PLAYING IN SCIENCE: A PROPOSAL OF ACTIVITIES TO ENGAGE INFANT EDUCATION CHILDREN IN LEARNING SCIENCE AND ENGLISH AS A SECOND LANGUAGE.

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Abstract

Since birth, children need to understand the world where they live and learn. That knowledge is achieved through the exploration of their environment with adults supporting their development, which is related to science learning.

Moreover, children achieve socialization step by step and one of the best strategies to understand their environment and socialize is "playing". Through play, they learn to interpret their world, to interact with others and to use language to express their ideas and feelings.

The present study focuses on describing learning through science play in order to provide some materials related to this idea to be used in English as a Second Language classroom.

Key words.

Play, Science, Infant Education, Foreign Language Learning, Materials.

0. Introduction:

Teaching at Infant level is considered as a globalized process, that is, all the areas are taught at the same time and children learn the different areas of the curriculum through global units which integrate those concepts through meaningful associations.

One aspect which has lead me to investigate about play in science learning is that although there is not enough research related to the lack of importance teachers give to science area in infant education classrooms, I have observed in my practical experience that science is not a typical area in early years classrooms and it should concern many teachers as it is crucial to children's development.

Moreover, in second language learning classrooms teachers usually spend their time on activities in which children repeat what the teacher does or says, so they do not give their pupils the possibility to play freely using their senses and do not propose activities where they explore the environment nor use the second language to interact with their peers. It is important to consider play as a resource to let children explore their world because play

engages children in the activity proposed and through exploration it provides them sensory experiences that make learning more meaningful, as everybody remembers better the experiences they have had with fun, lived and through investigation.

Due to the fact that science sometimes is not considered as an important area, as observed in my practical experience, and that teachers usually propose activities based on repetition in their Second Language classrooms, letting children interact with their classmates in a second language while they explore their environment and developing activities and materials that develop learning opportunities through play becomes paramount, as it is focused on developing all the aspects mentioned and it will allow us to explain the importance of children's learning through scientific play in English as a Second Language lessons.

In the literature the benefits that play has in learning have been emphasized. According to Jensen (1994) and Dryden and Vos (1997), play is used to learn because it creates emotional attachments, which is the clue to acquire learning. Therefore, play must be the centre in all Infant Education classrooms. Other benefit is that play also has importance in Second Language Learning classrooms, as it might be considered a good way to attract children's attention and they might be curious about the activities in which the use of the second language is included. In other words, play might be considered a tool to learn the second language.

Children often engage in play in situations where they use their senses and have opportunities to explore and learn about their environment. This type of play is very close to science learning, as science is based on children's use of the senses to explore the properties of objects and their ability to use the objects in order to develop their imagination.

Despite the valuable contribution which play activities can make to the bilingual classroom at Infant level, there is still very little research on how science play can be used in class to promote second language learning. The purpose of this paper is to examine the importance of scientific play in Second Language Learning and to create some materials and activities that might be useful for teachers to include in their lesson plans in English as a Second Language class.

0.1. Purpose of the paper. Research objectives.

With the development of this paper we are trying to achieve the following goals:

- To identify and define the different types of play and to explore their potential for the teaching of scientific concepts.
- To review Second Language Acquisition theories in order to identify a set of key theoretical principles for learning foreign languages.
- To apply those principles in order to create a range of activities which use play as a means for teaching English as a Foreign Language and Scientific concepts to Infant students.
- To provide a set of recommendations and steps for teachers, which can be taken into account before the creation of materials.

In order to reach these research objectives, I will first try to provide a clear definition of play, providing a categorization of different types of play related to science and the processes that might take place while children play**.** I will also try to establish the importance of play as a way to acquire learning in infant education, examining how children acquire a language. Next I will consider how activities involving play can help teachers facilitate both language and content learning. To conclude, I will provide a variety of resources for teachers to implement at the different stages of infant education created to engage children in science play.

1. Play

Play is a concept that is not very clearly defined in the literature, so it is important to have a clear definition of the concept that guide us throughout this study. After defining “play” as a general concept, I will provide a definition of the main types of play related to scientific learning and an overview of the processes that occurs while children play. Both the types of scientific play and the processes involved will then need to be taken into account for the creation and adaptation of activities and materials.

1.1. Definition:

"Play" is a difficult aspect to understand because takes many forms, which is why researchers, educators and philosophers have proposed different definitions of "play" over the years. The most widely accepted definition was made by Smith and Vollstedt (1985), who considered that "play" is joyful, flexible, imaginative, spontaneous and essential to the children's development and learning.

Although the definition provided by Smith and Vollstedt's is generally accepted, Rubin et al. (1983) established some aspects included in play, which narrow down the concept:

Firstly, the satisfaction of playing is an element that motivates children to participate in every activity. As it is known, playing includes a motivating element that usually helps engage children in the activity.

Secondly, playing occurs using familiar objects or exploring new ones. That is the main reason why children might feel motivated and start playing. On the one hand, using familiar objects can be a good idea to start playing, as they explore different possibilities to play with the object or use their imagination to create other uses with it. On the other hand, exploring new objects can awaken the children's interest to investigate the different characteristics of the object and the possibilities that may come from playing with it.

Thirdly, play does not follow any pre-established rules. It is related to the obvious difference between game and play, i.e. a game follows some rules, but play is more free and does not have rules, as you can play with different things in many ways and every time you play, it will be different than the other times you have played.

Finally, players must be engaged in play. It is very important because if this does not happen, it is not a play. As pointed out above, children need to be motivated to play and participate in the play process, so it is essential to engage them in the play itself.

In conclusion, teachers must include play in their lessons, as play motivates and engage children in the activities proposed, it allows children explore their environment and objects properties, and it makes them more creative as it does not follow any rule established before.

1.2. Types of play:

Children typically engage themselves in learning scientific concepts when they experiment with their environment, as it catches their attention and they seem to be more motivated to learn in those situations where they can freely use their senses. In this section I will provide the different types of play related to scientific learning, which will be the focus of the materials and activities that will be proposed afterwards.

1.2.1. Epistemic play

Epistemic play, also known as exploratory play, is the type of activity closest to science learning. Hutt (1979) claims that epistemic play refers to the exploration of objects and materials and finding out about new aspects of the environment and its properties whereby children gather knowledge about the world through their senses. This author also suggested that real learning takes place during epistemic play.

Based on Hutt's work, Moyles (2012) proposed that in epistemic play there is a component based on playful exploration which indicates more pure play than other types of play. She also claimed that children deal with challenges in play through exploration and the use of their senses.

The use of the senses makes a connection between this type of play and heuristic play, which will be described after epistemic play.

The use of the senses to explore the environment is related to science learning, as children learn freely about the world around them and its properties. Hutt made another connection between epistemic play and science learning, as he considered that in epistemic play when a child is presented with a new material, they usually follow some steps to learn the material's possibilities. Firstly, children touch the material and use their senses in many ways to learn about its properties. Secondly, children's curiosity leads them to use the material trying to do or create something. Finally, after children's exploration of the material and their trial of creations, they learn that different materials have different rules, as they have observed and experimented with materials that have different properties.

1.2.2. Heuristic play

The second kind of play we are going to describe is related to the exploratory game, the use of natural materials, and obviously also with play in science.

The main difference between epistemic play and heuristic play is based on the discovery made by Moyles (1989), who established two kinds of exploration: specific exploration, which is focused on exploring what the material is and its possibilities; and diversive exploration, in which children manipulate objects and are led to explore what they can personally do with the material. According to this classification, we can include epistemic play in the first type of exploration, as it is based on the investigation of materials, observation of the possibilities of those materials and testing of the theories created through the observation of those possibilities. In contrast, heuristic play can be seen as belonging to diversive exploration, as it is based on trial and error experiences and it is based on then children's interests in what they can do with natural materials.

Heuristic play as defined by the child psychologists Goldschmeid and Jackson (2004), consists in offering to a group of children, for a defined period of time in a controlled environment, a large number of different kinds of objects with which they play freely without adult intervention.

Heuristic play actively encourages exploration by using and developing children's senses. This idea was also proposed by Moyles (2012) who suggested that this play is focused on children's natural curiosity and their ability to manipulate through their senses. Children instinctively investigate objects that catch their attention and make discoveries through taste, touch, smell, sound and sight, as they use sensory experiences to make discoveries and categorize objects. According to Goldschmeid and Jackson (2004), in this play the role of the adult is to observe, set out the activity, support the children and collect natural materials like seashells, pebbles, fir cones and conkers, meaning that, during the activity children explore different materials and objects without adult interference.

1.2.3. Symbolic play

This kind of play is important for children's cognitive, language, social and physical development. According to NAYCE (2005), young children not only acquire knowledge through play, they also learn to express and represent their ideas, thoughts and feelings when engaged in symbolic play.

Santrock (2006) suggests that this type of play occurs when children learn to transform objects into other objects. Then, they substitute those objects and pretend that they are the

real objects. This period generally appears at 18 months, peaks at 4-5 years old and then declines.

To promote an appropriate development of symbolic play it is important for educators to select materials according to children's level and arrange the environment adequately. This idea was proposed by Reed (2007), who also suggested that symbolic play should be an important part of the preschool curriculum.

The level of complexity of symbolic play was dependent upon the context of play and the play situation. As Umek and Musek (2001) contended, in different stages of symbolic play many uses of language and communication occurs.

1.3. Processes that take place during play:

As there is no agreement among researchers about the processes included in play, in this section I will propose my own classification which focuses on the processes which take place in scientific play and not on play in general, and which has been created according to different sources of information.

Although I propose a classification which includes different processes, those processes do not follow any temporal correlation, so the processes occur with any regular order, and not all the processes should happen in every play situation.

It is important to explain the processes included in play, as at least one of these processes has to be considered by teachers when they are going to create materials.

1.3.1. Decision- making and play

This process happens while the children are playing, as they make decisions like doing one thing or another with an object to explore its possibilities. Therefore, they have to assume those consequences and live with them, valuing the impact they can produce. In this way, they will learn something for next time.

According to Moyles (2012), in decision-making the children are agents in their own learning, they also explore the outcomes of the play itself and they learn and develop some skills that might be useful in other contexts or situations.

In English classrooms it is important to provide children materials that let them make decisions through trial and error because it engages them in play and provides them meaningful learning.

1.3.2. First- hand experience

It is another process which takes place while playing. As we know, young children learn about the world using their senses. That is the reason why children are actively engaged with things and also play with their ideas, because they observe and interact with their world and they live many experiences using their senses, so they feel more motivated to play. In first-hand experiences children use touch sense, and through touch they learn some qualities of the materials (heavy, light, smooth, rough), feeling engaged in the activity.

First-hand experience is very close to science learning because the use of the senses takes place in heuristic play and epistemic play, as explained in the previous section. Moyles (2012) contended, that first-hand experiences will help young children to learn and to understand about themselves and the world around them, being more meaningful to find out things for themselves than listening or being told by others.

First-hand experiences must be guided by an adult, as some play experiences might be difficult for children to understand; those experiences should be playful and also adapted to their knowledge and possibilities, to let them reach it and have fun. If that kind of experiences is provided for children, they will feel more motivated to learn.

In English classrooms, children must be provided with materials that make them wonder about the world, because when they use their senses they want to make questions to have more information about what they observe and the teacher is the agent with whom they will interact to acquire the information. So, when first-hand experience is included in play in second language classrooms, children are encouraged to use the second language to interact with other.

1.3.3. Social Interaction:

Social interaction is another process which takes place during play and that is focused in the importance of sharing play experiences with peers.

Saracho and Spodek (2007) suggested that at first children become socialized by observing their family interactions. Through the observation of their family interactions, children learn appropriate behaviours and thought processes of successful interpersonal relations.

Also related to the development of social interaction, Rubin and Coplan (1998) contended that at the beginning of their life infants show interest smiling and making sounds, but when

they grow up their behaviours become more prosocial including more frequent social contacts. As they also indicated, their social skills are provided at first through the peer group. In conclusion, according to Ladd (2007), we can consider social interaction as the mean where children learn from peers, which is important to learn to take turns, assume roles and make social exchanges.

It is important to include materials that strengthen social interaction by providing children with activities and opportunities to interact with others, because in social interaction children interact with their classmates, talk about the game, they take turns and, by looking at their classmates how they play, so they can realize about their own mistakes playing that game.

1.3.4. Imitation:

The process of imitation also takes place while playing, when children look at others playing and repeat their actions to explore new possibilities. Rogers et al. (2003), contended that imitation is the repetition of body movement, vocalization or facial expression, which provides means of communication.

Piaget (1962) suggested that symbolic play develops from imitation, particularly deferred imitation, as children developed the ability to represent mentally events they had experienced and reproduce them at a later time. However, according to him, in the preoperational stage, which includes children from 2 to 7, the give and take of play and imitation is one way the child learns about the world around him. Imitative learning plays a crucial role in the development of cognitive and social communication behaviours, such as language, play and joint attention. Other aspect he indicated is that when children imitate, they improve their communication skills by interacting in social and emotional exchanges.

1.3.5. Creativity

This process is an important part of science play. It is important to include creativity in Second Language materials because it develops children imagination and makes them think in different ways. So, when children play in different ways, they interact with others using different language structures and a wide range of vocabulary.

Although there are many definitions of the concept among researchers, we are going to use that one created by Greenfield (2000), who considers creativity as the plasticity and

capacity for making connections between neurons in a brain by comparison with the more rigid structures present in later life.

When children play they search information and experiment. In this way, they engage in their own learning, as exploring with objects makes them more creative.

It means that exploration elicits children's creativity. According to Russ (2003), symbolic play can help children become more scientific and develop divergent thinking, which is an essential dimension of creativity.

Not only symbolic play develops creativity but also epistemic play is closely related to young children's scientific learning, as it gives children the confidence to be creative and learn from their mistakes.

Although the best materials to encourage children's thinking belong to the nature, when children use materials in new ways they can feel motivated to entertain new patterns of play.

Other important aspect which fosters creativity abilities is the planning of the physical environment where play takes place. That means not only thinking about the indoor environment, but also thinking about other important aspects such as providing natural materials, using ICT as an additional possibility, proposing activities focused on particular skills or giving them the opportunity to think different ways to start playing.

2. The use of play in early education classrooms

In this section of the paper, we are going to consider the role of play in education, more particularly in early education, and the role play can have in the development of the different content areas, in particular science learning, while children learn English as a Second language.

2.1. The use of play in the learning of general curricular areas

In order to create materials that develop children's science learning, we first need to clarify how play contributes to learning in different areas of infant education, as it is better to provide materials that make children learn in a globalized way. In the first part of this section we are going to introduce the importance of playing to learn in all the areas in general, focusing on the role of play to the learning in particular and not the language used

in the classroom. In the second part we are going to focus on the contribution of play to learning science, which is the main area we have been giving importance in this paper.

2.1.1. Contribution of play to all the areas

The use of play has a variety of benefits in early education classrooms as it contributes to the development of all children's areas. One of the benefits, according to Moyles (2012), is that play is the best way to implement the curriculum instead of being a break from it. It is important to implement a curricula focused on children's need which could also be playful. This author also suggested that the most effective curricula are play-based, they recognize the interests and choices of children and guide the development of some skills.

Furthermore, Saracho and Spodek (1987) suggested that play is an important tool to support young children's learning, as it provides them with the opportunity to express their feelings, put their knowledge of the world to test and acquire effective support for learning.

Moreover, Stone (1995) contended that children of all ages need to integrate the learning experiences in the curriculum based in play with language, maths, science, materials and music, considering children as learners of a future career, such as writers, scientists, artists or musicians, among other jobs.

In conclusion, we can say that play is a good method to support children's learning for the development of the different curricular areas.

2.1.2. Contribution of play to science learning

According to Henniger (1987) the play experience stimulates children's interest and builds a real world of experiences where children learn science. In other words, children explore as they play, which in turn helps them in their science learning.

Related to the experiences where children learn science, Hawkins (1965) coined a term called "messing about" to explain that science learning can be play. He said that it is a form of play related to science, where children are provided with materials to experiment. The process of experimentation starts when the children explore the properties and characteristics of things, continues when they ask reasonable questions about that materials and it finishes when they try to find an answer for these questions. This concept agrees with the idea proposed by Saracho (2011) who suggested that children engage in science when

they explore and put their ideas to test, ask the appropriate questions and interpret and explain their findings.

In summary, young children can assume the role of scientists when they play manipulating, exploring and finding out things, and as Henniger (1987) contended, through play experiments children can discover science relationships which will be useful for later learning.

2.2. The use of second language learning in early education

In this part of the work we will review the process of Second Language Acquisition and the principles that teachers must follow to support that process. This is important to be considered when Second Language teachers design activities to promote children's play while learning scientific or other curricular concept, as those materials can help children to improve their foreign language competence if they comply second language acquisition principles.

2.2.1. General stages for Second Language Learning acquisition

The way in which language is produced under natural conditions is very regular and systematic and it is important to know what early years' learners can do with their second language at different levels of development.

To explain what children can do at each level, Krashen and Terrel (1983) established four stages that drive children's second language learning. These stages roughly correspond to the stages children in infant education go through at different levels of proficiency, as some children might have been in touch and might have had more experiences with the language than others in the same classroom and throughout the different courses they gain experiences and improve their learning so they come from one stage to other:

1. The first stage they talk about is known as the *Preproduction stage*. English learners who are unfamiliar with the language are usually at this stage. Children can absorb the language but they get tired very quickly due to the need of intense concentration. They can acquire skills at receptive level, as they comprehend more than they can produce. For this reason they can engage in nonverbal responses, respond with movements or say simple formulaic structures, as simply language is

required. In this stage, the teacher can join children that have been exposed to English with others that never have been exposed to it, in order to stimulate them to learn the second language. Total physical response activities or plays in which repetition of words is included are the types of play which children can participate at this stage.

2. The second stage is the *Early production stage*, where they situated learners who begin to respond with short answers. At this stage they are experimenting with the language, so it is usual for learners to make mistakes both in grammar and pronunciation. The role of the teacher when he or she is interacting with these students is to provide feedback and demonstrate the correct language responses. In this stage, the teacher must provide a low-anxiety environment in the classroom to encourage children to speak in English being self-confident. In this stage children can participate in plays where the teacher asks and they answer or where little interaction with a peer is included.
3. The third stage is known as the *Speech emergence stage*; in which English language learners will begin to use the language to interact more freely. In this stage teachers must provide opportunities to work in structured small groups so that children can reflect and experiment with their language output. This stage allows children to play in sharing experiences with more than one peer at the same time in different contexts.
4. The last stage is *Intermediate fluency*. Learners in this stage have a near-native fluency in everyday social English, but not in academic English, so they will present some difficulties understanding and verbalizing cognitively some abstract concepts. Teachers must provide materials that lead children understand abstract concepts. In this stage it is unusual to situate any children of infant education, but if it occurs, children can engage in activities finding solutions to hypothetical concepts are included.

These stages have being selected instead of other classifications because, as explained above, it is important to give an education according to their levels of English, as teachers must guide the process of language acquisition of each child and support children's

improvement of their skills. In other part of this research, we will consider some of them to create different materials and activities for our lessons.

2.2.2. Communicative principles

After talking about the stages that children follow in the process of a second language acquisition, we are going to develop some principles that teachers use in classroom to help children becoming more proficient in their use of the second language. It is important to provide materials that foster those principles in order to support children's development in the second language and the improvement of their self-confidence while using the language.

Nutta et al. (2010) synthesized some generalizations in five principles which teachers must follow to supply children's effective second language learning environments. According to these researchers, those principles might provide some clues to construct a curriculum that is sensitive to the language needs of learners in the second language development.

The first principle consists in giving many opportunities to use English language in both oral and written ways developing all the possible skills, by giving them texts in plenty of forms. According to this principle teachers must provide children with texts that let them use their knowledge and skills in new situations. Children need to acquire knowledge of the type of language used in classrooms, so teachers must provide them with opportunities to create, discuss, share, revise and edit a variety of texts.

The next principle refers to the importance of paying attention to the patterns of English Language Structure. They explained that second language acquisition follows a natural order and sequence as firstly children practice with the language and while they do, they gain more confidence to use it in different contexts. According to this natural sequence of acquisition, teachers have to take advantage of that knowledge to help children develop, paying attention to those grammatical structures that emerge and supporting their learning by giving them more opportunities to improve their skills.

Other principle is related to the time teachers provide children in classroom to use English productively. This principle highlights the role of teachers to engage second language learners in the oral use of the language, as it will help them to make the language become more comprehensible, solicit corrective feedback and adjust their use of the language.

The next principle talks about the importance of giving the learners opportunities to notice their own errors and give them the chance to correct them. They provide six feedback moves to direct children's attention to their language output and help them correct their English: explicit correction, requesting clarification, recasts, metalinguistic clue, elicitation and repetitions.

The last one is related to giving Language Learners as many opportunities as possible to interact with their peers in English. To achieve that and help learners to progress with their English Language learning it is important to vary the types of instructional tasks teachers usually follow. The key to academic success is to involve children in using the language and force them to make an effort with the language while they learn English.

In conclusion, these principles are very important for learners in order to have an effective learning environment, they get many opportunities to interact with English and in this way they become more self-confident with the use of the second language; and for the teachers in a way to carry on with the English lessons, paying attention to the time they give children to use the second language and realize their own mistakes.

2.3. Play as a vehicle for content and language learning.

As mentioned above, play is a excellent tool to teach in infant education classrooms. However, it is important not only to consider play as a method to learn contents but also to acquire language. Due to the fact that content and language learning can occur at the same time through play, second language teachers can include play in their lessons activities and promote materials which promote both content and language learning. That is one of the reasons why, in 2011, the European Commission contended that children should be exposed to the target language in meaningful and authentic settings, in such a way that language is spontaneously acquired rather than consciously learnt.

Moreover, Moyles (1989) suggested that the challenge in learning a foreign language in infant education is to create a context in which the child-initiated learning and the teacher-led learning is balanced through play. As child-initiated learning and teacher-led learning are concepts that have not been studied enough and are important to lesson planning and the

creation of materials (as children need to be provided with materials that promote both types of learning), we are going to talk about both definitions.

According to Mourão (2014), when we use child-initiated learning as a term we are referring to child-initiated play as the opportunity for the children to explore freely materials and situations for themselves. However when we talk about teacher-led learning we consider it as teacher-led play, referring to routine activities that demonstrate and provide access to the target language. Through play teachers have an active role facilitating and directing children to those goals they are trying to achieve.

Children need language to play in English. Mourão (2014) claimed that to acquire the language needed to play children must first be exposed to the language required to participate in an activity. After that, through teacher-led play, they usually engage in an activity where the English teacher uses typical materials in their lessons. When the lesson has ended, children are used to interact with materials similar to the ones they have access to, like the ones used with the English teacher and start a child-led play, experimenting with the materials, making mistakes and deciding what they can do with those resources. Finally to reinforce the learning, in the next lesson the teacher provides the children with more opportunities for directed play and access to the language.

In child- initiated learning children can not only use the language but also play and learn concepts different from those learnt in classrooms, as they explore the environment and in a natural way they learn new concepts.

After explaining how play mediates in language learning, it is important to explain the role it plays in the learning process. Kolb and Kolb (2010) investigated how play mediates in content language and suggested that, related to the role of play as a mean to learn, that in its different forms and styles, play has a central place at each stage of children's development.

In their investigation they found different theories about the relation between play and learning. One of those theories is known as *arousal modulation theory of play*, which contend that there are two distinctive modes of play in which children have different behaviours: epistemic and ludic modes of play. Table 1 (in Appendix 1) shows the

classification of these behaviours developed by Hutt, C. (1979). It is important for teachers to know that children behave differently depending on the activity proposed in order to plan their lessons according to the aspects they want to focus on during that lesson.

As teachers we must promote both types of play depending on the concept we want to teach and in the play we must provide opportunities for children to use the second language.

Although, talking about theoretical concepts related to the role of play in the learning of concepts, recent research and developments explain the connection between play manifestation and the function of the brain. Different types of play behaviour seem to be related to the different ways the brain processes information. As Edwards, B. (1989) contended, the epistemic behaviour seems to be related to the left hemisphere of the brain's functioning, which is abstract, symbolic, analytical, rational, and logical; whereas the ludic behaviour might correspond with the right hemisphere, which is synthetic, concrete, analogical, non-rational, spatial, intuitive, and holistic.

Moreover, there are some cognitive developmental theories of play which explain the role of play in the children's cognitive development. Among these theories we can highlight the theory developed by Piaget, J. (1962).

According to Piaget, play provides children with a natural context where they can interact with the environment, experiment and improve their knowledge of the world. According to his observations about children's play, he claimed that in early childhood, two processes of adaptation are involved in children's cognitive development: imitation and play. Imitation would make children learn concepts and, at a later stage of cognitive development, play can help them to assimilate those concepts.

When children play interacting with the environment and they imitate, they also imitate the structures that their peers and the teacher use and also they comprehend better the concepts, as they learn it naturally through experimentation.

3. Activities and materials

In this part of the paper I will propose different kinds of activities and resources, which I have created from my imagination including different ideas that emerge from the internet,

focused on play for learning content and language and which can be implemented in infant education classrooms.

In order to develop these activities, it is necessary to establish a set of criteria that all the materials and activities must include so as to promote children's second language learning. These six criteria have been extracted from the most important aspects of all the previous sections and are the following:

1. Interaction: It must give to children opportunities to interact with others using their second language.

2. Scientific concept: It must develop at least one scientific concept.

3. Type of play: It must promote opportunities to play one or more types of play mentioned some sections above.

4. Play process: At least one of the processes included in play (decision-making, first-hand experience, social interaction, imitation and creativity) must be considered.

5. Flexibility: Each material must let do many activities and play in different ways and not only to use the material as proposed in this paper. In other words, the material must allow using it as other thing once the activity proposed is finished.

6. Teacher role: It must allow the teacher to guide children's use of second language, interacting with them, correcting their mistakes or encouraging children to use the language, among other aspects.

These principles will be used in order to create a range of materials according to the different criteria mentioned above. Some of the activities and materials that will be proposed are ideas from different activities observed in my practical experience in infant education adapted to science, and others come from my own imagination and experience.

It is also important to define what steps I have follow to create the different materials and activities in order to help ESL teachers that want to create their own materials related to science play. These steps are:

- Think what goal(s) you want to chase in you ESL classroom.
- Search ideas in many sources of information and use your previous experiences to create a material that fulfils the goal(s) you have imposed, thinking what might be useful for the creation of the material or activity.
- While you think about the material or activity try to include not only scientific concepts but also concepts related to the different areas of knowledge in infant education curricula.
- Be as creative as you can. There are a lot of materials that can be adapted to the idea you want to follow, so it is important to be imaginative and take advantage of every idea to turn it into a new and original resource.
- Once you have an idea of the object or activity you are going to create, try to make it open to play with it in as many levels as it might be possible.
- Finally, you have to think about the materials you need to create this resource. Try to do the resource in an easy way, as it might take you some time to create it and use cheap materials, recycled materials and everything you have at home (or school).

Activity 1: The Wisdom Tree

a) Materials:

- Mystery box with different pieces of paper inside with qualities of objects written.
- An umbrella without fabric (only the metallic part). (See appendix 2)
- Fishing line
- Stickers of different forms and colours
- Rubber padding feet, hands and fingers

- Objects with different forms and textures.

b) Target age:

This game can be implemented in second and third Infant Education classrooms, where children had previously learned all the vocabulary that is inside of the mysterious box, which is adapted to each level, but they might need to interiorize it and refresh previous knowledge.

c) Procedure:

The first day of the week, the teacher takes a piece of paper out of the mystery box, in which two different properties about an object have been written, one related to the length and the other one to the form, texture, colour... The length measures are: a finger, a hand and a foot, and the teacher provides them with those length measures made of rubber padding (available in appendix 3).

After that, the teacher tells the students that there is an umbrella at the back of the classroom, hanging from the roof, upside down, with the fishing line. The teacher will decorate it like a tree and will explain that it is the *"Wisdom Tree",* where children must hang with clothespins every object they have found that complies with the facts read from the piece of paper.

To find the objects, the teacher forms groups of three and assigns a different colour for each group. Each group will hang their objects in one of the "tree branches" which will be painted with the group colours that have been previously assigned. To encourage the children to play, the teacher can propose the game as a competition, asking each group to find throughout the week a fixed number of objects (ten, for example) that fulfil the requirements written in the paper.

At the end of each lesson, the teacher will give children five minutes to play the game, giving them the opportunity to find objects if they want to (if they prefer to play with other objects, they can). So they can explore the classroom trying to find objects, using their senses to observe scientific concepts about length, texture, form, colour…

At the end of the week, the teacher gives each group the objects of the "tree bench" gathered by their peers, giving them time to evaluate and reach an agreement about if they think that the objects fulfil the requirements or not.

This activity must be implemented at least one week, but it can be played every week if the teacher wants to, to review concepts and let children use the language related to those concepts.

Evaluation:

- ✓ Interaction: the activity proposed allows children to use the L2 to interact with their peers, because they have to discuss, and teacher, because they can ask her questions and she will correct mistakes.
- ✓ Scientific concept: there is at least one scientific concept included in the activity proposed, as they have to measure the size of the objects, and depending on the paper they might weight the objects they hang in the umbrella or search a specific shape, among other things.
- ✓ Type of play: It provides children opportunities to explore freely the environment searching objects that achieve the requirements imposed so this activity promotes both epistemic and heuristic play.
- ✓ Play process: The activity promotes first-hand experiences as they touch and test if the objects achieve the facts or not, and they play with others so social interaction also occurs.
- ✓ Flexibility: The umbrella can be a tree or other things. For example, if it has any object hung it can also be a balance. Children can hang at one side one object, and in the opposite side hang other. The umbrella will act as a balance, moving to one side or other, depending on the weight of the objects.
- ✓ Teacher role: This activity lets the teacher analyze children's use of L2 and correct their mistakes if necessary and encourage them to interact with their classmates.

Material 2: Big and small object slides.

a) Materials:

- Pieces of carton to make the small slide
- Tubes of carton
- A tray to make the big slide
- Egg carton to make the obstacles of the big slide
- Two little containers to make the big slide's legs.
- Glue to paste the different parts of both slides
- Scissors
- Paint to decorate both slides

b) Target age:

This activity can be implemented at the three courses of infant education, adapting the activity depending of the children's skills.

c) Procedure:

To create the small slide (see appendix 4), you will need to attach various pieces of carton tube vertically. After that, you have to cut a hole in the middle of the top tube. You have to put a large piece of carton inside the hole and stick it with glue or tape, which will be ramp of the slide. If the slide is not large enough, you can attach more pieces of carton with tape or glue. The last step is to paint the slide using different colours, even letting the kids use their imagination to do it.

To create the big slide (see appendix 5) the back part of the tray will be the front part of the ramp. To start the construction, you have to stick one container to one corner of the tray (the back part of the ramp) and stick the other to the closest corner where the other container has been stuck. At the front of the slide, you can stick different objects as obstacles in the slide, in this case has been proposed to stick parts of an egg carton. Finally you can paint and decorate the slide with different colours.

If you use these materials for children to play, you might also need different boxes with objects that might roll or not. I propose to provide different balls (create a spike ball using toothpicks, other made with holes, or made of paper...), and some materials like springs, an apple toy, small and big pine cones, small and medium stones, or even a sweet, that might catch their attention and spark their curiosity to know if it rolls or not. If you see that children play with the objects and materials, after their playing time you can make them discuss in pairs or groups of three which objects roll in which slide, which ones collide with obstacles and which ones pass through them. If they are in the third year of infant education, you can increase the difficulty asking them to decide which objects rolled straight and which turned off the way, or even which objects could get stuck in the obstacles.

Evaluation:

- ✓ Interaction: With these materials children can use L2 to interact with their peers before, while and after playing, as they can make predictions about what objects will role, talk during the exploration of the materials' properties and discuss if they were certain with their predictions or not.

- ✓ Scientific concept: In this activity children explore if the objects roll or, for the contrary, slide, which are concepts related to science area.

- ✓ Type of play: In this activity children explore some objects' properties by throwing it over two different slides, so it promotes exploratory and heuristic play.

- ✓ Play process: This material, as the first activity is based on first- hand experiences as children are the agents of the exploration by touching and throwing the materials and observing what does each object (roll or slide).

- ✓ Flexibility: These materials are open to other activities or plays, as if there is more than one slide of each size, children can make races using different objects, or as mentioned above, make "bets", among other things.

- ✓ Teacher role: While children play, the teacher can observe their behaviour and correct their mistakes if necessary. The teacher can also ask children questions as *"Do you think this pen can roll?"*, encouraging them to use L2.

Materials 3 and 4: the magic painting and the floating beach

I have decided to include in this section two similar materials to realize that there are many proposes of resources that although are different, fulfils the same characteristics. Therefore, the evaluation of both materials will be done as a whole.

a) **Materials** to use the magic painting:

- Four or five big boxes to put near the painting.
- Canvas or paper to paint on.
- Different materials to be put in the boxes.
- Pencil, paint and crayons to paint the picture.
- Tape to stuck the painting in the wall.
- Different materials that the teacher may want to add to the painting.

b) **Target age:**

This activity can be implemented at the three courses of infant education, but it is preferable to use it in second and third course, as children have used more the language and they might use better second language to interact with their peers.

c) **Procedure:**

The activity to use the magic painting is proposed for the third year of infant education. The teacher will put a big picture, painted in paper or canvas in a way that it attracts the children's attention. This picture can be made only using paint or can be created using other materials like salt, cotton... The picture I propose in this case is a train (see appendix 6) because it is long and it will give the opportunity for many students to play with (the picture can be another one, according to the children's interest and the teacher's creativity, but it's important that it's oriented horizontally, to make it easy for every student to play this game); it should be hanged in a place that children can see from every part of the classroom.

Under the picture, the teacher will put some boxes filled with different materials like sandpaper, pencils, crayons, rubber…

This way, children can experiment with textures and they will be able to explore different possibilities and effects produced by the materials in contact with the picture or with other objects. Children will have to use the second language too, because if they want to use a material that is being used by another student, he or she must ask the other student for permission to take the material, and the teacher needs to be alert to be a guide and encourage children to use the second language while they interact with their classmates. This game allows children to play with each other too, comparing experiences, waiting for their turns to use the materials and giving each other ideas about how to use the materials in the painting.

At the end of the class, teacher will tell students to work in pairs to classify some of the objects used in the picture in two groups: objects that have had an effect on the picture (sandpaper, for example), and objects that have had any effect (the rubber or the crayons). During this discussion, she will walk around the groups asking children some questions about what they have experimented, giving them the opportunity to express themselves.

a) **Materials** to create the floating beach:

- Two sides of a big carton box to each landscape you are going to create.
- Scissors
- One plastic box with water for landscape.
- Paint of different colours, or other materials to paint the carton box
- One container with different materials for each landscape

b) **Target age**:

It is useful for all three courses of infant education, as they will use the language adapted to their own level.

c) **Procedure:**

It is very easy to build this resource. The first step is to take the big carton box and cut it. Two large parts of the box are needed, but the two parts need to be joined (it has nook cover form, see appendix 7). Once you have cut the box, you have to make a big drawing related to water inside the two parts of the box (I propose to draw a beach, as in appendix 8, but there are other possibilities like a lake or a swimming pool, for example) and decorate it using all the materials you want (sand, cotton, paper of different colours, ...). Finally, put the decorated box in a corner and in the middle of the drawing put the plastic box with water, which will represent the water of the beach, and next to this box leave the container with the different materials (if you want to draw the children's attention, decorate those materials, making it more attractive).

The materials I propose to use this material are things that float (cork, foam rubber, wood, an empty bottle...) and don't float (a key, a heavy ball, a sponge...), but you can use it for different activities. Children can explore throwing the objects to the water and observing if they float or not, they also can try to make some object float (put the heavy ball in the bottle, for example) and find out what happens. If the teacher sees one or more children playing with those materials, she will ask children questions like *"what happened when you put the sponge in the water?"*, or make children share their experiences.

As there is a landscape, other possible game is one in which children may engage with these materials in symbolic play, as they have different objects that might be used as persons and an attractive setting to play with the different objects and let their imagination run wild. They can play alone or ask their friends to play with them to make it more fun, but this is a good material to develop children's creativity.

Evaluation:

- ✓ Interaction: Both activities proposed to do with the materials allow children to use L2, as in the magic painting they can share experiences with their peers and ask for some materials, and in the floating beach they discuss with other classmates what happened when they threw some objects to the water.

- ✓ Scientific concept: In both activities there is one or more scientific concepts included. In the magic painting they have to classify objects according to a specific criteria; but in the

floating beach activity, the scientific concept included is objects that float and objects that do not float.

- ✓ Type of play: In both activities proposed children can explore freely the qualities of the different materials provided and they also have a setting to play with the different materials as those materials were people that live in that place (for example, an empty water can be "transformed" as a girl who goes to the beach), so all the types of play are possible to occur.
- ✓ Play process: The processes included in these activities are first-hand experience, because they have to use their senses, in this case the touch, and creativity, as they can use the objects in many forms.
- ✓ Flexibility: As mentioned above, the materials are not only settings to catch children's attention to explore the different materials, but also children can see it as real landscapes.
- ✓ Teacher role: In both activities the teacher acts as a mediator, as she can encourage children to speak with their peers, ask them questions, and interact with them in L2.

Materials 5 and 6: Magnetic monster's head and the storyteller book.

There are two different resources that are similar for children to experiment with the materials, as in both activities there are two different materials that children have to joint one to the other. As the resources are similar, it will be evaluated as a whole.

a) Materials to make one monster's head:

- Paperclips
- Bolts
- Magnets
- A carton box
- Glue

- Empty plastic bottles
- Pieces of a carton box
- A big piece of paper
- Different materials to decorate the head (markers, paint, stickers…)

b) Target age:

This material might be useful in the three courses of infant education.

c) Procedure:

Firstly, take the carton box and all the faces of the box except one side that will be the down part of the head. Cover the box with the big piece of paper. Then, stick metallic and magnetic pieces in the front side of where the different parts of a monster's face should be (at the top stick different eyes: one eye with a metallic piece and two with magnet, for example; in the middle the nose, which can be made of magnet; and at the back, the mouth which might be made of metal). At the right and left sides of the box do the same to create the monster's ears and arms. Finally, at the back part you can make other monster face if you want to allow more children to play with the same "monster's head" or decorate it using stickers and colouring it.

With carton pieces make different eyes, nose and mouth types simulating different feelings (angry, sad, scary...) and in the back of some of them stick metal pieces (paperclips or bolts, for example) but in others stick magnet pieces. With plastic bottles you can create different monster arms and stick magnet or metal pieces on some arms too. Use the spheres as the monster ears and stick one of the types of pieces on one side. Put some of the pieces on the monster head to catch children's attention but let the others in a container next to the head to allow the children see it and play. The teacher can be as creative as she wants to, but to have an idea about the material I propose a monster head model as the one available in appendix 9.

With this activity children can play alone or with others and create different monster head models, exploring what materials go together and using their creativity (as they can put

an eye in the place of an arm, or an ear instead of the mouth). They can recall previous vocabulary and understand magnetic concepts. They can interact with their peers using expressions' vocabulary (a scary mouth, sad eyes...), talking about the colours (put here the red eye), and this material also is useful in symbolic play, as children can put their head inside the box and simulate they are a monster.

a) **Materials** to create the story teller book:

- A ring binder.
- Velcro
- Cardboard
- Laminated pictures
- Coloured markers
- Plastic cover

b) Target age:

This material is valid for the two last courses of Infant Education, specifically the third course of Infant Education, as it is in the last course of infant education when children usually start to read texts in a second language by themselves. But it can be implemented in second course too because the teacher can help children using the material.

c) Procedure:

The teacher must decorate the covers of a ring binder wrapping them with some kind of flashy paper (decorating it with different markers), after that, the teacher must cover the interior of the ring binder with paper and write a title with markers (for example, "The storyteller").

Inside the rings, the teacher will put different cardboards with parts of a story written in it with some spaces for the children to create their own story. The story must be divided in three parts: Morning, afternoon and night.

In the spaces, laminated pictures will be stuck on, with a picture with the pertinent English word (these pictures can be handmade, with different markers or pens, or printed). Behind the picture, the teacher must stick the opposite part of the Velcro (rough one or soft one, depending if it is a verb or a noun). In this way, children can develop their creativity and explore the material, sticking the different pictures in the spaces, depending on what story they want to tell and, by that way, they will differentiate the things they do in the morning, evening and night.

Additionally, this material improves the second language use, because they can use a large vocabulary in English and it favours the Symbolic Play, if they want to act like "storytellers", and exploratory, because they learn about the characteristics of the Velcro material.

This material is an adjustment of different materials that autistic children use to look over their routines and to communicate with others.

At the end of the filling cabinet, there will be a plastic cover where the laminated pictures must be kept in.

With this material, the teacher can add more images of the story and new pictures according to the vocabulary the children have acquired, so this book is not a monotonous and boring activity as it encourages them to use all the words they know and reinforce it, making them have more fun.

Some book pictures and objects or verbs pictures are available in appendix 10.

Evaluation:

- ✓ Interaction: Both activities allow children interact with their peers using L2 while they create their own version of the material or where they play with it.
- ✓ Scientific concept: In both activities there is a scientific concept included, as in the monster's head children explore the magnetic property of the different parts of the monster and, in the storyteller book, there is a clear distinction between day, afternoon and night an there are also some numbers included if they want to count the number of a food they have eaten.

- ✓ Type of play: Both materials allow children the possibility to choose exploratory play, heuristic play or symbolic play; as they can play with the different parts of the material or become a monster or a storyteller.

- ✓ Play process: Both activities allow children to be creative because there are many possibilities to create a final version of the material and they can use their imagination to create different versions.

- ✓ Flexibility: children can use the monster's head as a cupboard to keep things or a computer, and the book can be a ring binder (what the real object is).

- ✓ Teacher role: In the monster activity, the teacher can correct mistakes when children use L2 and encourage them to use the language by asking them questions. Otherwise, in the storyteller book, the teacher can help children to tell the story and correct the mistakes children commit in pronunciation on reading words.

Conclusions:

Although there is not enough research related to how play mediates in learning scientific concepts in Second Language infant education classrooms, with this paper I have explored this concepts and I have tried to link them. This study has viewed all the aspects which concerned the relation between scientific play and second language acquisition. Moreover, different materials have been created according to a set of criteria established according to the aspects developed throughout the paper.

This research is important for teachers as it gives them some guides to create materials in their second language classrooms, which it has not been investigated by many researchers. It is also given some ideas of resources to use in second language classrooms to integrate scientific play and the use of the language, and some steps that teachers can follow when they want to create a material.

This work also gives teachers clues to guide both content and language children's process of acquisition. On one hand, they can guide content learning preparing a setting where children feel motivated to learn and providing activities that catch children's attention and

engage them to participate. On the other hand, they can guide language learning by giving a correct model, providing feedback, prompting them to use the language or interact with their peers and proposing plays and activities at different levels of proficiency.

One limitation I have had throughout the paper is the lack of literature related to scientific play as a tool to acquire second language, as it is a recent topic that has not been investigated enough. Due to this fact, in some sections of the paper it has been difficult to find valid researches that include the concepts I was trying to explain. It has been also difficult to extract ideas from different sources of information that could be useful to create activities and materials according to the principles established, so this paper provides a new proposal with original materials for those teachers who want to introduce play in order to teach scientific concepts in second language classrooms.

Some people believe that teachers include play in their class because children have fun while playing, but it is a wrong myth that this paper has refuted as it has been explained that play contributes to both language and content learning and it is an excellent tool to engage children in activities and support their learning.

Therefore, I have realized that it is important to be creative in lesson planning and to include new ideas and resources related to scientific play, because children acquire better second language while they are engaged to scientific play as it gives them many possibilities to explore the world and use second language in a natural way. As infant education teachers, we have the responsibility to include scientific materials in Second Language classrooms if we want to make children acquire the language in a more meaningful and enjoyable way.

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