Physics curriculum for children with learning difficulties

The course of physics is an interesting lesson for high school students. However students with learning difficulties because of various problems encountered (lack of concentration , memory loss , difficulty in understanding , difficulty in expressing etc) often find the lesson of physics difficult to understand so many of them fail .

In the days we live in, with the new technological means at our disposal, we should be able to find new ways to approach the teaching of physics in order to make the course more attractive to all students and more accessible for students with learning difficulties.

The Erasmus + program which began in September 2014 and ended in June 2016, was intended to teach these children, Sciences courses which are tested at the end of the year and try to find ways to make these courses more attractive and easy to understand , since these children are disadvantaged compared to the rest.

In March 2016, the children were taught Physics in Cyprus, by four different teachers, from four different countries (Spain, Greece, England and Cyprus) and in particular the Forces lesson. Our purpose was for each country to teach a part of the curriculum of the course of physics in its own way, in order to see which way is best suited for those children, or if necessary, to remove something from the curriculum, so these children can attend class more easily and in the end not fail in their exams.

The results we released after four teachings are shown below:

1st lesson: Introduction to Forces - Cyprus

Students were taught the introduction to Forces (what is a Force, how it's symbolized, what size it is, what are the characteristics, etc.), by using a projector and simulations which each student individually performed on the computer with the help of instructions. At the end of the course, students were asked to play a

game - treasure hunt, following instructions based on what they have learned, so they can find the treasure.

From the results, it was shown that students with this way of teaching understood this part of the chapter, since all students at the end, found of the treasure.

2nd lesson: Buoyancy - Spain

Students were taught the Buoyancy and how it affects a material when it's being thrown in a liquid, using a projector and real experiments. Students, with the instructions they received from a worksheet, performed the experiments themselves and were making their conclusions about how Buoyancy affects a material immersed in a liquid. But when asked to extract the type that is the result of all these factors themselves, they found it difficult to express themselves and capture it.

From the results, it was shown that students with this way of teaching understood this part of the chapter, but found it difficult to write and implement the type of Buoyancy in exercises.

3rd lesson: Tightening- England

Students were taught Tightening and how it affects our daily lives, using the projector and real experiments. Students, with the instructions they received from a worksheet, performed the experiments themselves and were making their conclusions about how Tightening affects a material and how this applies in everyday life. But when they were asked to extract the type that is the result of all these factors those themselves found, again struggled to express themselves and capture it.

From the results, it was shown that students with this way of teaching understood this part of the chapter, but found it difficult to write and implement the type of Tightening in exercises.

4th lesson: Composition of Forces – Greece

Students initially learned the composition of Forces with the same or different direction, using a projector and simulations, which each student individually performed on the computer with the help of instructions. During the course the students seemed to perform the instructions on the computer very easily and remove their conclusions on their own.

Then, after they explained in detail the composition of Forces with different direction and angle, it was given to them a little exercise to implement the above, and students easily enough designed the resultant Force when the Forces are formed between a right angle, but found it difficult to apply the formula (Pythagorean Theorem) to confirm their actions. Also they found it very difficult to draw the resultant Force when the Forces are formed between acute and obtuse angles.

From the above, we made the following conclusions regarding the curriculum of Physics for children with learning difficulties, and which we present below:

1. The course is more understandable when real experiments or simulations are made by the students, since they are involved and apply in practice what they have learned or will learn in the present future.

2. The examples should be given from everyday life, which students experience daily. This helps them to better understand the concepts they need to know.

3. The teaching should not be frontal but cooperative with the involvement of students in the 80% and in the 20% by the teacher.

4. The curriculum should be more simplified for these students and some not so necessary formulas which are tough not to be taught to them. For example:

a) In the course of the Buoyancy, pupils easily found that when the Buoyancy is greater than the Weight ($A > B$), the body is floating and when the Buoyancy is less than the Weight ($A < B$), the body is immersed. They also understood that the Buoyancy depends on the density of the fluid and the volume of the body through

the experiments that were made , but have failed to extract the type of Buoyancy $A = d.g.V.$

So this formula could be removed from the curriculum for these children, and to keep the first piece which again gives the whole concept of Buoyancy and the whole idea of how it affects our daily lives.

b) In the course of Tightening, the students had fun adding and removing masses in different distance on the stripe given to them. They also understood that if increasing the mass they should reduced the distance and the opposite, they also understood what must happen so that the rod balances but when asked to apply the formula, they found it difficult to implement equality and find the unknown. For example when they were given type $P_1 = P_2$ and placed a body of a mass on one side and they were asked the question: "were should we place the other mass on the other side so that the rod is balanced", all the students found it to act but only three of the eight managed to prove it with the formula.

So this formula could be removed from the curriculum for these children, and to keep the first piece which again gives the whole concept of Tightening and the whole idea of how it affects our daily lives.

c) In the course of the Force composition , students easily exported the results of what happens when the Forces have the same or different direction, i.e.
$F_{ol} = F_1 + F_2$ and $F_{ol} = F_1 - F_2$, but failed to understand the composition of Forces with different direction and angle or to implement the Pythagorean Theorem.

So the formula of the Pythagorean Theorem could be removed from the curriculum for these children, as well as designing Forces with acute and obtuse angle and leave only the first piece which again gives the whole concept of Forces composition and the whole idea of how it affects our daily lives .

In conclusion it would be good to point out that these children have some learning particularities as compared to the others, which prevent them from attending the class and perform to the maximum extent of their capabilities. Let us not make

their struggle for learning even more difficult. Let us give these children the chance of proper learning and satisfaction of success in the course of Science.