

Programming with Emil in Lower Primary Years: Workshop Part 1 for Year 3, Part 2 for Year 4

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1 Part 1: Year 3

Drawing on our previous experience in developing programming environments for schools and our recent exceptional opportunity to work in the ScratchMaths team, we concluded that securing *sustainable computing education for every learner* requires **paying much closer attention to lower primary years** and providing teachers with systematic support and complex teaching/learning content.



Figure 1. A learner has built a plan (see it in the panel above the stage) for Emil to pick some mushrooms and turn the light off in the blue house. When woken up, Emil will run the plan.

Thus, in 2017 we launched a long-term project Computing with Emil, with an ambition to gradually provide all primary years with new software environments, teachers' and pupils' materials and corresponding professional development sessions, based on design research approach. We run all developments in close collaboration with our *design primary schools*. We strive to facilitate **holistic learning process for computing education for all**, borrowing from modern mathematics education, genetic epistemology and social constructivism.

Main design principles of our pedagogy include: pupils always work in pairs, discuss, solve problems and learn together; they regularly meet in common whole group

discussions carefully scaffolded by their teacher – a **generalist primary teacher**; original software environment does not provide learners with any kind of feedback – pupils themselves are expected to conclude (and justify in the discussions) whether their strategy or solution is correct or not; however, many problems and tasks have no solution, or have multiple solutions, or sometime even ‘unclear’ solutions to be negotiated in discussions; software environment itself is useless without accompanying paper worksheets and vice versa, thus providing multiple representations of the problems and requiring pupils to transfer their thinking between those; ‘wrong’ solutions are considered important catalyst for learning; we strive to build the learning process on intrinsic motivation of the learners. Intervention for Year 3 is currently being used in more than 200 schools in Slovakia, Cech Republic and Norway, and is planned for around 16 lessons. In this hands-on workshop participants will solve and discuss some of the tasks of the three worlds of Emil for Year 3 (i.e. for pupils around 8 to 9 years of age). They will experience our approach when we try to identify basic computational concepts and break them into natural progressions of what we call *pre-concepts*, so that no explicit or direct lecturing is needed at all. Instead, each group of tasks brings in (usually one) new option or functionality or constraint – to be discovered by the pupils, adopted, used, and validated in hands-on activities and continuous discussions.

2 Part 2: Year 4

This will be a sequel to our Programming with Emil in Year 3 workshop (see section 1 for the background and motivation). With Emil for Year 4 intervention we provide schools with another step of systematic support to develop computational thinking (again with the focus on programming) for every learner. The intervention for Year 4 requires around 16 lessons.

Applying the same pedagogy and design principles as with Emil for Year 3, we decided to bridge lower primary elements of programming with Scratch, which we consider productive descendant of Logo philosophy and legacy, and very good follow-up of Emil.

In the world of Emil for Year 4 pupils progressively undertake key transition from ‘absolute frame’ navigation to relative one in the turtle geometry style – within a virtual programming environment (in contrast to relative navigation in the physical world of programmable toys like Blue-Bots etc. where body syntonicity makes such navigation rather natural).

In this new world, some basic commands have ‘parameters’ (like filling a closed area with a colour, setting pen colour or setting pen width). We also take further steps in the thread of developing the concept of procedures (which has already been initiated in the third world of Emil for Year 3).

In this hands-on workshop participants will solve and discuss some of the tasks of Emil for Year 4 (i.e. for pupils around 9 to 10 years of age). They will experience our approach when we try to identify basic computational concepts and break them into natural progressions of what we call ‘pre-concepts’, so that no explicit lecturing is needed in the class at all. Instead, each group of tasks brings in (usually one) new option

or functionality or constraint – to be discovered by the pupils, adopted, exploited, and validated in continuous collaboration and discussions.

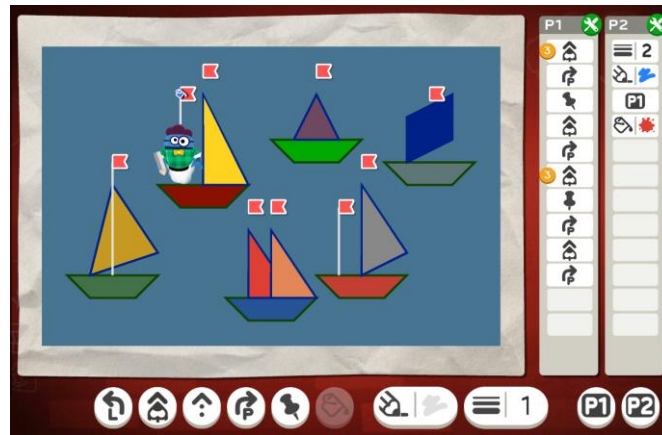


Figure 2. In Year 4 Emil gradually provides the learners with more and more simplified Logo-style commands for basic ‘turtle drawings’. In this task pupils work also with two ‘memories’ P1 and P2 – a pre-concept to procedures. For our learners, transformation to Scratch will then be smooth and straightforward.

In the workshop we will also discuss whether our method gives space to constructionist learning, in spite of the fact that the learning process is organized in gradations of (mostly predefined) tasks. In Emil for Year 4 however we take another step towards open programming language.

3 Technical Information for Organisers

The audience for our workshop(s) are primary teachers with no prior computing or programming experience, educators, or researchers – anybody interested in supporting the systematic development of early computational and algorithmic thinking (with the clear focus on programming) at the lower level of primary schools.

This will be an online hands-on practical workshop where participants will play the role of the learners and supported by the lecturers will solve and discuss some selected tasks from the educational interventions (content) of Emil 3 and Emil 4. The maximum number of participants is between 20 and 24.

Depending on the decision of the PC and the organizers, it can be run as one workshop (just Part 1, covering then only educational content for Year 3, taking e.g. 60 minutes – depending on the PC decision), or two workshops (Part 1 for Year 3, taking e.g. 60 minutes, and Part 2, taking another 60 minutes). If the PC decides to accept both Parts, we recommend that Part 2 is visited only by participants that have already taken Part 1 or are already familiar with the method of Emil and the content for Year 3.

Depending on the conditions, we can run the workshop(s) online or face to face, if we are physically present in the conference.

If it is run online, we will provide each participant with several sample pages of the workbooks. The participants will be present via Google Meet online event created by us in advance and they will also be provided a temporary access to both apps Emil 3 and Emil 4 to be run in their browser.

If the workshop is run face to face, we will bring our own set of tablets for the participants; participants will work in pairs and we will provide them with some sample worksheets for pupils. Thus maximum number of attendees will be 20 to 24. We will need a standard 'school' room with a data projector, we will use our own laptop.