family, the science fairs allowed to develop and express some of the competencies established by the National Common Curricular Base [BNCC] in elementary school in the final years. This document defines essential and fundamental knowledge for basic education, establishing skills and competences in each stage of teaching. 8 out of 10 general competencies were covered. Thus, the science fair allowed students to increase their knowledge when explaining a reality; the exposure of scientific, critical and creative thinking when investigating problems; practice communication; develop digital culture using technologies; understand the world of work and

[8] We read on the image: Title – Comparison of presentation grades; Subtitles – Class grades and Fair Grades.

make choices aligned with the life project; talk about their arguments; practice empathy and cooperation among peers; make decisions that require responsibility and citizenship.

Final considerations

The results of this research allowed to reveal the effects of the formative evaluation, which was evidenced qualitatively and quantitatively in each analyzed phase, during the whole process of construction of the fair, being possible to highlight the performance of the students during the creation and development of their teamwork. It is worth highlighting the facilitating actions, such as: the exchange of information and materials for the preparation of the written work, the presentations that teams made in the classroom, the evaluation by colleagues of the same team and also that of the evaluating teacher. The observation of the positive and negative points for the improvement of their results, the experience of the evaluative practices performed, were necessary conditions for the transition from feedback to self-monitoring, the main objective of formative evaluation, developing the student's intellectual autonomy. Thus, the school science fair project was formative, as it helped students learn ways to develop, participating in the learning and development of regulations in the sense of an educational project within the school. It is hoped that this research will help to disseminate the importance of formative evaluation in science fairs, so that similar projects can benefit other educational institutions.

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