Integrating Design Thinking in Teacher Education

Teacher students develop learning scenarios for elementary schools

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Framework and Research Question

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Interdisciplinary PhD project at the University of Education, Freiburg and Reutlingen University, Baden-Württemberg (BW), Germany

In cooperation with

Hochschule Reutlingen
Reutlingen University

To what extent can a teaching method based on Design Thinking foster

- Creativity
- Problem-solving skills
- Collaborative work

in 3rd and 4th grade of elementary schools?

in the Subjects

- Art/Crafts i.e.in German: *Kunst/Werken*
- General Science & Social Studies (GS&SS)
  i.e. in German: *Sachunterricht,* related to STEM education, biology, history and everyday culture

This project is funded by the State Ministry for Sciences, Research and Arts.

Baden-Württemberg
MINISTERIUM FÜR WISSENSCHAFT, FORSCHUNG UND KUNST

Creativity, Problem-solving Skills and Collaborative Work

as competences for the 21st century

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- Creativity, problem-solving skills and collaborative work as key competences in order to master the challenges of the 21st century (Kay and Greenhill 2011; OECD 2017).
- Requirement of the perspective and expertise of interdisciplinary teams, the ability to think in a networked way and to work on joint solutions (Kay & Greenhill (2011).
- Creativity as the ability of a person to produce new ideas and to deal with them in a goal-oriented manner (Drevdahl 1956).
- Creativity can be regarded as a special form of problem-solving ability and therefore can be significant for the learning success at school (Theurer, Berner and Lipowski 2012).

Decrease of creativity in children

and lack of diagnostic competence of teachers

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- Creativity decreases in the course of children's school career (Berner 2018).
- Teachers often feel insecure about how to guide collaborative learning in classroom. Possibly because they are missing the capability to perceive goal-oriented interactions between children (Kaendler, Wiedmann, Leuders, Rummel, and Spada 2016).
- In the design process, communication between the team members in finding a solution is an important part of achieving a common result (Meinel, Weinberg & Krohn, 2015).
- Design Thinking offers the opportunity to encourage creative thinking and acting through its collaborative and interdisciplinary approach (Brown 2009).

International studies on Design Thinking

at secondary level

Studies conducted in the United States, Germany and Asia show promising results. (Goldman, Britos, Koh, Royalty and Hornstein 2010; Scheer, Noweski and Meinel 2012; Koh, Chai, Wong and Hong 2015).

- More sustainable learning success for children by applying creative and collaborative elements.
- Greater satisfaction for educators while teaching their subject matter.
- Design Thinking promotes collaborative work among children and the ability of teachers to better evaluate learning outcomes.

Design Thinking at elementary level in Germany

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- Worldwide, the Design Thinking approach has been little explored at elementary level (Lor 2017).
- Revision of Baden-Württemberg (BW) education plans in 2016
  → Introduction of content- and process-related competences.
- → Basis for research interest

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Congruence of process-related competences and DT process

Concerning Art/Crafts and GS&SS in the current BW educational plan

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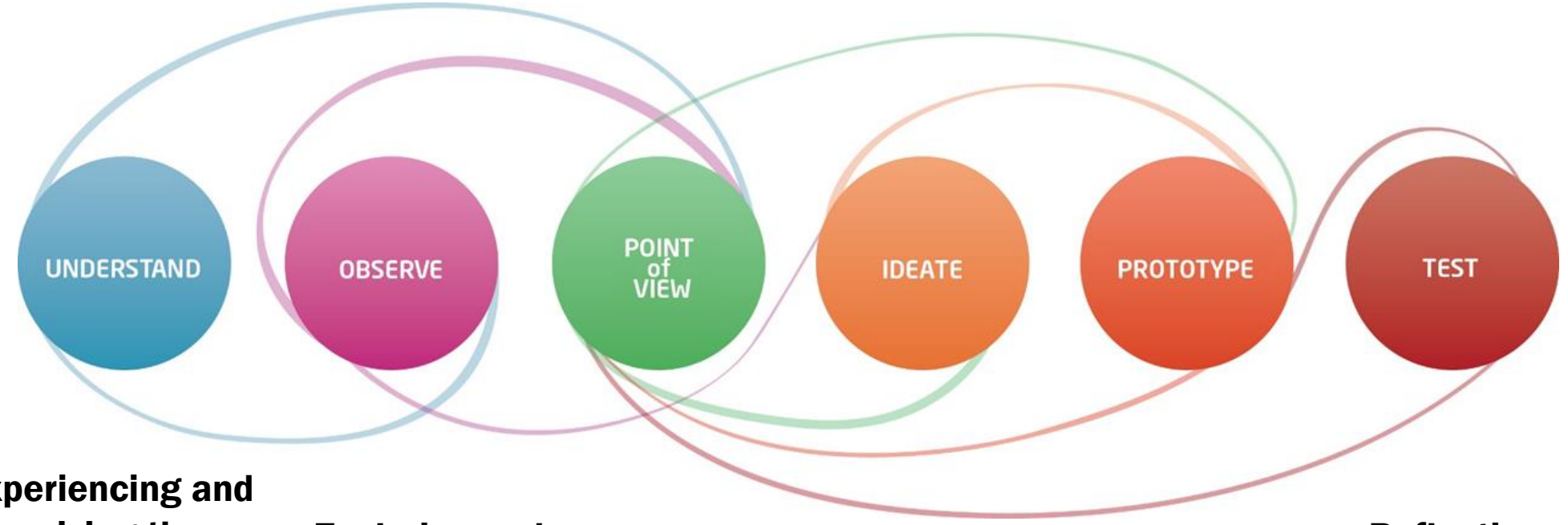

Experiencing and perceiving the world

Exploring and understanding the world

Communicating and making yourself understood

Acting in the world – shaping the world

Reflecting and positioning yourself

Ministerium für Kultus, Jugend und Sport Baden-Württemberg, 2016

Preliminary studies in advance of the students' seminar

according to the Design Based Research Approach (DBRC 2003; Reinmann 2005)

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- Jun to Oct 2018: Survey on the knowledge of design and design thinking of BW teachers and their motivation to promote creativity in classroom.
- Oct 2018: 1st pilot study at an elementary school in 3rd grade
- Nov 2018: BW-wide DT workshop with teacher trainers with subsequent questionnaire survey
- Feb 2019: DT workshop with students, teachers, and teacher trainers as part of the international symposium "Creative Methods in Art and Design", Basel, Switzerland,
- Mar 2019: 2nd pilot study at an elementary school in 3rd grade
- May to Jul 2019: **Interdisciplinary seminar: Teacher students develop TUs by using DT**

Results of our preliminary studies

with teachers, teacher trainers and children of 3rd grade (Högsdal & Grundmeier 2019)

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Surveys after workshops with teachers and trainers:

- Open-mindedness towards the Design Thinking approach by teachers and teacher trainers
- High potential for the application of Design Thinking in classroom.

Pilot studies with children in 3rd grade:

- Process and principles of DT enable children to achieve a goal-oriented form of independent learning and creative problem-solving.
- Children stated to appreciate working in teams and to develop ideas on their own without the teacher's instructions.

Conclusion:

- Need to provide teachers with a solid understanding of Design Thinking, which enables them to apply it in a self-sufficient way.

Interdisciplinary seminar with 17 teacher students

for different elementary school subjects

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- Conducted in summer term 2019 at the University of Education Freiburg
- Carried out in six half days within three block weekends, stretched over three months, Mai to July
- The participants studied different subjects for elementary school education, that made it possible to let them work in interdisciplinary teams.




Announcement and learning goals of the seminar

Design Thinking – a new method for the subjects Art/Crafts and GS&SS?

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How do designers actually work and what can we learn from them in terms of designing our own Learning Scenarios?

- Getting to know the Design Thinking process and go through it.
- Applying methods and tools that are relevant for the respective process phases.
- Developing ideas for own teaching-learning concepts for Art/Crafts and GS&SS.
- Building prototypes for Learning Scenarios by using the objectives of Education for Sustainable Development (ESD) according to the BW education plan.

Design sprint of d.school's K12 Lab

as a framework of the seminar

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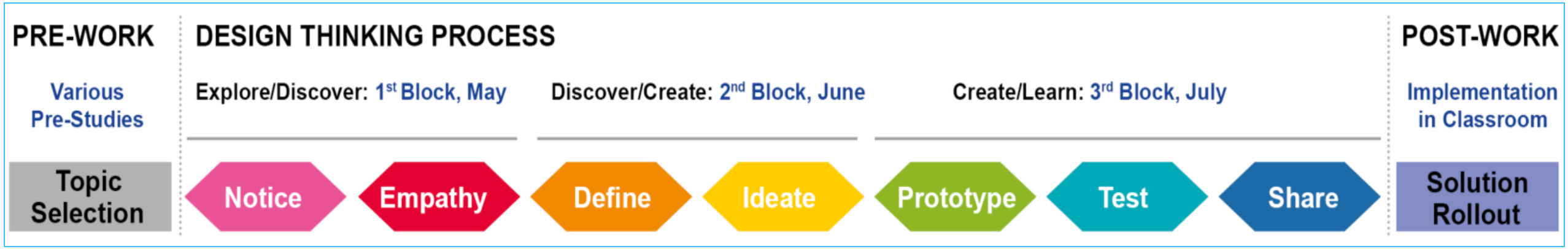
Source: Högsdal 2020 according to d.school (2019)



- Notice of Expectations and Biases
- Getting Empathy with Design Thinking by different Exercises

- Discovering the needs of different target groups
- Defining Point of Views
- Creating first ideas for Learning Scenarios

- Ideate and Prototype of Learning Scenarios
- Presentation and getting Feedback
- Share Learning Experiences and Conclusions for future work as teachers

1st Block: Theoretical introduction to DT and exercises

18 and 19 May

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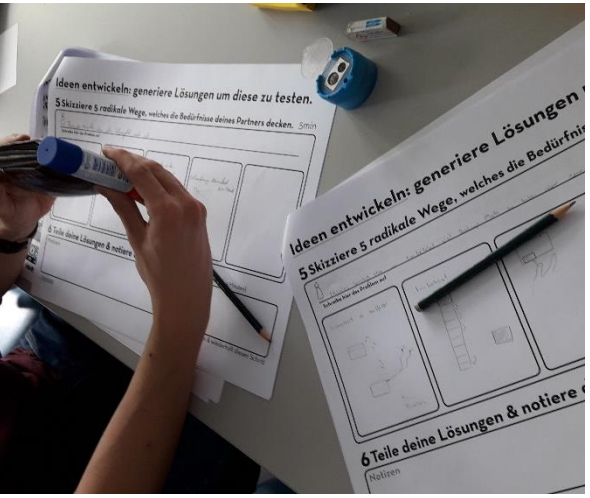
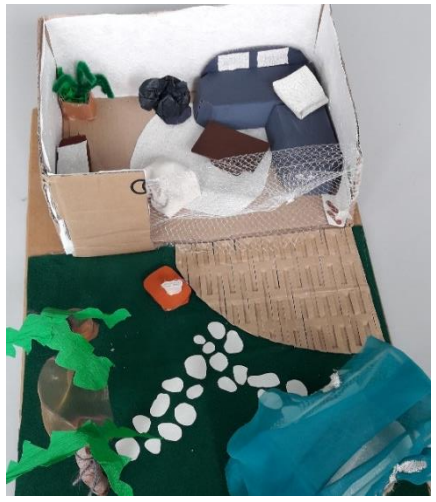
- Exercise *Wallet Project* by d.school
- Theoretical input about anchoring and congruence of DT elements in the BW education plan
- Exercise *The perfect Reading Place,* which was the challenge in our pre-studies
- Homework: Reflection of student's own teaching experiences and preparation of a presentation about





2nd Block, Focus on Empathy for Users and their Needs

28 and 29 June

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- Presentation of homework: Personal teaching experience
- User centered design approach → analysis of target groups and user requirements → Like in school teachers and children are the users of Learning Scenarios
- Elaboration of Personas, Empathy maps, and Mood boards → presentation
- Research on guidelines of Education for Sustainable Development (ESD) in the BW education plan
- In Teams: elaboration of first ideas for Learning Scenarios two for Art/Crafts and two for GS&SS

3rd Block, Focus on designing Learning Scenarios & Prototypes

12 and 13 July

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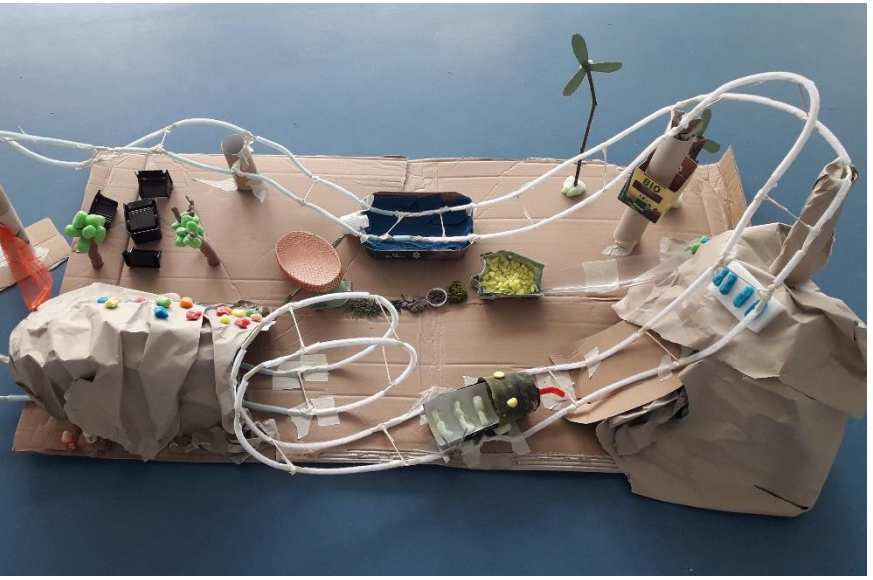
- Presentation of ideas for topics and progress charts for four different Learning Scenarios
  → Receiving feedback from the whole group
- Completion of the Learning Scenarios and construction of prototypes
- Final presentation of Prototypes for four Learning Scenarios
- Group discussion about individual learning processes and potentials of Design Thinking, participation at an anonymous questionnaire survey



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1st Learning Scenario for GS&SS

according to the requirements of the BW education plan

Thematic areas:

- Animals and plants in their habitats
- Importance of natural resources
- Different insect species and their respective habitats

Aspects of ESD:

- Importance of sustainable development
- Awareness of its complexity, dynamics, and threats
- Use of natural materials for construction of prototypes

Social skills to be acquired:

- Mutual support in handling materials and tools
- Team coordination in decision-making situations

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“Flat-sharing community“ for Insects

Prototype of the 1st learning scenario for GS & SS

- Children work in teams to build spaces for different species of insects.
- These spaces are put together to a whole building.
- Installation on the campus thus visible for other children, teachers and parents
- Sensitivity and awareness for the habitat of insects and their requirements
- Distribution of student‘s expertise within the team:

EC & H*	English
EC & H*	German
German	EC & H*
German	History
German	PRE**

* Everyday Culture & Health, ** Protestant Religious Education

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2nd Learning scenario for GS&SS

according to the requirements of the BW education plan

Thematic areas:

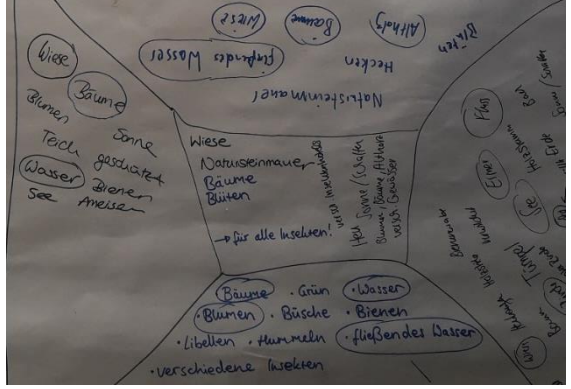
- Importance of natural resources for humans, animals, and plants
- Knowledge of insect species and their usefulness for bats

Aspects of ESD:

- Significance and threats to sustainable development, its complexity and dynamics
- Criteria for actions that promote and inhibit sustainability
- Reflection on environmental pollution and its effects
- Reflection on dealing with natural resources in general

Social skills to be acquired:

- Working together as a team
- Empathy for the requirements of animals in their habitats



„Biotope for Batman“

Prototype of the 2nd learning scenario for GS & SS

- Children build a habitat as a functioning ecosystem for bats and insects.
- Different teams work on different parts of the ecosystem such as watercourses, protected areas, food sources.
- Distribution of student‘s expertise within the team:

EC & H	History
German	EC & H
German	EC & H
German	EC & H

1st learning scenario for Art/Crafts:

according to the requirements of the BW education plan

Thematic areas:

- Architecture, Building Design, Mobility
- Living in different cultures
- Various types of housing according to the residents' requirements

Aspects of ESD:

- Waste of paper, plastic and textiles as working materials
- Creating awareness of sustainability by up-cycling of useless things

Social skills to be acquired:

- Values and norms in decision-making situations
- Tolerance and openness for different requirements
- Participation, involvement, co-determination

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„Dream House“

Prototype of the 1st learning scenario for Art/Crafts

- A building with a triple function:
  house, boat and flying object
- Children work in teams on different "rooms",
- In the end these rooms are put together to a whole building
- This way the different requirements of the inhabitants are respected and combined.
- Distribution of student‘s expertise within the team:

Mathematics	Art
Mathematics	EC & H
Art	EC & H
German	Biology

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2nd Learning scenario for Art/Crafts

according to the requirements of the BW education plan

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Thematic areas:

- Different forms of renewable energy
- Different forms of mobility and drive

Aspects of ESD

- Remains of paper, plastic and textiles as working materials
- Sustainable design of one's own living environment

Social skills to be acquired:

- Awareness of own thoughts and experiences
- Communicate own experiences and interests and at the same time being able to perceive those of others.
- Reflect and respond to basic feedback.

„Roller Coaster driven by sustainable energy“

Prototype of the 2nd learning scenario for Art/Crafts

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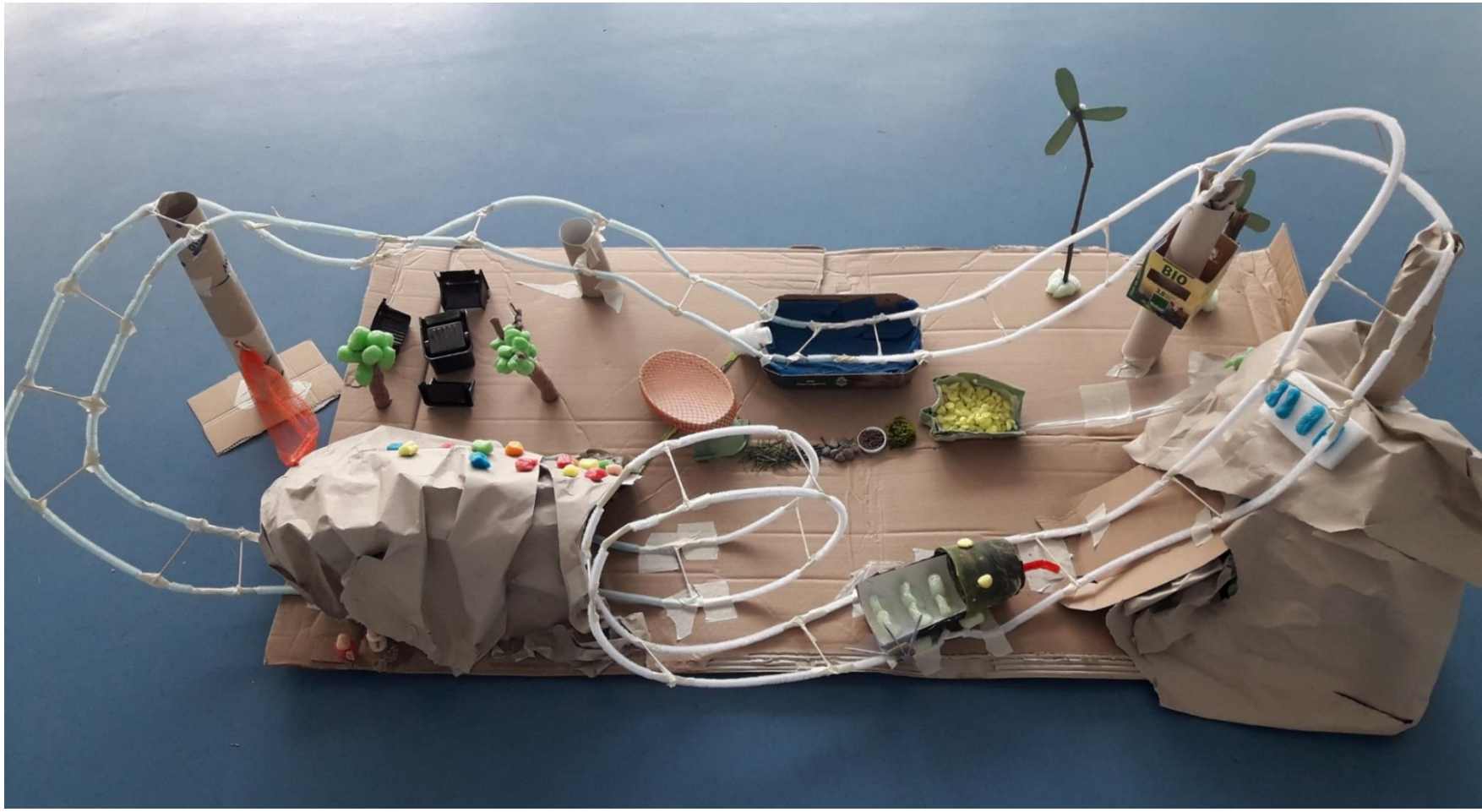
- Children build different roller coasters in teams.
- These are driven both by renewable energies and by fictitious forms of energy.
- Goal: Awareness for sustainability through fun
- Distribution of student‘s expertise within the team:

German	Economy
German	Art
Mathematics	Art
EC & H	Sports



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Group Discussion and Questionnaire Survey

on the Potentials of Design Thinking in elementary classroom, participants n = 17

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- Statements were recorded with an audio device, transcribed and evaluated by qualitative content analysis (Kuckartz 2016).
- Benefits for Teachers
  - *Preparation of lessons*
  - *Meaningful structure during the lessons*
- Benefits for Children
  - *Fostering collaborative work*
  - *Strengthening will, motivation, and self-expression*
  - *Fostering independent work*
  - *Improving learning methods*

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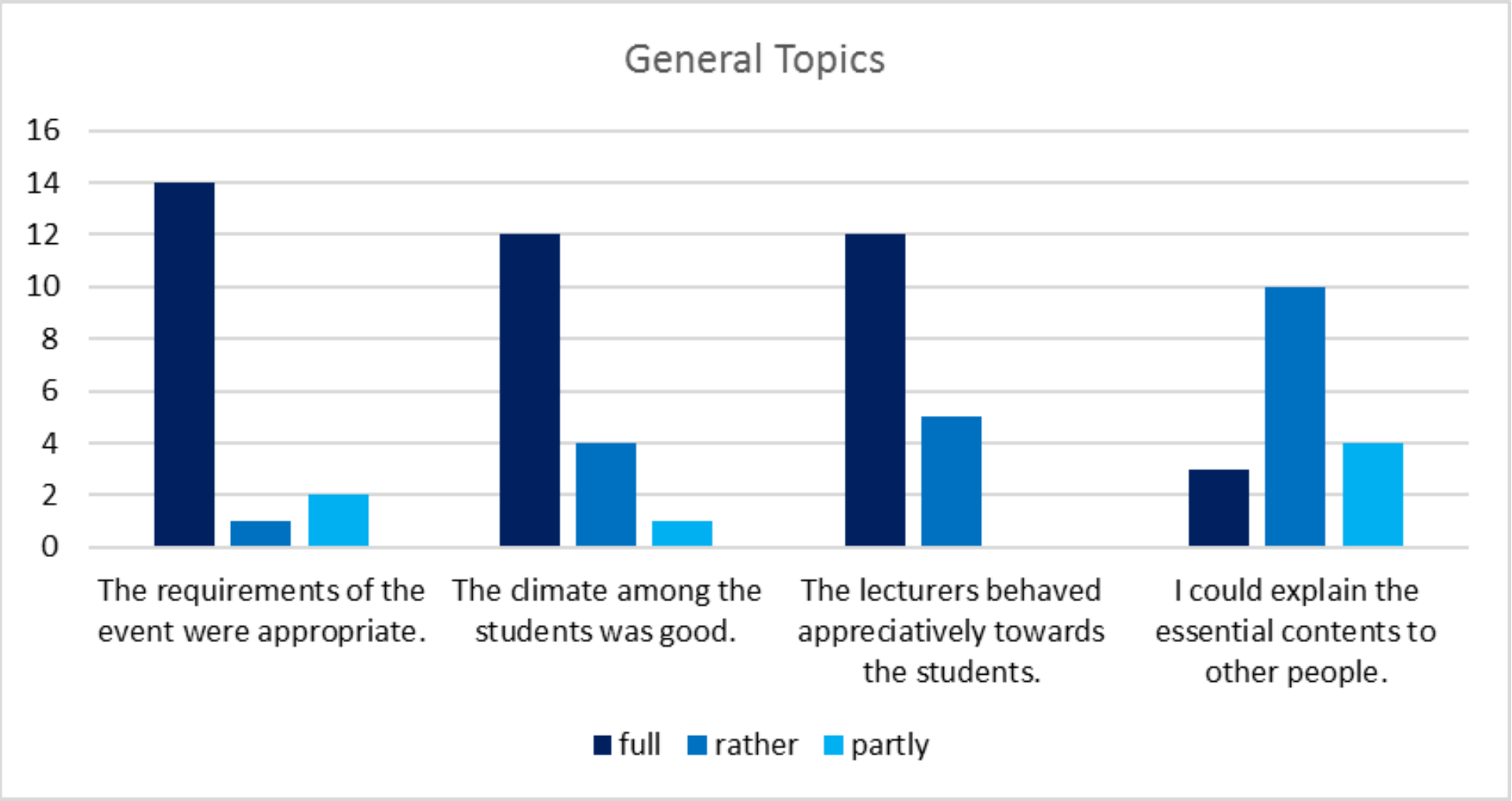
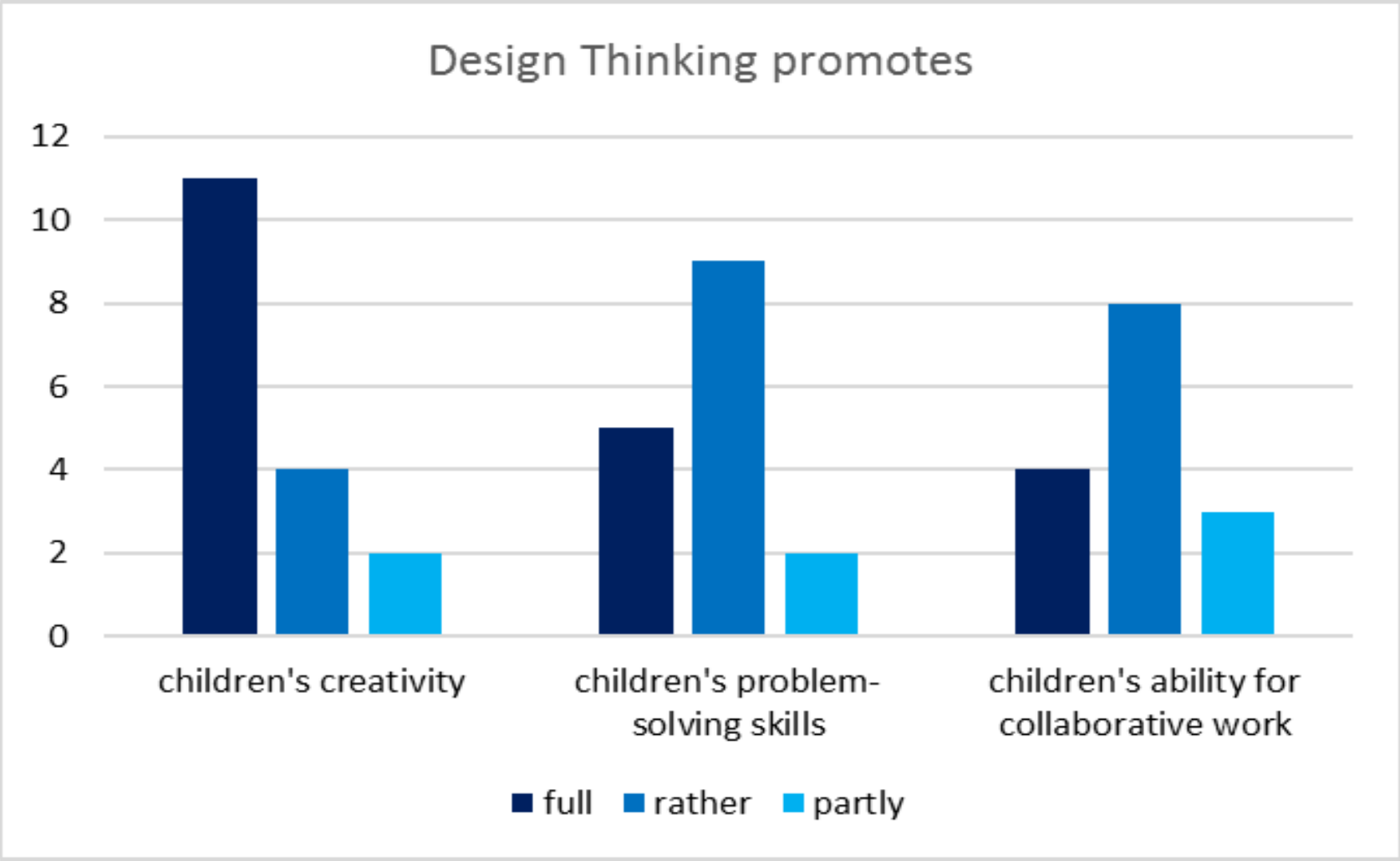
General Topics of the Seminar

Results of the survey by questionnaire, participants n = 17



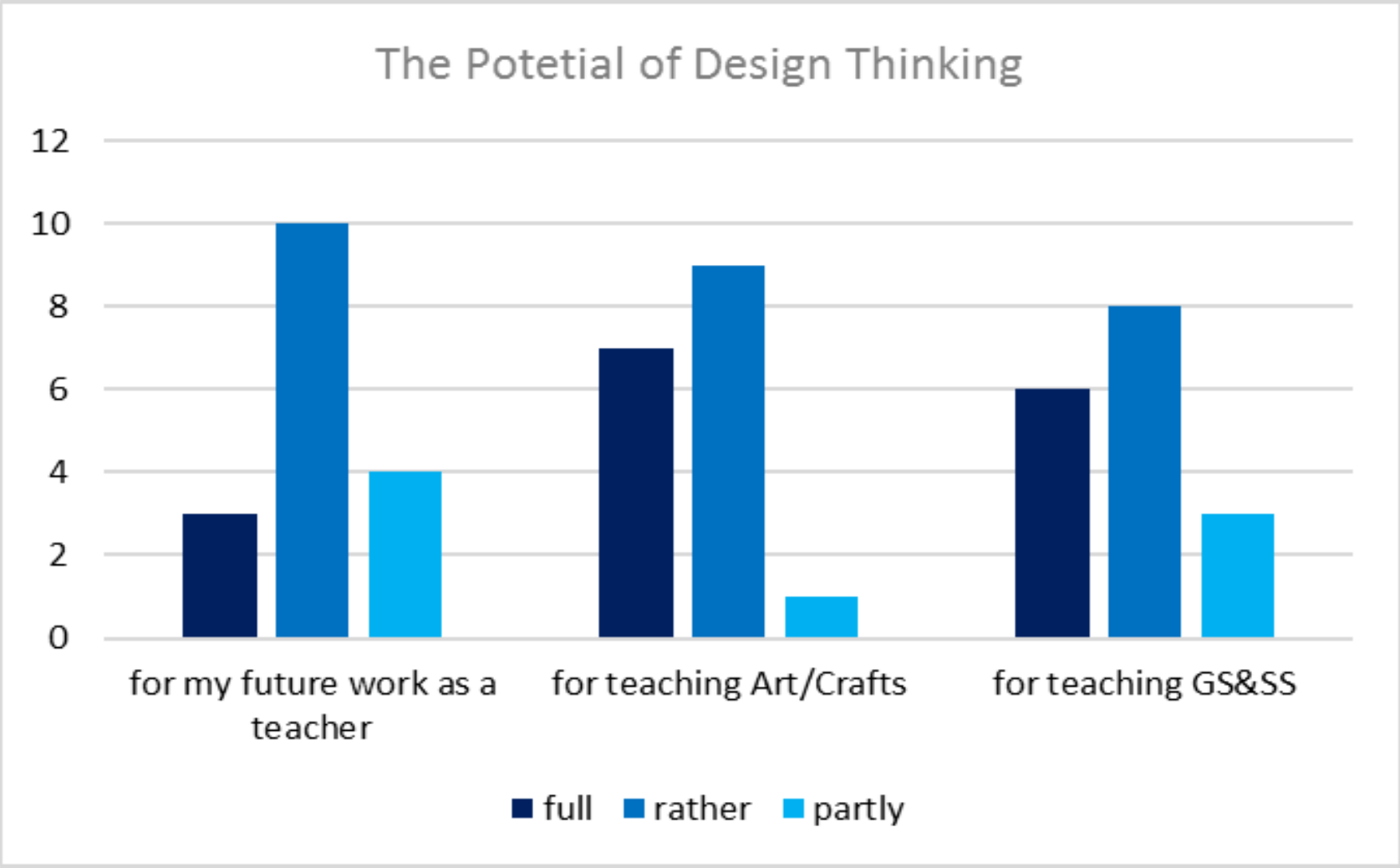
Design Thinking promoting 21st century skills

Results of the survey by questionnaire, participants n = 17



The Potential of Design Thinking for teaching

Results of the survey by questionnaire, participants n = 17



Future Outlook after the students' seminar

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- Output of prototypes for Learning Scenarios in Art/Crafts and GS&SS
- Students' statements on Design Thinking in classroom → cause for optimism concerning the further research process:

- Fall 2019: Evaluation and further development of the Learning Scenarios
- Spring 2020: **Implementation of the Learning Scenarios** in different elementary schools in order to evaluate them with teachers and children
  → postponed to Fall 2020 due to Covid19 pandemic
- Summer 2020: Evaluation in terms of answering the research question
  → postponed to Spring 2021 due to Covid19 pandemic

Objective of Future Work

- Evaluation with children and in-service teachers by means of qualitative social research
- Answer to the research question:

To what extent can a teaching method based on Design Thinking foster

- Creativity,
- Problem-solving skills
- and collaborative work

In elementary classrooms?

- Derivation of guidelines for the training of teachers and students

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Thank you for your attention

Time for questions and feedback

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Literatur

Brown, T. (2009). *Change by Design: How design thinking can transform organisations and inspire innovation*. New York: Harper Business.

Bell, S. (2010). Project-Based Learning for the 21st Century: Skills for the Future. *The Clearing House, 83 (2),* 39-43, DOI: 10.1080/00098650903505415

Carroll, M., Goldman, S., Britos L., Koh, J., Royalty, A. & Hornstein, M. (2010). Destination, imagination and the fires within: Design thinking in a middle school classroom. *International Journal of Art & Design Education, 29 (1),* 37-53.

Cobb, P., Confrey, J., diSessa, A., Lehrer, R. & Schauble, L. (2003). Design Experiments in Educational Research. *Educational Researcher, 32 (1),* 9-13.

Design-Based Research Collective (2003). Design-based research - An emerging paradigm for education inquiry. *Educational Researcher, 32 (1),* 5-8.

Högsdal, S. & Grundmeier, AM. (2019). *Enabling 21st Century Skills for Textile Education by Integrating Design Thinking in Elementary Schools*. AUTEX2019, 19th World Textile Conference on Textiles at the Crossroads, 11-15 June 2019, Ghent, Belgium.

Kaendler, C.; Wiedmann, M.; Leuders, T.; Rummel, N.; Spada, H. (2016). Monitoring Student Interaction during Collaborative Learning: Design and Evaluation of a Training Program for Pre-Service Teachers. *Psychology Learning & Teaching. 2016, 15 (1),* 44–64.

Koh J.H.L., Chai C.S., Wong B. & Hong HY. (2015). *Design Thinking for Education: Conceptions and Applications in Teaching and Learning*. Springer: Singapore.

Meinel C.; Weinberg U. & Krohn T. (2015). *Design Thinking live.* Murmann: Hamburg.

Meinel, R. (2016). Selbstgestalten statt fremdbestimmt! Zu einigen Aspekten der Designpädagogik. In: J. H. Park (Hrsg.), Didaktik des Designs. *Schriftenreihe Design & Bildung – Schriften zur Designpädagogik*, Bd. 1, S. 19–28).

Ministerium für Kultus, Jugend und Sport Baden-Württemberg (Hrsg.) (2016). *Bildungsplan der Grundschule.* Neckar-Verlag: Villingen-Schwenningen.

OECD (2017). *PISA 2015 Results (Volume V): Collaborative Problem Solving*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264285521-en [24.06.2019].

Reinmann, G. (2005). Innovation ohne Forschung? Ein Plädoyer für Design-Based Research-Ansatz in der Lehr-Lernforschung. *Unterrichtwissenschaft 33/(1)*52-69.

Scheer, A., Noweski, C. & Meinel, C. (2012). Transforming Constructivist Learning into Action: Design Thinking in education. *Design and Technology Education: An International Journal, 17 (3),* 8-19.

Theurer, C.; Berner, N. & Lipowski, F. (2012). Die Entwicklung der Kreativität im Grundschulalter: Zur Kreativitätsmessung im PERLE-Projekt. *Journal for educational research online 4 (2),* 174-190.