

Recommendations

Pedagogical Aspects

The Mathematics is a very important and necessary subject to learn that benefits us all throughout our entire life. But not all children like it and we (parents and teachers especially) have to find a way to increase their motivation for learning Mathematics. The exhibits we offered during our project did exactly that: the children, and even the teachers and adults who accompanied them were highly motivated to engage with the stations and were having a lot of fun during the process asking for additional time to stay.

Learning Math through this kind of exercises increases children's motivation.

Another positive thing is that the method of learning that the exhibits offer is **highly inclusive**. During our observation we came to the conclusion that all children regardless of ethnicity, gender, specific age or disability act the same way: extremely motivated and happy to learn cooperating with each other and having a lot of fun together. Teachers can use such learning objects not only to promote the integration of certain students, but in this way the inclusion of disabled students can also be promoted.

Furthermore, this way of learning **promotes the individuality** at the same time. Each child is a story by itself and has different level of understanding, ways of dealing with issues and needs different time to come to a conclusion. Thus, it is important to treat children as equals and give them enough time in the process of learning. The exhibits provide this as well and give the opportunity to the children to individual approach through research

developing their cognitive, affective and psychomotor skills including logical thinking.

Learning in pairs or in group is also available as we observed that children simultaneously engage in conversations and activities sharing their thoughts on mathematical notions and solutions.

It has been shown that it is possible and necessary that **even children at the age of 4** can make progress in learning by dealing with the objects. This way **Mathematics as a subject is introduced since very early age**, which is necessary for developing proper attitude and love towards it.

Dealing with the objects **enables ortho-sensory learning and spatial experiences**, which is particularly important for the children and which no longer plays a role in most subjects. These skills are extremely important for proper development of children and this way of learning enables it.

From everything learned through the observations, the conclusions and the recommendations, schools should be given the support for developing interactive curriculum for learning Mathematics based on the exhibits through research and play, so that children can develop their mathematical skills and interest for the subject from their early age. We could see that children were given the opportunity to develop their own style and approach towards learning Mathematics, they could choose the activities according personal interest, understanding and acceptance, practice persistence in doing an activity till its finalization, and could develop their own opinion regarding learning.

All of this is extremely important for their proper development and this type of learning has extremely positive impact on teaching Mathematics in general, especially in the early ages.

As a final conclusion, we highly recommend that teachers use this method of teaching which will contribute not only for the proper learning and development of their students, but also to their professional development.

Practical Advice

The specific objects that we were able to use during the project are of course hardly available in all facilities, kindergartens or primary schools. But there are also simple, similar objects of mathematical phenomena that are suitable for educational practice - the child's independence is important. In addition, many objects can easily be created by yourself - even in class. Finally, there are inexpensive objects from various providers that we would recommend for educational practice. In addition, many games are easy to make yourself - maybe even in class?

We would therefore like to make the following suggestions to everyone who is professionally or voluntarily involved in the education and upbringing of children:

1. Use objects or experiments more often with which the children can search for solutions on their own - by trying out, grasping and reflecting on them.
2. Try to structure the exercises in such a way that the children have reason to communicate with one another, but do not have to permanently.
3. Explain the task (e.g. build a pyramid), but not the solution.

4. Give the children enough time so that the sense of achievement can come by itself and the child feels self-efficacy..
5. Make it clear to yourself again and again that the children are learning with their hands, all their senses and their own imagination - this is important, even if there is no mathematical calculation at the end. The child's enthusiasm should be the focus.
6. Try to eavesdrop on the children at work from a distance - you will find them talking about math problems! The 'MiniMathematikum' is also an instrument for language training. To a certain extent, you can measure your teaching success by this.
7. If no one finds the solution for a particular experiment, repeat it another day before you reveal the solution.
8. Observe whether children talk to each other during the experiments who otherwise would not and whether everyone participates.
You will likely find that the individual children are moving closer together.
9. Think about how you can implement research-based learning on mathematical exhibits in your facilities. What resources do you need for this?