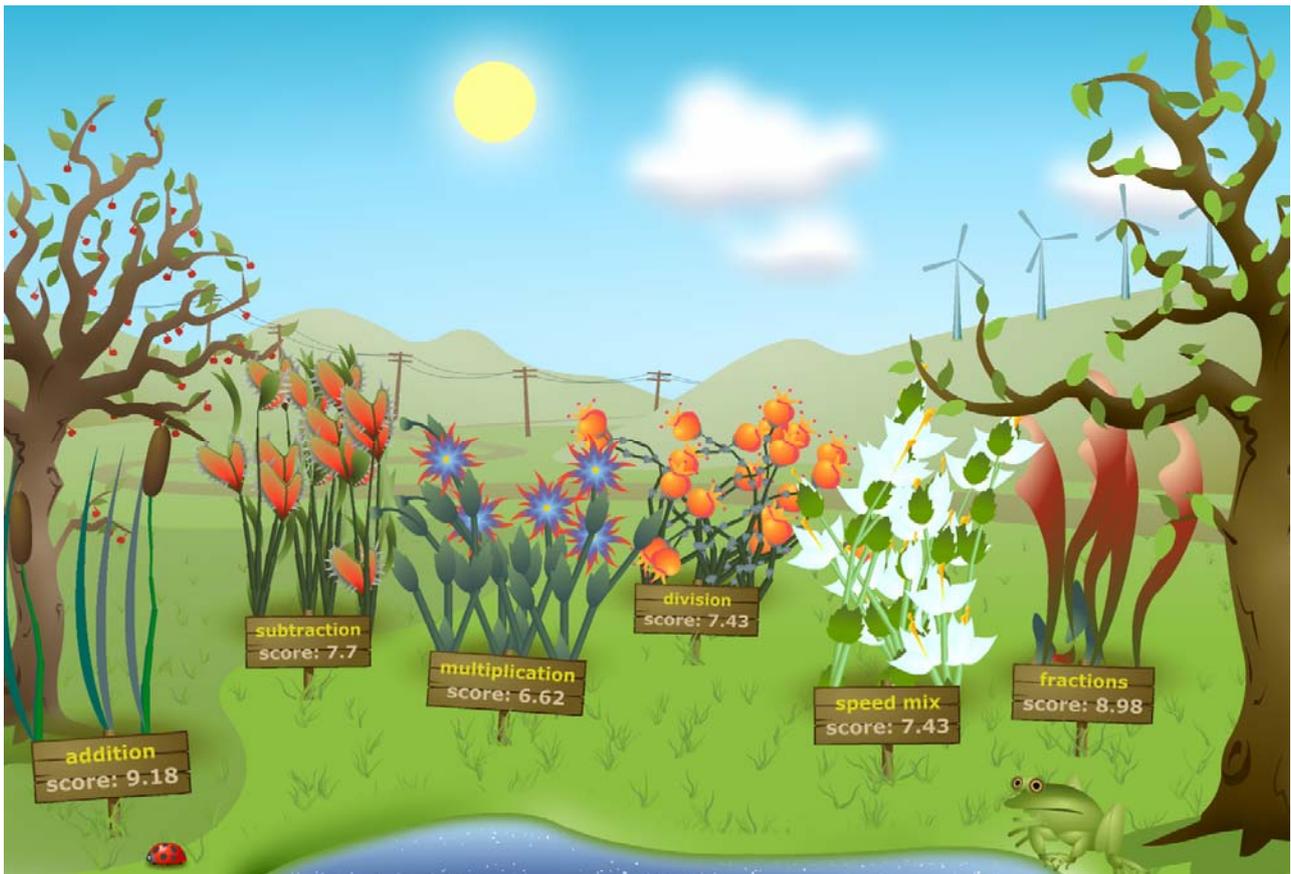


Web-based and game-based learning is fun!

Education has got its good and bad sides. Maths Garden, created by Oefenweb.nl (a spin-off company of the University of Amsterdam), is a web-application that takes over the less appealing parts like testing, memorisation and marking, and makes them more pleasant and better. This article tells you how Maths Garden works and how it makes use of the possibilities that IT has to offer for education.



Training and memorisation of maths skills on a regular basis is important in primary education. IT offers possibilities to make training much more attractive. Maths Garden is a web-based training-tracking system in which children are stimulated through an attractive online environment to train their mathematical skills while at the same time their development is being measured.

Maintaining the Garden

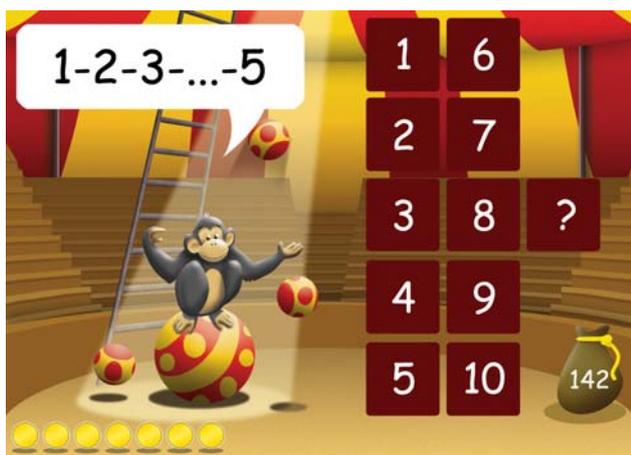
Children can log into their own garden on www.Mathsgarden.com. The state of the garden gives you an indication of the mathematical skills of the child. The size of the plants indicates the scores that the child has achieved in the several domains. Children can make the plants in their garden grow by playing maths

games. The garden needs to be maintained, just like a regular garden, because if the child does not play in it regularly the plants will wither. In this way children are stimulated to practice maths on a regular (weekly) basis.

Testing children's scholastic skills takes a lot of the available time for education. The popularity of digital tests is ever increasing, as computers can take over a lot of the marking activities. Moreover, computers enable the possibility of adaptive testing. This entails that every child gets training exercises on its own level.

Adaptive testing

In an adaptive test the choice of the next exercise is determined by the success a child has gained on previous exercises. A good mathematician who is continuously giving correct answers to easy questions will automatically get offered more difficult questions. This way the accurate level of maths of a child can be determined more quickly, which is useful to map their development. Furthermore, adaptive testing is motivating for children, because they all, even the weaker mathematicians, are challenged on their own level. Adaptive testing is already in use in several tests, but Maths Garden, using a new adaptive testing system, is making even more use of the possibilities that IT has to offer.



Measuring maths skills

Firstly, the adaptive testing system of Maths Garden not only takes into account whether a maths problem is answered correctly, but the time that children use to solve a maths problem is also used to measure maths skills. Since reaction times can be registered by computers easily, it should be a pity not to use them. These reaction times provide extra information about the maths skills of a child. They are taken into account in a score line, which is incorporated in a playful manner in the maths games.

Children can earn coins by answering the questions quickly and correctly, but they lose coins when they answer a question incorrectly. So, the games stimulate children to choose a strategy that helps them to answer the sums correctly and quickly as well. With the coins the children collect during the games, they can buy trophies. Since every child gets maths problems on their own level, everyone can earn about the same amount of coins, depending on how much someone plays.

The use of reaction times by measuring the math skills has got another big advantage. By getting extra information from the reaction times of the children it is possible to present easier maths problems and still test efficiently. This way, sums can be offered of which children answer 75% correctly on average. This high success rate turns out to be very motivating.

Self-organising system

With the new adaptive system, it is possible to create a new test for a new domain quickly. Every teacher could basically do it. In traditional adaptive tests it is necessary to determine beforehand with a representative sample taken at random how difficult the maths problems are. To offer maths problems on someone's own level, you naturally have to know how difficult they are. This takes a serious amount of time and money. Maths Garden uses a self-organising system that makes this process unnecessary. It is a variant of the Elo rating system which has been developed to compare chess players.

In Maths Garden children and maths problems are considered as opponents. They both have a rating. In case of the children, their rating is an indication of their maths skills and in case of the maths problems the rating is an indication of their difficulty. If a child solves a sum correctly, the child has 'won' and its rating will improve a little. The sum on the other hand has 'lost' and its rating will drop a bit. Because Maths Garden is web-based, it is possible to store all the answers of all children playing in Maths Garden in a central database. Thanks to this database, the rating of the children as well as the rating of the maths problems can be determined quickly and accurately.

Training, not a test

Maths Garden is a training-tracking system, since doing maths in Maths Garden is training and not a test. The children can play the maths games at school, as well as at home. All training data are stored and can be used by teachers to get a detailed view on the development of their pupils. Furthermore, because of the central database, it is easy to make comparisons to reference groups and to see whether the maths skills of a pupil fall behind compared to children of the same age, or if a pupil makes progress faster than its peers. Moreover, Maths Garden takes marking tests to the next level. Teachers often only have time for superficial correction. Computers offer the possibility for a more extensive analysis of the given answers. Maths Garden offers, for example, error analysis, with which teachers can see if pupils often make mistakes of the same type due to a wrong solving strategy. This gives opportunities for individual instruction. Subsequently, the teacher can tell by the development of the rating of the pupil whether the instruction was effective.

The collected data are not only interesting for teachers, but also for researchers. The University of Amsterdam, for example, uses the anonymised data for scientific research. The aim is to develop new insights into the development of scholastic skills and in that way improve Maths Garden specifically and education in general. In this way the University of Amsterdam and Oefenweb.nl seek to bridge the gap between education and science.

Under development

The Maths Garden keeps on developing. Additions, like new maths domains, are soon to be expected. Furthermore, a Language Garden is being developed and there are plans for a version for handheld computers. For when every child has got its own computer, it is easier to practice on a regular basis in the Maths Garden.

You can try Maths Garden by creating a demo account at www.mathsgarden.com/demo.

Teachers who like to develop maths problems for a specific domain are warmly invited to get in contact with Maths Garden. And also for more information you can send an e-mail to: info@mathsgarden.com.

