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SOCIAL INCLUSION THROUGH ACCESS TO HERITAGE, CULTURE AND EDUCATION IN AN INFORMAL ENVIRONMENT

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ABSTRACT. This article describes the planning, performance and assessment of guided visits at the National Museum for pupils in state schools in Rio de Janeiro. The theoretical basis was the personal, physical and socio-cultural approaches for facilitating learning in museums contained in the John Falk model. The main objective was to create access to heritage, culture and education in an informal environment for a section of the population that lives in marginal areas without cultural amenities. The aim was also to establish the National Museum as an informal space for teaching chemistry. Questionnaires completed before, during and after visits provided data that was used to assess the procedure and to identify differences between visiting pupils, based on their level of education. The results lead us to conclude that the procedure and dynamic applied in this program generated affective and cognitive benefits for the visitors, and that the physical environment of the National Museum is suitable for informal chemistry teaching, particularly for secondary school pupils.

Keywords. Education in museums, informal education, social inclusion, science teaching

1. INFORMAL EDUCATION AND SOCIAL INCLUSION

Social inclusion is one of the biggest challenges facing Brazil, a country that for a number of historical reasons has developed huge enormous social inequalities in the distribution of wealth and land, access to material and cultural assets and ownership of scientific and technical knowledge. In this sense, social inclusion can be interpreted as giving populations on the margins of social and economic development the opportunity and means to access quality healthcare and education, basic sanitation, lasers, culture etc. In the wider sense, social inclusion also means creating conditions that will give everyone in the country a proper standard of living and that will enable them, as full citizens with the knowledge, resources and means to exercise their political rights, to act with full knowledge and understanding. According to Moreira (2006), social inclusion also means giving all Brazilians the opportunity to acquire a basic knowledge of science and how it works so that they can understand discoveries, increase their opportunities on the job market and exercise

their political rights as citizens.

To the extent that informal education, including visits to cultural centres, museums, zoos, botanic gardens etc, creates direct contact with heritage and culture, it is an important way of filling the huge gaps in these areas that are experienced particularly on the outskirts of Brazil's big cities. It also has the advantage that when offered to school children it can inspire interest in curricular activities and consequently improve educational performance.

2. The need to improve science teaching

For much of Brazilian society, science is a closed book that only a few highly intelligent people can understand. Another equally large portion of society finds science boring and has absolutely no interest in it. Pereira *et al* (2011) believe these highly preconceived views about science are largely the result of the mistaken way in which physics, chemistry and biology are taught in schools. Taught during compulsory and secondary education in Brazil, transmission of these subjects is primarily unidirectional, from the teacher to the pupil. Emotional involvement, cultural baggage, prior knowledge, spontaneous ideas and experimentation form no part of the equation.

In line with the *Orientações Curriculares para o Ensino Médio* [Curriculum Guidelines for Secondary Education] (Brazil, 2006), several researchers have maintained that science education today can no longer be restricted to the school context. The view places emphasis on the importance of informal educational environments such as botanic gardens, eco-parks, zoos, museums, cultural centres etc, where the curriculum can be taught more playfully and in context and where pupils can interact with the environment and society (Vieira *et al*, 2005; Rocha *et al*, 2007; Jacobucci, 2009). These spaces also offer a way of at least partly mitigating the shortcomings of state schools in Rio de Janeiro, such as lack of laboratories and of the audiovisual and other resources that stimulate learning. Science museums in particular are recognised as providing some of the best informal environments for developing and expanding knowledge. This is generally supported by the literature (Valente, 2005; Queiróz *et al,* 2002; Marandino, 2003; Taylor and Neill, 2008; Colombo Júnior *et al*, 2009; Falk and Storksdieck, 2005).

All means used to increase access to these spaces are therefore welcome but most visits fall into one of the two following categories: either pupils are given no orientation (guidance) and are simply left to look at items on their own or they are shown around in guided tours of 30-40 pupils in which only a small proportion actually understand the descriptions given by the guide. In this study the planning of visits to the National Museum offers an alternative approach that falls between the formality of classroom education with all the problems we have described and a purely visual visit in which the educational potential for acquiring knowledge can be lost. Guidance was provided in an informal environment to groups of up to 8 pupils per guide. The questionnaires completed before, during and after the visits provided data later used to assess the procedure. Based on items in the collection, chemistry was presented without disregard for its artistic, historic or cultural aspects.

3. The theory: learning in museums

Falk and Storksdieck's Contextual Model of Learning (2005) is a well-known theory. Learning is defined as a targeted and contextualized effort that constructs meaning to solve problems, survive and prosper in the world; it is a dialogue through time between the individual and the environment that connects past and current experience. The model describes the targeted dialogue as a process/product of interactions in various personal, sociocultural and physical contexts, each of which involves a large number of factors that facilitate learning. The model was developed and applied on the basis that learning was to take place in a museum.

The personal context covers mainly the motivation, expectations and opportunities for learning and control. Here, learning is strongly influenced by the individual's interests, previous experience and convictions.

The sociocultural context includes social guidance provided within the group and/or by others. Since individuals are the product of social and cultural relationships, learning in museums will be strongly influenced by the sociocultural relationships that are present in these spaces. These include opportunities for the visitor to interact with others, the presence of guides and other artistic and/or educational activities intended to make the visit as pleasurable and enjoyable as possible.

The physical context also needs to be considered. The context for learning in museums involves a series of architectural factors that include illumination, groupings of people, the quality and quantity of information presented, the availability of a general plan of the museum etc.

Since learning is not instantaneous but a gradual process of acquiring knowledge and understanding meaning, what happens after a museum visit is also important. Visitors should leave museums with additional knowledge that will improve their understanding of the events that have occurred or will occur in nature, the world and society in general. Events after a visit will therefore also facilitate learning so long as they reinforce the actual museum experience.

In this study, the planning of visits to the National Museum considered most if not all the above factors to provide relaxed and playful visits that created a friendly relationship between the guide and the visitor in a pleasant environment recognised as facilitating learning.

4. The National Museum

Established by John VI of Portugal on 6 June 1818, the National Museum is the oldest scientific institution in Brazil and the biggest natural history and anthropological museum in Latin America. Originally named the Royal Museum and located in Campo de Sant'Anna, it covered cultural and economic matters of interest to the country. In 1946 it became part of the University of Brazil (now the Federal University of Rio de Janeiro - UFRJ). The National Museum moved to Paço de São Cristóvão in 1892 and combines the history of

science with research by including research laboratories and offering post-graduate courses under Latin America's leading scientists. About three thousand exhibits are on view to the public - just a small part of the thousands of items in the museum's science collections. The Museum also has a botanic garden and central library (Brazil, 2008). Figure 1 shows the façade of the former Imperial Palace, now the National Museum.

Figure 1. Façade and gardens of the former Imperial Palace, now the National Museum

5. Methodology

The guide team made a number of preliminary visits to the National Museum in order to be able to produce a detailed description of its contents. The importance to successful educational work of a proper knowledge of museums and the history of their collections is discussed by Marandino (2009).

The population in the study was a number of pupils at the Centro Integrado de Educação Pública (CIEP) Raul Ryff 312 [Paul Ryff State Comprehensive School 312] in Paciência, Rio de Janeiro. The group was split among 4 guides to ensure no guide had more than 8 pupils. All pupils were studying the science of investigation and had signed a consent form to take part in the study. In the case of pupils under 18, the form was signed by a parent or guardian. This study presents the results and conclusions of 5 visits by a total of 118 pupils.

The level of education of the pupils is shown in table 1, which describes pupils in year 9 of compulsory education and years 1, 2 and 3 of secondary school as groups A, B, C and D.

Table 1 – Education level of pupils

GROUP	EDUCATION	NO. OF PUPILS
A	Year 9 compulsory	27
B	Year 1 secondary	30
C	Year 2 secondary	37
D	Year 3 secondary	24

Each visit was made with only one group of pupils. The 37 pupils in group C were split into two visits. The questionnaires completed before, during and after visits are referred to as questionnaires 1, 2 and 3.

In the school, the pupils who had volunteered to take part in a visit and had a signed consent form were first gathered together in a classroom and assigned among the 4 guides. The guides introduced themselves, explained how the visit would be organised and distributed questionnaire assess the socio-cultural profile of the pupils and their expectations of the visit.

Upon arrival at the museum, the pupils were invited to take a walk through the gardens to get a panoramic view of the former Imperial Palace. During the walk the guide explained the main historical facts about the palace. The visit proper commenced after the walk with the distribution of questionnaire 2 that was based on a survey of the museum's collection and included a number of chemical, historical, artistic and cultural questions that could be answered using the written explanations and videos available during the visit. In each room in which answers to questions could be found, the guide collected the group together and gave a brief explanation to help with understanding and to motivate the pupils to find the answers. At this point pupils were stimulated to look themselves for the answers in the written explanations displayed for the exhibited items. In rooms where no questions needed to be answered, the guide answered questions put by the pupils and gave explanations if requested.

At the end of the visit, the pupils were collected together in the museum auditorium and the third questionnaire was distributed, which compared actual impressions with expectations, cognitive gains (learning) with affective gains (emotions and motivation to find answers). Part of questionnaire 3 is based on the Likert scale. The questionnaire assessment methodology applied was that of Colombo Júnior (2009) and Rocha (2007).

6. Results and discussion

Table 2 shows the age and sex of the visitors. In all groups examined, most pupils were of the appropriate school age. For example, in group A, 23 pupils (85.2%) were between 14 and 15. It is interesting that the proportion of boys in each group fell consistently from 40.7% in group A to 29.2% in group D.

Table 2 – Age and sex of pupils in groups

GROUP	AGE RANGE (YEARS) NO. PUPILS	SEX (MALE)
A	14 – 15 23 (85.2%)	11 (40.7%)
B	15 – 16 21 (70.0%)	12 (40.0%)
C	16 – 17 28 (75.7%)	12 (32.4%)
D	17 – 18 18 (75.0%)	7 (29.2%)

Table 3 shows the number of pupils and the percentage who answered the following questions in the affirmative: Do

you take any after-school classes? What is it/are they? Have you ever visited a museum?

Table 3 – Pupil groups by attendance of out-of-school classes and visits to museums

GROUP	DO YOU TAKE ANY AFTER-SCHOOL CLASSES?	HAVE YOU EVER VISITED A MUSEUM?
A	6 (22.2%)	17 (63.0%)
B	10 (34.5%)	14 (46.7%)
C	10 (27.0%)	20 (54.0%)
D	6 (25.0%)	15 (62.5%)

About ¼ of pupils took after-school classes, mainly English and/or computing. Around 56% of pupils had already visited a museum.

Table 4 shows pupils' expectations from the visit. The opportunity to learn new things was the expectation most frequently mentioned by the four groups examined but was most often cited by group D (78.3%). In the youngest group (group A), the expectation that the visit would be interesting and/or entertaining was mentioned more often than by the other groups on a proportional basis. It is significant that there were no negative expectations of the visit. Quotes from the pupils:

A1: «I think I'll learn new things."

A2: "I really want to go, I'm all worked up.
I've always wanted to go to a museum."

Table 4 – Pupils' expectations from the visit

GROUP	KNOWLEDGE ACQUISITION	ENTERTAINMENT	INTEREST
A	16 (55.2%)	4 (13.8%)	8 (27.6%)
B	16 (51.6%)	4 (12.9%)	6 (19.4%)
C	28 (75.7%)	4 (10.8%)	5 (13.5%)
D	18 (78.3%)	1 (4.3%)	3 (13.0%)

During this study, the following 5 questions from Questionnaire 2 were selected: 1) What is the average temperature in Antarctica? 2) What is the chemical composition of the Para de Minas meteorite? 3) Why is it dangerous to cook food in bronze pots? 4) What is natron? 5) Why is natron used in mummification? The answer to question 1 was in the Fossils from the Frozen Continent room which shows the huge climate change that has occurred in the Antarctic as a result of natural causes and the climate change that might occur as a result of human intervention. The Meteorites room shows how to distinguish a meteorite from a rock from the Earth's crust and provides the answer to question 2. The answer to question 3 is given in the Mediterranean Culture room, which exhibits a number of bronze items and provides context by showing the danger of using worn and damaged polytetrafluoroethylene (Teflon) non-stick saucepans. Questions 4 and 5 are covered in the Egyptian Culture room. The written explanation of mummification describes natron (sodium carbonate) and how it was used as a drying agent and disinfectant during the process. Table 5 shows the number and percentage of correct answers by pupil group. The number of correct answers to questions 1 and 2 (approximately 74-97%) was high for each of the four groups, For question 3, the percentage of correct answers by groups B, C and D was about 80% and around 60% by group A. These results indicate that the pupils were motivated to find the answers. There was a disparity between the correct answers given to questions 4 and 5 by group A and by the other groups. Here, the proportion of correct answers given by group A (about 25%) was significantly lower than that of the other groups (70-95%). A number of hypotheses will be given for these results.

Table 5 – Number and percentage of correct answers in questionnaire 2

GROUP	QUESTIONS*/CORRECT ANSWERS				
	1	2	3	4	5
A	20 (74.1%)	25 (92.6%)	16 (59.3%)	7 (25.9%)	6 (22.2%)
B	29 (96.7%)	29 (96.7%)	23 (76.7%)	21 (70.0%)	21 (70.0%)
C	33 (89.2%)	32 (86.5%)	29 (78.4%)	35 (94.6%)	33 (89.2%)
D	22 (91.7%)	23 (95.8%)	19 (79.2%)	22 (91.7%)	20 (83.3%)

*To questions 1 – 5 as described above.

Questionnaire 3 was distributed after the visit to assess the affective and cognitive gains obtained. Part of the questionnaire was based on the Likert scale, requiring pupils to rate statements on a scale of 1 to 5, ranging from "Totally disagree" to "Totally agree". The statements about the visit were: I) It has made me interested in one aspect of chemistry or science in general; II) I found nothing new; III) Better than I expected; IV) I found it hard to find answers to the questions on the questionnaire during the visit; and V) The guide explained things clearly and helped me find the answers. Table 6 shows the number and proportion of agreements with statements I - V. In the case of statements I and III, agreement levels were high across all groups, indicating that the pupils made affective and cognitive gains through

greater interest in certain aspects of science. Statement III shows that initial expectations were exceeded in all groups. Similarly, the high level of agreement with statement V indicates that guiding motivated and helped pupils to find answers. The low level of agreement with statement II shows that the visit gave pupils new perceptions while statement IV reveals that pupils in group A found it harder to find answers for questionnaire 2. Quotes from the pupils:

A3: "I really liked the history of Antarctica, it was very interesting because I never imagined a forest could totally freeze and stop being vegetation (and end up not being a forest any more)."

A4: "What most grabbed my attention was to see really close up what I usually only read about in books…"

Table 6. Agreement levels in questionnaire 3 (Likert scale)

GROUP	OPINION/AGREEMENT*				
	I	II	III	IV	V
A	18 (66.7%)	3 (11.1%)	22 (81.4%)	9 (33.3%)	23 (85.2%)
B	27 (90.0%)	xxx	25 (83.3%)	5 (16.7%)	29 (96.7%)
C	28 (75.7%)	4 (10.8%)	33 (89.2%)	9 (24.3%)	34 (91.9%)
D	23 (95.8%)	2 (8.3%)	20 (83.3%)	6 (25.0%)	23 (95.8%)

* Answers 4 and 5 on a scale of 1 "Totally disagree"; 2 "Partly disagree"; 3 "Undecided"; 4 "Partly agree" to 5 "Totally agree".

Generally speaking, the results of questionnaires 1, 2 and 3 indicate that all groups examined made affective and cognitive gains from the visit. In the case of questions 4 and 5 of questionnaire 2, where the level of correct answers given by group A was significantly below those of the other groups, a number of comments should be made. Since these pupils, like those in the other groups, agreed that the visit exceeded their expectations, the possibility that the group was not motivated to answer the questions can be discarded. Possible reasons for the disparity include the fact that the pupils in group A (year 9 of compulsory education) did not understand the chemical concepts involved, such as inorganic salt, the common names of chemical substances or dehydration. Other possible reasons can be found by examining the written explanations providing the answers. Figure 2 shows the written explanations in the museum that give the answers to questions 3, 4 and 5 in questionnaire 2. The explanation giving the answers to questions 4 and 5 (Figure 2B) is clearly considerably bigger than that giving the answers to question 3 (Figure 2A).

(A)

(B)

Figure 2. Written explanations giving the answers to question 3 (Figure 2A) and questions 4 and 5 (Figure 2B) in questionnaire 2. Approximate sizes: Figure 2A: 40 x 50 cm; Figure 2B: 150 x 100 cm.

Given the serious difficulty the pupils at the end of compulsory education had in reading and understanding the explanations, the discrepancy might be attributable to reading problems and would consequently have reduced the motivation to find answers.

Conclusions

Based on the results of this study, the following conclusions have been reached:

(i) The procedure and dynamics applied produced pleasurable and relaxed visits that generated affective and cognitive gains in a population of pupils from an area without cultural spaces.

(ii) The lower proportion of correct answers given by pupils in year 9 of compulsory education was the result of their lack of familiarity with the chemical concepts discussed and of their difficulty reading and understanding the written explanations, as discovered during the visit.

(iii) As an informal space in which to teach chemistry, the

National Museum is a promising alternative that can at least partly mitigate the structural shortcomings of state education.

(iv) The physical environment of the National Museum can provide an informal chemistry classroom for secondary school pupils.

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