Pros and Cons of Asking Students to do their own GeoGebra Constructions

The Seventh Nordic GeoGebra Conference

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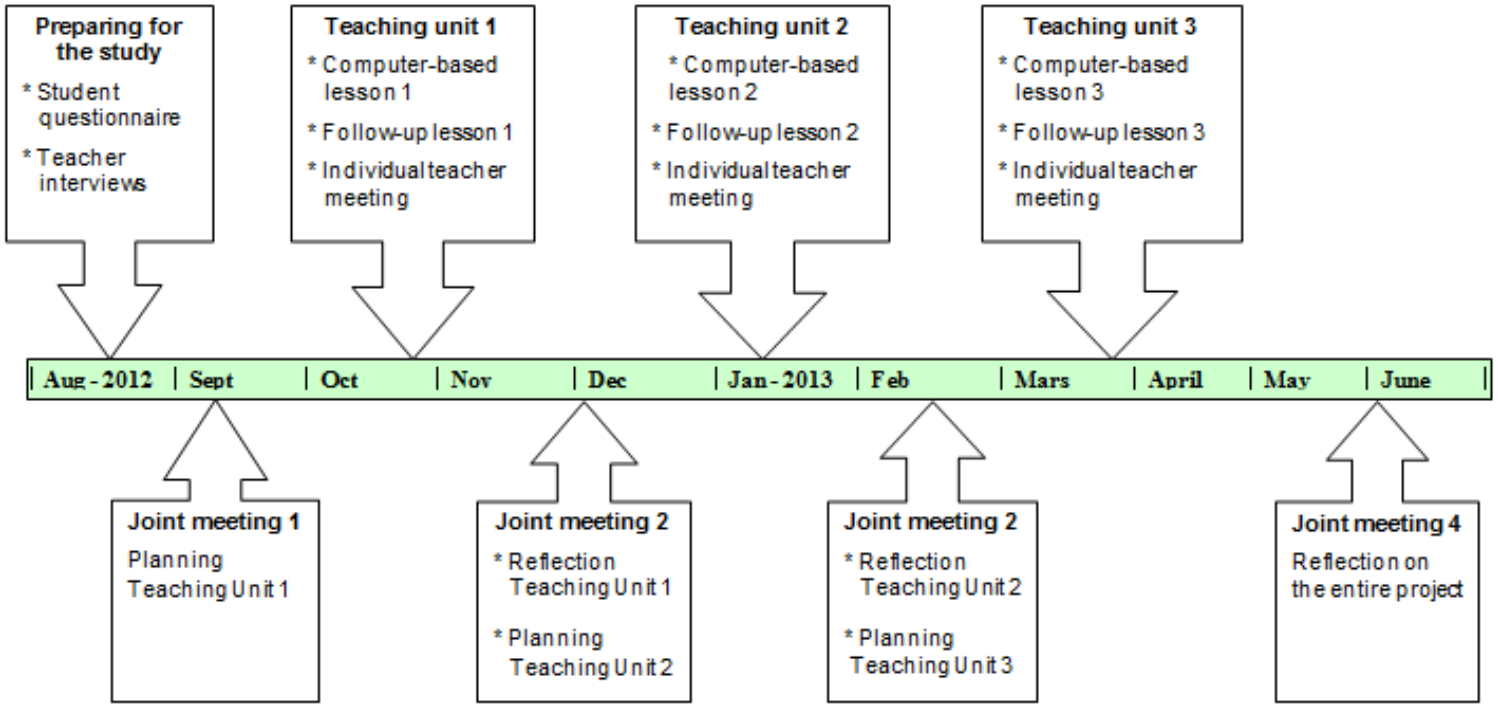
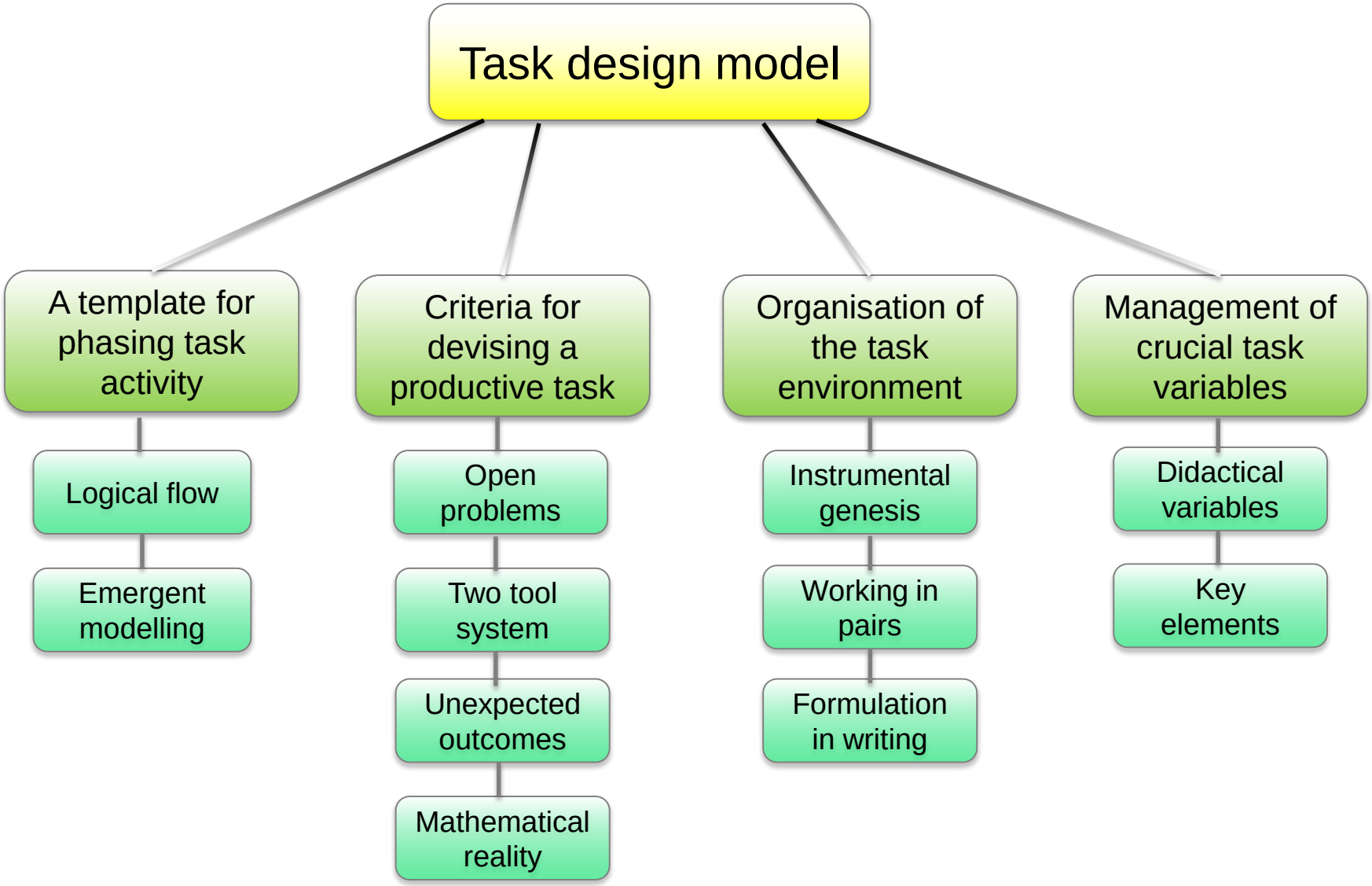
A Task Developing Research Project

The aim of the project

Investigate aspects of the design of classroom mathematical tasks which make use of dynamic software environments

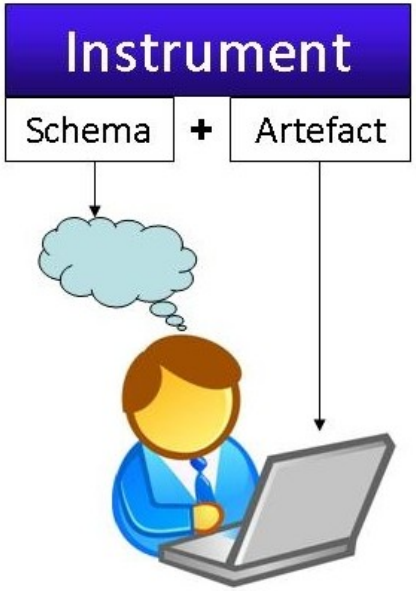
Research design

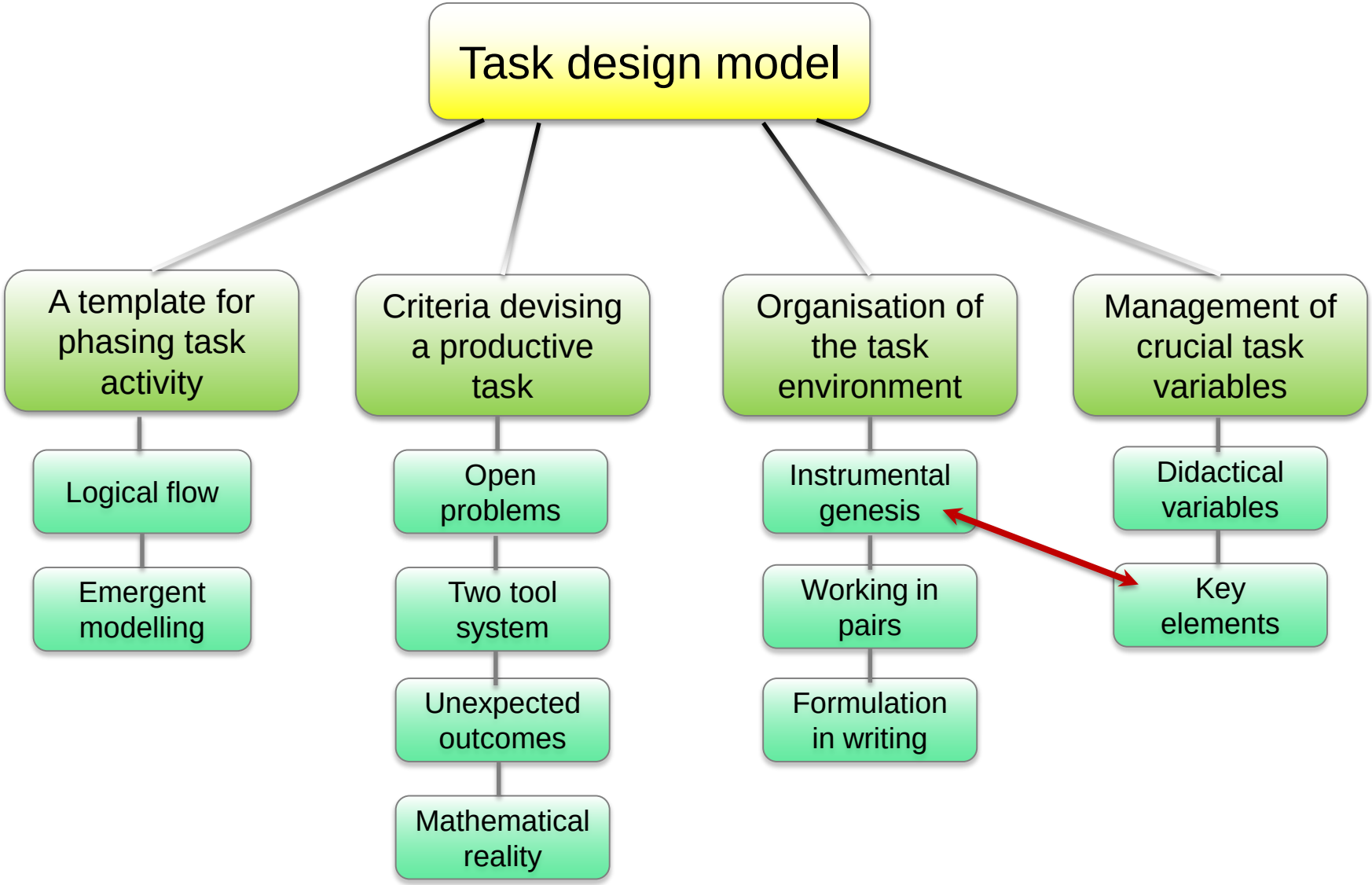



Task design model
A template for phasing task activity
Logical flow
Emergent modelling
Criteria for devising a productive task
Open problems
Two tool system
Unexpected outcomes
Mathematical reality
Organisation of the task environment
Instrumental genesis
Working in pairs
Formulation in writing
Management of crucial task variables
Didactical variables
Key elements

Instrumental genesis

The process in which an artefact becomes an instrument for a user.

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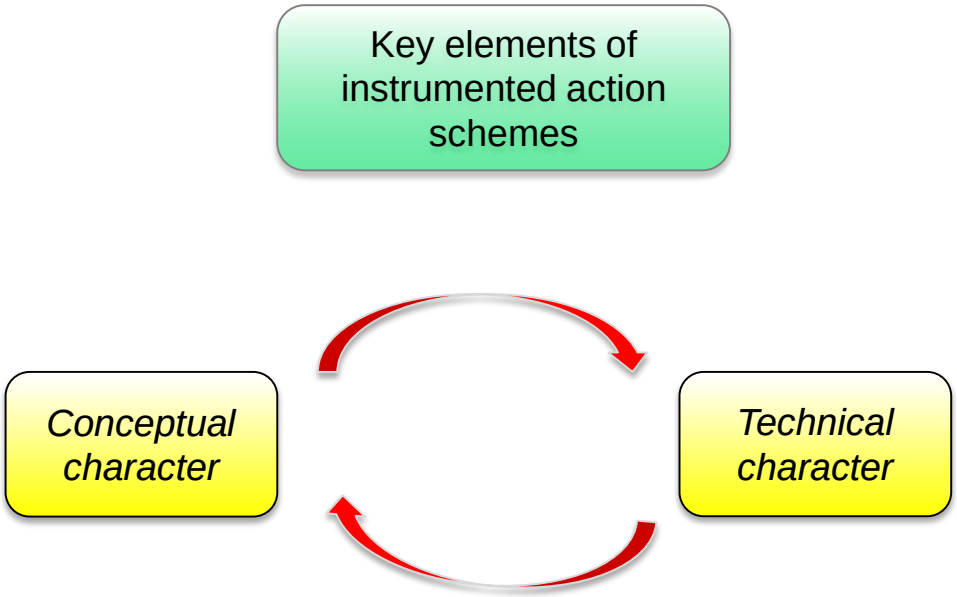

Key elements of instrumented action schemes
Conceptual character
Technical character

Exponential functions

We are now going to study different kinds of *exponential functions*. First, we will repeat one example of exponential growth that we have studied earlier: "How does a sunflower grow?" This example was about a sunflower that was 50 cm when it was measured for the first time (June 1) and grows so that it becomes 30 % longer each week

This means that the length (in cm) of the sunflower is:

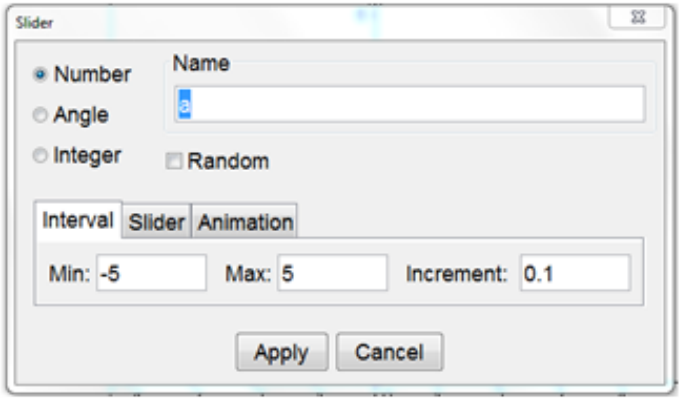
after 1 week: $50 \cdot 1.3$ (the growth factor is 1.3)
after 2 weeks: $50 \cdot 1.3^2$
after x weeks: $50 \cdot 1.3^x$

The *formula* describing the length of the sunflower (y cm) as a function of time (x weeks) is therefore: $y = 50 \cdot 1.3^x$ (or $f(x) = 50 \cdot 1.3^x$)

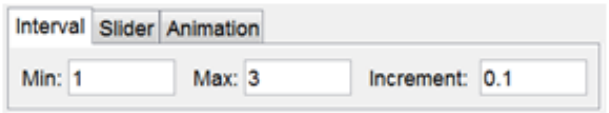
Another sunflower with the starting length 70 cm (June 1) grows so that it becomes 20% longer each week. The formula describing the growth of this sunflower is
$y = 70 \cdot 1.2^x$ (or $f(x) = 70 \cdot 1.2^x$).

Now we will use the "**Slider tool**" in *GeoGebra* to make it easy to change the starting length (June 1) and the growth factor.

- Right-click in the Graphics View and mark *Grid*.
- Move the coordinate system so that the origin is located in the bottom left corner. Use  .
- Choose the "**Slider tool**":  and click somewhere in the Graphics View. The following box will appear:



- Change "Min", "Max", and "Increment" as follows:



- Create one more slider, BUT change the name to C,and change "Min", "Max", and "Increment" as follows:

Insert the formula $f(x) = C \cdot a^x$: Input: **f(x)=C*a^x**

1. a) Which values should be used on the sliders C and a to get the graph of the sunflower that is 50 cm June 1 and that is growing in length with 30 % each week?

C = _____ a = _____ And the formula is: _____

Use the values you chose above to set the sliders C and a!

7. The value of a car drops from 100 000 SEK to 50 000 SEK in two years. What is the annual decrease in percentage if the value of the car is decreasing exponentially?

   Use *GeoGebra* to solve this problem (by finding appropriate values of the sliders).

Tip! The increment of the slider *a* could be changed to 0.01 to get a more accurate value.

To summarize, there are both pros and cons

Prons

- Students' lack of conceptual knowledge can be visible
- Students can use GeoGebra in new situations e.g. to explore, verify and generalize
- Making constructions require and consolidate conceptual knowledge and foster mathematical reasoning

Cons

- Technical obstacles can hinder
- Technical aspects overshadow mathematical aspects
- Takes time

Thank you for your attention!