DEVELOPMENT OF A METHODOLOGY FOR DISSEMINATION AND FORMATION FAVOURABLE OF USING NUCLEAR ENERGY

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ABSTRACT

Space Nuclear Technology (ENT), located in the IPEN is the basis for the study of a reporting methodology of Nuclear Energy Technology, for the public get some physical-chemical knowledge, benefits of using radioactivity and the activities carried out by the Institute Energy and Nuclear Research - National Commission of Nuclear Energy (IPEN / CNEN), for increased acceptance of its use. This article reports the survey in two schools, with groups of teachers from different areas of elementary and secondary education of the state São Paulo. The strategies used to establish communication by means of an environment of trust are: a questionnaire at the beginning and end of the presentation, one sensationalized reporting, *Césio -137 -Linha Direta*, aired by Rede Globo TV, in 2007, theoretical foundation of physics and chemistry, figures picturesque and photos as the Nuclear Reactor IEA-R1. The contributions of this research will improve the methodology for future presentations.

1. INTRODUCTION

The Nuclear Technology Space (NTS), located at IPEN, receive varied audiences, to communicate the benefits of Nuclear Energy Technology (NET) and some activities that IPEN / CNEN develops, through a methodology based in knowledge, making them disseminators of opinion favorable to their use.

Most of the population is against the use of NET, as it forms its opinion based on sensationalist media and common sense, staying in memory the bombs used in World War II in Japan and the consequences of accidents at nuclear power plants. Worry and fear are feelings that arise when speaking the word radioactivity in the most recent case in Japan in 2011 when an earthquake measuring nine triggered a series of tsunamis, causing the accident at Fukushima Daiichi thermonuclear plant. According Boemer [1], nobody died due to the effects of radioactivity, however in Brazil increased the rejection of using Nuclear Energy (NE).

The methodology was firstly tested with groups of teachers, because they are critical, spontaneous, realizing the degree of understanding, positioning before and after the presentation, observing their speaking, questioning, discussing or even the indifference, performing other tasks such as correcting proofs, readings, because we've gone to the schools and used the week pedagogical meeting , to approximate the teachers to the university, increasing the disseminators of opinion, in favor to the use of NE.

The methodology consists of the following strategies: a questionnaire with five open questions at the beginning and end of the presentation, one sensationalized reporting, *Césio -137 -Linha Direta*, aired by Rede Globo TV, in 2007, theoretical foundation of physics and chemistry, figures picturesque and photos as the Nuclear Reactor IEA-R1. It's explained grounded theory of radiotherapy equipment and radiography, differences between nuclear and atomic forces, contamination and irradiation, irradiation of food, presentation of some activities by IPEN / CNEN as the production of radiopharmaceuticals for scintigraphy tests, greenhouse effect, global warming and electricity production in Angra I and II, emphasizing clean energy be compared with other forms of production.

2 OBJECTIVE

The objective of this research project to better understanding was divided into five topics:

1. Become NST known;
2. Develop in school environments a methodology to be applied in the NST;
3. Disclose NET;
4. Implement scientific dissemination program based on physical concepts used in the Nuclear Energy (NE);
5. Use teachers as disseminators of acceptance of the use of NE in its class and community room.

3 PROJECT DEVELOPMENT

The study of NST methodology was initially applied with teachers from different areas, such as Portuguese, Mathematics, History, Geography, Philosophy, Sociology, Physical Education, Biology, Chemistry and Physics, who give classes for Elementary and High School.

The methodology was first applied in state schools *Ermano Marchetti in Pirituba* and *Milton da Silva Rodrigues, Freguesia do Ó*, located in São Paulo, in a total of thirty-four teachers from different areas of elementary and secondary education.

The methodology needs to be clear, accessible, understandable and above all there needs to be a climate of cordiality and informality, for that matter which is

regarded as unattainable, can be understood and mastered, so the knowledge becomes an ally to increase acceptance of the use of NE. According to Fini [2], the knowledge imparted with quality is relevance to life today and in the future, beyond the school boundaries.

3 1 STAGES OF THE METHODOLOGY

1. Application of the questionnaire before the presentation of the lecture;
2. Use of sensationalized reporting, *Césio -137 -Linha Direta*, aired by Rede Globo TV, in 2007 and the questioning;
3. Theoretical foundation of physics and chemistry;
4. Application of the same questionnaire after the lecture.

3 1 1 Application of the questionnaire before the lecture presentation

At the schools, first of all, introduced the speaker, the institution that represents and the research objectives for the group, then were asked to answer the questionnaire in groups with two teachers, but some became more comfortable in answering in a largest group, which was accepted. The same questionnaire was applied after the lecture, for the evaluation.

The questionnaire is a evaluation instrument necessary to know the teachers' knowledge and also so that they begin to interact with the subject that will be addressed, thus making a survey of preconceptions concerning NE and practices in his line of work, diagnosing initially the level of acceptance. The questionnaire is also to contextualize, giving meaning to knowledge that will be introduced, according to Lopes [3], the context associated with interdisciplinary, has been released by the Ministry of Education (MEC) it is included as a tool in the school curriculum of the National Curriculum Proposal for High School (PCNEM).

Questionnaire

1. What is Nuclear Energy? Where can it be used?
2. If you were Brazil’s president, would you be in favor using nuclear energy? In which area? Justify your answer.
3. Has Brazil benefited from the Evolution of Nuclear Technology? How?
4. Do you know any environmental impact caused by the use of Nuclear Technology? Please cite example (s).
5. About Nuclear Energy issue, do you have questions or interest in knowing which item?

3 1 2 Use of sensationalized reporting, *Césio -137 -Linha Direta*, aired by Rede Globo TV, in 2007 and the questioning

While the completed questionnaires were collected, some teachers expressing their spontaneous conceptions to the group, many based on common sense. The media, explores various themes tragically to win audience, causing much fear in the population, often without any foundation, getting in the public memory the pictures of deformed people from exposure to radioactivity, in many films, superheroes gain superpowers by being irradiated by radioactivity or from the cosmic radiation, respectively, the incredible Huck, or even the "Thing" in Four Fantastic, to analyze the dilemma that superheroes face with self-esteem , the consequences of exposure, even if fictitiously, it causes rejection by this type of technology or at least much suspicion.

To silencing the talking's group, an excerpt is presented (first ten minutes) sensationalized reporting, *Césio -137 -Linha Direta*, aired by Rede Globo TV, in 2007 about the accident in Goiania, with radiotherapy apparatus. When you want a person changes his opinion in the case in favor of use of EN, it is necessary to awaken the interest for the subject, in this case discussing fear, according Gaudêncio [6] of the effects of an accident with material. The video simulates the accident that occurred with a radiotherapy unit in Goiânia, in September 1987, of sensationalist way, fixing the public's attention, because the style is popular, because it occurred in Brazil and still be in memory some older teachers.

After viewing the video, questioning was released "- What were the main causes of the accident with the radiotherapy apparatus?" The teachers interacted in an active way, trying to solve the problem. According to Ribeiro [7], it is a method of instruction, cooperative learning, constructivism and contextualized using a problem of actual practice to start, motivate and focus the building of knowledge. When performing this interactive context, the public is led to compare the behavior of the population in the accident in Goiania with Fukushima, even the situation being more serious in Japan, earthquake, tsunami and the accident at the nuclear plant, there was no panic, because there is greater knowledge of NE, such that forty percent of the population, continues to support its use for production electricity, according Boemer [1].

In the accident at Goiânia, had argued that the accident occurred due to the lack of responsibility of the owner of clinical radiotherapy, public agencies in supervising, in its disaccreditation, unfortunately to the theft of the radiotherapy apparatus of the abandoned clinic, the breaking of the shielding, sealing of the radioactive material and mainly, due to lack of knowledge of NE of the workers and community, which caused panic in that moment, according Okuno [8].

3 1 3. Grounding Concepts

People form their opinion using the sensationalist media as a reference, by common sense. Using the video, it is observed that lack of knowledge can lead

to accidents, possible deaths, which could be avoided if everyone had access to studies. Within this environment, presented some concepts as:

- Natural phenomenon - Radiation Particles and Electromagnetic;
- Differences between Radiotherapy equipment - X-rays and Nuclear Energy – Atomic;
- Difference between contamination and irradiation;
- Difference between an ordinary X-ray and using radiopharmaceuticals (scintigraphy);
- Production of electricity with NE - Clean Energy.

3 1 4. Application of the same questionnaire at the end of the lecture

After the end of the lecture, the same initial questionnaire was applied at the end, to evaluate the methodology, if there was clarification, improving acceptance and contributions.

4 RESULTS AND DISCUSSION

4 1 Teachers as initial public

According Carlotto s / d [18], the teacher is a professional who suffers from mental exhaustion - Burnout syndrome, also called burnout syndrome, which causes depersonalization, unhappiness, lack of enthusiasm, the result of many emotional pressures, by dealing with too many people daily. These professionals also accumulate positions consequently does not have time or resources to undertake university courses. Using a methodology that communicates not only informing, that is, according Zarur [19] there is dialogue between the parties on the activities and quality of IPEN-CEN products to result in increased knowledge, improving acceptance, or at least lessen the wrong pretrial use of NE.

As in the myth of Plato's cave, quoted by Chaui [20], the university has the important role of educating professionals who were imprisoned to outdated methodologies, often without validity for the current times. Greater acceptance of NE, according to Aquino [21] will come only with the clarification of the population and how, for different aspects, the use of media in favor to the NE is prohibitive, than to change of the the opinion, can be by the education, the understanding of this technology, not to be rejected and decimated, because the population benefits greatly with it.

4 2 Analysis of questionnaires answered by teachers after the lecture

1. What is Nuclear Energy? Where can it be used?
The thirty-four teachers answered Energy that comes from the core and can be used in medicine and in the production of electricity

2. If you were Brazil's president, would you be in favor using nuclear energy? In which area? Justify your answer.
Thirty-two answered yes, for medicine and for electricity production only a double, wanted more statistical data to determine the impact on living beings in the short and long term.

3. Has Brazil benefited from the Evolution of Nuclear Technology? How?
The thirty-three said yes, for treatment, medical diagnosis and only one teacher said very little.

4. Do you know any environmental impact caused by the use of Nuclear Technology? Please cite example (s).
All they said yes, the nuclear waste problem, such as making less harmful; Chernobyl; Fukushima; Goiania; Hiroshima and Nagasaki.

5. About Nuclear Energy issue, do you have questions or interest in knowing which item?
Atomic waste; Finalization of "containers"; decay within the "container"; cost-benefit impact of the nuclear power plant; Health area; consequences of misuse.

Results:

1. By means of Figure 1, there is increased from 21% to 94%, respectively, the acceptance of the use of NE with the data obtained in question two, the questionnaire, proving the good acceptance of the proposed methodology.

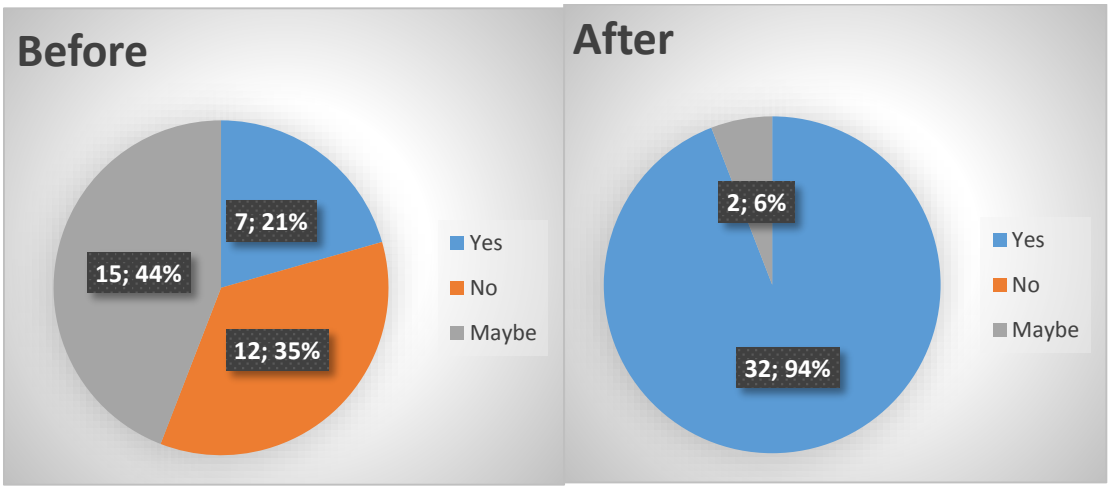

Figure 1 Acceptance of the use of nuclear energy before and after the application of NET methodology, value and percentage.

2. Due to the communicative environment that is established between the group of teachers and the subject, due to the video sensationalized reporting, which led the discussion environment will be maintained, the questions of the questionnaires mainly due to context, the problematizations, photos and colorful figures.

3. Analyzing question two, increased acceptance for use in EN, particularly for treatment and diagnosis in medicine, but they are unsecured to accept its use for the production of electricity. The item that will be added will be about radioactive waste (garbage, as they cited), the prevention of accidents at nuclear power plants and information about *Angra* III and the enterprise repository for Waste Low and Medium Activity.

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