

*Learning science is easy  
with games*



# Learning science is easy with games

A product of an



project from

- Orosházi Vörösmarty Mihály Általános Iskola – Orosháza (Hungary)
- Kymintehtaan koulu Kouvolan kaupunki – Kuusankoski (Finland)
- I.E.S. LOS PACOS - Fuengirola (Spain)

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[www.erasmuspl.us](http://www.erasmuspl.us)

„Game is the best way of searching”

-Albert Einstein

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## 1. About the project

Our Erasmus+ project, called "Learning science is easy with games" contract number: 14/0045-KA2SE/2214 started in September 2014 with the below mentioned partners:

- Orosházi Vörösmarty Mihály Általános Iskola - Orosháza, Hungary
- Kymintehaan koulu Kouvolan kaupunki - Kuusankoski, Finland
- I.E.S. LOS PACOS - Fuengirola, Spain

### The aims of the project

Due to the dramatic reduction of the number of scientific subject lessons but teaching the same amount of materials as earlier it is crucial to find a balance between the theoretical lessons and practices.

And it can be reached only with calling up students' attention and preserving pupils' interest with fun and through game like activities and in a playful way. If we reach it we can also aim that they will inquire towards topics. Owning the latest technical equipments and ICT tools is not enough these days when our children are keen on using these equipments. We have to be familiar with new methods, which are widely used in the partner countries so that we can be able to keep up with new trends and keep our pupils motivated and make them like science subjects although these are not amongst the popular ones.

We developed this project bearing in mind both the need and usefulness of methodological renewal. One of the ways to reach this is the way of choosing ICT based techniques in the process of teaching and learning. It is needed because in the everyday life of children these equipments play an important role and we have to teach them to use the web self-consciously to share information and knowledge. On the other hand teachers also have to be clear with the advantages and disadvantages of these to guide their students.

Our programme based upon three main pillars. In the first our colleagues became familiar with IBL, and with the help of this they developed teaching materials and tried out them. With the help of IBL tasks were based on real problems of life, so natural science subjects were brought closer to children. Project method and VLE are also individual and unique ways of teaching with. Our aim was to make these techniques popular with the help of creating a methodological product.

Although the theme of the programme is mainly methodological, the effect reflected on students. The earlier used frontal class work became old fashioned

teaching in heterogeneous groups, personalized learning can be attained through these three new methods. Moreover as pupils had to work together, cooperate with each other, their social skills powerfully developed.

The main target group of our project is that of those teachers who deal with such students who are either talented or under motivated.

Talented pupils interested in science subjects are often bored in the lessons as they have preliminary knowledge in several topics. The other group is children with low basic skills. If these two edges of the statistic bell shape are there in a class, teachers need methodological renewal. Teachers have to be familiar with the latest pedagogical methods and use collaborative and cooperative techniques in classes.

According to this project teachers got familiar with the new methods, they developed teaching materials, then they tried them and they shared their best practises to other colleagues not only inside the borders, but on an international level.

#### Impacts:

This cooperation surely had a positive effect on both teachers and pupils. During the learning, training, teaching activities all participants increased their knowledge about their own and the partners' educational system and characteristic features of the schools.

The theme of the programme is applicable and all the tasks are complement of the institutional curriculum and can be carried out in subject lessons.

Teachers became motivated to use innovative and creative pedagogical practices. These teachers were experts in their own field of interest moreover they were enthusiastic in trying out new approaches (IBL, VLE and project method) to achieve success in teaching and learning. This project encouraged teachers to apply collaborative teamwork, too.

Both teachers and pupils' skills in computer technologies and communication in foreign languages increased.

With this programme in the first round we could involve at least three hundred people but later with the sustainability of the project more and more people can benefit from the results of this multilateral transnational cooperation from year to year.

## 2. Inquiry-based learning

Inquiry-based learning is primarily a pedagogical method, developed during the discovery learning movement of the 1960s as a response to traditional forms of instruction – where people were required to memorize information from instructional materials. The philosophy of inquiry based learning finds its antecedents in constructivist learning theories and can be considered a constructivist philosophy. Generating information and making meaning of it based on personal or societal experience is referred to as constructivism. Inquiry can be conducted through experiential learning because inquiry values the same concepts, which include engaging with the content/material in questioning, as well as investigating and collaborating to make meaning.

Specific learning processes that people engage in during inquiry-learning include:

- Creating questions of their own
- Obtaining supporting evidence to answer the question(s)
- Explaining the evidence collected
- Connecting the explanation to the knowledge obtained from the investigative process
- Creating an argument and justification for the explanation

Inquiry learning involves developing questions, making observations, doing research to find out what information is already recorded, developing methods for experiments, developing instruments for data collection, collecting, analysing, and interpreting data, outlining possible explanations and creating predictions for future study.



## Levels

There are many different explanations for inquiry teaching and learning and the various levels of inquiry that can exist within those contexts. The article titled *The Many Levels of Inquiry* by Heather Banchi and Randy Bell (2008) clearly outlines four levels of inquiry.

### **Level 1:** Confirmation Inquiry

The teacher has taught a particular science theme or topic. The teacher then develops questions and a procedure that guides students through an activity where the results are already known. This method is great to reinforce concepts taught and to introduce students into learning to follow procedures, collect and record data correctly and to confirm and deepen understandings.

### **Level 2:** Structured Inquiry

The teacher provides the initial question and an outline of the procedure. Students are to formulate explanations of their findings through evaluating and analysing the data that they collect.

### **Level 3:** Guided Inquiry

The teacher provides only the research question for the students. The students are responsible for designing and following their own procedures to test that question and then communicate their results and findings.

### **Level 4:** Open/True Inquiry

Students formulate their own research question(s), design and follow through with a developed procedure, and communicate their findings and results. This type of inquiry is often seen in science fair contexts where students drive their own investigative questions.

Banchi and Bell (2008) explain that teachers should begin their inquiry instruction at the lower levels and work their way to open inquiry in order to effectively develop students' inquiry skills. Open inquiry activities are only successful if students are motivated by intrinsic interests and if they are equipped with the skills to conduct their own research study.

Source: Wikipedia

More information: <http://www.primas-project.eu/en/index.do>



### 3. IBL, Project method and VLE in Kymintehtaan koulu

IBL was introduced to other teachers in the school as well by sharing it in a teachers' weekly meeting and sending them a power point presentation on the method. Nobody else despite Ulla Salo or Tiia Koivosto really took time to try out the method. The same occurred with sharing information on Project method and VLE in the meeting and on power point. Though, VLE is at the same time breaking through among the staff by the school having acquired more laptops and several tablets for classroom working this year and the staff has been given more training on VLE.

Trying out the methods was difficult, because so many teachers seemed to be too busy in going through the teaching materials and information sharing in traditional methods. IBL and project method are closely related. So is phenomenal based learning/teaching, which one teacher, Heli Hyppönen-Setälä, actively uses in Kymintehtaan koulu. All these methods aim to put pupils in game like situations and give pupils tasks where they are in the centre of learning. So, in a way, there are teachers who try to put the new approaches of teaching into practice in their own work, but many stick to the old method of teaching. However, all this with these methods supports the new Finnish national curriculum, which will be launched in the autumn 2016 and one of its guidelines is to move on to this kind of approach in teaching in the future.

Ulla Salo started with IBL method with her 3<sup>rd</sup> graders in spring 2015. They started by planning on how to organize an athletics event. They also made a dice experiment on numbers. Using IBL method with the 3<sup>rd</sup> and, as they later were, 4<sup>th</sup> graders was challenging because of their young age. Trying out IBL, and other methods, was challenging also because the teachers had to create the situations themselves and there was nothing precisely instructed but only the given method and a few examples.

Using IBL method in teaching has made Ulla Salo to change her own manners of working and they have become more pupil oriented. In other words, she has started to observe her own actions more. She has also started to search different choices in her teaching and the pupils have also had to ponder on finding answers and explore rather than only receive information. IBL has not only been used in science lessons. As a method it has been very useful method to challenge also other subjects. Ulla Salo's pupils have not only made researches on farm animals, vegetables, fishes and various landscapes of Finland, but also on Easter and they also made a class newspaper in the Finnish language lessons.

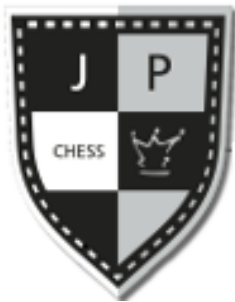
Tiina Hämäläinen concentrated on trying out project method and VLE. Project method was an interesting approach of teaching. As a language teacher she created the method tasks related to science and adopted content and language integrated learning (CLIL) aspect in the processes so that pupils not only found out about a subject matter but also used foreign language in realization. One game like method she learned herself during this Erasmus+ project was making trailers. She asked her pupils to try out that as well in one of the project method tasks. The pupils were very enthusiastic. Using project method in part of teaching is useful and gives pupils more freedom in learning things. The difficulty might be how the teacher is clever enough to give pupils significant tasks so that they learn things that they preferably should learn, tasks that relate to things that should be learned.

## 4. Chess Palace by Judit Polgár Chess Foundation

Judit Polgár and her team have developed a new and unique educational method. Instead of teaching chess as a sport and game the traditional way, the Educational Chess approach goes beyond the usual boundaries of teaching chess. Starting from 2013, Skill Developing Chess is officially part of the National Curriculum in Hungary.

According to this method, chess becomes an exceptional learning tool, especially useful for children born into our present day digital society. The Judit Polgár Chess Palace programme is not about training chess players. Although it is based on the basic rules of chess, Educational Chess is integrated into the regular curriculum in order to facilitate students' progress in the principal subjects such as Mathematics, Science, and even Reading, Writing and Arts & Crafts. Playing chess is not the goal, it is a tool; an extremely efficient tool for logical thinking and a quick, smart decision-making. Chess Palace is a learning playground with physical boundaries of the chessboard and endless creative solutions in education.

Source: [www.sakkpalota.hu](http://www.sakkpalota.hu)



## 5. Complex Instruction Program by K. Nagy Emese

Complex Instruction Program is an instructional approach that allows teachers to use cooperative group work to teach at a high level in academically diverse classroom. The goal of this instruction is to provide academic access and success for all students in heterogeneous classrooms.

This method has three major components:

- Multiple ability curricula are designed to foster the development of higher-order thinking skills through group work activities organized around a central concept or big idea. The tasks are open-ended, requiring students to work interdependently to solve problems. Most importantly, the tasks require a wide array of intellectual abilities so that students from diverse backgrounds and different levels of academic proficiency can make meaningful contributions to the group task.
- Using special instructional strategies, the teacher trains the students to use cooperative norms and specific roles to manage their own groups. The teacher is free to observe groups carefully, to provide specific feedback, and to treat status problems which cause unequal participation among group members.
- To ensure equal access to learning, teachers learn to recognize and treat status problems. In Complex Instruction Program the more the students talk and work together, the more they learn. Students, who are social isolated or students who are seen as lacking academic skills often fail to participate and thus learn less than they would if they were more active in the groups. In Complex Instruction Program teachers use status treatments to broaden students' perceptions of what it means to be smart, and to convince students that they each have important intellectual contributions to make to the multiple ability task.

In schools where students are tracked into high and low level science courses, they have different educational experiences in terms of access to scientific materials, information and instruction. In essence, tracking denies low-tracked students' access to the knowledge and skills needed to pursue scientific careers or to become informed, productive members of an increasingly technological society.

Complex Instruction Program permits teachers to teach at a high intellectual level while reaching a wide range of students. The method was developed by Elizabeth Cohen and Rachel Lotan at Stanford University. The aim of the method is to develop every student's intellectual ability and to give success during the class-work. Teachers are using this approach in many European countries as in Sweden, the Netherlands, Switzerland, Iceland, Italy and in Hungary.

Cooperative learning has been offered as an effective instructional strategy for untracked (academically, linguistically, and culturally diverse) classrooms. Teachers create equal status interaction within the small groups. For students to have a successful educational experience within a small group, teachers need about to think carefully about the following issues:

- The nature of the group tasks.
- The new roles for teacher and the students when working in groups.
- The problems of unequal participation in small group interaction.
- The integration of group-work and other modes of interaction such as labs or whole-class discussion.
- The assessment of students' knowledge and performance in group-work.

When the goal is the development of scientific thinking skills and the active participation of all students in learning, activities for science classes need to be redesigned. In Complex Instruction classrooms, where promoting equal access to information and fostering higher-order thinking is paramount, teachers use specialised curricular materials. Teachers apply the following criteria when developing or adapting group tasks: teachers organise activities around a central concept or "big idea", teachers design activities that are open-ended and they ensure that students use multiply intellectual abilities to understand and to complete the task, and they create task that are interdependent and that incorporate individual accountability.

Teachers organise the activities of Complex Instruction unit around a central concept or a central scientific question ("big idea"). Students rotate to complete the activities of the unit, they encounter this idea, this question or concept in different context. Because of it they have multiple opportunities to grapple with material, explore related questions, look at different representations and think of different applications.

Open-ended and inherently uncertain tasks increase the need for interaction since students draw upon each other's expertise and problem-solving strategies.

Given the intellectual heterogeneity of the group, students' repertoires of strategies are rich and varied. When working with group tasks, teachers encourage students to explore alternative solutions, communicate their thoughts effectively, justify their arguments and examine issues from different perspectives. These are the processes that contribute to the development of higher-order thinking and to other desired outcomes of learning.

Traditional classroom tasks use a narrow range of intellectual abilities. When asked to describe their middle grades science experiences, most students mention listening to lectures, reading textbooks, highlighting key passages and sentences and memorising information.

To develop scientific thinking skills, group activities need to incorporate a wide range of intellectual abilities. Multiple-ability group tasks a prerequisite for Complex Instruction. Students use different intellectual abilities as they rotate through the different tasks.

The multiple representations provide students with additional opportunities to access ideas and information, as well as opportunities to demonstrate multiple intellectual abilities. When such abilities are necessary to complete the tasks, more students have the opportunity to make substantial contributions to the group and to be recognised for these contributions.

The feature of group-work tasks is positive interdependence. When tasks are complex, rich and demanding, a single students will not be able to complete it in a timely fashion by himself or herself. In Complex Instruction, designing tasks that are multiple-ability and open-ended fosters interdependence.

Teachers must hold each student personally accountable for contributing to the group's success and for mastering the concepts or the big idea of the unit. Students are required to complete individual reports after the group's discussion and presentation.

Teachers must realise that when students work in groups, direct instruction is no longer practical. When instruction shifts to small groups, both teacher and student behave differently than during traditional, whole-class instruction. Teachers delegate authority to the students so that they will take responsibility for their own behaviour and learning. When teachers delegate authority, they often worry about losing control of the classroom.

Norms are written or unwritten rules for how one ought to behave. Cooperative norms control student behaviour in groups and ensure that group-work work. But following rules doesn't always come naturally for students – skill-building activities at the start of the year help develop these new behaviours students need to use.

Delegation of authority is supposed by specific student roles (facilitator, reporter, timer, materials manager...). These roles give each person in the group a task to accomplish. This reduces the probability of one person in the group doing all the work.

Delegation of authority doesn't mean that the teacher withdraws from the class or completely stays out of the action. The nature of the activities as well as the system of norms and roles relieve the teacher of the mundane tasks of classroom management. By making students responsible for their own learning, the teacher has a new role as facilitator. While the students are at learning stations, the teacher is freed up to engage students in higher-order questions, to stimulate and extend their thinking, to provide specific feedback, and to deal with problems of unequal participation. By delegating authority to the groups, teachers can do what they like to do the best: teach. In classroom where teachers delegate authority, the proportion of students talking and working together increases.

Teachers who have used cooperative learning know that students within a group do not participate equally. Unequal participation leads to unequal learning. It is a problem rooted in the students' perceptions of themselves and each other.

The classroom is a social system in which students' perceptions of themselves and their classmates dictate relative status and participation. In classrooms children are constantly evaluated by both their peers and their teacher. Teachers and students form a social ranking (status order). Social theory suggests that when students work together on a group task, those perceived as high achievers dominate the group interaction. The high-status students are more influential in group decisions, low-status students barely participate. This is called a status problem.

Status problems lead to unequal opportunities for learning. Since high-status students interact more in the group, they learn more from the tasks, since low-status students participate less, they learn less.

## Conclusion

When planning for group-work in heterogeneous classes, the teacher need:

- Develop or adapt activities that are organised around a big idea or central concept, are open-ended, use multiple intellectual abilities, and incorporate group interdependence as well as individual accountability.
- Take time to prepare students for group-work. Teach them how to behave following cooperative norms and how to play their assigned roles. Learn how to delegate authority and make your students responsible for their own and their group mates' learning. Stimulate and extend their scientific thinking by asking probing questions and making connections between their classroom activities and real-life situation.
- Pay attention to status problems. Use multiple-abilities treatment to convince your students that in your classroom there are many different ways of being smart. Look for instances where low-status students make intellectual contributions and assign competence to them.
- Use a rich repertoire of instructional strategies together with group-work. Problem-solving group-work is particularly effective when the goal of instruction is the development of conceptual understanding.
- Use multiple tools to access students' knowledge and performance. Think about individual and group products and how to combine the different forms of assessment.
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More about this program: <http://www.komplexinstrukcio.hu/>



## 6. Open air school in Hungary

It is a 5-day long program for the sixth graders with the following aims:

**Environmental Education:** Learning about nature may be achieved in nature. The aim of our open-air school is to let students learn about the living nature, while we are endeavouring to form children's environmentally aware behaviour. We achieve that students learn new things with less and less teacher's help. Their studies are based on their experiences in reality, their observations and measurements.

**It is related to certain subjects such as:**

- Hungarian literature: poems about forests and birds
- Art: lines (edge of leaves, lines from tree trunk to the branches), surfaces and structures cortex – leaf vein – graining), shapes and scales (flowers – leaves – mushrooms)
- Biology and Geography: how to use a map, biomes of different Hungarian landscapes (wood, water, shores), to protect nature
- Hygiene: nutrition, moving and personal hygiene
- PE: orienteering, race in it, sport games
- Music: folk-songs about nature, folk customs in spring
- Mathematics: determining the age of a tree, measuring its height



We reached that students cooperate in a task and respect other's views, their community behaviour develop. Let them pay attention to each other, solve their problems together, we expand their communicational culture in a playful form (folk customs, games) in their free time activities in the evening and at the

campfire. We formed a correct and healthy daily routine. We accomplished their healthy nutrition, washing, motion and sport in their daily schedule.

### **Tasks, programmes:**

We organise modules around the project of the forest's inner and outer contacts, which are discussed before the beginning of the camp paying attention to children's proposals and considering weather. Children work in a group of ten in the modules.

In their free time they sing and play near the campfire. On Wednesday there is orienteering competition and on Thursday we organise a competition „Who is the most skilful?“

### **Methods used in the open-air school:**

- Methods of examining the place in several points of view: Groups of ten work together in the modules. Their observations and examinations are based on given aspects. They do simple experiments and induction and collect data alone.
- Methods of helping children with learning disability and behaviour problems; and methods of problem solving and conflict management skills. Competitions in groups of 2-3: distributing task, discussion and help etc. These are sport games, singing at campfire and playing together.
- Using project method: Modules are organized around the project of the forest's inner and outer contacts.



## 7. Nuorisokeskus Anjala – Youth Centre Anjala and Environmental School Regina in Finland

*“The common goals for Youth centre Anjala and Environmental school Regina are developing sustainability and preserving nature. These values guide our everyday life both in our actions and in teaching methods. We aim towards more environmentally responsible choices.*

*Our environmental school provides environment education and guidance for kindergartens and schools. Target groups also include professional educators, students and other adult groups. Activity programs for children support the curriculum.”*

This is how Youth Centre Anjala introduces its activities. The centre really is a companion for certain grades in Kymintehtaan koulu in arranging activities relating to environment and nature. Most commonly educators from Anjala come to Kymintehdas to arrange various tasks in the nearby nature or surroundings of the school. Also this year they arranged two days of environmental education for Ulla Salo’s class. It is also possible to get connected to other schools in environmental education, but so far it has not been much.



## 8. Teaching English as a second language using CLIL methodology by Concha Cuevas

The Junta de Andalucía, the regional government of the Southern region of Spain, has been keen on promoting foreign languages in Secondary School for more than a decade now, and to that aim it launched a plan which aimed at improving the speaking skills of our students through the use of CLIL methodology. The regional government is launching a second phase of this project which aims at creating or promoting in 1.500 schools throughout the region this type of programme by the year 2020. This goal demands growing numbers of teachers to be trained to achieve a C2 level of proficiency in the language used to teach the specific subjects.

Basically and in a few words, CLIL methodology aims at improving the capacity to understand and produce in a foreign language by being exposed in the classroom to that language throughout the teaching-learning process. So the idea is to teach contents through a foreign language. This methodology has been tested in our school with very good results. When we joined the Bilingual Programme in 2010, we already had a clear picture of what we wanted to achieve in the field of foreign languages. And it involved a big change in methodology: Teaching English from a grammar-based perspective was not enough. So from the starting point, it demanded a lot of effort and compromise from the English Department to adapt to a rapidly evolving classroom environment.

Steps were given to little by little adapt the way we taught English, one of the very first decisions taken being to teach English in English. So from that point on, we put into practice the CLIL methodology in different subjects, in accordance to the resources and the bilingual staff provided by the educational authorities. Three subjects were chosen for this Bilingual Programme: Science, Mathematics and Social Sciences (Geography and History), the choice being conditioned mainly by the compulsory character of these throughout the Secondary Educational Stage.

Although Spanish people have been traditionally known for their poor performance in learning foreign languages and although the first teachers to join our school as bilingual staff didn't have the fluency or the skill necessary to teach their subjects proficiently in English, that didn't stop us in our efforts to continue with the programme, in such wise that from the 30% that the legislation at that

time fixed as the minimum foreign language input in the classroom we reached a full 100% shortly after. Legislation evolved as the programme gave its fruits.

CLIL methodology calls for the use of new ways of understanding not only the teaching of foreign languages but also the teaching of any subject involved in the process. The current legislation demands the preparation and elaboration of integrated units that involves team work and the planning together of the different subjects, requirements that have become a common point and exigency in any other subject, be it or not in a bilingual programme. The process is still going on in our school and the division of knowledge into strictly separated subjects of study doesn't make it easy to find points of coincidence where to start planning joint activities or lessons. But still, CLIL methodology makes it absolutely essential to reconsider the way we teach our students.

As we understand it, the acquisition of languages is not just an academic knowledge, but a human competence, since the capacity to acquire languages is a natural condition available to all human beings. In spite of the initial misgivings and fears from parents and teachers alike as to the capacity of students to learn in a CLIL environment, reality has proved the validity of the methodology in improving the competence of our students without degrading their general level of knowledge. Much has to be improved and more research is needed to find better ways of teaching languages through this methodology, but what it is clear to us by now is that CLIL methodology not only provides effective tools to teach languages but also involves teachers in a process of innovation and research that put them into the very forefront of teaching innovation, which has taken us to put into practice routines which later on have been proven to be part of new methodologies that are achieving recognition everywhere. Here is where IBL makes its appearance.

Without even knowing that there existed such a methodology called IBL, we started a process both in the English and in the Non Linguistic Subjects taught in English to get students more involved in their learning process and make connections between the contents taught and their closest reality. The idea of connecting the classroom with the immediate reality that students experienced was at the starting point of a change in methodology in the English department that took us to undertake several training courses and try new ways of teaching English by involving students in project making or, as later we came to understand, what it is currently known as IBL.

One of those first projects was the filming of a video which aimed at integrating the contents taught in Social Science about the Mediterranean Climate with the English and Science contents. The final result mixed oral presentations of our students talking in English about the characteristics of the Mediterranean Climate with field visits to the nearest market and greengrocer's to search for the fish and seafood locally caught and the fruit and vegetable locally grown, that were obviously in season, and to witness the difference in price between the later and the fresh products imported from abroad, together with a visit to the beach to find out for themselves what traces of fauna could be found on the sand and for them to be able to report on the cleanliness of our beaches and draw conclusions on what measures could be taken to improve it.

This line of action using research work and linking the contents taught in the classroom with the real life of our students evolved into more formal ways of conceiving Integrated lessons in our weekly meetings where the bilingual staff would discuss the integration of contents. With more or less success, we have been able to produce a way of approaching the teaching of different topics from different subjects. We choose a central point which can be, for example, the setting up of a company or business, which then becomes the focus of the project for our students and from the different subjects involved we help them build the knowledge they need to put into practice or achieve the challenge of coming up with their own original idea of business.

### **A business project**

Kind of project: Team task. Three to four people teams

Project goal: Building a viable business up.

Specifications:

a, Business planning:

- Economic goods business is going to produce (physical goods or service)
- Kind of business: cooperative or single share-holder corporation.
- Human resources'. The amount of workers and their specific qualifications for the task.
- Capital. Invested money. Location. Tech or machines needed. Human
- Capital, qualified workers.
- Land or raw materials needed.
- Price list. The price of the products must be connected to the budget,
- Target costumers,

- b, Business budget: Every team must estimate a budget in the most accurate and actual way. The internet may help the teams to find prices, rents, investors, etc.
- c, Project presentation:
  - All projects will be handed over at the set deadline for their evaluation.
  - All projects will be presented before the class.
  - Teams could use all means needed in order to present their projects (Slides presentations, videos, physical items, etc.)

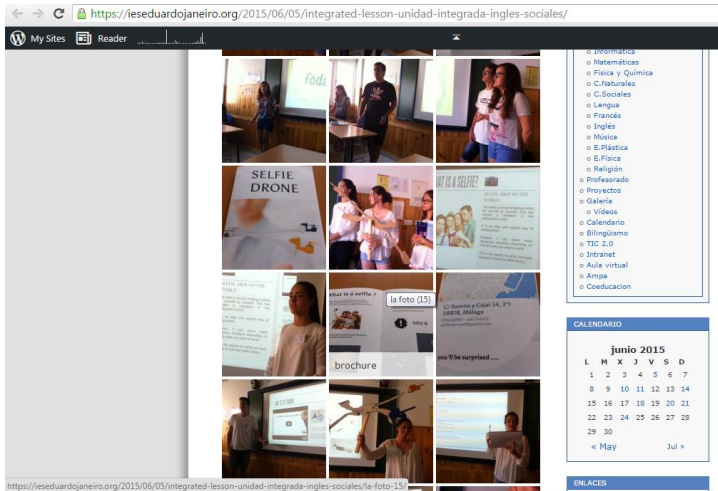
## Evaluation

All projects will be equally evaluated according to the following items:

- Originality. It does not mean that teams cannot be inspired by actual and current business but inspiration does not mean copying. Besides, each project must be different than the others and the ideas must be as fresh as the can. (Two points)
- Accuracy and reality. All the parts of the project (business s planning and budget) must be accurate and actual. The quality and Quantity of the information will also be evaluated. (Three points)
- Presentation. The use of different ways to present the business, the originality of the presentation- The level of English. The equality of the presentations.
- Classmates evaluation. All projects will be evaluated by the group using a rubric that the teachers will provide, (two points)

Following the guidelines provided by the team of teachers, in some cases they even surprised us by making models of their products, apart from brochures and leaflets to advertise their services, creation of logos and corporate image and some of them even came to the presentations with identification badges showing their position in the company they had created.

In our blog and our website we have uploaded the results of those integrated lessons:



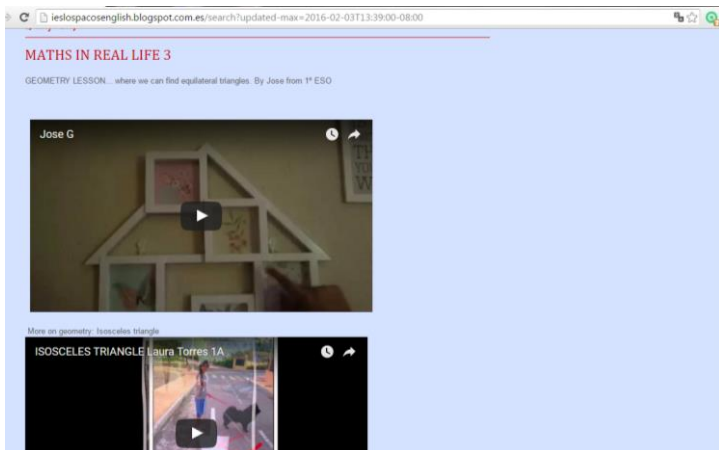
From the more formal study of the I World War in the History classroom to the reading of “War Horse” in the English subject to the final video with the opinions of our students about studying from different perspectives the topic of the Great War it proves that integration of contents is a productive method for our students to grasp concepts and information that would otherwise be more arid and less connected to their own lives, therefore contributing to building more meaningful learning.

Another topic such as the Nutrients and their balance in our diet in the Science classroom gave way to different presentations and videos showing how our students took the idea to different levels. The Universe and the Solar System was also part of another Integrated Unit, which gave the opportunity to have an exhibition at the entrance hall with all the projects done by students from 1ESO. In English they had to depict an imaginary planet and the living conditions on it and in the subject of Social Sciences, for example, they studied where the names of the planets come from and what their connection is to History and the Roman and Greek gods and goddesses.





In the Maths Department they have also used video production as a way to enhance students' engagement with the study of Geometry, showing how geometry is everywhere in our daily lives.



These efforts, although at the beginning not strictly or consciously connected with IBL methodology, are in itself part of this Inquiry Based Learning or Project Based Learning, since the starting point for both of them is a problem or a question to solve and a final product to come up with.

The Erasmus+ project we have been working on for two years now has given us an opportunity to consolidate the knowledge of these methodologies and has driven us to look for training courses on the topic in order to have a more formal knowledge about them and share our experiences with and get feedback from other teachers and professionals in the area or region. We have seen that IBL is taking its place within the classroom routine in many places in our country that it has proven to be a well-tested methodology at Pre-School level and is finding a way into Secondary School too.

In the wider perspective, we have become more aware of the innovation practices that we have been carrying out in our own school thanks to the driving force of bilingualism, with its stress on team work and integration of contents. We now understand that it is part of a much wider tendency in Secondary Education to implement better teaching practices adapted to the exigencies of new generations who are more familiarized with new technologies and the enormous amount of information that they provide rather than with the book-based learning of former generations. This shift in means has urged a shift in the role played by teachers and consequently in the methodologies used in the classroom.

In this specific Erasmus+ project we focused on improving the teaching of sciences to make them more appealing to students and closer to their interests. To that aim, the programme developed during the mobilities turned around arising the curiosity of the students for Sciences. For the mobility of the Hungarian and Finnish partners to Spain, we planned several visits to institutions like the **Science College of the University of Málaga**, where senior students showed them the facilities and the laboratories, and introduced them to the different degrees and masters the College offers. The students and visiting teachers could also see the **Botanical Garden** grown by the College.







Another of the high points of the mobility was a trip to Granada, planned in conjunction with the Social Science department for students of 2<sup>o</sup>ESO (13-14 years old) to visit the **Science Park** and the **Alhambra Palace**.

**The Science Park** is an interactive museum of over 70.000 m<sup>2</sup> located a few minutes on foot from the historic city centre of Granada. It has one of the most varied offers for cultural and scientific leisure in Europe and among its attractions are:

**The Pavilion for Journey into the Human Body:** A sojourn from the origin of life up to the human anatomy.

**Al-Andalus Science Pavilion.** The scientific and technological legacy of al-Andalus.

**The Prevention Culture Pavilion.** To improve the perception of risks in the workplace and in daily life.

**The Techno-Forum Pavilion.** A space for new technologies, innovation and art.

**The Museum Atticís.** Exploration Hall that brings science closer to the smallest visitors through discovery and exploration.

**Temporary Exhibition Pavilion** where visitors can enjoy exhibition productions from Spain and around the world.

**Foucault's Pendulum Building** where you can discover the fragile balance of our planet, multiply your reflection inside the Tunnel of Infinity and trap your shadow in the Biosphere, Perception and Eureka exhibition halls. There is also a Planetarium with a projection of over 7.000 stars.

**Natural Spaces Pavilion.** All about the natural spaces of Andalusia, as well as a focus on the environment and its conservation.

And as a final outdoors activity we took the students of 2ºESO together with the visiting team to **the Algaba Natural Classroom.** Located in the heart of the Serranía de Ronda, this educational resource offers activities for the students and general audiences, not only to know about the Mediterranean environment where it is located, but also to promote and enhance a cultural, environmental and proactive consciousness of our natural resources.

The **Algaba Natural Classroom** is located in a 50 Has plot where you can have a first-hand knowledge of the Mediterranean vegetation and fauna: with splendid samples of Mediterranean trees such as cork and holm oaks, quejigos, etc., it is a privileged area to show the different ecosystems and habitats of some of the most representative bird species in the South of Spain.

The **Geology Area** turns around a geological model of the Serranía de Ronda, a set of didactic panels describing the main features of the area together with a collection of the rocks that altogether make the landscape around.

The **Settlement Area** recreates a model of Prehistorical society, with a surface of 4.000 square metres enclosed within a stone wall 250mts. long, it consists of 16 huts with all sorts of utensils and domestic tools of Prehistoric times. The result is an original spot to learn understand and experience the Prehistoric life in the south of the Iberian Peninsula.



Finally the idea of working with the students participating in the last mobility on an IBL project passed through different phases:

1. After two first meetings all together (12 students from two different levels, aged from 13 to 15 years old) in the form of brainstorming sessions that led them to think about different projects to be deployed in the school itself, they finally made up their mind on working on a video to show their school and the activities carried out in it.

The idea was for them to decide on what project they wanted to work on and to organize by themselves the implementation of the task. We discussed the activities that should be shown on the video, and who should be responsible of filming each part. The project has been carried out totally by the younger students; they have organized their time out of the lessons, arranged the appointments with the different teachers to film in the classrooms and edited the final version of the video.

2. The feedback from the teacher coordinating the project was to point at the spelling mistakes in the video and to give some suggestions as to how to improve the presentation of the activities shown, since the sound recording was very poor in some parts, so it wasn't self-explanatory. She has also participated in offering an assessment grid for the students to grade their level of satisfaction with the project.

3. The senior students participating in the mobility had to carry out a survey among teachers and students about Virtual Learning Environment. We discussed at the brainstorming sessions what questions should be asked to find out the most engaging ways for students to learn and for teachers to teach and how deep the involvement of teachers was in the use of technology in the classroom. Then they would take all the data collected and draw their conclusions in a presentation to be shared at the final meeting in Finland.



As the second phase of the project was based on VIRTUAL LEARNING ENVIRONMENTS, which is new to most of us, we consider interesting to mention some points about this methodology. Many researchers and authors agree on the advantages of using new technologies in the classroom, whether in the form of on-line resources such as moodles, wikipedias, edmodo and in the classroom with new tools such as mobile phones and tablets to carry out tasks in the classroom environment. New options for the educational process such as the FLIPPED CLASSROOM could be unthinkable of without these new means on the internet and the universal access to them.

Mention has to be made that in our school BILINGUALISM was one of the factors that led the Managing Team to take firm actions towards investing in technology such as computers, projectors and screens to help the teachers in Non-Linguistic Subjects with their bilingual teaching work. At first our school lacked those means and the teachers had to struggle with mobile head projectors to be carried everywhere if they wanted to have some interactive or visual support for their lessons. Bilingual material was scarce, so it rested heavily on the teachers' shoulders to create their own lessons in English.

Step by step we invested in computers with internet connection, screens, overhead projectors and speakers to help them with their CLIL methodology and the English Department with their radical change in classroom approach. Later on, we were provided by the educational authorities with Digital White Boards and coincidentally the different publishing trusts, seeing that the promotion of languages was a real and decisive step taken by the educational authorities, started to release reference textbooks to address the needs of the growing bilingual community.



In general, the main positive features highlighted by researchers are:

- Communication – opens up an infinite number of channels in the format of forums, discussion threads, polls, surveys – instant feedback either as a group or individually
- Producing work – students do not physically have to find their teacher to hand in work
- Resource hub – teachers have infinite online storage space for PPTs, docs, worksheets etc. that can either be secure or shared with students
- Dynamic home pages – teachers have the opportunity to create an exciting virtual space to represent their room/subject
- Links to outside sources – pathways to all other online learning spaces are linked via the VLE
- Embedded content – YouTube, BBC, newspapers can all be embedded as the dynamic feed of the homepage
- Podcasts & videos – both teacher- and student-produced podcasts and videos have a shared platform

The most common negative aspect is the lack of a high quality access to those resources on the internet due to school policies that limit either the connectivity or the internet providers (as such is the case with our school where the internet connection is already hired and provided by the Regional Educational Authorities) and other issues such as the security of our students on the web. But the main obstacle for many teachers is their own lack of ability with these new tools and the sense of having their own students overpass them in skills and know-how in this sense.

We are giving a few steps towards overcoming these and other obstacles and the staff of teachers are trying new ways to connect with the students via video production, use of Edmodo and Wikispace tools to upload tasks and activities and download or store lesson contents. Also the website of our school offers to all students access to the lesson contents in the different subjects, although it is not used equally by all the teachers.

Video and podcast production is a routine already established for several years in Departments such as English for the promotion of the speaking skills and in Maths, for instance, they promoted an original way of using video production by asking their students to search for geometric figures in their immediate environment: their own house, streets, neighbourhood, town and produce a

video with their results. These are basic routines that can be seen on our blog <http://ieslospacosenglish.blogspot.com.es/>

We are just in the process of getting to know the possibilities of new technologies in the classroom and some of the teachers are already using tablets and mobile phones for their lesson plans and for specific purposes, but we have to assess the results of this implementation.

We cannot but mention the shift that we have witnessed in our school as to the use of a reference textbook. In previous years, it was unthinkable not to have a reference textbook which students took home to study. Although it is part of the general policy of the educational authorities to provide free instructional material to all students as a means to guarantee equal access to education, they are becoming increasingly less useful in class and at home from the moment most families have internet connection and most contents and activities can be stored digitally, be it a website, a moodle or a Wikispace, making it less compulsory to go back to a reference book to study. A side effect of this new situation is that students must be more responsible for and more self-independent with their learning, since they are provided with different ways to access the information they need and the activities they have to carry out.

Nevertheless, in this as in other aspects of education, we cannot remain on the surface of dichotomies that paralyse rather than help our process of research in our field: paper versus digital is not an option. Both means are useful and necessary to the aims of promoting learning. The discussion about which means is best is amply recognized as useless and can lead us to a battleground with no clear results. The generational gap must be taken into account as well as the change in the use of technology, so we have to adapt gradually to the use of these new means in the classrooms without utterly discarding the benefits of firmly-based practices like hand-writing or reading from a paper book rather than from a screen in terms of the higher intellectual processes and focused attention they activate, which interactive means do not promote to such a degree.

It is clear that students are more comfortable with a Virtual Learning Environment than we teachers are and we have to accommodate to this new situation by keeping up our involvement with our profession, which must include vigorously a compromise with continuous professional training.

## 9. Project method + CLIL in Finland

### 6th graders, English class

#### **Task**

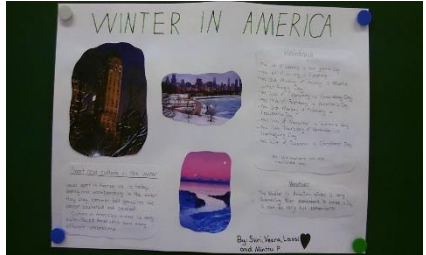
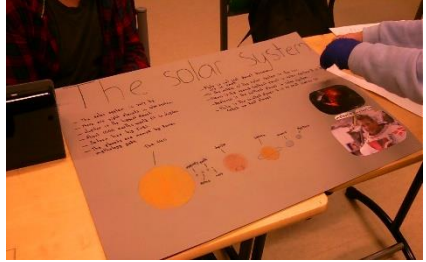
- Constructive project
- Group work project
- Realisation free: a poem, a story, a poster, a show/a play
- The problem: dealing with the subject matter in foreign language, English terminology -> English product
- Planning: the subject matter given by teacher (several choices): -> how to deal with it, what is the product, from what angle to approach the subject matter, how to limit the subject matter?
- Producing: gathering information, materials needed, sum up, the show
- Showing the final products to others
- Evaluation orally

#### **The list of subject matter**

- The subject matter is based on the things handled in the English book and related to science, in addition with seasons:
- English speaking countries and areas in the world: Great Britain, USA, Canada, Ireland, Australia, New Zealand, South Africa, Malta, Gibraltar, India, Hong Kong, Singapore
- Animals of the English speaking countries
- Dinosaurs
- Our solar system
- Science and technology
- Seasons of the year: one to be chosen

#### **Working and outcome**

- 6th grade was divided in to groups of three people by a lottery
- Each group got 3-4 lessons, after which they had to present the product
- The groups used their English books, dictionaries and Internet for information search
- Group working was succeeded, everybody worked despite the level of language skills
- Although several choices were offered to be the final product, all groups were eager to make posters
- Reporting and evaluation was made orally



### Pupils' opinions

Pupils were asked questions afterwards and this is how they answered (no repeated opinions here):

- Was the project method task nicer than the traditional class working?**

Yes. Yes because it was group work. It was nice, because you can work more freely than in doing exercises. Yes, a little. Yes, in some phases. I think the traditional class work is a bit nicer, but it doesn't always teach so much. Yes and no, nice to decide on your own, but listening to units in the book is also nice.
- What was best?**

To do group work. To be able to decide and plan on your own. Freedom of choice. I got a lot of help. Freedom in working. To be able to do something. That there was no real instruction on what we had to do. Presenting the project work for others. I don't know.
- What was worst?**

Maybe translating into English. When we didn't come up with any ideas. If someone didn't listen or work properly. Presenting to others. When I got to do nothing. Difficult to say. Nothing.

- **What did you learn/did you learn anything?**  
Group working. Cooperation and things related to my subject. More about culture and a few words. I got to know others better. Animals. More grammar by writing the text. Something. No.
- **How would you like to change the task?**  
No. More options. Smaller groups. Nothing much to change. To be able to choose the group on your own. I would have wanted a different topic. Wider choice of things to choose from.
- **Anything else:**  
The project was educating and nice from every aspect.

### 9th graders, Swedish groups

Project method + CLIL:

- group project (pair work)
- complex project: Swedish language, environmental issues
- constructive project: a trailer on environmental issues in Swedish language (CLIL)

Media:

tablet: iPad,

application: iMovie

### PHASES

1. Creating a situation
  - Making a trailer using iPad iMovie
2. Choosing the problem
  - Chapter 19 in the Swedish book, Mera om –texts, subject matter should be related to environmental issues, the purpose is to make a trailer, the content can be freely chosen
3. Planning
  - Showing how iMovie works
  - The plan is first handwritten using the iMovie trailer planner sheet (or in notebooks): the subject and the topic, then the script writing needed for iMovie and the pictures are planned for each space, how they will be, where will they be taken etc.

#### 4. Realisation

- Texts are translated into Swedish if they are not already
- Texts are written on iMovie and the photos taken, screenshots can be used from the internet as well. If the project will be saved and kept, one has to be careful not to use any pictures without permission. Own drawings can also be produced and photographed, writings etc. as well as spoken and acted parts.
- The finished product: can be shown to others through document cameras or airdropped to the teacher, who saves it through other devices and then shows it

#### 5. Evaluation

- Finished products are shown to others in the class and evaluated orally, whether the project was fulfilled according to the plan, what was challenging and if the desired finished product has been achieved



iMOVIE

## 10. Project in Hungary: How to reuse plastic bottles

### 1. Painting a picture:

- First we painted the branches and the trunk of a tree.
- We put some tempera painting in a plate
- We plunged the bottom of a small plastic bottle in the painting and we printed it on the paper
- Finally we painted yellow dots in the middle of the 5 blue „petals”.



### 2. Pincushion:

- We cut off the bottom of a plastic bottle.
- We stuffed a sock with some cotton wool.
- We put the stuffed sock in the bottom of the plastic bottle.



Zsófi Szőke Molnár and her group from class 6.a

## 11. VLE and ICT in Kymintehtaan koulu

VLE = Virtual Learning Environment

ICT = Information and Communication Technology

### **ICT and VLE as concepts:**

*Information and communication technology* ICT means all the electronic media that can be used as help in handling information. Its broadest concept means all the products that are able to record, search, handle, transmit or receive information electronically in digital format, e.g. computers, digital TV, e-mail, robots, magnetic discs/tapes, optical discs (CD, DVD), flash memories etc. Also writings on paper can be included as belonging to ICT.

### **Tablets in lessons: e.g.**

- As a medium – a calculator, a map, a camera, a sound recorder, a bar code reader, a QR code reader, a notebook, a timer, a dictation machine, a screen shooter, a navigator, a dictionary
- For information search
- For sharing teaching material: e-books, videos, recordings, presentations, saved pages, tests
- Producing own contents by writing
- As a medium for learning by games
- One can take screen shots on web pages to store information
- For video recordings, photographing (picture presentations, animations, trailers...)
- Reading QR codes for example on task paths (QR code opens information on previously chosen subject, QR readers: QR-reader, Scan)
- Taking part in other pupils' or teacher's screens: chat forums and platforms etc. (Socrative, Kahoot, FB, Messenger...)

### **QR-codes in teaching**

A good Finnish summary here

<http://mobiilisti.blogspot.fi/2011/08/tunnetko-jo-qr-koodin.html>

### **Game platforms, where a map is used and pupils move**

Seppo

<http://seppo.io/#lyhyesti>



ActionTrack

[http://www.taz.fi/?page\\_id=38#whatisat](http://www.taz.fi/?page_id=38#whatisat)

Grafetee

<http://www.grafetee.com/>

### **iMovie trailer in teaching**

<http://learninginhand.com/blog/2014/8/6/plan-a-better-imovie-trailer-with-these-pdfs>

A form to help script writing [tässä](#).

The form for planning the Expedition trailer: [Expedition](#)

If you want to brush up the video more:

<http://www.macworld.com/article/1156828/imovietrailer.html>

Changing picture styles etc.

### **Virtual environments to help teaching:**

Peda.net: the educational virtual environment for Finnish schools

Ekapeli: Finnish reading and mathematics (for the small)

Padlet.com: for creating a wall, for giving and doing tasks

Slideshare.net: you can e.g. share your own PowerPoint presentation to others  
(you don't need a PP program for reading)

Quizlet: to create learning games and quizzes

Evernote: or note making

Kahoot!: questionnaires, conversations, writing essays and studies

[https://www.youtube.com/watch?v=pFFv6\\_6was4](https://www.youtube.com/watch?v=pFFv6_6was4)

Educational programs of TV

Information and links on using tablets in education received among others from:

Johanna Sunikka (Ympäristökoulu Polku, Pääkaupunkiseudun Kierrätyskeskus Oy,  
Ympäristöpäivät 2015)

Sari Uski (XAMK, a lesson" Tablettitietokoneet opetuskäytössä" 2015)

## 12. Useful links

<http://www.funbrain.com/numbers.html>

Number Games Online for Kids

[SoccerShootout](#)

Have fun with fractions and win the soccer game.

[One False Move](#)

Step into the wrong room and you'll be doomed.

[MathCar Racing](#)

Gear up your math skills and win the race.

[Tic Tac Toe Squares](#)

Get three in a row to prove all you know.

[What's the Point?](#)

Keep track of your coordinates on the graph

[Operation Order](#)

Use algebra to build a pyramid

[Measure It!](#)

Find the length in centimetres or inches.

[Cookie Dough](#)

Write numbers and make a cookie fortune.

[Number Cracker](#)

Get the secret code or get soaked.

[Math Baseball](#)

Score runs with your math skills.

[Guess the Number Plus](#)

Hey, who turned on the lights?

## Power Football

Kicking field goals requires brains.

## Shape Surveyor

Train to be an archaeologist.

## Line Jumper

ump on the right number.

## Change Maker

Never get short-changed.

## Fresh Baked Fractions

Fraction Jackson is hungry for pi.

## Guess the Number

Are you feeling clucky?

The image shows the Funbrain website interface. At the top, there's a navigation bar with the Funbrain logo and five tabs: 'math arcade', 'reading', 'fun arcade', 'playground', and 'all games'. Below this, the page is divided into several sections. On the left, there's a 'Most Popular' section with a list of games including 'Fun Arcade', 'Reading Arcade', 'Math Arcade', 'Flavorboard', 'Galactic Hot Dogs', 'Math Baseball', 'Dessert Dice', 'Mine Time', 'Sewna Fling', and 'When Fioss Fly'. Below that is a 'Number Games' section with a list of games like 'Bumble Numbers', 'Moon Rocks', 'Math Basketball', 'Mummy Hunt', 'Soccer Shootout', 'Math Car Racing', 'Fio Toes', 'Inkator', 'Night Swimmers', and 'Math Baseball'. At the bottom left is a 'Funbrain Jr. Games' section with a list of games including 'Beach Ball Balance', 'Letter Digraph', 'Rhyme Time', 'Treasure Hunter', 'Shape Shack', 'A-Mazing Words', 'Doodle Mix', and 'Elastic Cards'. On the right side, there's a large yellow-bordered box for a game called 'Timmy Failure has lost his pants! Help him find them!'. The box features a cartoon illustration of a boy named Timmy Failure and a white bear. Below the illustration is a 'PLAY NOW' button. At the bottom of the page, there's a 'By Grade' section with a list of games categorized by grade level: Kindergarten (Sewna Fling, Mine Time, Dessert Dice, Lost Run, When Fioss Fly), Grade 1 (Azalea Catch, Froggy Bits, Color Creature, Treasure Dice, Shape Invasion), and Grade 2 (Bumble Numbers, Math Baseball, Penquin Drop, Mighty Guy, Moon Rocks).

(One False Move)

<http://www.education.com/games/math/kindergarten/>

[http://www.adaptedmind.com/landing-](http://www.adaptedmind.com/landing-responsivev13jsfix.php?utm_expid=33853517-)

[responsivev13jsfix.php?utm\\_expid=33853517-](http://www.adaptedmind.com/landing-responsivev13jsfix.php?utm_expid=33853517-)

[85.aV3h48VGQfctLLYyE2CVew.2&gclid=CNzLwfbvh8gCFUe3Gwod1](http://www.adaptedmind.com/landing-responsivev13jsfix.php?utm_expid=33853517-85.aV3h48VGQfctLLYyE2CVew.2&gclid=CNzLwfbvh8gCFUe3Gwod1)

[usCkg&utm\\_referrer=http%3A%2F%2Ftpc.googlesyndication.com%2Fsafe%2Fframe%2F1-0-2%2Fhtml%2Fcontainer.html](http://usCkg&utm_referrer=http%3A%2F%2Ftpc.googlesyndication.com%2Fsafe%2Fframe%2F1-0-2%2Fhtml%2Fcontainer.html)

Each lesson has 500 problems, explanations, and an instructional video.

<http://www.topmarks.co.uk/maths-games/5-7-years/counting>



Tablet friendly online games:

<http://www.topmarks.co.uk/maths-games/5-7-years/counting>



<http://nrich.maths.org/public/leg.php?code=5039&cl=1&cldcmpid=5651>  
<https://www.geogebra.org/>

<http://www.kidsmathgamesonline.com/>

**Kids Math Games 5 8**  
Have fun learning online!

Science  Math  English 

Google™ Custom Search  Search

**Home** **Numbers** **Geometry** **Facts** **Worksheets** **Videos** **Quizzes** **Pictures** **Fun Stuff**

Logic Puzzles Money Addition Subtraction Multiplication Division Counting Problem Solving Sudoku Board Games Memory Fractions Probability

## Fun math games for kids!

Welcome to Kids Math Games Online! Enjoy a wide range of free math games, interactive learning activities and fun educational resources that will engage students while they learn mathematics.

Find cool math games, interesting facts, printable worksheets, quizzes, videos and so much more!



### Numbers

Learn about numbers with these fun interactive games and activities. Complete challenges related to number patterns, fractions, decimals, place values, graphs, probability, codes, data, mean, median & mode, calculators and more.

- Fun fraction game
- Decimals activity for kids
- Learn about probability
- Percentage game for kids

1 2 3  
4 5 6  
7 8 9

### Geometry

Check out these educational geometry games for kids and have fun improving your geometry skills. Learn about shapes, grids, weights, building blocks, angles, measurements, reflection, rotation, transformations and more.

- Fun shape game for kids
- Measuring length & weight
- Angle game for kids
- Learn about grids & coordinates



### Facts

Enjoy our interesting math facts, trivia and information related to the world of mathematics. Learn about numbers, read famous quotes and learn about shapes such as circles, squares, triangles, spheres and cubes.

- Interesting number facts
- Fun geometry facts for kids
- The history of mathematics
- Famous mathematicians

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