



TEACHER'S MANUAL

OCTOBER 18, 2013
FIRST EDITION

About DragonBox^{edu}

The game DragonBox aims at supplementing the teaching of the basics of algebra to kids in a natural, fun and effective way. These pages will tell you about the game and how it works as well as how the game can be used in the classroom.

We believe that children should be actively engaged in their learning process because they are, by nature, curious and inquisitive. From birth, they learn about their 'world' by asking questions and by experimenting, using trial and error. DragonBox was conceived and developed to draw on these traits.

We want children to rely on their innate ways of learning when playing DragonBox because, in doing so, they not only become self-reliant, they also learn how to learn.

DragonBox teaches how to solve simple algebraic linear equations but it also lays the foundation for further algebra learning. It demystifies algebra and gives players confidence in mathematics.

DragonBox is based on common sense observations that are confirmed by researchers:

- Students learn more when they are engaged
- The most important factor to learning is feedback and it should be immediate to be effective
- To feel mastery is key to staying motivated
- Students should be presented with challenges that match their level of mastery
- Students should be assessed in a formative, non-intrusive way
- Discovery learning is much more effective than instructional-based teaching
- Students learn differently and at different paces

Age recommendations:

- DragonBox^{edu} is recommended from age 10 and up
- It is well suited as a supplement for the older students learning the basics of algebra, in addition to younger students searching for more challenges in math

DragonBox^{edu} as a learning tool:

- Gives students a thorough introduction to algebra in a fun and intuitive way in a matter of hours
- Gives the teacher an overview of the progress and knowledge level for each student in their class and the possibility to customize their teaching accordingly with use of our reporting tool

Learning goals	Chapter side A	Chapter side B
Basic equation solving skills	1-3	1-4
Number factoring, signs	4-5	5
Parenthesis, distributive properties	6	6
Factoring, simplifying fractions	7	7-9
Addition of like terms	8	8
Creation of parameters	9-10	10

How to play DragonBox^{edu}

DragonBox^{edu} lets the students learn algebra by using colorful and fun objects that are gradually replaced by numbers and mathematical expressions similar to equations on paper. Students should be encouraged to articulate what they observe because it enhances the learning process and they will acquire the vocabulary necessary to be cogent of their thinking.




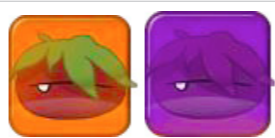
The goal of the game is to get "the dragon box" , representing the unknown 'x', alone on one side of the game board. The rules and strategies for solving each level are introduced one at a time throughout the chapters.

The games consists of a side A and B. On side A, the students learn the rules, while the levels on side B allow the students to practice what they have learned.

Side B also provides a way to connect the game with equations the students would solve on paper.

If the student chooses to restart a level, a lightbulb will appear in the top right corner. By clicking on the lightbulb, the student will get a short animation describing the solution for this level. The student can stop the animation at any time and go back to solve the equation again.

Grades are not used in the game, but the students collect stars as they play. If the students solves a level, they are awarded with a star. Solving it and simplifying will get the student another star. The last star is earned when you can successfully solve the puzzle and simplify the solution in a minimum number of moves.

Symbol	Meaning
	"The Dragon Box" represents the unknown 'x'. The goal of the game is to get the box alone on one side of the game board.
	"The Green Vortex" represents '0'.
	Example of how numbers are represented in the game.
	Example of cards with two sides which gradually will be replaced by numbers or letters

How to use DragonBox^{edu} in the classroom?

It is possible to work with DragonBox^{edu} by defining six learning blocks according to the curriculum:

- 1: Basic equation solving skills
(3 hours, worksheet 1a&1b)
- 2: Number factoring and signs
(2 hours, worksheet 2)
- 3: Parenthesis and distributive properties
(2 hours, worksheet 3)
- 4: Factoring and simplifying fractions
(2 hours)
- 5: Addition of like terms
(1 hour)
- 6: Creation of parameters
(2 hours, worksheet 6)

DragonBox^{edu} can also be used mainly as homework if the teachers chooses to do so, letting the students explore and play the game on their own.

If the game is used in the classroom, we suggest to divide the lectures into bolks of individual work and group work. Remember that is important to take 2-3 minutes break while playing the game.

We have made worksheets that can be used at school or as homework. These worksheets are important training for practicing the strategies and rules learned through DragonBox^{edu} while solving equations on paper.

In addition, we have created a document describing each rule with screenshots from the game as examples.

One of the advantages of using DragonBox^{edu} is that the teacher gets an overview of the progress and knowledge level for each student in their class and the possibility to customize their teaching accordingly with use of the reporting tool.

Teacher's task:

- Prepare all the necessary materials and equipment before class
- Make sure everyone has access to a PC/tablet and can log in to DragonBox^{edu}. The students must have a pencil and paper to be able to note down the different rules as they play the game
- Remind the students of the goal of DragonBox^{edu}, which is to get "the dragon box" alone on one side of the board
- Ask questions that will help the students put words to what they are learning. Remind them of the rules and to write these down as they go
- After each session: Is there anything that should be changed? What could be done differently? Did the whole class become engaged in the work?

Individual session: Let the students play the game for about 15 to 20 minutes. They can also work together with their neighbour. Remember to talk a small break afterwards.

Group session: The students gather around the blackboard/whiteboard for a 10 minute session where the students take turns at solving an equation in the game while explaining the strategy used. It is important that the student explain what they are doing in their own words so they remain focused on the strategies they use for each new rule. By explaining the rules in a group session, it will be possible to detect if the wrong strategies are used and many students will get a "light bulb moment" at this point. Let the students solve equations in groups until they have mastered the strategies.

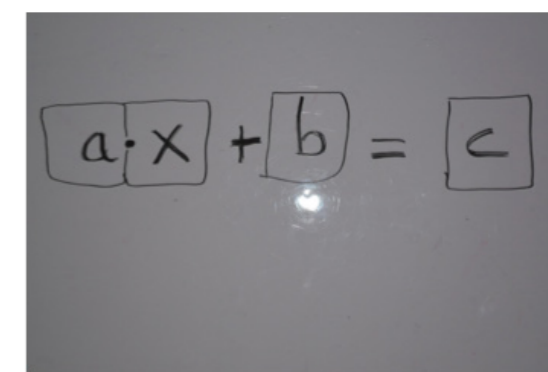
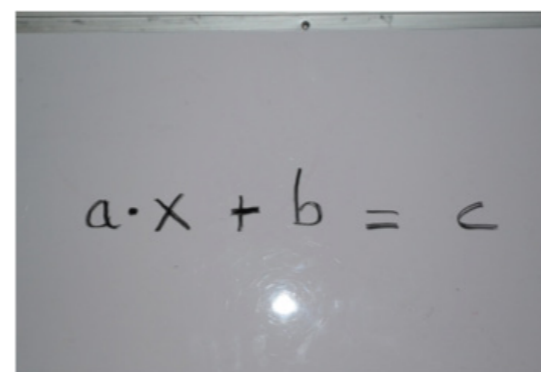
Homework: The teacher can distribute the worksheets as homework, then collect these for evaluation and go through some of the equations next math class.

How to use DragonBox^{edu} in the classroom?

From playing the game to solving equations on paper

In the last hour of part 1, the teacher can show the students on the blackboard how the strategies and rules learned in the game relate to solving equations on paper. Here are some tips on how the teacher can do this:

- The teacher can take out some examples from side B and solve equations on the blackboard
- When writing the equations on the blackboard, make enough space between each element in order to draw squares around them to resemble the cards in the game. In that way, the students would be able to associate between the strategies used in the games and equations on paper
- Solve the equations specifying the strategies and rules from the game. Use one new line for each change in the equation.
- The teacher should stress that operations have to be made on both sides of the equation.



The reporting tool

- gives the teachers an overview of how the class and each student progress while playing the game
- provides information on how far each student have come and how well they have solved the different levels
- the tool will reveal if any students have difficulties learning new rules and strategies, and the teacher can use this to customize the individual and group sessions

Algebra challenge:

Algebra Challenge is an event for all students in every age group where the goal is to solve as many equations as possible in a week. The first Algebra Challenge took place in Washington State, USA, and 4000 students participated playing the Challenge-version of DragonBox. Together they played 250 000 equations!

The challenge gives an unique opportunity to learn and master algebra and all schools can be invited to participate.

For more information on Algebra Challenge, take a look at the web page <http://algebrachallenge.org> or contact us at contact@algebrachallenge.org