

# EXPERIENCES IN PEDAGOGY OF DESIGN

Drs. S. De Haan - Topolscak EngD

SEC TNW 2023/24



*image source: TUD*

# EXPERIENCES IN PEDAGOGY OF DESIGN

Technology/Design Pedagogical  
Specialist

at Science Education and Communication of  
Technical University Delft teacher training

Research & Design Course Teacher  
(in Dutch O&O) at TECHNASIUM of secondary  
school Christelijk Lyceum Delft (CLD)

**Drs. S. De Haan - Topolscak EngD**

SEC TNW 2023/24



*image source: [www.chrlyceumdelft.nl](http://www.chrlyceumdelft.nl)*

Main question of research:

What can STEM design-based concept learning in project education learn from experiences in the pedagogy of design within subject Research and Design?



image source: TUD

What can STEM design-based concept learning in project education learn from experiences in the pedagogy of design within subject Research and Design?

**Subquestion**

***What is a R&D ( O&O in Dutch) teachers and students frame of reference about the concept of 'model' within design ?***

franckreporter

image source: [www.gettyimages.nl](http://www.gettyimages.nl)

Research & Design (R&D) is a project-based secondary school course.

R&D is in Dutch called Onderzoek en Ontwerpen (O&O)

Main goal of R&D course is to involve students in real-life design (or research) problems with a problem owner at a company or organisation.

Students work and learn in teams coached by Technasium teachers.

R&D teachers are mostly teachers in various subjects like mathematics, physics, physical exercise, arts etc. sometimes engineer with a teacher degree.

Often R&D teachers have no design knowledge.



***What is a R&D ( O&O in Dutch) teachers and students frame of reference about the concept of 'model" within design ?***

*image source: J. de Haan, R&D consultation*

This is a model.

## The aim of the research

Investigation of the conceptual understanding of the term 'model' for the following reasons:

- The meaning of concepts directly influences learning in technology.
- Technological concepts serve as the foundation for the construction of new concepts and deeper understanding.
- No unequivocal definition is found among STEM subjects.
- There is a need for clear and unambiguous curriculum content to enable students to think critically and apply knowledge in context.

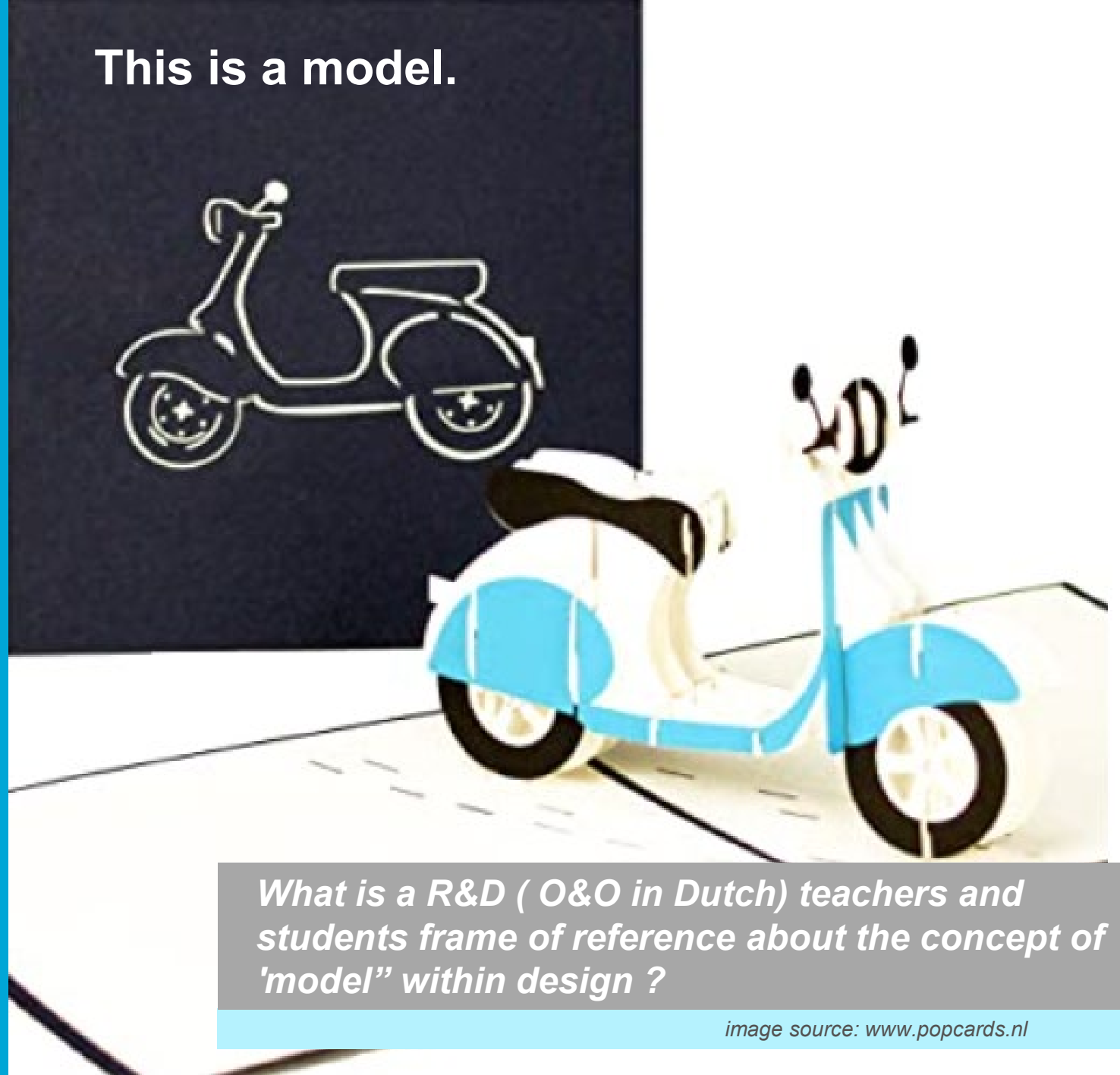
*What is a R&D ( O&O in Dutch) teachers and students frame of reference about the concept of 'model' within design ?*

*image source: [www.istockphoto.com](http://www.istockphoto.com)*

## This is a model.

A survey was conducted among 14 teachers and 32 students to test:

- Previous knowledge and their own understanding of the concept of model (two open questions, analysis by Atlas.ti)
- Ability to recognize and identify different forms of models on three levels of abstraction (ten close ended questions)
- Understanding of the purpose behind creating models (by one multiple choice question based on a set of characteristics that can be used to identify a model in the natural sciences provided by van Driel (1997))



*What is a R&D ( O&O in Dutch) teachers and students frame of reference about the concept of 'model' within design ?*

*image source: [www.popcards.nl](http://www.popcards.nl)*

## This is a model.

Models serve as simplified representations or descriptions of reality and can be used as examples for something.



*What is a R&D ( O&O in Dutch) teachers and students frame of reference about the concept of 'model' within design ?*

*image source: [www.gettyimages.nl](http://www.gettyimages.nl)*

The respondent role within the school determines a purpose of the model. The students opt for testing and presentation and teachers for clarification and explanation.

Previous knowledge and their own understanding of the concept of model

"What is your definition of a model?"

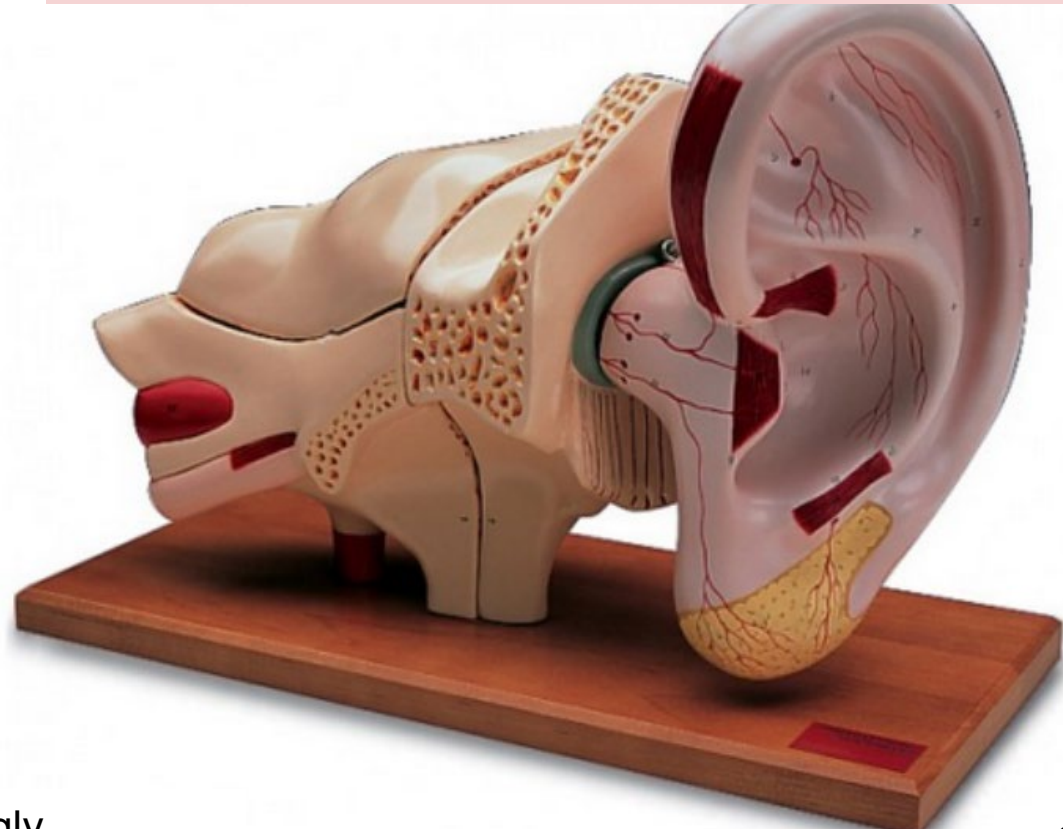
"Why do we create models?"



## This is a model.

*What is a R&D ( O&O in Dutch) teachers and students frame of reference about the concept of 'model' within design ?*

*image source: www.fysiosupplies.nl*



strongly disagree

1

2

3

4

5

strongly agree



Ability to recognize and identify different forms of models on three levels of abstraction

Models which are very close to reality such as scaled car model on the wright were recognized as a model by all groups.

A clear increase in recognition of abstract models from first to last year of high school.

The interpretations among teachers varied greatly.

## Understanding of the purpose behind creating models

Answer: “A model is always a model of something, namely of an object of investigation” has been chosen unanimously.

Least chosen answer was: “A model differs from the object of research in that reductions are applied when drawing up a model by scaling or in some other way.”



1 A model is always a model of something, namely an object of investigation.



2 A model is a tool for research into the object in question.

3 A model differs from the object of research in that reductions are applied when drawing up a model by scaling or in some other way.

4 A model shows a number of similarities with the object of research

5 A model is not derived directly from the object of study, such as a photograph or a measurement result. It contains elements that the object of investigation does not possess. Creativity therefore plays a role in the choice of a model.

6 A model therefore has a built-in compromise character and the researcher has a certain freedom in choosing a model. The research question plays a role in that choice

7 In the course of a study, a model may undergo an iterative development. The object of research is always studied in more detail.

8 A model should always has a purpose (for R&D)

table source: J.de Haan

### Part 1

- Models serve as simplified representations or descriptions of reality and can be used as examples for something.
- The respondent role within the school determines a purpose of the model. The students opt for testing and presentation and teachers for clarification and explanation.

### Part 2

- Models which are very close to reality such as scaled car model on the wright were recognized as a model by all groups.
- A clear increase in recognition of abstract models from first to last year of high school.
- The interpretations among teachers varied greatly.

### Part 3

- Answer: “A model is always a model of something, namely of an object of investigation” has been chosen unanimously.
- Least chosen answer was: “A model differs from the object of research in that reductions are applied when drawing up a model by scaling or in some other way.”



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## Conclusions

A clear overlap in purpose and example-oriented definitions of models, emphasising their role as simplified representations or descriptions of something, often referred to as reality.

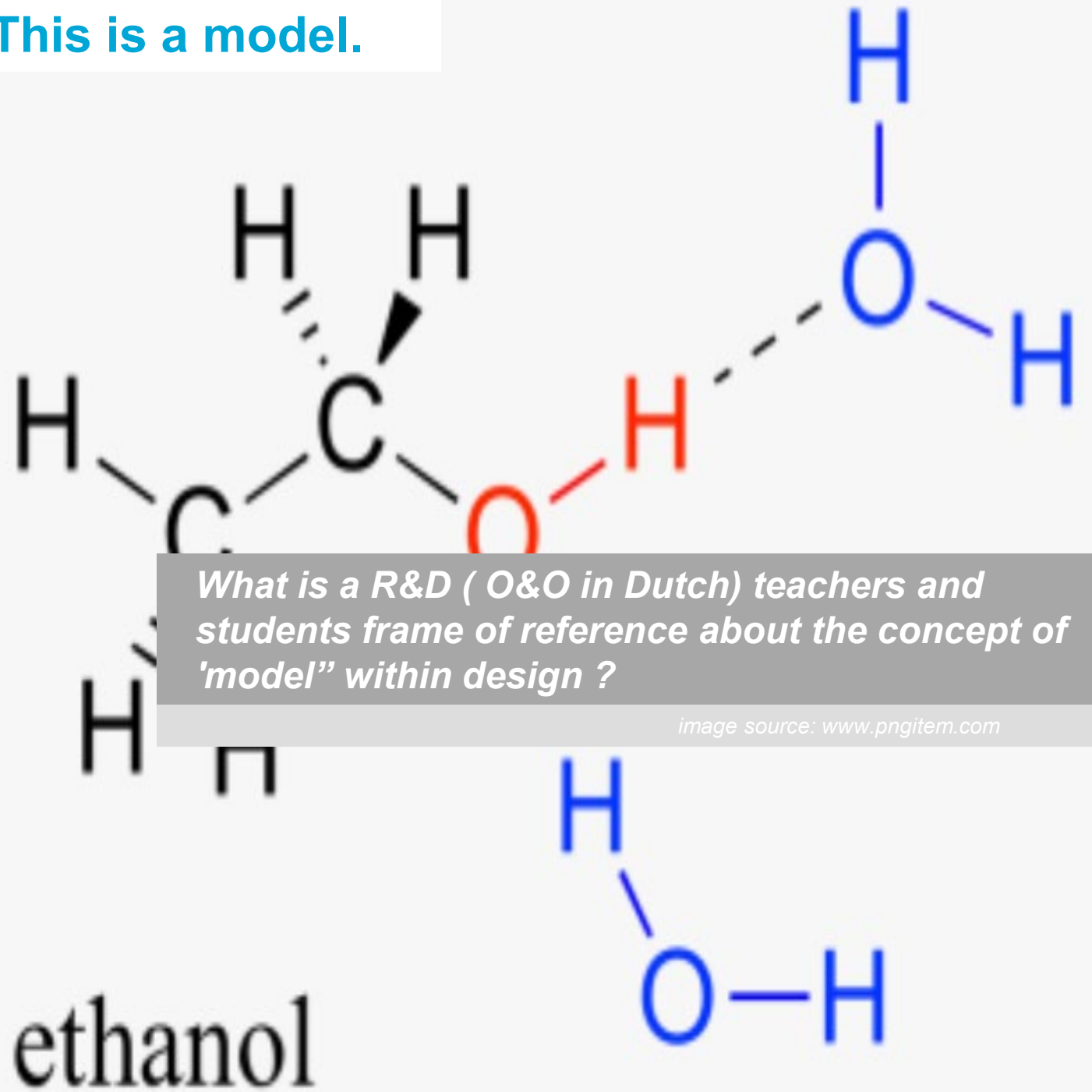
The recognition of models remained predominantly at a lower level of abstraction among young students, with an increase in recognition observed among older students

The recognition of models among teachers showed unexpected variation.

The majority of respondents, across all three groups, identified "To highlight important components" as the main reason for creating models.

The majority of teachers agreed with the statement that "A model is always a model of something, namely of an object of investigation." But at the same time they do not recognise that the model could be different from reality.

This is a model.



Providing teachers with more comprehensive knowledge about the characteristics of models, considering the lack of unanimous choice among the provided definitions, is crucial to establish a common frame of reference and enhance their ability to teach students effectively.

The absence of unanimous answers about what a model is and why we make one suggests a potential need for cross-disciplinary courses for teachers in STEM subjects to foster a more cohesive understanding of models across disciplines.

The conceptual understanding of the term 'model' among R&D teachers with very different subject backgrounds, within this pilot, is incomplete and ambiguous.

## This is a model.



*What is a R&D ( O&O in Dutch) teachers and students frame of reference about the concept of 'model' within design ?*

*image source: www.googlemaps*



## Main discussion points

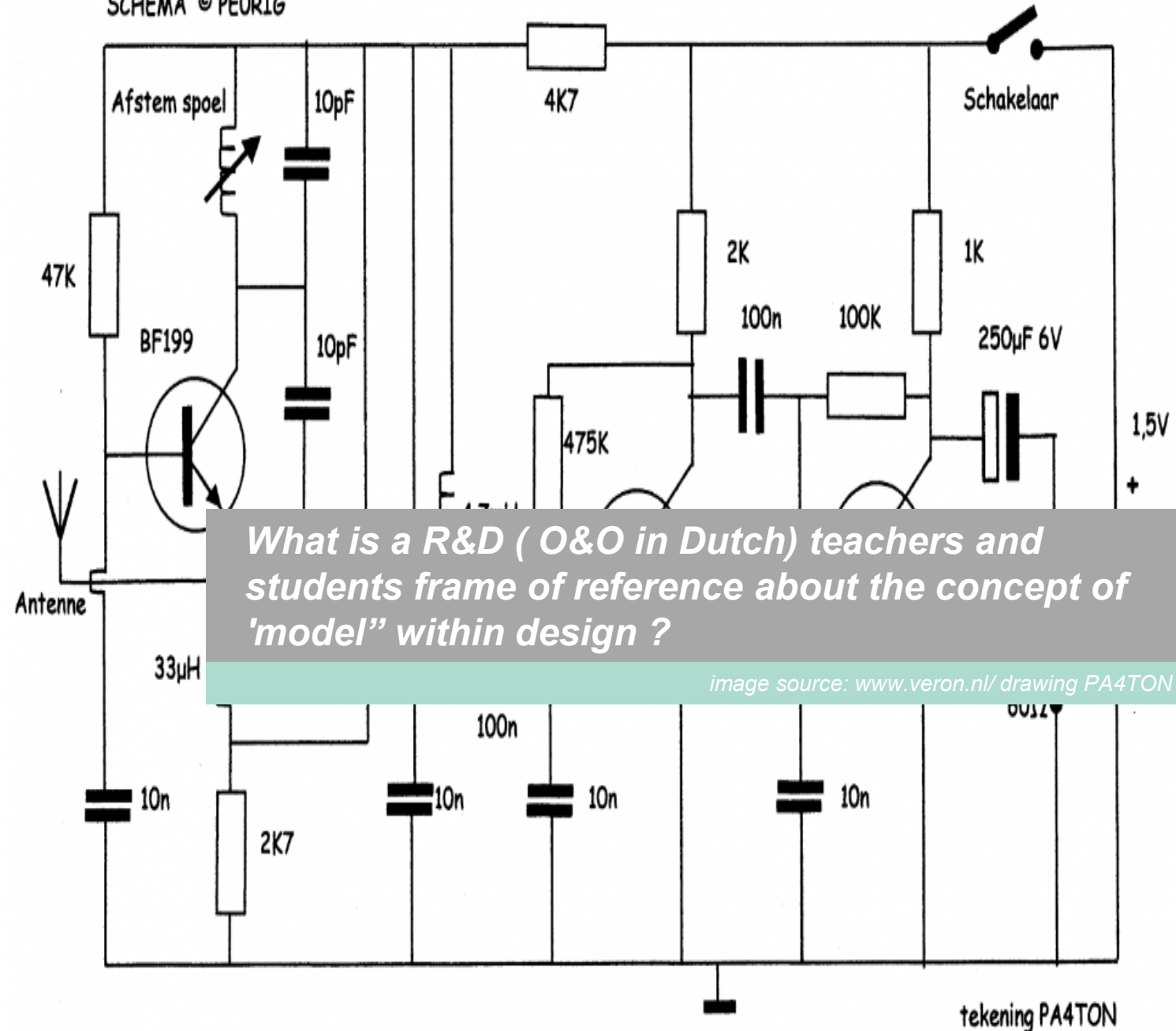
Comparison between different R&D teams from different schools can provide more clarity about similarities which may be related to school.

Abstraction level of the models is not further explored focusing on recognizing purpose and definition of a model.

Focusing on high abstraction level models which differ from reality could be interesting for further research and provide a frame of reference which can connect a curriculum and learning about models in R&D.

LOW-COST KIDS-FM-RADIO  
SCHEMA © PEORIG

This is a model.



*What is a R&D ( O&O in Dutch) teachers and students frame of reference about the concept of 'model' within design ?*

image source: [www.veron.nl/](http://www.veron.nl/) drawing PA4TON

## Questions

This is a model.

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*image source: / [www.amazingarchitecture.com](http://www.amazingarchitecture.com)*

**House 00 - Villa for Solitude in Jebel Jais, UAE by MEAN\*  
(Middle East Architecture Network)**

Thank you for your attention



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