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INQUIRY-BASED LEARNING IN PRIMARY EDUCATION

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Abstract

Different methodologies have arisen in the last century, and all of them advocate for a change of the traditional method. In this paper, Inquiry-Based Learning is introduced in an experimental group (17 students) to see the different results of children following this innovative method as compared to the control group (16 students) that followed the traditional method. The participants of the study are doing the third year of Primary Education in Spain. The assessment results showed that although just after the post-test both groups did not have significant differences, they became more prominent when the test was repeated in a couple of weeks. This suggests that inquiry-based learning is a better methodology to teach Science due to the students' significant learning, their interest and motivation, and the academic results achieved. The biggest problem we are concerned with is if children acquire the knowledge or it is just because they study to pass the exams.

Keywords: academic results; comparative study; Inquiry-Based Learning; Primary Education.

1. Introduction

The main objective of an educational system should be to make citizens capable of joining their fundamental and applied learning. Teaching has been a practice carried out since ancestral times. Many

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different methodologies have been implemented, and lots of studies and improvements have been carried out. Lately, there has been the necessity of a thorough revision of the teaching-learning process at both a national and international level.

As well as society evolves, so do the educative centres, and there have always been new methodologies that try to fill the gaps that previous ones did not do satisfactorily. In this sense, Scheiler (2012, mentioned in Abei et al. 2020) stated that this teaching- learning process moves to a more active learner-centred method to fulfil the skills that a student needs to achieve in this 21st century.

For this research, Inquiry-Based Learning, which is the methodology that will be studied and compared with a more traditional method, is a methodology in which students can learn a second language and all its skills (reading, listening, writing, speaking, communication). According to Piaget, in Wadsworth (1996) in his theory of cognitive development, girls and boys are curious by nature. They usually ask many questions, and they love to explore the world around them and learn how things work. However, the traditional education has focused on reading long scientific texts, memorizing contents, and repeating definitions with no sense. Sánchez et al. (2013) stated that the reasons for that could be the lack of teachers' motivation and preparation. With this methodology, pupils cannot develop their curiosity by exploring or understanding the world around them. In consequence, many students lose their motivation to learn Science at school.

Learning through inquiry is a perfect methodology for students avid of knowledge and curiosity because it lets them do research work and find answers to questions asked by the teacher or even by themselves, as stated by Busquets et al. (2016). Revising the most significant issues about this conception of teaching and learning, we find lots of similar methodologies, such as "experimental learning" (Kolb et al. 2001), "active learning" (Pardjono 2016), "inquiring teaching" (Marble 2007), and "scientific method or guided research" (Mishler 1990). In this paper, we use the nomenclature "inquiry-based learning" because it is the name that has been most spread and used by teachers and researchers.

In the last years, most countries have included in their programs suggestions for teachers to use inquiring activities in their Science activities because it has been proved to be a methodology with outstanding results. For instance, the United States of America was the first country that proposed, in 1990, the inquiry as a practice to teach Science in its educational curricula. In the 21st century, the European Commission wrote a report to conclude that the inquiry was a suitable method to teach Science.

In general, every Science program in elementary education encourages teachers to practice active methodologies, such as inquiry-based learning. Nevertheless, the reality in the Science class is different because many teachers keep teaching Science as they were taught at school many years ago, following the lines of a traditional methodology (Anderson, 2002). In the school of the case of study, teachers follow the traditional method. So, in order to analyse whether the new methodologies can impact positively the children's academic results in the area of Sciences, the Inquiry- Based Learning

(IBL) methodology will be implemented in an experimental group. The results obtained from the tests will be compared with the results of the control group following the traditional method.

Therefore, the main objective of this research paper is to compare the IBL and the traditional method in the teaching of Sciences in a public Spanish primary school. From this primary objective, we can also pose some other secondary objectives such as to check whether students following this new method participate more in class, to check whether pupils in the experimental group are more motivated towards the lesson, and to contrast how integrated into the teaching-learning process children are

1.1. Literature review

This study analyses the impact of inquiry-based learning in a group where a unit is taught following this methodology and comparing the results with a similar groupthat followed a traditional methodology for the same unit. To know what IBL is, we have a definition according to the National Research Council (1996) defines inquiry in an educational context as: "A multifaceted activity that involved making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results" (National Research Council, 1996, p. 23).

However, the term "inquiry" can be difficult to define or delimit. Inquiry is often confused by the words investigate or experiment. According to Prince and Felder (2007), we use inquiry-based learning (IBL) as an umbrella term covering a range of pedagogical approaches united by the central place that they give to the students' investigative work.

According to Ernst et al. (2017), inquiry-based learning is a form of active learning where students have to solve some scaffolded activities, and children need to solve them, making sense of them. This author also says that the activities can be done either in groups or individually. This conception includes exploring, wondering and questioning, or experimenting and playing with different possibilities that children will come up with. As it is childrenwho think about it, they will be making connections between previous learning and current learning. They learn how to make predictions and act purposefully to see what happens. They learn to collect data and explain what they have found in the research. They use the scientific method to make and test theories to solve problems in a variety of ways taking and defending a position.

The following table summarizes the most important characteristics in the methodologies carried out by the experimental group (on the left) and its correspondence in the control group, which follows a traditional methodology. In this table, we can observe important differences not only in our role as teachers, we went from a directive role to one of guidance and support, but also in the student's role, since they went from a passive role to a very active one when they have to build their knowledge.

Table 1. *Comparison of IBL and the Traditional Method*

INQUIRY BASED LEARNING	TRADITIONAL METHOD
Meaningful learnings. It means, learnings are scaffolding from the previous knowledge.	Memorization and repetition of definitions and data.
Learnings applicable to real and future experiences.	Very limited future applications.
The learning-teaching process is focused on each student.	The learning-teaching process is focused on the teacher.
Teacher guides and helps students in their research.	Teacher is who possesses all the knowledge and the truth.
Students are very active, they are active elements, researchers who learn from their own inquiries and reflections.	Students are passive, they listen to the teacher, read and study from the book.
Students have more autonomy in their learnings, but also more responsibility due to students are conscious that their learning is achieved because of their effort, skills, commitment and interest in the inquiry process.	Autonomy is not promoted as children do and follow the teachers' instructions.
Children develop critical thinking.	Children do not have to think, they only do as commanded.

Source: Own elaboration.

Inquiry-based learning is not a methodology born out in the last years but it has been used as a teaching and learning tool for thousands of years. However, the use of inquiry within public education has a much briefer history. The term "inquiry" in an educational context has been employed for decades in countries like the United States of America, Germany, or England. For example, John Dewey was the precursor of the inquiry-based learning methodology in the thirties. Dewey developed the "progressive pedagogy" which focused on the students' active participation, while the teacher is a guide or facilitator of learning.

In the sixties, the pedagogical approach "discovery-based learning" was founded. It had a quick acceptance and rise because of the traditional failure and depletion of the educative system. One of the most important representatives of this approach was Jerome Bruner (1961), who thought that learning was much more than mechanical memorization. According to him, learning should be a situation in which teachers present a question or problem to foster and encourage curiosity and interest and develop students' skills and capacities.

Similarly, some years later, in 1966, Schwab affirmed that traditional educational programs were obsolete and exhausted. He claimed that the didactic model and the teaching in every school should be

focused on inquiry, reflection, and critical thinking.

Also, Sánchez et al. (2013) said that it was necessary to contextualize and carry out scientific investigation for a better teaching-learning of natural sciences. In this line, Löfgren et al. state that "the pupils learn the nature of science, the scientific phenomena are presented in a context, and scientific methods and concepts are used in functional ways" (Löfgren et al., 2013, p. 482).

According to Sánchez et al. (2013), it is clear that Science is the best area to develop an inquiry-based learning methodology as students can develop scientific knowledge through research and experiments. Moreover, learning through inquiry encourages the students' curiosity, creativity, reflection, enthusiasm for knowledge, and active participation. Inquiry-based learning method lets students learn scientificknowledge applying the scientific method through their research, implementing critical thinking by using strategies as identifying problems, asking questions, formulating hypothesis and predictions, designing researches, carrying out investigations or experiments, analyzing and exposing results, contrasting hypothesis.

There are other studies similar to this one in primary education too. Abdi (2014), analysed the effect of the method in the fifth year of Primary Education and Sciences. In this case, the procedure lasted eight weeks, and in it,the experimental group achieved higher marks. In the same way, HarlEn (2013) also sets strong arguments for using the method in the areas of Sciences and mathematics. Similarly, Khalaf (2018) says that the two more used teaching models are the IBL and the traditional method. However, his research is based on 43 empirical studies between the years 2002 and 2017 and shows that IBL "increases learners' knowledge and skills" (Khalf, 2018, p.545). To finish, Furtak et al. (2012) think that a well- guided inquiry has a great positive effect on the students' academic achievements.

As seen in the previous lines, the authors advocate that the IBL is an excellent methodology for the teaching-learning of Sciences. Other authors also defend it in the Sciences classes. For example, French and Russel (2002) also write that the characteristics that make the difference are the following:

1.- Inquiry-based instruction places more emphasis on the students as scientists.

2.-IBL places the responsibility on the students to pose hypotheses, design experiments, make predictions, choose theindependent and dependent variables, decide how to analyze the results, identify underlying assumptions.

3.- Students are expected to communicate their results and support their own conclusions with the data they collected

There are also several classifications about the phases of teaching through inquiry. In the following table, we are going to see the phases according to Garritz et al. (2010), and the pedagogical activities associated with the inquiry process:

Table 2. *Phases and abilities students achieve*

PHASES	**ABILITIES STUDENTS ACHIEVE**
A. Identify and consider questions that can be answered through inquiry	Engages in scientifically oriented questions Gives priority to evidence in responding to questions. Formulates explanations from evidence. Connects explanations to scientific knowledge. Communicates and justifies explanations.
B. Define and analyze properly the question to be solved andidentify its relevant aspects	
C. Gather bibliographic information to be used as evidence.	
D. Think about everyday problems and display relevant historical aspects.	
E. Design and conduct a scientific investigation through a setof actions.	
F. Communicate by means of argumentation what has been learned through inquiry.	

Source: Own Elaboration from Garritz, Espinosa, Labastida and Padilla (2010).

On the other hand, there are several opinions and classifications about inquiry levels in the learning-teaching process. Inquiry-based learning has evolved since Schwab defined it in the sixties. Since then, several approaches or tendencies have arisen, from an open inquiry process that teachers scarcely intervene to a guided inquiry. Teachers promote the questions to the inquiry, having an essential role in the inquiry process.

Table 3. *The four levels of inquiry*

1. Open or "full" inquiry	**2. Guided inquiry**
It can be defined as a student-centred approach that begins with a student's question, followed by the student (or groups of students) designing and conducting an investigation or experiment and communicating results. Open inquiry requires higher-order thinking and usually has students working directly with the concept and materials,	In guided inquiry the teacher helps students develop inquiry investigations in the classroom. Usually, the teacher chooses the question for investigation. Students may then assist the teacher with deciding how to proceed with the investigation. Teachers find that this is a time when specific skills needed for future open-inquiry

equipment, and so forth Guided inquiry. In guided inquiry the teacher helps students develop inquiry investigations in the classroom. Usually, the teacher chooses the question for investigation. Students may then assist the teacher with deciding how to proceed with the investigation. Teachers find that this is atime when specific skills needed for future open-inquiry investigations can be taught within context. Guided inquiry isa natural lead-in to open inquiry.	investigations can be taught within context. Guided inquiry is a natural lead-in to open inquiry.
3. Coupled inquiry	**4. Structured inquiry**
Coupled inquiry combines a guided-inquiry investigation with an open-inquiry investigation. By beginning with an invitation to inquiry along with the guided inquiry, the teacher chooses the first question to investigate, specifically targeting a particular standard or benchmark. After the guided inquiry, a more student-centred approach is taken by implementing an open-inquiry investigation.	It, sometimes referred to as directed inquiry, is a guided inquiry mainly directed by the teacher. Typically, this results in a cookbook lesson in which students follow teacher directions to come up with a specific end point or product. Sometimes this approach is appropriate to use in the classroom; however, student engagement in the task is limited to following teacher instructions.

Source: Own Elaboration from Lisa Martin-Hansen (2002).

It is necessary to make IBL tasks motivating for students and easy to work for teachers. Therefore, there is a criterion for IBL tasks in four domains; (a) tasks needto be meaningful for students, (b) give the potential to evoke multiple solution strategies, (c) let the students plan their inquiry, (d) let students collaborate and communicate

2. Method

In this paper, the experimental group will be taught following the Inquiry- Based Learning methodology, while the control group will use a more traditionalmethodology. After that, the results will be compared, so it will be possible tosee the effect of IBL on children in terms of motivation, interest, and their academic results.

2.1. Participants

As for the participants, this research was carried out in the third level of primary education. In the experimental class, there are 17 students; there are ten boys and seven girls. Most of them are Spanish,

two of them come from Morocco, but they have been in the same school for three years now. Three of them repeated a year, and one another had just arrived, and she did not come from a bilingual school.

In the other class, the control group, there are 16 students, 9 of whom are boys. One girl arrived from Morocco last year, just before the lockdown, and the other boy arrived from a non-bilingual school in Zaragoza. In this case, those two children are not fluent in English. What is more, in the case of the girl, she struggles quitea lot in Spanish too. Two children have repeated a year. Taking all that into account,both classes are quite similar, as in the school when children move from one cycle to another, teachers regroup the students, and they make fair groups.

In this research, the experimental group has been taught about states of water and the water cycle following IBL. The other class of the same level, the control group, has been taught the same contents but following a traditional method.

2.2. Instruments

Three tests were used to measure the results. A pre-test was used to measure the children's initial level before starting the unit. Other observation techniques have also been used in class to see different aspects such as thereflection of the children about the unit, the students' self-evaluation, or the children's behaviour. After the intervention, a post-test wasadministered at the end of the unit and the same test was given two weeks after the unit was finished.

Some facts were taken into account for the preparation of the pre, post, and delayed test. Firstly, there are some specific topics we have to work on so as to cover up the minimum requirements in the subject for the third course. Secondly, the reports from last year were read tosee whether there was some introduction to the topic. We can observe that, due to the pandemic from the last course, children could not work properly on this topic, then we resolved to work on this topic from the very beginning. So, first of all, we needed to know their previous knowledge in order to plan our work. Finally, both the experimental group teacher and the control group teacher, after checking the previous steps, decided on a practical test to evaluate the pupils' learning and the way to carry on with the unit

2.3. Data collection procedures

As a starting point of this research, children in both the experimental and the control group had to do a pre-test, and they had to correct it using self-evaluation. In this way, they will be aware of the knowledge they have on the subjectand will be able to see what we want to achieve in this unit. The test was carried outin the same week. After that, in both groups, the intervention consisted of teaching aunit about the water cycle but in the experimental group the IBL was implemented, whilst the control group carried out the unit of the syllabus. The intervention had a duration of 4 weeks in the month of October. The main activities in the experimental group were:

Table 4. *Activities during implementation*

	SCIENCE ACTIVITIES	**INTERDISCIPLINAR ACTIVITES**
WEEK 1	Problematic scenario Thinking Routine "Chalk Talk" Experimenting water	Water vocabulary game (Spanish Language) "A long walk to water" (English Language) Water vocabulary game (English Language) Volume and Capacities (Maths)
WEEK 2	Thinking Routine "Compare and Contrast" Problems about water in the world	"A long walk to water" (English Language) Reading comprehension (English Language) Countries and Continents (Geography) Maths problems about water (Maths)
WEEK 3	Problems about water in the world Water cycle project	"*En el corazón de la lluvia*" (Spanish language) Reading comprehension (Spanish Language) A long walk to water" (English language) Watercolour landscapes (Arts & crafts and Geography)
WEEK 4	Water cycle project Final Assessment Unit Reflection	"Creative writing" (Spanish Arts) "A long walk to water" (English Language) Daily consume of water at home (Maths)

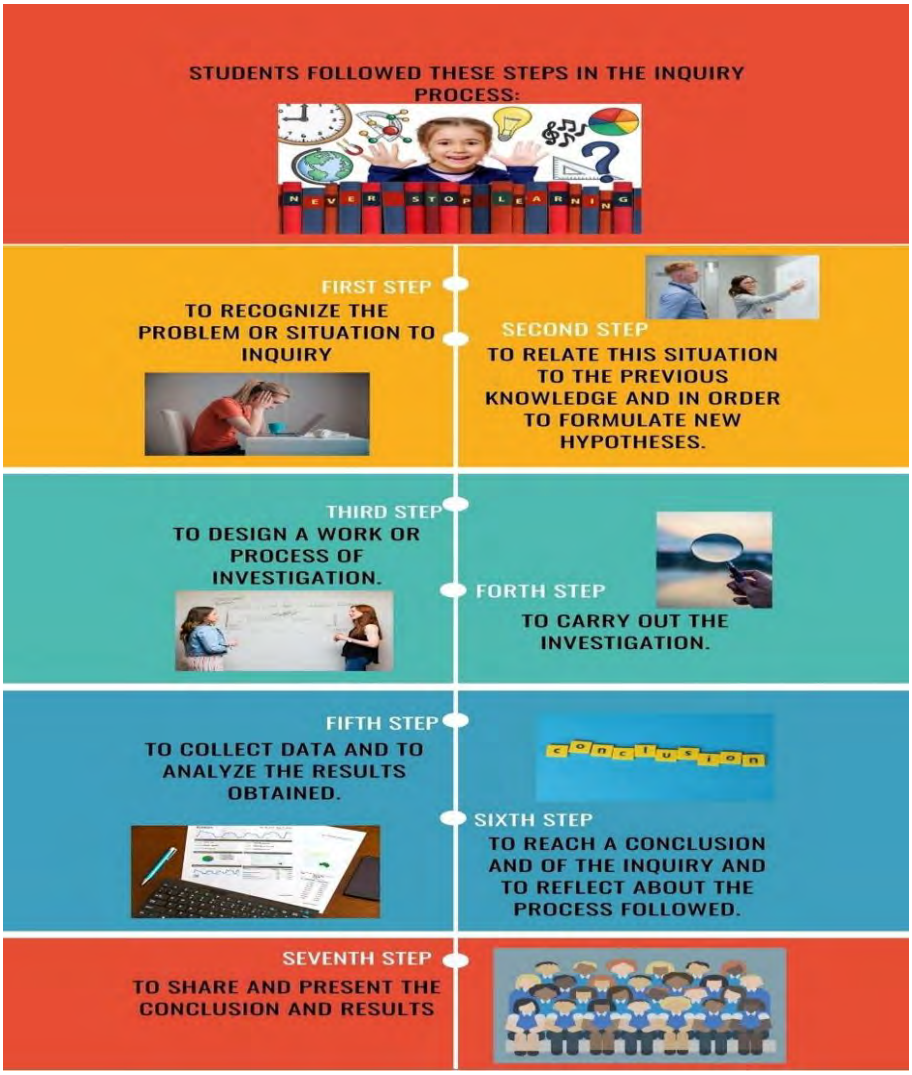
Source: Own elaboration

In the experimental group, children were divided into teams. There were three teams of 4 children and one team of 5. However, there were many difficulties in carrying out team activities, because of the social distance measures implemented due to the pandemic

2.4. Data analysis

For the experimental group, during the 4 weeks in which the procedure has taken place, children had to follow some steps for the activities proposed, in the image below, it is possible to see those steps.

Image 1. *The steps in the IBL followed by the experimental group*



Source: Own elaboration

We have seen that along the IBL methodology, children are asked to think, to do and to comment what they consider it is good to solve the problem. After the implementation, children were asked to do a self-evaluation and a rubric for the reflection of the unit. After that, the post-test was distributed, and two weeks later after the unit was finished, they also had to complete a delayed post-test. With all that, the analysis obtained from the data included is that children for a period of 4 weeks had different methodology in the teaching-learning process

3. Results

This research paper aimed to compare the results of an experimental group that followed the Inquiry-Based Learning methodology with a control group that followed the traditional method. In order to carry out the research, two groups (the experimental and the control group) were selected, corresponding with two classes of the third level in a public Primary Education school. These two groups were taught for four weeks with very different methodologies. The results were obtained through the pre- and post-tests to collect and record the evaluations.

And in order to evaluate the results, the items proposed in the self-evaluation were taken into account, and they were used to do an excel file which can be seen in the following table:

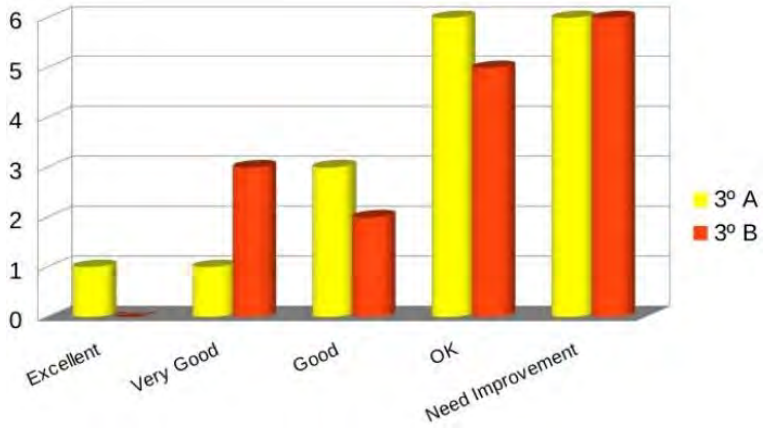
Table 5. *Evaluation Pre-test*

Vocabulary	Chose 0-2 items correctly			
	Chose 3-5 items correctly			
	Use, correctly, all of the water cycle vocabulary			
Gral. knoledge	Order 0-2 water cycle steps, correctly			
	Order 3-4 water cycle steps, correctly			
	Order all water cycle steps, correctly			
Writing	Wrote some English words (question 9)			
	Wrote a sentence, to explain question 9			
	Wrote a paragraph to explain question 9			
Accuracy	Incorrect labels or missing information			
	I labeled part of the diagram correctly			
	Labels corrects, all diagram			
Neatness	Work looks messy			
	Work looks net, but not the best			
	Both, writing and coloring are perfect			

Source: Own elaboration.

Once the process is ended, it was necessary to check results of the experimental group (3º A) and the control group (3º B). In order to prepare the figures, the data were collected inexcel files. The first test children had to face was the pre-test, and the figure1 below shows the test results.

Figure 1. *Results of the Pre-test*



Source: Own elaboration

As we can see, the results are very similar in both groups. There is already onepupil with an

excellent mark on the test because he is the son of a teacher, and as his mother declared, they had been working very hard during the lockdown. This child could have got bored in the activities as the subject had already been studied not long ago, but it did not happen. On the contrary, the child was very motivated and was helping other students in the class.

On the other hand, the control group followed a traditional method following the Sciences coursebook. In this case, children did not follow an active learning. The grades of this control group were very similar as last year they were taught the topic, not as deep as this year, but thewater cycle is studied in year one too.

After this pre-test, the intervention took place. During the following four weeks, the teachers proposed a series of activities. During these, the teacher used different resources and strategies, such as observation, record sheets, checklists, inquiry notebooks, and oral questions before, during, and after the activities. Sometimes children needed a little bit of help, which came by asking them some questions to make them think.

It is important to reflect the results at the end of the unit. We want to compare our pupils' knowledge from the very beginning and the differences between the two groups. Consequently, after the intervention, children had the post-test. Again, an excel file was done. In it, we have taken into account the previous items and some new referring to oral expression.

Table 6. *Evaluation Post-test*

Vocabulary	Chose 0-2 items correctly		
	Chose 3-5 items correctly		
	Use, correctly, all of the water cycle vocabulary		
Gral. knoledge	Order 0-2 water cycle steps, correctly		
	Order 3-4 water cycle steps, correctly		
	Order all water cycle steps, correctly		
Writing	Wrote some English words (question 9)		
	Wrote a sentence, to explain question 9		
	Wrote a paragraph to explain question 9		
Accuracy	Incorrect labels or missing information		
	I labeled part of the diagram correctly		
	Labels corrects, all diagram		
Orally	Provides relevant information about the water cycle.		
	Describes the water cycle in a very simple explanation		
	Knows a vague idea about the topic.		
	Does not know any idea about it		
Graphic	It is able to organise correctly the water cycle graphic.		
	It is able to organise 3-5 items about the water c. graphic.		
	It is able to organise 1-2 items about the water c. graphic		
	It is not able to organise any item about the water c. graphic		

Source: Own elaboration

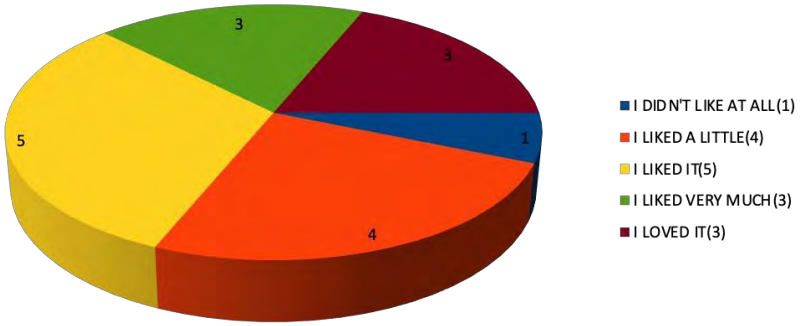
With the data results, we created the figure 2 showing a comparison of the test results of both the experimental and the control groups. We can see that the results are not as different as thought before doing the research, but that might be due to allof the problems carried out during the process. In any case, the results between the pre-test and the post-test were slightly different than expected before doing the research.

Figure 2. *Results of the Post-test*

Source: Own elaboration

As seen in the graph, there is a difference between the two groups, but it is not as high as was expected. However, it is stated that the experimental group has better marks than the control group. Children also had a moment for a self-evaluation. In the next graph, as mentioned in the method, children were asked to fill a rubric to see what the students think about the process. Therefore, students were asked for their opinion aboutinterest and satisfaction in the different activities of the unit. Children were also asked what they would change or improve, and what they said is that theywant more hands-on in Science.

Figure 3. *Children self-evaluations*



Source: Own elaboration

Table 7. *Students self-evaluation*

Knowledge and Skills	**Totally agree**	**Agree**	**Partially agree**	**Disagree**
I can describe the water properties and characteristics, and I can experiment it satisfactorily	29,4%	47,05%	11,7%	11,7%
I can understand and describe the current problems about water, and their causes.	41,1	35,2%	17,6%	5,8%

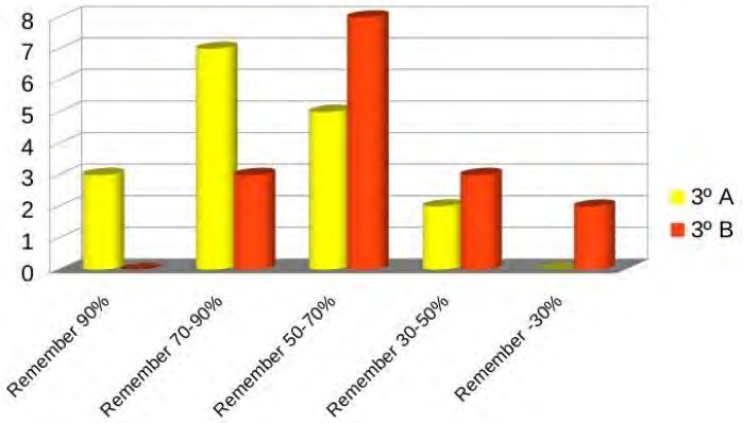
I can present the projects, communicating my ideas clearly.	35,2%	35,2%	17,6%	11,7%

Source: Own elaboration

Analyzing the previous chart, most students think that they had an interest always orusually during the unit. Likewise, there were excellent self-evaluations about attitudes like collaboration, using the time efficiently, or fulfilling the classroom expectations. However, some students recognized that they struggled with speaking with their peers in the target language during the class activities.

Once the unit was finished, and in order to have a clear idea of the knowledge and skills acquired (as the ultimate goal of the methodology) children had to do adelayed post-test again two weeks after they had done it in the first time. The results obtained can be seen in the next figure:

Figure 4. *Delayed Post-test*



Source: Own elaboration

Now, it is possible to see more significant differences when we compare the topic's knowledge after a couple of weeks of the final tests in both cases. It is clear that children following the traditional method, even though they have quite good marks too, study a lot for their exams and just learn by heart, but they forget quite fast. It is also clear that children following the traditional method forget what they have learned much easier, and they don't transfer the acquired knowledge. In this case, we can see that the differences between the experimental and the control group are higher than just after finishing the intervention. So, with this IBL methodology, what children learn seems to last longer.

4. Discussion

In general, the figures, the observation, and the data from the research show positive results, not only in the academic aspects but also in the skills and attitudes developed by students. As already said in this research, all the authors emphasize that the teaching-learning methodology should move towards a

learner-centred method and with hands-on activities. It has also been said that it requires time, preparation, and effort from teachers, administration, and students. However, as in other research similar to this one, they seem to be better for students as they acquire the concepts and learning endures.

At the end of the pre-test, the results were more or less what could be expected, but after the results of the post-test, things changed a bit. Those results were a bit worrying as they were very similar in both groups. Even though it is clear that children learn independently, the method we use to teach, as Calvo (2014) states, reveals that when children are little, as in this case, they can learn following their way, maybe not how we want them to do it. Students had a great interest and enjoyment in the unit in general because the choices "I like it a lot" and "I like it" were eight, and only one student did not like the topic at all. The motivation and enjoyment were higher in those activities in which children had to manipulate things and experiment.

The interest in the activity "characteristics and properties of water" was minor. This result could be explained by the type of activities proposed (students had to use writing skills as reading and writing to complete the tasks, which could be found more challenging or more boring). On the other hand, some of the experiments planned were a bit tricky for their age.

To finish with the children's self-evaluation, they also had to carry out an analysis of self-evaluations. First of all, it should be noted that students were very responsible and honest to answer the self-evaluations. Despite the fact that children often tend to evaluate themselves below their real level, students were conscious about their successful learning in the unit because "mastered" and "learned" represent a very high percentage in the water contents learned in the unit.

Children also said that they struggled a little bit when commenting on the results to their peers. That probably was because they were not used to do it. Some students showed a bit of improvement in this phase of the IBL. However, some other still struggle with the L2. On the other hand, some others liked the idea of being themselves who were telling their results rather than listening to the teacher's conclusions.

5. Conclusions

In this research, the objective was to compare the results of two similar groups carrying out different methodologies (Inquiry-Based Learning and the traditional method) during four weeks with the water cycle study. The analysis of the results reveals, in general, positive results not only in the academic aspect but also in the attitudes and skills of students. Anderson (2002) agreed with this idea because he said that science inquiry is synonymous to good teaching and learning.

The positive results confirm the statement of Lederman, et al. (2013), who conclude that the best way to learn Science is through inquiry. Students learn better Science contents by doing Science. Given the results, it is appreciated a high level of enjoyment and interest in most students in this research. On the other hand, their academic grades in the unit have been, overall, excellent orvery good. More than

83% of students exceeded or met the expectations in the test.

Another critical aspect is the level of dedication, innovation, training, and background of teachers. According to Couso (2014), the benefits of inquiry-based learning in students are highly influenced by the teacher: how they plan, facilitate, and guide the process, and also how they engage and activate students. Little by little, teachers are being trained. Nevertheless, a methodological change is not easy. Rabadán and Martinez (1999) voice that transforming teaching practices is very difficult for most teachers. According to what the previous authors say, there is a tendency of the authorities to encourage more active methods.

In this sense, Abd el Khalick (2004) is optimistic because he thinks that significant effortsand advances have been made in the last years training teachers to carry out activemethodologies, such as inquiry-based learning. Also, the Science program has beenmodified in most countries to give more importance to investigation, inquiry, and engineering, amongst other methodologies, and the author states that there has been an improvement of teachers' training, and that is one of the consequences of the implementation of such methodologies.

In this study, the analysis gathers the different evaluations that the students of the experimental group did during the unit about water in October and the comparison with the control group. For the evaluations, the goals of the unit and the Science standards for third grade were taken into account. After the research, it is clear that it is not the best year to carry out a project of these characteristics due to school's health and safety rules because of the COVID- 19 pandemic. There are too many aspects to consider and make quite significant differences in the normal development of the teaching-learning process.

It is also important to consider the characteristics of the students since they are not familiar with learning through inquiry. But, on the other hand, they are usually supported by their families, and they try to help students as much as they can. Therefore, the social and family background is decisive in the education of the pupils and their academic achievement.

Although at first sight the results of the class following the traditional method are quite similar as seen from the tests, it is clear that after some time, children who have followed the inquiry-based learning method achieved a more consolidated learning. That is, they can remember more concepts and details. This fact, by itself, would be enough to justify any change in the teaching-learningprocess. This methodology makes children learn in a much more significant way, letting them use and transfer that knowledge about a specific topic in anotherdifferent situation.

After the unit has been taught and the results have been analysed, many conclusions can be considered. We can say that as the authors of the theoretical framework stated, teaching Science through guided inquiry motivates students, encourages their active class participation, and provides an excellent means to learn. Another advantage of using this method is that students who carry out inquiry projects learn and understand new knowledge in a meaningful way by relating it to the previous knowledge and real experiences. What is more, they can retain that knowledge over the test. Besides, the introduction

and reflection in the unit have an essential role in the unit since they foster curiosity and interest at the beginning of the unit. Reflection lets the teacher have feedback about the unit and encourages critical thinking and learning conscience in students.

As we can see, students play the leading role in inquiry-based learning. Therefore, itis a learner-centred method. However, teachers have a crucial role as they should be useful guides, engaging for students, and facilitators of learning. Working in an integrated way helps students reinforce contents, make learning more manageable, and increase the students' interest as they can see that topics have a real use.

Therefore, it is necessary to introduce activemethodologies, such as inquiry-based learning, since kindergarten or the first years of elementary education to let students familiarize themselves with this process as soon as possible. If inquiry-based learning is introduced in isolation, students will take more time and effort to adapt to this approach.

After all that, it is clear that the results between the pre and post-tests are quite similar in both classes, regardless the methodology followed in the teaching-learning process. On the other hand, there is a change in the tendency of the results obtained when we compare them after a couple of weeks. The problem is not whether children study or do not study for the exams. The biggest issue here is whether children acquire the knowledge or what happens because they study just to pass the exams.

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Appendix A. An example appendix

We will now include some appendixes whereby the results obtained both in the experimental and in the control group were gathered.

A.1. Excel file data for evaluation (Pre-test Experimental Group)

PRE-TEST EXPERIMENTAL GROUP																	
	VOCABULARY			G. KNOLEDGE			WRITING			ACCURACY			NEATNESS				
	CHOSE 0-2 ITEMS CORRECTLY	CHOSE 3-5 ITEMS CORRECTLY	USE ALL OF TYHE WATER CYCLE VOC.	ORDER 0-2 W.C. STEPS CORRECTLY	ORDER 3-4 W.C. STEPS CORRECTLY	ORDER ALL W.C. STEPS CORRECTLY	WROTE SOME ENGLISH WORDS (Q9)	WROTE A SENTENCE TO EXPLAIN (Q9)	WROTE A PARAGRAPH TO EXPLAIN (Q9)	INCORRECT LABELS OR MISIN INFORMATION	LABELS PART OF THE DIAGRAM CORRECTLY	LABELS CORRECT ALL DIAGRAM	WORK LOOKS MESSY	WORK LOOKS NET, NOT THE BEST	WRITING AND COLORING ARE PERFECT	**SCORE**	**MARK**
*A1			3			3			3		2			2		13	E
*A2	1			1			1			1			1			5	NI
*A3			3		2			2			2			2		11	VG
*A4		2			2		1				2			2		9	G
*A5		2			2		1				2			2		9	G
*A6	1			1			1				2			2		7	OK
*A7	1			1			1			1			1			8	OK
*A8		2			2		1			1				2		8	OK
*A9	1			1			1			1			1			5	NI
*A10	1			1			1			1			1			5	NI
*A11		2		1			1				2			2		8	OK
*A12		2		1			1			1				2		7	OK
*A13	1			1			1			1				2		6	NI
*A14	1			1			1			1			1			5	NI
*A15	1				2		1				2		1			7	OK
*A16	1				2		1			1				2		7	OK
*A17	1				2		1			1				2		7	OK

A.2. Excel file data for evaluation (Pre-test Control Group)

PRE-TEST CONTROL GROUP																	
	VOCABULARY			G. KNOLEDGE			WRITING			ACCURACY			NEATNESS				
	CHOSE 0-2 ITEMS CORRECTLY	CHOSE 3-5 ITEMS CORRECTLY	USE ALL OF TYHE WATER CYCLE VOC.	ORDER 0-2 W.C. STEPS CORRECTLY	ORDER 3-4 W.C. STEPS CORRECTLY	ORDER ALL W.C. STEPS CORRECTLY	WROTE SOME ENGLISH WORDS (Q9)	WROTE A SENTENCE TO EXPLAIN (Q9)	WROTE A PARAGRAPH TO EXPLAIN (Q9)	INCORRECT LABELS OR MISIN INFORMATION	LABELS PART OF THE DIAGRAM CORRECTLY	LABELS CORRECT ALL DIAGRAM	WORK LOOKS MESSY	WORK LOOKS NET, NOT THE BEST	WRITING AND COLORING ARE PERFECT	**SCORE**	**MARK**
*A1	1			1			1			1				2		6	NI
*A2	1			1			1			1			1			5	NI
*A3			3		2			2			2			2		11	VG
*A4		2			2		1				2			2		9	G
*A5		2			2		1				2			2		9	G
*A6	2			2				2			2				3	11	VG
*A7	1			1			1			1			1			11	VG
*A8		2			2		1			1				2		8	OK
*A9	1			1			1			1			1			5	NI
*A10	1			1			1			1			1			5	NI
*A11		2		1			1				2			2		8	OK
*A12		2			2		1			1				2		8	OK
*A13	1			1			1			1				2		6	NI
*A14	1			1			1			1			1			5	NI
*A15	1				2		1				2		1			7	OK
*A16		2		1			1			1					2	7	OK

A.3. Excel file data for evaluation (Post-test Experimental Group)

POST-TEST EXPERIMENTAL GROUP																							
	VOCABULARY			G. KNOLEDGE			WRITING			ACCURACY			ORAL				GRAPHIC					
	CHOSE 0-2 ITEMS CORRECTLY	CHOSE 3-5 ITEMS CORRECTLY	USE ALL OF TYHE WATER CYCLE VOC.	ORDER 0-2 W.C. STEPS CORRECTLY	ORDER 3-4 W.C. STEPS CORRECTLY	ORDER ALL W.C. STEPS CORRECTLY	WROTE SOME ENGLISH WORDS (Q9)	WROTE A SENTENCE TO EXPLAIN (Q9)	WROTE A PARAGRAPH TO EXPLAIN (Q9)	INCORRECT LABELS OR MISIN INFORMATION	LABELS PART OF THE DIAGRAM CORRECTLY	LABELS CORRECT ALL DIAGRAM	DOES NOT KNOW ANY IDEA ABOUT IT	KNOWS A IDEA ABOUT THE TOPIC	DESCRIBES WC IN A SIMPLE EXPLANATION	PROVIDES RELEVANT INFORMATION	NOT ABLE TO ARGANISE ITEMS CORRECTLY	ABLE TO ARGANISE 1-2 ITEMS CORRECTLY	ABLE TO ARGANISE 3-5 ITEMS CORRECTLY	ABLE TO ORGANISE CORRECTLY THE WC GRAPHIC	SCORE	MARK
*A1			3			3			3			3				3				3	18	E
*A2	1			1			1			1			0					1			5	NI
*A3			3			3		2				3			2					3	16	E
*A4			3			3		2			2				2					3	15	VG
*A5			3			3		2				3			2					3	16	VG
*A6	2				2			2			2				2					3	13	VG
*A7		2			2			2			2				2				2		12	G
*A8		2			2		1			1				1					2		8	OK
*A9		2			2			2			2				2					3	13	VG
*A10		2			2			2			2			1					2		11	G
*A11		2		1			1				2				2			1			9	OK
*A12		2			2		1			1					2					3	11	G
*A13		2			2			2			2				2					3	13	VG
*A14	1				2		1				2				2					3	11	G
*A15		2				3		2			2				2				2		13	VG
*A16		2			2			2			2					2				3	13	VG
*A17		2			2			2		1					2				2		11	G

A.4. Excel file data for evaluation (Post-test Control Group)

POST-TEST CONTROL GROUP																						
	VOCABULARY			G. KNOLEDGE			WRITING			ACCURACY			ORAL				GRAPHIC					
	CHOSE 0-2 ITEMS CORRECTLY	CHOSE 3-5 ITEMS CORRECTLY	USE ALL OF TYHE WATER CYCLE VOC.	ORDER 0-2 W.C. STEPS CORRECTLY	ORDER 3-4 W.C. STEPS CORRECTLY	ORDER ALL W.C. STEPS CORRECTLY	WROTE SOME ENGLISH WORDS (Q9)	WROTE A SENTENCE TO EXPLAIN (Q9)	WROTE A PARAGRAPH TO EXPLAIN (Q9)	INCORRECT LABELS OR MISIN INFORMATION	LABELS PART OF THE DIAGRAM CORRECTLY	LABELS CORRECT ALL DIAGRAM	PROVIDES RELEVANT INFORMATION	DESCRIBES WC IN A SIMPLE EXPLANATION	KNOWS A IDEA ABOUT THE TOPIC	DOES NOT KNOW ANY IDEA ABOUT IT	ABLE TO ORGANISE CORRECTLY THE WC GRAPHIC	ABLE TO ARGANISE 3-5 ITEMS CORRECTLY	ABLE TO ARGANISE 1-2 ITEMS CORRECTLY	NOT ABLE TO ARGANISE ITEMS CORRECTLY	SCORE	MARK
*A1			3			3		2			2				2					3	15	VG
*A2		2		1			1			1					2			1			8	OK
*A3			3		2			2			2				2					3	14	VG
*A4			3			3		2				3				3				3	17	E
*A5		2			2			2			2				2					3	13	G
*A6		2				3		2				3				3				3	16	E
*A7		2			2			2			2					3			2		13	VG
*A8		2			2			2			2				2				2		12	G
*A9	1			1			1			1				1				1			6	NI
*A10		2		1			1			1					2				2		9	OK
*A11		2		1			1				2				2				2		10	G
*A12		2		1				2			2				2				2		11	G
*A13		2			2		1			1					2			1			9	OK
*A14	1			1			1			1				1				1			6	NI
*A15		2			2		1				2				2				2		11	G
*A16		2			2			2			2					3			2		13	VG

A.5. Excel file data for evaluation (Delayed Post-test Experimental Group)

DELAYED POST-TEST EXPERIMENTAL GROUP					
	REMEMBER 90%	REMEMBER 70-90%	REMEMBER 50-70%	REMEMBER 30-50%	REMEMBER -30%
*A1	x				
*A2				x	
*A3	x				
*A4	x				
*A5		x			
*A6		x			
*A7			x		
*A8				x	
*A9		x			
*A10		x			
*A11			x		
*A12			x		
*A13		x			
*A14			x		
*A15		x			
*A16		x			
*A17			x		

A.6. Excel file data for evaluation (Delayed Post-test Control Group)

DELAYED POST-TEST CONTROL GROUP					
	REMEMBER 90%	REMEMBER 70-90%	REMEMBER 50-70%	REMEMBER 30-50%	REMEMBER -30%
*A1		X			
*A2				X	
*A3			X		
*A4		X			
*A5			X		
*A6		X			
*A7			X		
*A8			X		
*A9					X
*A10				X	
*A11			X		
*A12			X		
*A13				X	
*A14					X
*A15			X		
*A16			X		

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