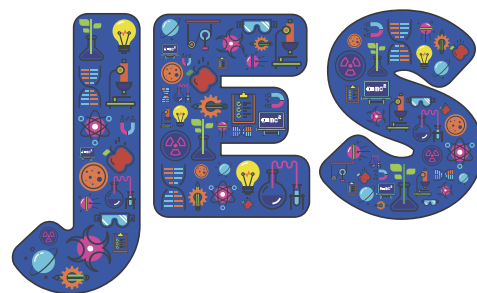


Enabling positive experiences in an informal learning environment for the youngest ages



● Montserrat Pedreira ● Conxita Márquez

Abstract

This article is grounded in the premise that educators of out-of-school activities ought to build environments in which children can enjoy science and have positive experiences. The idea is backed by a broad consensus on learning science in early childhood. However, how can it be validated that a child really has had a positive experience in a given activity? What evidence would allow us to confirm that an educational proposal has truly been experienced in a positive way? The article addresses these questions through a specific case analysis of the activity 'Can I touch?', offered by the Natural Science Museum of Barcelona for children aged 2 to 6. The analysis identifies three areas to validate children benefiting from a particular experience in a positive way, and leads to the identification of operational factors relevant for the design and creation of new proposals.

Keywords: Science education, childhood education, free choice learning, out-of-school learning, learning environments

'If attitudes are formed in even the earliest stages of life, and if they have a significant influence on the child's future development, educators ought to build environments in which students will enjoy science and have positive experiences' (Eshach & Fried, 2005, p.321).

The concept of children enjoying themselves, having positive experiences, being moved, feeling excited, etc., has been conveyed by different authors with respect to science learning. The Science Education Commission of the United States (Bell, Lewenstein, Shouse & Feder, 2009) has established that, as the first of six desirable products for its visits to centres where information about scientific education is given, 'experiencing

enthusiasm, interest and motivation to learn about the phenomena of the natural and physical worlds' is paramount to learning science. Harlen (2010) states that schools should aim to develop and sustain learners' curiosity about the world, enjoyment of scientific activities and understanding of how natural phenomena can be explained. From the field of neuroscience, the importance of emotion associated with the learning process has been identified, highlighting that 'only those things that speak to you, that captivate your attention and generate emotion can be learned' (Mora, 2013, p.73). From the museum research realm, Falk and Dierking (2000, p.18) have written that 'All learning, even of the most logical topic, involves emotion, just as emotions virtually always involve cognition'. Pintrich, Marx and Boyle's (1993) research about factors that influence conceptual change highlights the importance of having control over one's own actions, which means the importance of free choice in order to increase internal motivation.

The consensus among researchers on the need for children to live out positive experiences related to science learning is broad, but how can we determine that a child is really having a positive experience in a given activity or proposal? What evidence would make it possible to confirm that an educational proposal has truly been experienced in a positive way? This article addresses this research question through a specific case analysis of the activity *Can I touch?*, offered by the Natural Science Museum of Barcelona for children aged 2 to 6.

Context: the *Can I Touch?* activity

Can I Touch? is an activity for children up to 6 years of age, carried out in a specially prepared room of some 90 square metres, located near the entrance to the Natural Science Museum of Barcelona.

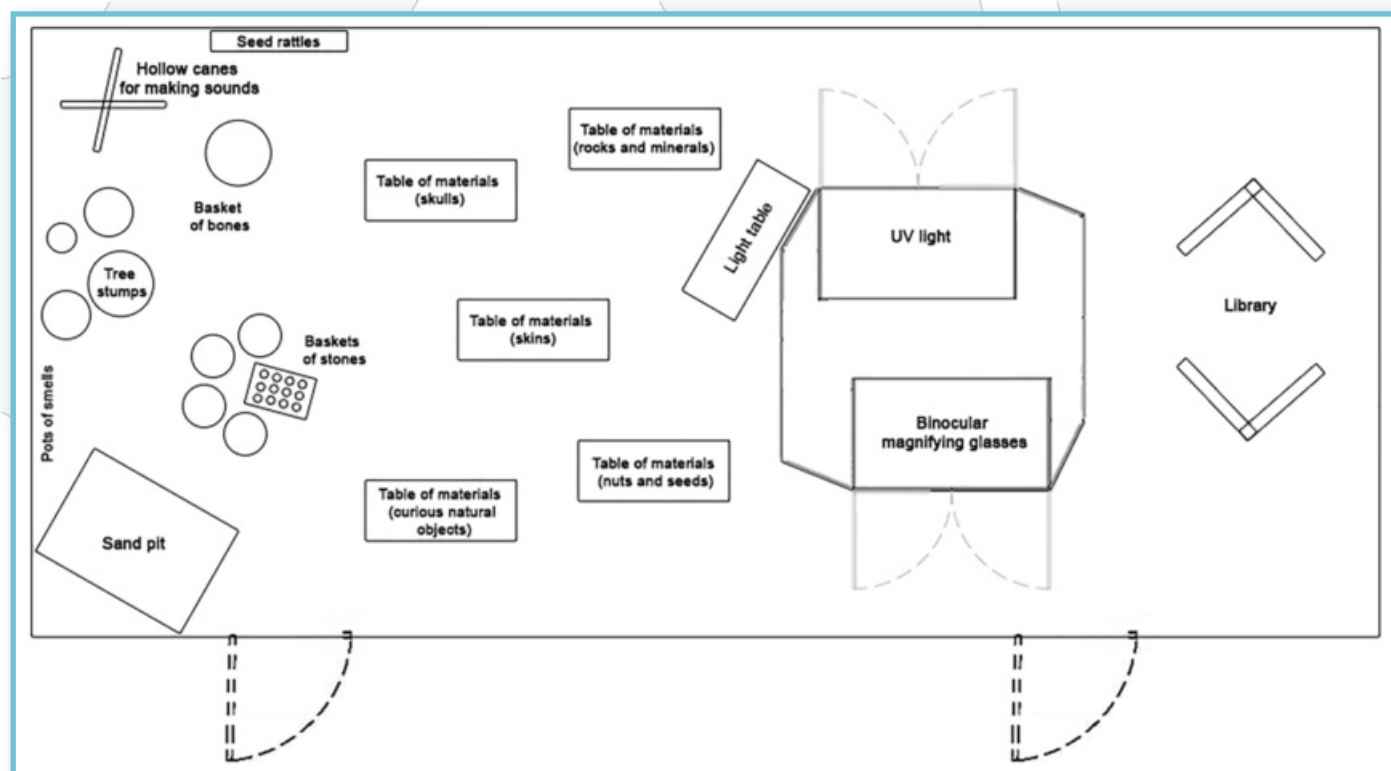


As these form part of a natural science museum, the objects and materials made available to the children are elements from the flora, fauna and geology of the territory. Boys and girls, in groups of up to 15, enter the room accompanied by their teachers and two museum educators. They are invited to freely explore the materials. They can go wherever they want, for as long as they want, with whomever they want, and can freely interact with the materials – on one condition; they must be careful not to damage them. The educators take a relaxed informal approach, talking with the children in soft voices and prioritising interventions with individuals or small groups rather than addressing the entire group at once.

The room is organised into a number of 'microproposals' that present the materials grouped by collections such as 'skulls', 'skins' and 'rocks and minerals' (see Figure 1), which aim to show the diversity and sensory richness of the natural world, and encourage free exploration and the emergence of children's natural curiosity (Pedreira & Márquez, 2016).

The room arrangement for *Can I Touch?* was designed to create an environment that was both comfortable and relaxed, facilitating concentration

Figure 1: Spacial distribution of the *Can I Touch?* activity (Source: Alba Carbonell, *Science Nest*).



on the specific activity either as individuals or small groups. For that reason, the 'microproposals' are distributed throughout the space in a way that allows fluid circulation but not broad movements, with discrete furnishings and decoration to highlight the value of the natural materials.

Methodology

In order to identify factors that would make it possible to determine whether the boys and girls are having a positive, exciting experience around science with the *Can I Touch?* proposal, a qualitative study was proposed, based on the observation of practice in a natural context, which highlights the richness and complexity of real situations (Rennie & Johnston, 2004), and therefore meets the purpose of this research to a greater degree.

The data have been collected through non-participatory observation of the *Can I Touch?* school visits and are shown in Table 1. The observations were made throughout the 2013-14 school year, during visits by three different schools from the Barcelona area that covered the range of ages to which the activity is offered.

The sessions were video-recorded and then transcribed for later analysis. The children's behaviour, their actions and words, as well as where they were and with whom they interacted, were faithfully noted.

Group of children ¹	Date of recording	Exploration length	Number of children	Number of sequences identified (n)
2 years	27th February 2014	42 minutes	22	59
4 years	27th September 2013	27 minutes	13	60
3, 4 and 5 years	4th April 2014	30 minutes	12	143

Table 1: Basic data from observations.

¹The children in the 2 year-old group were born in 2011. Therefore, they would turn 3 throughout 2014, the year of the observation. The children in the 4 year-old group were born in 2009. The children in the last group were mixed from three different grade levels, and were born in 2008, 2009 and 2010.

The transcript has been organised by sequences, with 'sequence' being defined as a set of actions that follow a single logical line, a narrative unit that takes place with a number of protagonists with intentionality, and a beginning and end. When narrative units cross each other, the transcription maintains the independent storylines. It is important to bear in mind that we can ensure that the situations reflected in the transcripts have happened, but that many others may have occurred that were impossible to capture.

For the internal comparison of data, frequency analysis has been used. This is defined as the number of sequences in which a given behaviour is identified (a), divided by the total number of sequences of the session (n) (frequency = a/n).

Data analysis

To assess whether children experienced *Can I Touch?* as a positive learning experience, all the observations were reviewed, looking for evidence of enthusiasm or wellbeing and conflicts or unease (non-wellbeing). These different types of evidence have been grouped into three categories: personal expressions, peer-to-peer interaction and adult interventions.

Personal expressions:

A child's positive experience was identified through verbal expressions or gestures: laughing, smiling, humming or softly singing, different body movements or expressions of admiration (e.g. Wow! Look!). A child's negative experience was identified by such things as crying, complaining,

expressing uneasiness or various disruptive behaviours: children who run or move in an agitated way, make excessive noise or use materials inappropriately.

Peer-to-peer interaction:

Favourable interactions were considered to be those that showed wellbeing in relation to others, such as situations of co-operation, when a classmate spontaneously participates and is active in another child's proposal, or those of complicity, seen in situations in which contact with the other takes on a great deal of importance: children who devote full attention to each other, imitate each other, make proposals to each other, lend materials, etc. Conflicts among the children, which emerge mainly in association with possession of the materials, are considered unfavourable interactions.

Adult interventions:

Positive experiences are understood as interventions in which the adults show themselves to be receptive to children's needs, which includes both responding to their direct requests for help, or contact with situations in which the adults show with a look, smile, or the initiation of dialogue that they attach value to what the boys and girls are doing, and encourage them to continue with what they are doing.

Non-positive experiences are understood to be those interventions oriented to keeping order and the rules of mutual respect, preventing actions of material misuse, and/or any that could affect their classmates, or having to settle conflicts between



the children. Although this adult intervention clearly promotes wellbeing, it is considered a non-positive experience from the children's standpoint, as adult intervention prevents or defuses a non-positive situation.

Table 2 below features examples from each of the categories.

Blue print indicates portions of the sequence in which evidence is identified:

Personal expressions	
Wellbeing	Non-wellbeing
2014-02-27 _2 year-olds	2014-04-04 _3-4-5 year-olds
<p>8:00</p> <p>Boy with the large magnifying glass shouts with joy</p> <p>Boy: Aah, aah, aah!</p> <p>He stands in front of the teachers with the magnifying glass to his face, happily showing it to them. He repeats the cries, and looks for more adults to show them his discovery.</p> <p>Boy: Aah, aaah! I discovered..!</p> <p>8:15</p>	<p>27:55</p> <p>(...)Girl: So what will we do here?</p> <p>Educator 5: What do you want to do now?</p> <p>Girl: What can we do?</p> <p>Educator 5: What can we do?</p> <p>Boy: Are we going to be here the whole time?</p> <p>Educator 5: We'll be here a while longer and then we'll go to the exhibition.</p> <p>The boy leaves the light table.</p> <p>The girl insists.</p> <p>Girl: Can we see if there are any birds here?</p> <p>She points toward the other side of the nest.</p> <p>28:50</p>
Peer-to-peer interaction	
Favourable	Unfavourable
2014-04-04 _3-4-5 year-olds	2014-02-27 _2 year-olds
<p>4:17</p> <p>(...)</p> <p>They look at the rocks, one after the other, then go to the skulls. A girl looks at another girl and makes happy noises while bouncing up and down.</p> <p>Girl: Chye, chye, chye! She goes toward the classmate, and lowers the arm of the magnifying glass to take it off her face. She looks at her with the magnifying glass in her face. She goes bouncing away with the classmate behind her, and goes to the light table. They use the magnifying glass to look at the X-rays on display there. One leaves and, after a little while, so does the other. They go to the back of the room...</p> <p>5:23</p>	<p>1:42</p> <p>The other two boys appear to be having a conflict. One is practically on top of the other. Each has a rattle in their hand. They seem to want to pick up the same one. The boys can be heard saying:</p> <p>Boy: Eh, eh, eh!</p> <p>An adult comes and calms the one who is on top of the other. The adult says:</p> <p>Teacher: You have this one, he has this one.</p> <p>(...)</p>



Adult interventions	
Receptive	Maintains order
2014-02-27 _2 year-olds	2013-09-27_4 year-olds
<p>17:05</p> <p>There are two boys, one girl and a female adult on the ground with the stones.</p> <p>(...)</p> <p>The boy gives the teacher a stone, who makes the gesture of weighing it and leaves it on the panel. The teacher offers the child a stone while she says:</p> <p>Teacher: What about this one? Does it fit? She gives the boy a stone. He fits it in.</p> <p>The boy gives the teacher a stone. She keeps it in her hand.</p> <p>The teacher tells him that the stone goes in the container, and the boy leaves it there.</p> <p>(...)</p>	<p>3:25</p> <p>(...)</p> <p>Educator 2: Please give me that sharp object you're carrying.</p> <p>Boy: It pricked me!</p> <p>Educator 2: Right, that's why I should put it away, huh? Or better yet, why don't you take it back to where you found it? Look, Boy 10 will show you where it was. Take it back to its place.</p> <p>4:00</p>

Table 2: Examples of the different categories identified as evidence.

	Total sequences of each session	evidence of a positive experience					evidence of a non-positive experience				
		Wellbeing expression	Favourable interactions	Receptive adult	Total	Frequency	Non-wellbeing expressions	Unfavourable interactions	Adult keeps order	Total	Frequency
2 year-old group	60	30	17	18	65	1,08	8	8	12	28	0,47
4 year-old group	59	25	14	31	70	1,19	10	3	1	14	0,24
3-4-5 year-old group	143	77	22	39	138	0,97	3	19	8	30	0,21
Total	262	132	53	88	273		21	30	21	72	
Frequency		0,50	0,20	0,34	1,04		0,08	0,11	0,08	0,27	

Table 3: Number of sequences in which the described behaviour has been identified (absolute numbers and frequency).

In the wellbeing expressions, the number of times that the children show excitement associated with the materials is noteworthy. In 132 out of the 262 sequences (freq=0.50), the objects captured the attention of the children, who made verbal expressions of admiration and often felt the need to share their excitement with the others.

The expressions of non-wellbeing detected were crying (1 case), showing unease or complaining (3 cases), excessive movement (2 cases), making inappropriate noise (7 cases) or hazardous

situations (8 cases). The act of identifying the cases of inappropriate noise or hazard helped to suggest measures to reduce their frequency (for example, modifying the way in which the proposal was presented).

The favourable interactions were co-operation in 7 cases and complicity in 46 cases. The most common behaviours of complicity were: devoting full attention to the other child, either taking turns, repeating the same scheme, imitating what a classmate does, watching, giving or lending



materials, sharing tasks or joking. The co-operation behaviours observed consisted of filling or emptying containers together, and constructing towers or structures.

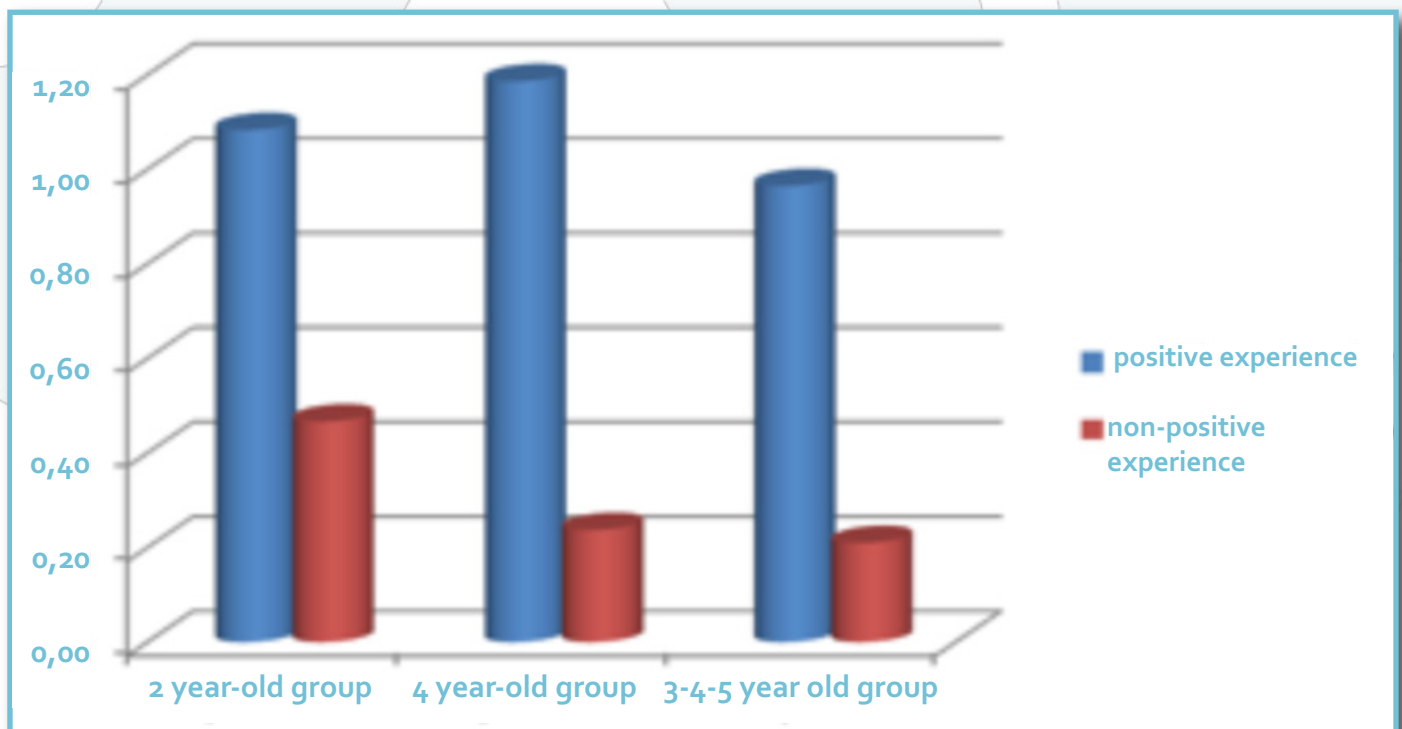
Unfavourable interactions tended to be conflicts associated with usage of materials. In the sessions analysed, the main source of conflicts was one specific instrument – the magnifying glass (11 cases out of 30). Identifying the source of conflict made it possible to think of ways to modify the proposal to avert future conflicts (increasing the number of magnifying glasses).

The analysis of the situations in which the adult was attentive to the children showed 8 cases in which the adult gave a direct response to children's demands, but 80 cases in which they were the person of reference to whom the children came to show what they were doing, to get them to smile or enter a dialogue.

In the cases observed in which the adult made the decision to intervene to make sure the rules were followed, this was done with direct, close dealing with the children involved, and the adult addressing the conflict from a calm vantage point.

Figure 2: Comparison: positive and non-positive experiences (frequency).

(The foregoing data indicate a possible way to analyse the setting of an educational proposal for small children based on observation, and make it clear that, in the case of *Can I Touch?*, a comfortable setting is created in order for the children to enjoy science.)



These adults did not speak in a loud tone of voice, or make abrupt movements around the room. Often, a simple look from them modified the children's behaviour.

Figure 2 shows the overall numeric comparison between positive and non-positive experiences over the three sessions. It clearly shows the greater ratio of situations linked to positive experiences.

Discussion

Different authors emphasise the importance of comfortable, stress-free environments, where young children can enjoy learning about science and feel safe and secure while engaging in exploration (Rennie & Johnston, 2004) in contexts that do not generate anxiety (Mora, 2013).

It seems clear that the free-choice design of *Can I Touch?*, which does not impose itineraries or sequences but lets the children interact freely, favours experiencing the environment in a comfortable way.

Also important is the use of careful criteria regarding the 'microproposals' that are presented,

both in selection and their distribution around the space. In the case of *Can I Touch?*, using 'microproposals' that do not facilitate the making of disruptive noises or the inappropriate use of the materials was a premise considered from the beginning and has been successful, as can be deduced from the low number of cases identified. Furthermore, the arrangement of 'microproposals', all around the space and properly delimited, allowing fluid traffic flow and not leading to broad, uncontrolled movement as shown by the low number of occasions in which excessive movement occurred, is also important.

The low but necessary impact of an adult who keeps order has also emerged as essential to the maintenance of the feeling of safety, as it averts undesirable situations. As shown in the sequence transcribed below, it seems that the mere presence of such an adult contributes to maintaining a favourable, safe environment and prevents most of the undesired behaviours:

2014-04-04_3-4-5 year-olds

6:37

Boy 6 goes toward the horse skull, picks it up and lifts it. The teacher looks at him and shakes her head. Boy 6 leaves the skull where it was and goes running after her.

The data also make clear the greater importance of an adult presence as a means of guaranteeing order in groups of the youngest children. It can be supposed that the socialisation that comes from children's evolving with age helps to reduce the number of conflicts.

The materials are also important in generating a comfortable setting. A number of authors highlight the importance of collections of objects, which in the case of a natural science museum are selected, highly stimulating fragments of reality (Broadhead, 2010; Hooper-Greenhill, 1994; Shuh, 1994). Schwan, Grajal and Lewalter (2014) add, as conditions essential to the generation of an exciting experience, the discovery of new and fascinating information perceived without effort, and the stimulation of multiple senses. In the case of *Can I Touch?*, the frequent demonstrations of positive excitement associated with the objects make clear the attractiveness of the natural materials exhibited there.

This attractiveness can be generally extrapolated to materials from nature, which are fascinating due to their newness as well as the richness and diversity of sensory stimuli that they offer. Careful attention must be paid to the quality of the material; it must be attractive enough to guide children's attention, action and curiosity. Quantity must not be overlooked; there must be enough to avert conflicts over possession.

Other authors refer to the importance of interactions, either from the idea that visits to science centres are a social activity in themselves (Hooper-Greenhill, 2009), or due to the relationship between interaction and construction of learning (Falk & Dierking, 2000; Tal & Morag, 2007). The data collected on the peer-to-peer interactions that occur in *Can I Touch?* make the high frequency clear, with interactions that favour a positive atmosphere being greater in number than those that do not. Given the possibility of introducing modifications in the design of the proposal to reduce conflicts of possession, which are the most relevant, it must be considered that interventions to reduce non-favourable interactions are possible.

Again, the key factor favouring positive interactions is free choice – in other words, the possibility that the children choose the materials with which they want to get involved, in which order, for how long and with whom, in an absolutely personal way, without impositions. This is a factor that reappears as something key to be taken into account when designing proposals that involve children having positive experiences.

The information collected points to the importance of the adult as interlocutor and person of reference. In all sessions, many situations occur in which the attentive response of the educators helps children's positive experience, in which the adult acts as a person of reference, a welcoming presence who promotes children's own actions, and whose look gives value to the children's actions during the activity. This is an adult who behaves discreetly, who emphasises the appreciation of each child's actions and who does not aim to impose him/herself or direct all of the children's actions at the same time, but rather is always available and attentive to the possibility of intervening to just the right degree, and facilitating scaffolding (Wolf & Wood, 2012).



One final important aspect in achieving a comfortable atmosphere is the ongoing revision of the proposal's operation, based on observations focused on behavioural evidence associated with positive and negative experiences. The identification of elements that do not favour a good atmosphere for the proposal is the first step toward introducing changes that will improve it. Therefore, remembering the adult role of observer-evaluator is essential for the continuous improvement of the proposals.

Conclusions

The research discussed herein makes possible the conclusion that, based on observation, evidence of behaviours associated with positive and negative experiences can be found. This allows the validation of the children's visit as a positive experience.

The categories defined in the article can be derived and are shown in Table 4. These categories are not meant to be an exhaustive or universal list, as they

correspond to a specific case, though it is understood that they could be the basis of other research. On another note, the integration of the results obtained in *Can I Touch?* with the different ideas contributed by the research makes it possible to identify key factors that have to do with achieving an environment in which to enjoy science at the youngest ages, and that can therefore be useful when implementing new activities. They are listed in Table 5.

Positive experience is very important in promoting positive attitudes toward science, but it also seems reasonable to think that such situations are highly educational and have great learning value. This article has outlined a way to identify, in the case of *Can I Touch?* or any other science proposal for children of the youngest ages, analysis categories with which to validate that an educational proposal is lived as a positive learning experience, and key working factors that influence this experience have been determined. Future research must address the learning that takes place in these conditions.

Table 4: Analysis categories to validate, based on observation of a natural situation, whether an educational proposal generates a learning atmosphere lived as a positive, pleasant experience.

Personal expressions	<p>Wellbeing: laughing, smiling, humming or softly singing, different body movements or expressions of admiration</p> <p>Non-wellbeing: crying, complaints or various disruptive behaviours (broad, abrupt movements, exaggerated noises or dangerous use of the materials)</p>
Peer-to-peer interactions	<p>Favourable: co-operation, complicity, (children who devote full attention to each other, imitate each other, make proposals to each other, lend materials, etc.)</p> <p>Unfavourable: conflicts over possession</p>
Adult interventions	<p>Being receptive to children's needs: responding to their requests, showing that they appreciate what the children do</p> <p>Keeping order: preventing misuse of material, pacifying conflicts between children</p>



Factors	Characteristics	Contributions
Free-choice operation	Free access to materials Non-sequential Non-direction of adult	Positive atmosphere: there are no impositions to follow. Therefore, everyone can follow their own preferences in terms of activity and classmates. Favours interactions.
Objects and materials	Attractive, diverse material (quality) Appropriate number of materials (quantity)	The attractiveness of the material guides children's attention and causes positive emotions to emerge. The appropriate number minimises conflicts due to possession.
'Microproposals'	Distributed in a balanced way throughout the space Non-disruptive proposals	Proper arrangement of the 'microproposals' prevents broad, abrupt movements. Proper selection prevents noise, hazards or undesired conduct.
Role of the adult	Discreet and respectful, but firm in preventing undesirable conduct Attentive and receptive of children's needs Observer-evaluator	Keeps order, prevents undesired behaviour. Provides a response to children's needs. Attaches value to what children do. Favours the analysis and evolution of 'microproposals' and the space in general.

Table 5: Key factors in building a learning environment for children to enjoy science at the youngest ages.

References

- Bell, P., Lewenstein, B., Shouse, A.W. & Feder, M.A. (Ed.). (2009) *Learning Science in Informal Environments: People, Places, and Pursuits*. Washington, DC: National Research Country. The National Academies Press
- Broadhead, P. (2010) 'Co-operative play and learning from nursery to year one'. In: *Play and Learning in the Early Years* (pps. 43–59). London: SAGE
- Eshach, H. & Fried, M. (2005) 'Should science be taught in early childhood?', *Journal of Science Education and Technology*, **14**, (3), 315–336
- Falk, J.H. & Dierking, L.D. (2000) *Learning from museums: visitor experiences and the making of meaning*. Walnut Creek, CA: AltaMira Press
- Harlen, W. (Ed.) (2010) *Principles and Big Ideas of Science Education*. Great Britain: Ashford Colour Press. Retrieved from: <http://www.interacademies.net/File.aspx?id=25103>
- Hooper-Greenhill, E. (Ed.) (2009) *The Educational Role of the Museum* (2nd Edition). New York: Routledge
- Mora, F. (2013) *Neuroeducación: solo se puede aprender aquello que se ama*. Madrid: Alianza
- Pedreira, M. & Márquez, C. (2016) 'Espacios generadores de conocimiento', *Cuadernos de Pedagogía*, (466), 46–49
- Pintrich, P.R., Marx, R.W. & Boyle, R.A. (1993) 'Beyond Cold Conceptual Change: The role of motivational beliefs and classroom contextual factors in the process of conceptual change', *Review of Educational Research*, **63**, (2), 167–199
- Rennie, L.J. & Johnston, D.J. (2004) 'The nature of learning and its implications for research on learning from museums', *Science Education*, (88), S4–S16



Schwan, S., Grajal, A. & Lewalter, D. (2014) 'Understanding and Engagement in Places of Science Experience: Science museums, science centers, zoos and aquariums', *Educational Psychologist*, **49**, (2), 70–85

<https://doi.org/10.1080/00461520.2014.917588>

Shuh, J.H. (1994) 'Teaching yourself to teach with objects'. In: *The Educational Role of the Museum* (pps. 80–91). New York: Routledge

Tal, T. & Morag, O. (2007) 'School visits to natural history museums: Teaching or enriching?', *Journal of Research in Science Teaching*, **44**, (5), 747–769 <https://doi.org/10.1002/tea.20184>

Wolf, B. & Wood, E. (2012) 'Integrating Scaffolding Experiences for the Youngest Visitors in Museums', *Journal of Museum Education*, **37**, (1), 29–38

Montserrat Pedreira, Department of Childhood Education, University of Vic-Central University of Catalonia, Barcelona, Spain.

E-mail: mpedreira@umanresa.cat and

Conxita Márquez, Department of Science and Mathematics Education, University Autònoma de Barcelona, Barcelona, Spain.

E-mail: conxita.marquez@uab.cat

