# MAIKE – Mathematics in Kindergarten

## Information

### What is MAIKE?

MAIKE is a mathematics education app for children aged 4 to 6. The app can be used individually and self-determined in kindergarten as well as at home.

It offers mathematical tasks on arithmetical and geometrical fundamental ideas which promote a 'good beginning' of school experiences (NAEYC 2010). Furthermore specific content which has a proven impact on the outcome of $2^{nd}$ grade has been selected (Dornheim 2008). Selection was based on empirical research in developmental psychology and mathematics education.

In a nutshell: If your child is able to solve all MAIKE tasks without any help, he or she is well prepared for starting school in mathematics.

### What isn't MAIKE trying to accomplish?

Early mathematical education is possible without any ICT. It is important to explore mathematical objects and situations, to talk about findings, to imitate elder ones' actions and words. All MAIKE tasks offer play ideas involving real-life objects and materials to explore together with the child (direct interaction).

### How is MAIKE structured?



MAIKE offers six different ,worlds' with 10 games each. Overall approximately 480 tasks are presented. Game access is given progressively depending on the progress the child makes. Throughout the worlds complexity and difficulty of the games are increasing. Each and every mathematical content is returned to across worlds (spiral curriculum).

Each activity is designed to be self-explanatory and features no verbal or text-based descriptions.. Neither reading skills nor knowledge of numbers as figures are conditional. The handling is kept straight forward and easy based on simple swiping. Nevertheless it is appropriate to accompany your child exploring the mathematical games –although MAIKE is ready for action without any instructions.

### Which content does MAIKE offer?

MAIKE offers kindergarten children the possibility to explore all important facets of mathematics. The children go on a journey of discovery through the realms of numbers, shapes, and measurement whilst playing the games. Each World includes games in all different content fields.

In the realm of **numbers** a good perception of quantity is most important (cardinal aspect of numbers). Objects can be counted: toys, cutlery, fingers, etc. If objects are presented in an appropriate structure, counting is gradually replaced by 'seeing' the number (subitizing). Children are then able to see the quantity at a glance without counting. In particular structures in patterns of five and ten (finger numbers, egg cartons) are very serviceable for mathematics.
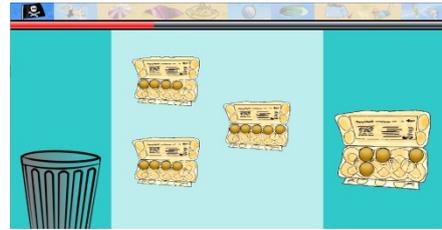


Besides the simultaneous perception of quantities the order of numbers in the counting sequence is an important discovery (ordinal aspect of numbers). Every number has got an antecessor and a certain successor. Every number owns an exact place in the number sequence and on the number line.

Quantities of sets may be larger, smaller, or the same. To compare sets with each other is another challenging activity kindergarten children should conquer.
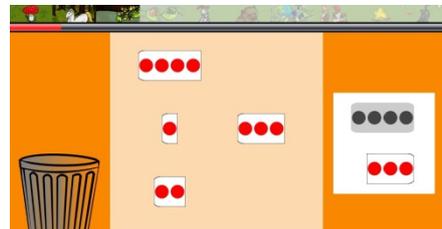
Last but not least children discover how to calculate with numbers of course. At the age of kindergarten writing tasks in figures (digits) and symbols is less important. Rather it is all about perception of quantities. Every quantity can be divided into parts and parts can be put together (part-whole-relationship). First this relation between quantities of sets can be found out by counting, later the children are encouraged to find parts or wholes without countable objects.

Mathematics with numbers is in summary far more than reading and writing figures and symbols. Nevertheless MAIKE slowly introduces to figures and symbols up to 10.
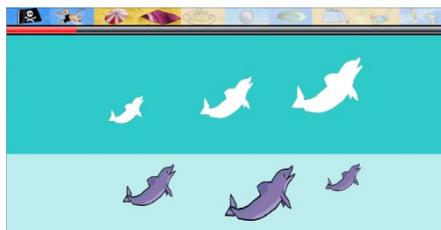
In the realm of **measurement** sorting and classifying objects by size (small – middle – large, smaller than …, larger than …) is a fundamental part of mathematics in kindergarten.

Matching objects of suitable size (large spoon belongs to large cup) is yet another challenge in this content field.

In the realm of **geometry** the child discovers shapes (round, angled) and puts shapes in order. The child learns to discriminate between important shapes like circle, triangle, quadrilateral etc. and matches corresponding shapes. MAIKE offers the chance to improve drawing attempts of geometrical shapes as well.
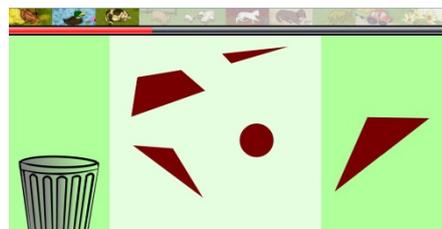
A mathematically important attribute of some shapes is symmetry. Two halves of a figure are mirror images of each other. Also children should recognize place and position (left, right, up, above, below) of figures and objects and copy the order (e.g. with building bricks).
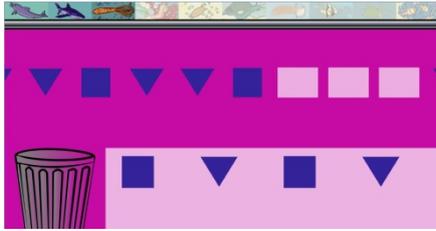
Different objects can be used to form nice (linear) **patterns**. The child is asked to continue the pattern in the right structure or to complete a pattern with blanks. The difference between the objects is getting more and more subtle throughout the worlds. The child needs to detect the attributes of shapes which may for instance only differ in colour or size.

To recognize patterns is an overall concept of mathematics. Patterns and structures are fundamental in all realms of mathematics.

## What does this display mean?

Of course it is possible to start playing MAIKE without any further information about technical details, although there are screen displays. In the top row of the screen a positions display of ten icons (instead of number line 1 to 10) indicates the game played in this world. Next there is a progress bar turning from red over orange and yellow to green indicating the progress (number of tasks already solved) within the game.
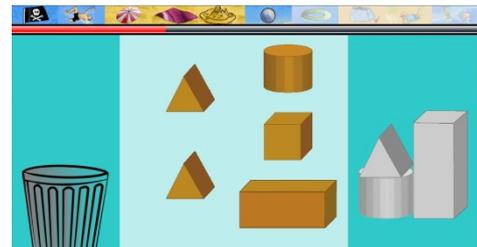




After a game is finished the screen swaps to the world picture automatically. The next game, now highlighted, can be clicked on. By and by the grey details of the world picture are coloured. If some details stay grey, a certain amount of errors were made solving the tasks in this game. Playing this game again (without or only minor errors) fills the blanks.

## Want to know more?

Bredekamp, S. (2004). Standards for Preschool and Kindergarten Mathematics Education. In Clements, D. & J. Sarama (Eds). *Engaging Young Children in Mathematics – Standards for Early Childhood Mathematics Education* (pp. 77-82). Mahwah, London: Lawrence Erlbaum Associates Publisher.

Clements, D. & J. Sarama (2007). *Early Childhood Mathematics Education Research – Learning Trajectories for Young Children.* New York, London: Routledge.

Devlin, K. (1997). *Mathematics: The Science of Patterns. Second Printing.* New York: Scientific American Library.

Dornheim, D. (2008). *Prädiktion von Rechenleistung und Rechenschwäche* [Prediction of calculation performance and weakness].Berlin: Logos.

Maier, A. S. & Ch. Benz (2014). Children's Constructions in the Domain of Geometric Competencies (in Two Different Instructional Settings). In U. Kortenkamp et al. (Eds.) *Early Mathematics Learning. Selected Papers of the POEM 2012 Conference* (pp. 173-187). New York, Heidelberg, Dodrecht, London: Springer.

NAEYC (National Association for the Education of Young Children) & NCTM (National Council for Teachers of Mathematics) (2002/updated 2010). Early Childhood Mathematics: Promoting Good Beginnings. Retrieved from: http://www.naeyc.org/files/naeyc/file/positions/psmath.pdf

Oers, B. van (2014). The Roots of Mathematising in Young Children's Play. In U. Kortenkamp et al. (Eds.) *Early Mathematics Learning. Selected Papers of the POEM 2012 Conference* (pp. 111-123). New York, Heidelberg, Dodrecht, London: Springer.

Steinweg, A. S. (2016). MaiKe - A New App for Mathematics in Kindergarten. In Meaney, T., Helenius, O., Johansson, M., Lange, T., & Wernberg, A. (Eds.). *Mathematics Education in the Early Years - Results from the POEM2 Conference 2014* (pp. 341-357). Heidelberg New York Dordrecht London: Springer.

**available at**     https://play.google.com/store/apps/details?id=de.unierlangen.maike

Legal Notice

**sw-soft**               sw-software.net

**Project,
Design, Concept,
& Contents:**          Prof. Dr. Anna Susanne Steinweg
                       Mathematics Education & IT, University of Bamberg
                       Prof. Dr. Thomas Weth
                       Mathematics Education, University of Erlangen-Nuremberg

**Programing
& Graphic Design:**    Claudia Gohl