AuthOMath :

Towards a didactic concept for designing digital interactive tasks with automatic answer based feedback

Guido Pinkernell ∘ Pädagogische Hochschule Heidelberg
ICTMT Athens ∘ June 2023

AuthOMath

Authoring Online Material with
Multimodal, Dynamic
and Interactive Applets
and Automated Feedback
for Learning Math

www.authomath.org
mathebruecke.pinkernell.online

The creation of these resources has been (partially) funded by the ERASMUS+ grant program of the European Union under grant No. 2021-1-DE01-KA220-HED-000032031. Neither the European Commission nor the project's national funding agency DAAD are responsible for the content or liable for any losses or damage resulting of the use of these resources.

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AuTo

- a moodle based authoring tool
  for randomized interactive and dynamic
  multimodal mathematical tasks
  with automatic adaptive feedback

  which basically means to

  extend STACK to facilitate
  the implementation of
  GeoGebra applets into
  task and feedback

DiCo

- a didactical concept
  for designing online based
  interactive learning material
  for use in mathematics teacher
  education

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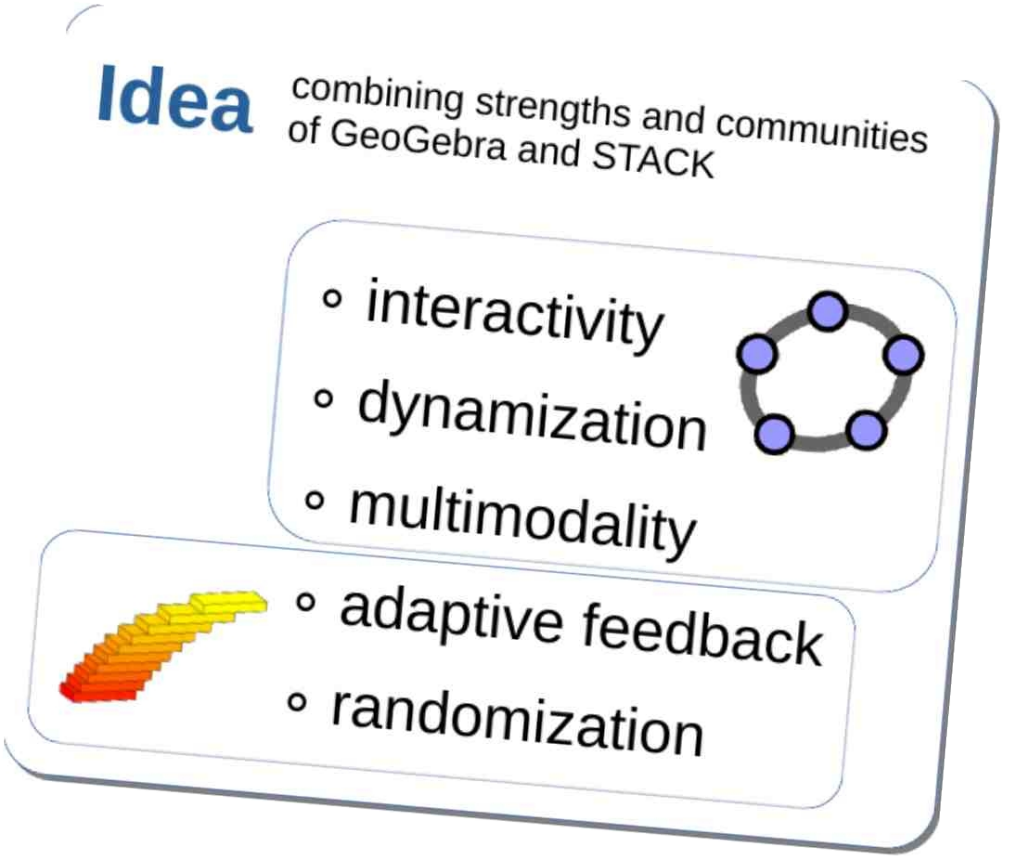
towards a didactic concept

...in teacher education:

technical advances
resulting from combining
GeoGebra and STACK
initiate
didactic reflection



towards a didactic concept

1. **how to address the learning object**
2. how to address learners
3. how to use media

- mathematical analysis:

  “do research on
  how to address the object of learning
  such that it supports
  mastery and understanding”

  focus on:

  - relevant definitions and terminology
  - mathematically valid explanatory models (aka basic ideas, “Grundvorstellungen”)
  - specific representations, strategies, and applications

Pinkernell (2019): Conceptualising knowledge of mathematical concepts or procedures ∘ vom Hofe & Blum (2016): “Grundvorstellungen” as a Category of Subject-Matter Didactics

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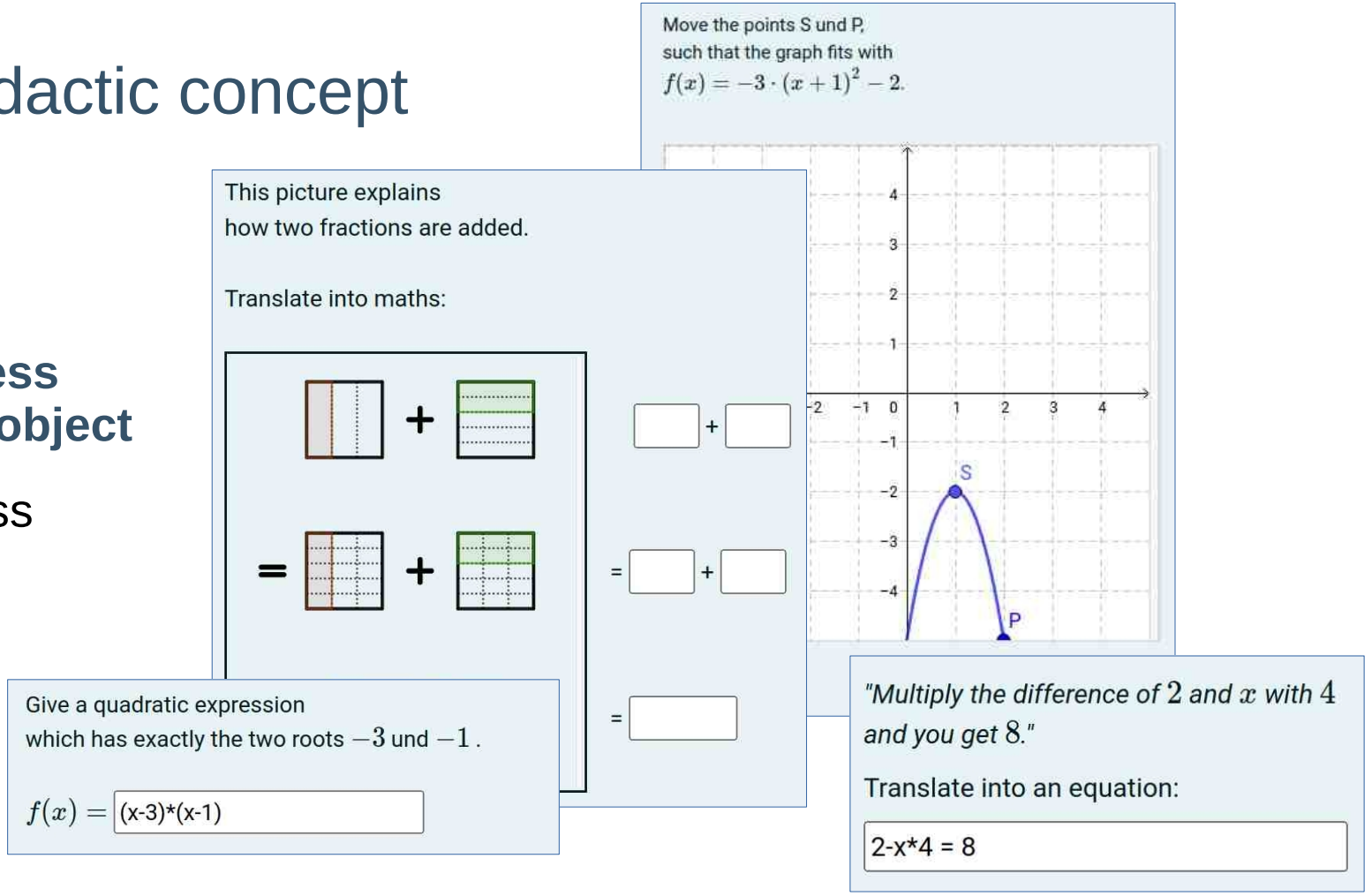

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- didactic perspective:

  “do research on
  how learners actually do access
  the object of learning
  (correctly or wrongly)”

  focus on

  - as novices or experts in the topic,
    as low or high achievers in general
  - individual conceptions,
    misconceptions,
    systematic errors
  - range of
    possible solving strategies

Pinkernell (2019): Conceptualising knowledge of mathematical concepts or procedures ∘ Prediger (2008): Discontinuities for mental models - A source for difficulties with the multiplication of fractions ∘ Rittle-Johnson & Star (2009). Compared with what? The effects of different comparisons on conceptual knowledge and procedural flexibility for equation solving

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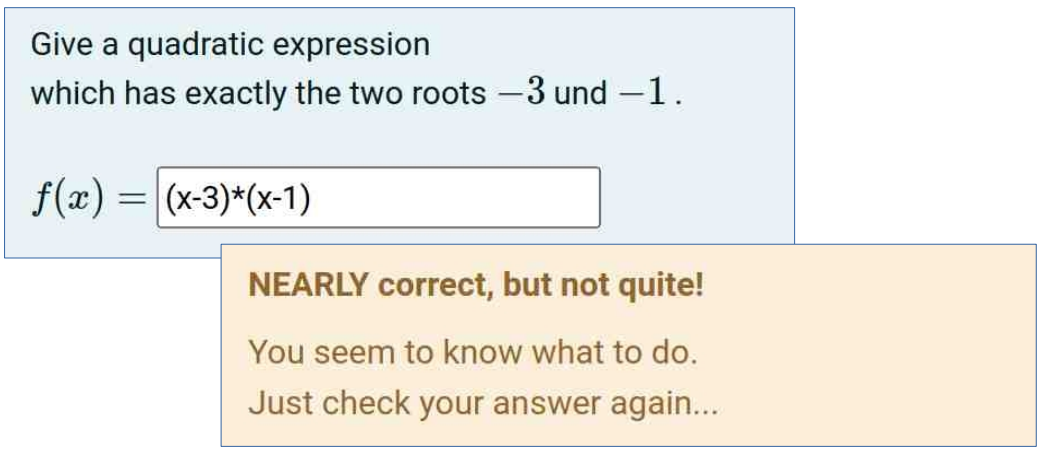

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- media perspective:

  “now decide on the use and structure of textual and pictorial elements of task and feedback area”

  focus on

  - how to use language
  - how to use static, dynamic, interactive elements
  - how to structure task and feedback

Yerushalmy (2005): Functions of Interactive Visual Representations ◦ Duval (1999): Representation, Vision and Visualization ◦ Pinkernell, G., Diego Mantecón, J. M., Lavicza, Z., Sangwin, C. (2023): AuthOMath: Combining the strengths of STACK and GeoGebra

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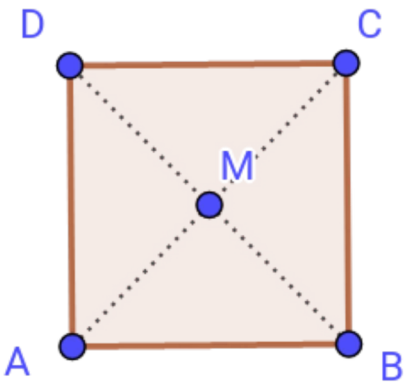

This is not a square.

Move points
to explore the range of appearances,
and then decide
what this quadrangle really is.

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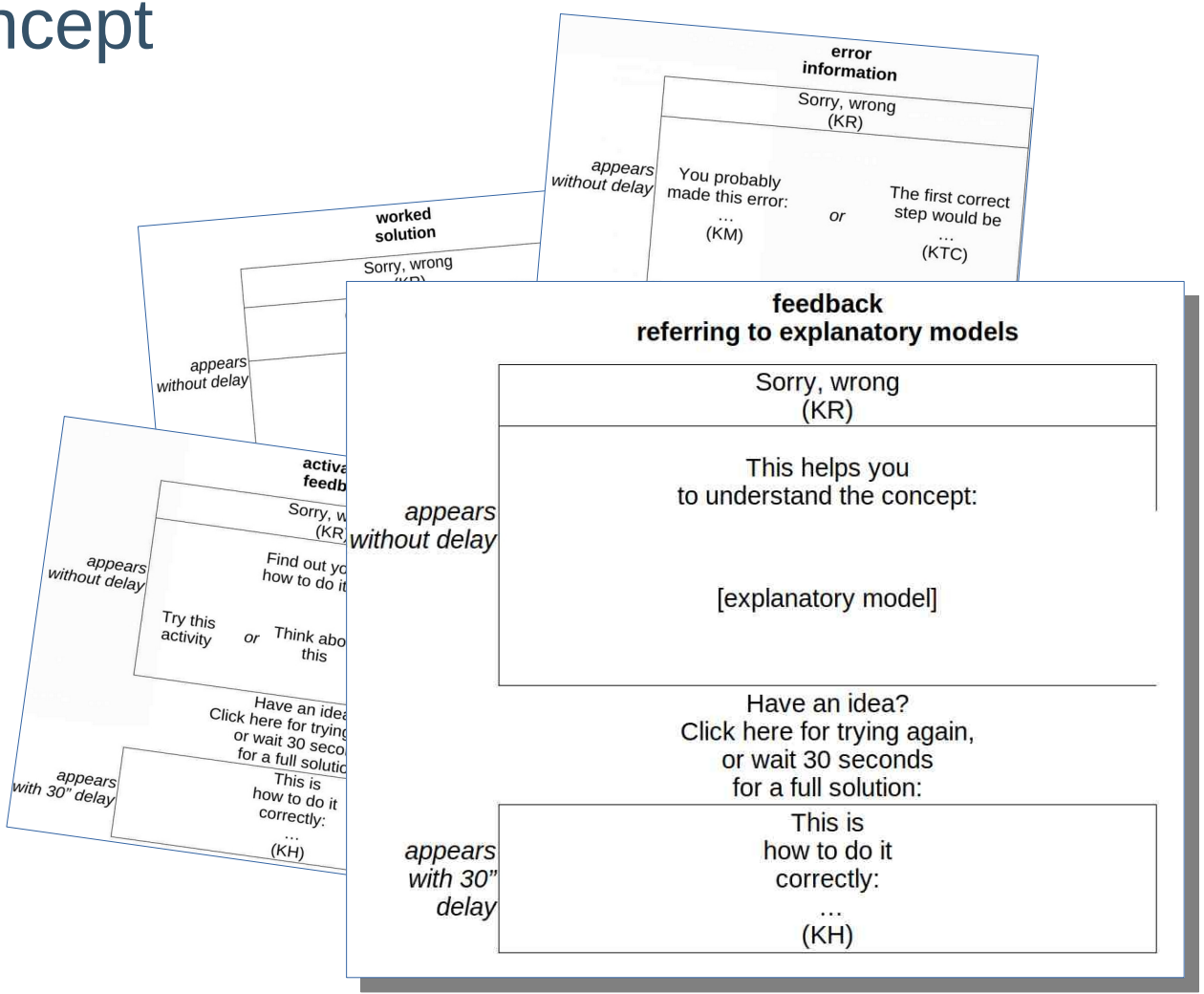

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open questions

1. clarify relation between
   the product of digital task design and
   the process of digital task design
2. clarify the objective of task design activity in teacher education
   as creating a product or
   as doing didactic reflection for creating a product
3. how to adapt the didactic concept
   presently structured into 3 perspectives on activity planning
   to real life processes of task design

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