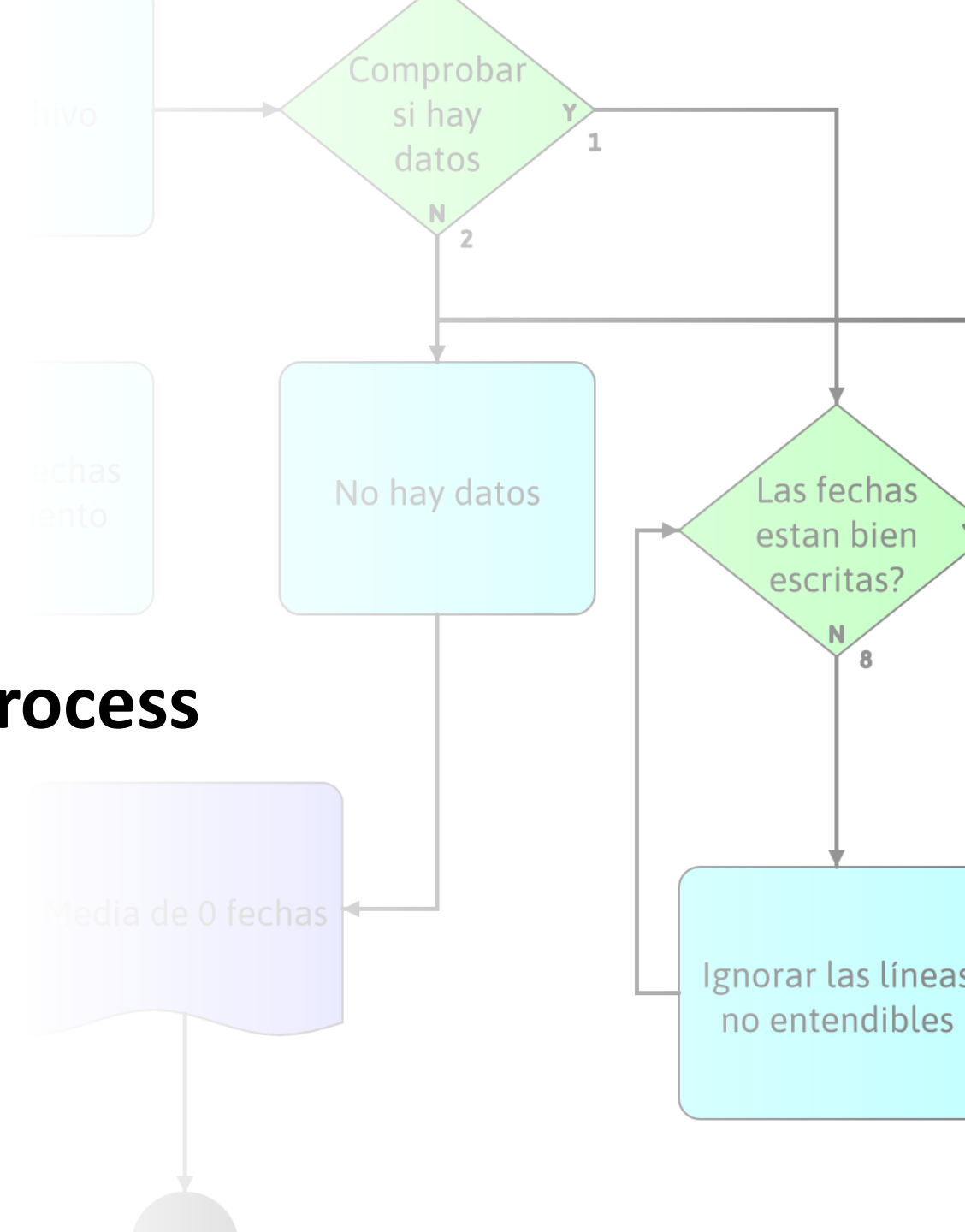


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# Understanding the Sensemaking Process in Test Case Design

Enhancing Software Testing Education



# Towards understanding students' sensemaking of test case design

Niels Doorn<sup>a</sup>  , Tanja E.J. Vos<sup>a b</sup>, Beatriz Marín<sup>b</sup>

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**Software defects are to be avoided**



## TESTING IN EDUCATION

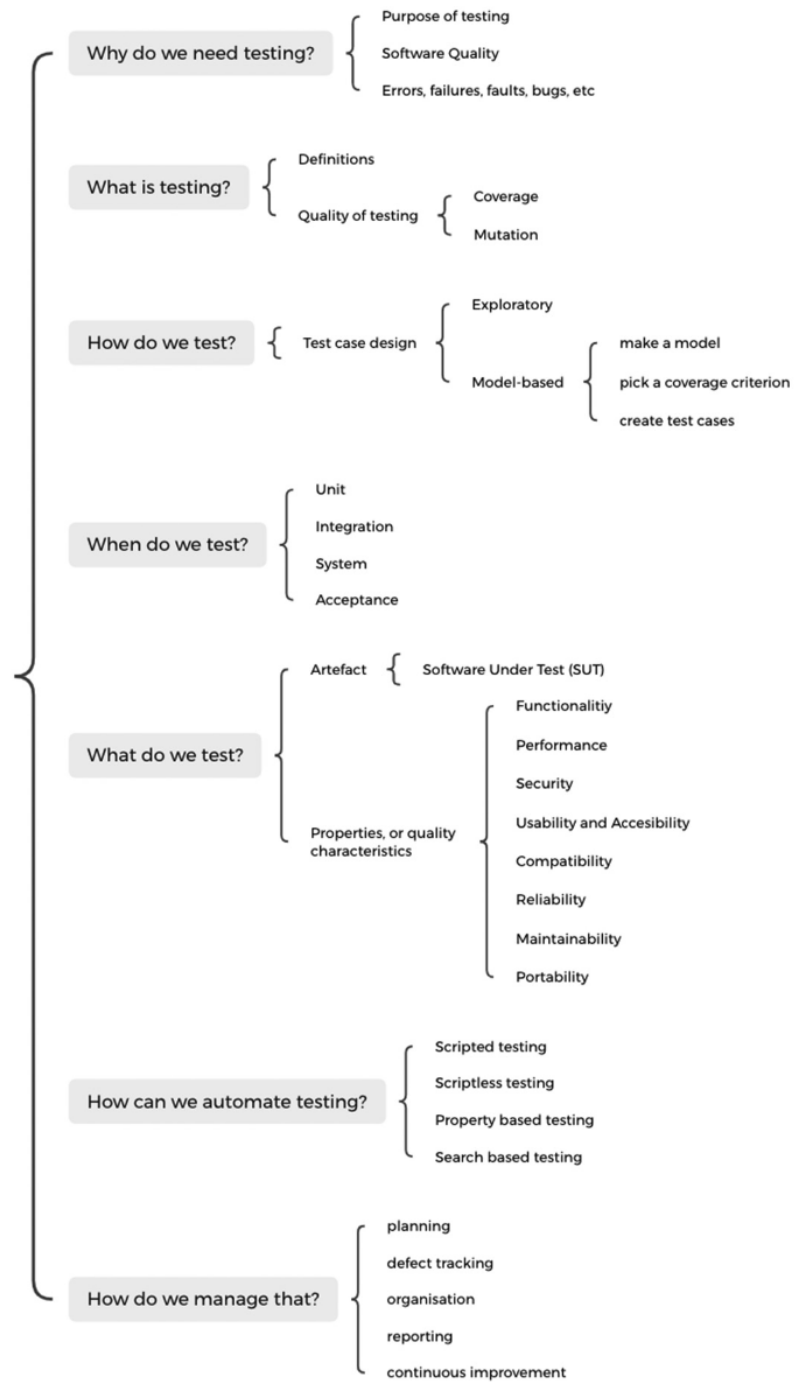
- Software Testing is most used QA technique
- In CS Education 2nd class citizen
- Students don't test their software well enough
- It is a complex learning activity
- Very limited success to improve this





# WHAT WE WOULD LIKE THEM LEARN

## Software Testing Education



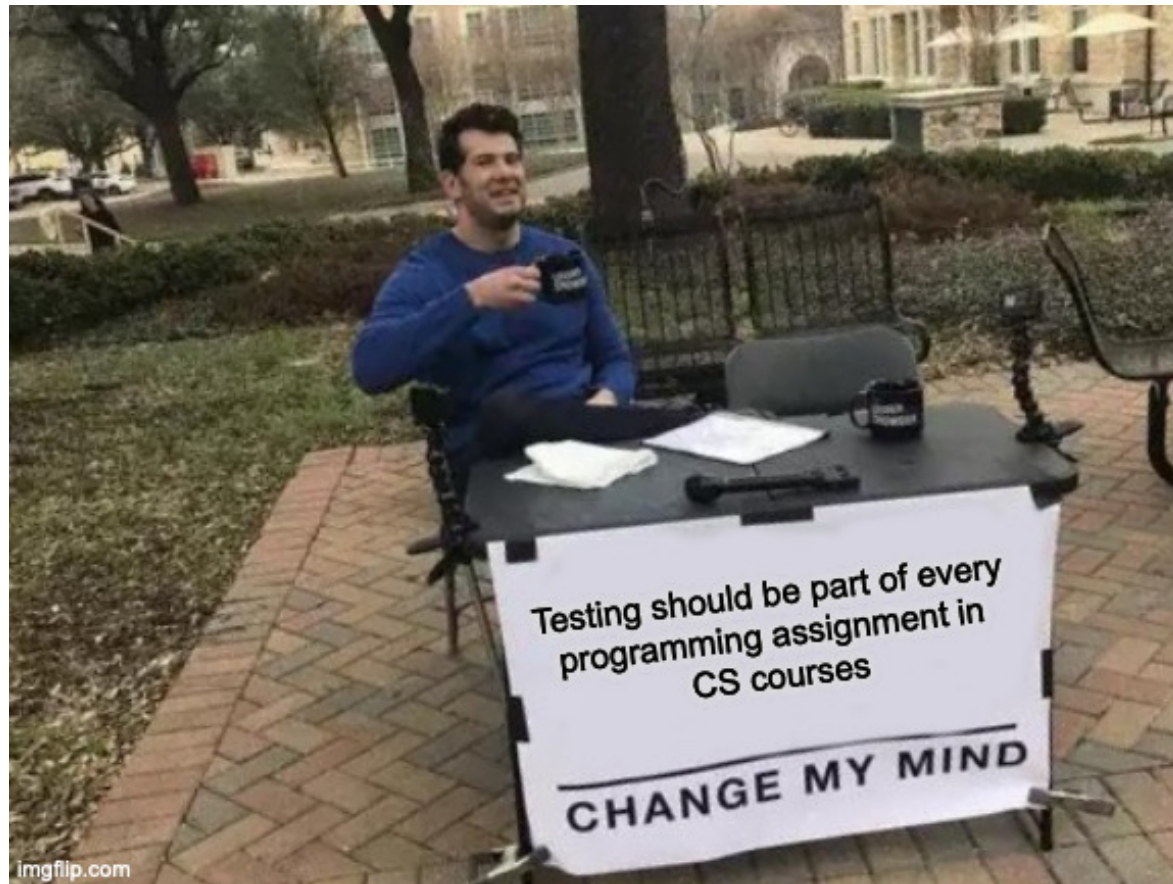


**WE DON'T REALLY KNOW HOW**

A fully developed body of knowledge and skills of didactic approaches for software testing education is lacking.



## TESTING SHOULD BE PART OF EVERY PROGRAMMING ASSIGNMENT IN CS COURSES





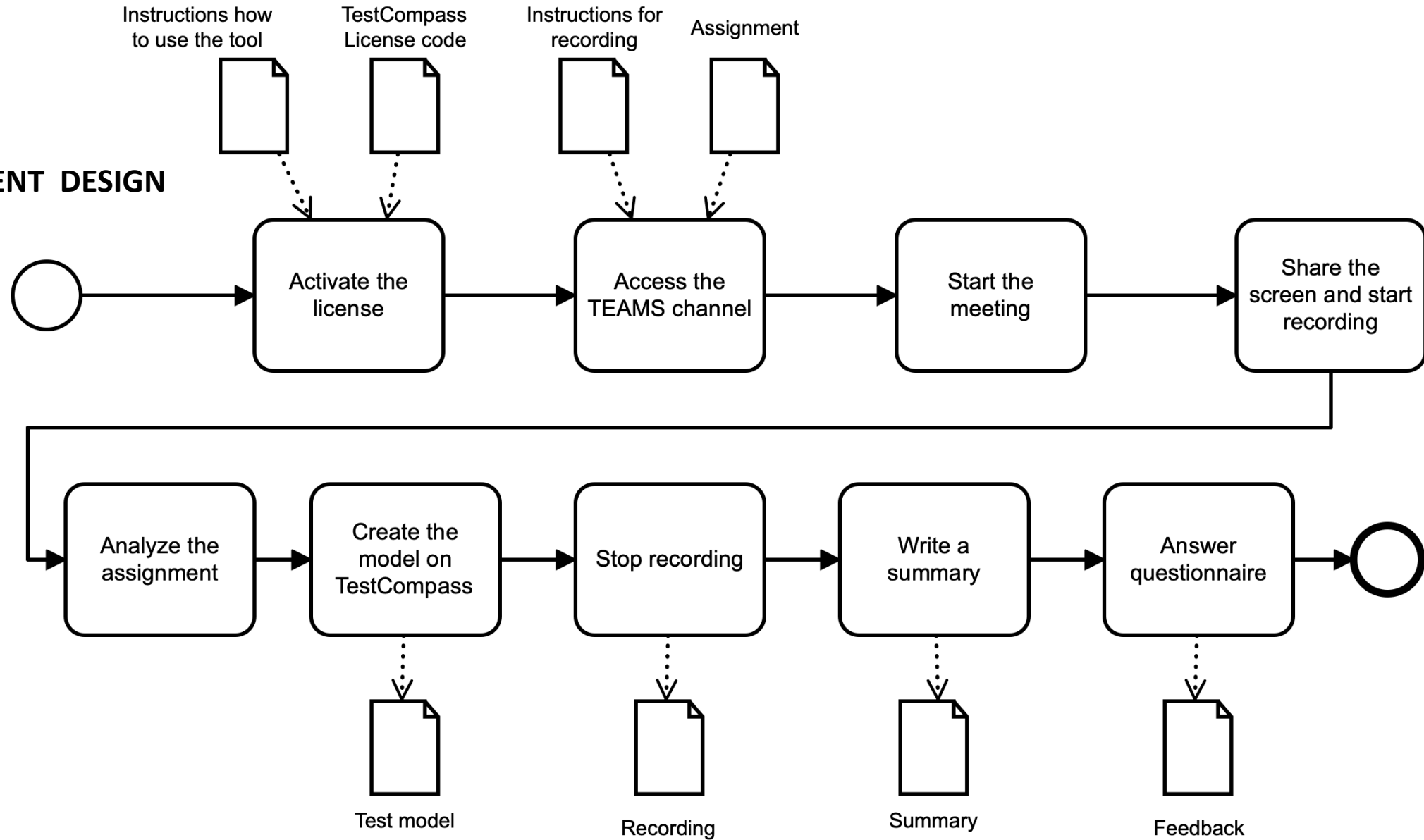
## MAKING SENSE WHEN TESTING SOFTWARE

Sensemaking is a dynamic process of building or revising an explanation in order to  
“figure something out” – to ascertain the mechanism underlying a phenomenon in order to resolve a gap or inconsistency in one’s understanding.

(Odden and Russ )

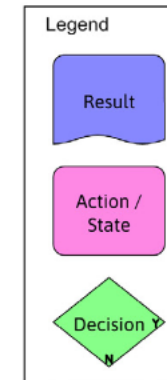
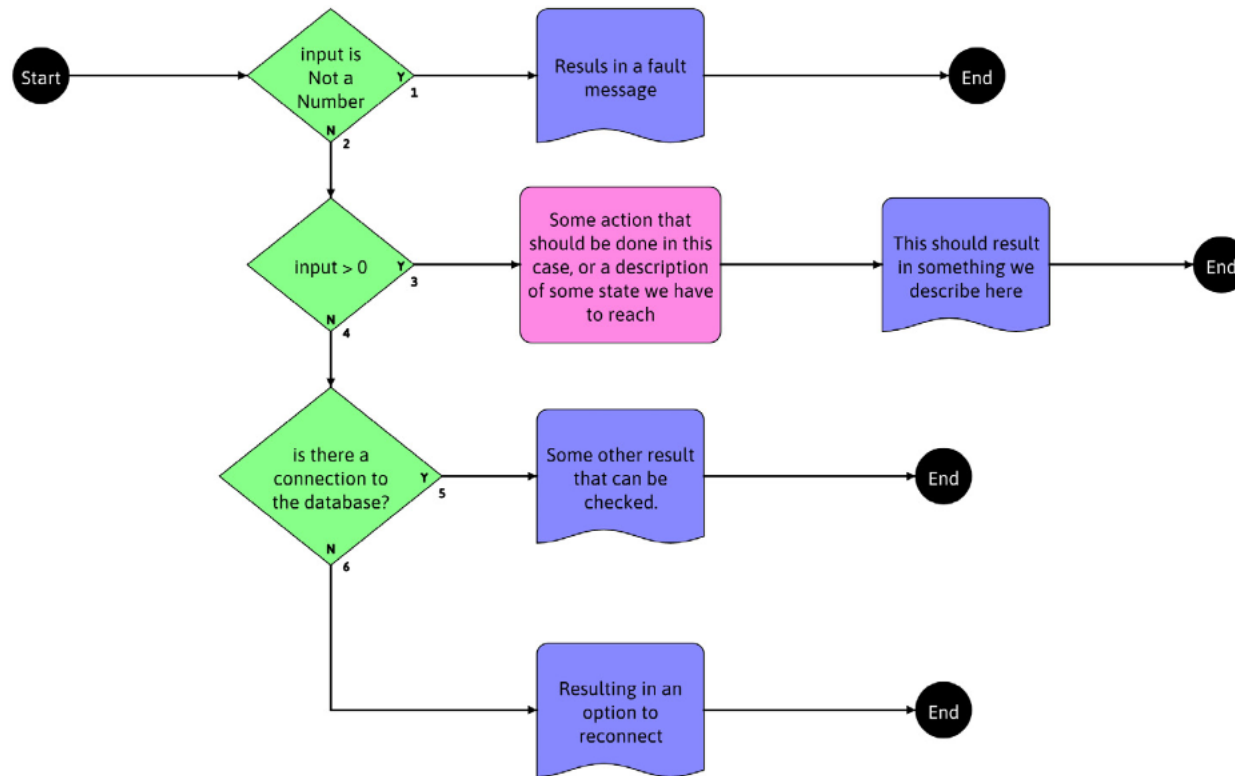


## EXPERIMENT DESIGN





## TOOLING: TESTCOMPASS, EARLY MODEL BASED TESTING





## TOOLING: TESTCOMPASS, EARLY MODEL BASED TESTING

- node coverage — in which all nodes are visited at least once
- link coverage — in which all links are visited at least once,
- condition coverage — in which all paths from condition nodes are visited,
- path coverage — in which all possible paths through the model are visited



DEMO TIME

TESTcompass

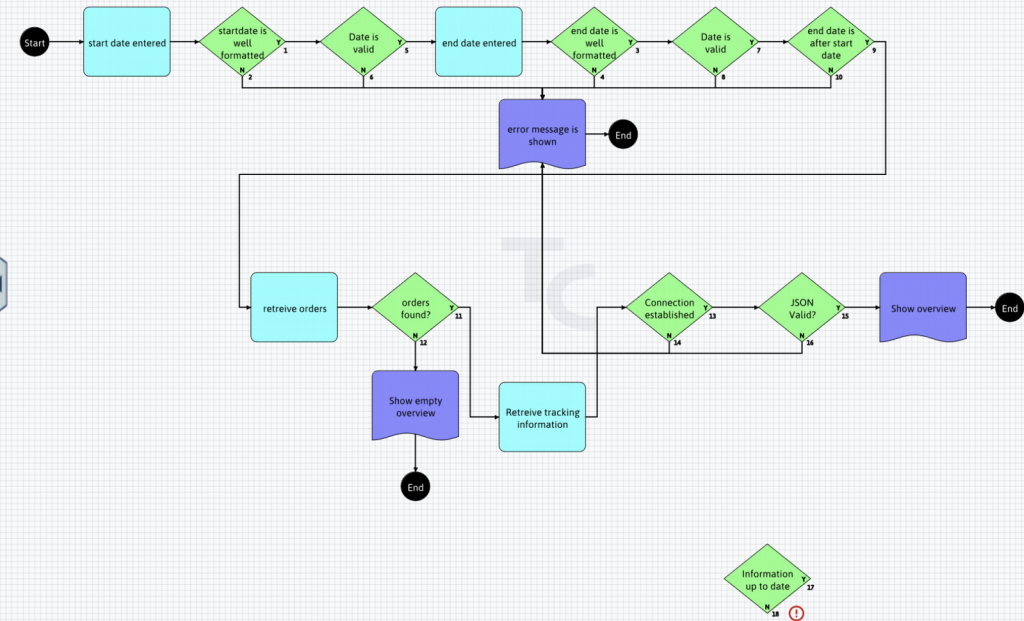
New Model



Project Model Test

Create New Project Import Project

- exercises
- Hardware store
- Real estate agent
- The Rental Company - Niels
- New Project
- New Model
- OU 20221126
- UPV20210510
- UPV20211220
- UPV20211220 Travel Agency results







## RESEARCH QUESTIONS

**RQ1: What are the different approaches that students use for creating test models and “figuring out” what to test?**

**RQ2: How is the use of each approach distributed among the student population?**

**RQ3: What is the students’ perception of understanding and usefulness of the created test model?**

**RQ4: What connections have students made with their prior gained knowledge?**



## ASSIGNMENT

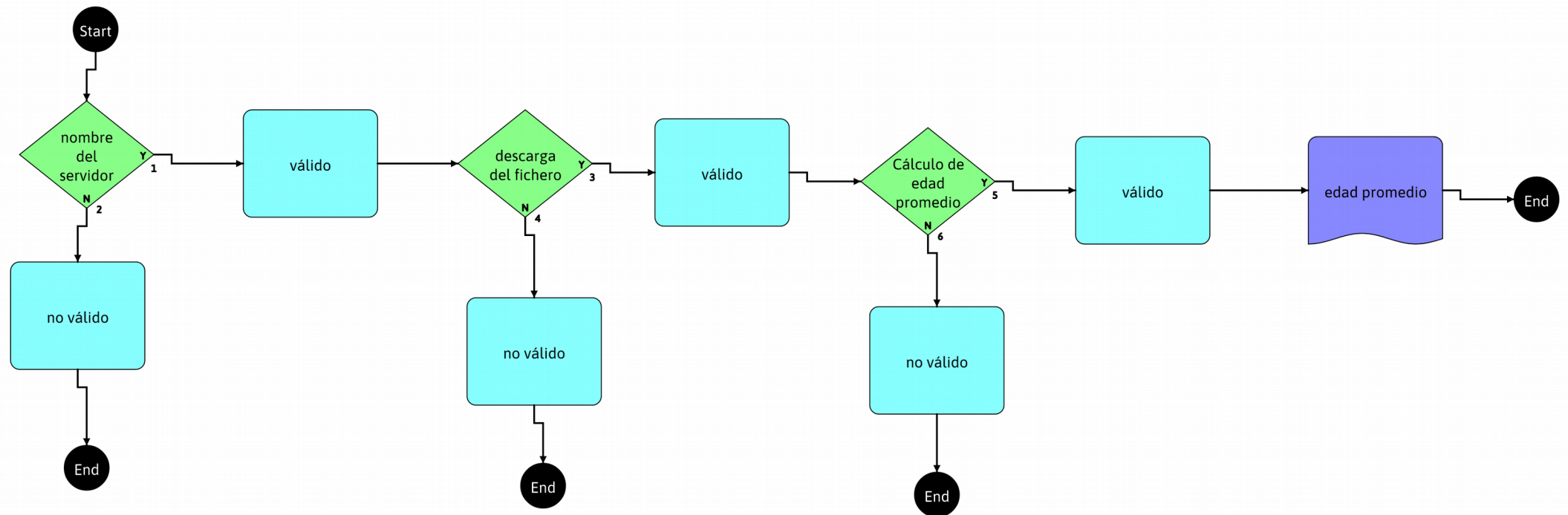
### Testing the average age calculator

You work for a travel company. The sales department wants to know what the average age is of the people who booked their holidays with your company. One of the developers in your team has developed a program to calculate the average age for a hundred people at the time. The program can handle up to a hundred dates of births and calculates the average age in years. It gets its data from a remote server as a .txt file, where each line contains the name and the age.

**Assignment:** Design a test model in TestCompass to adequately test the application.

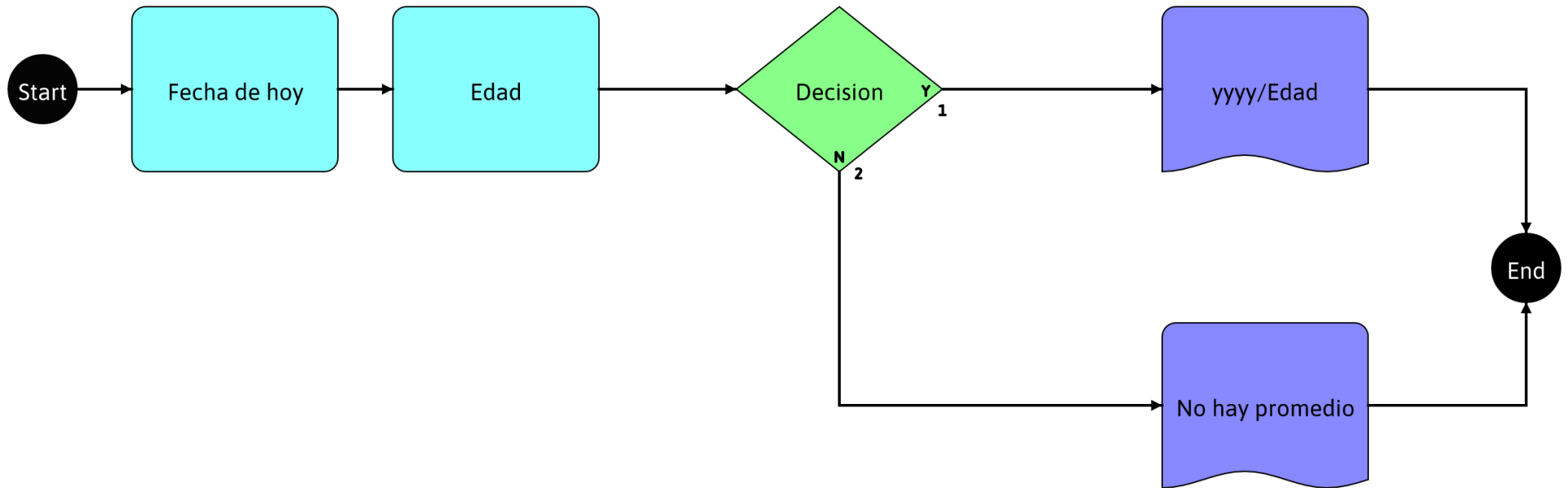


## MODELS: LAZY STUDENT



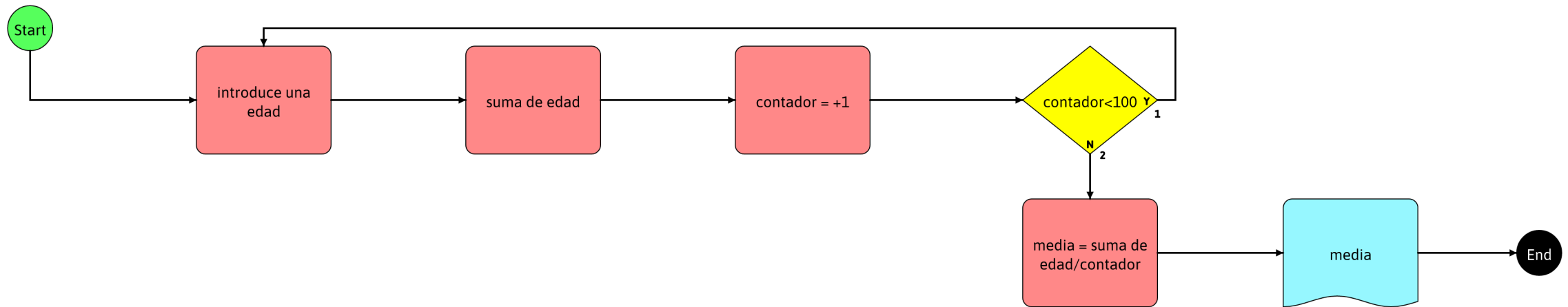


## MODELS: CLUELESS STUDENT



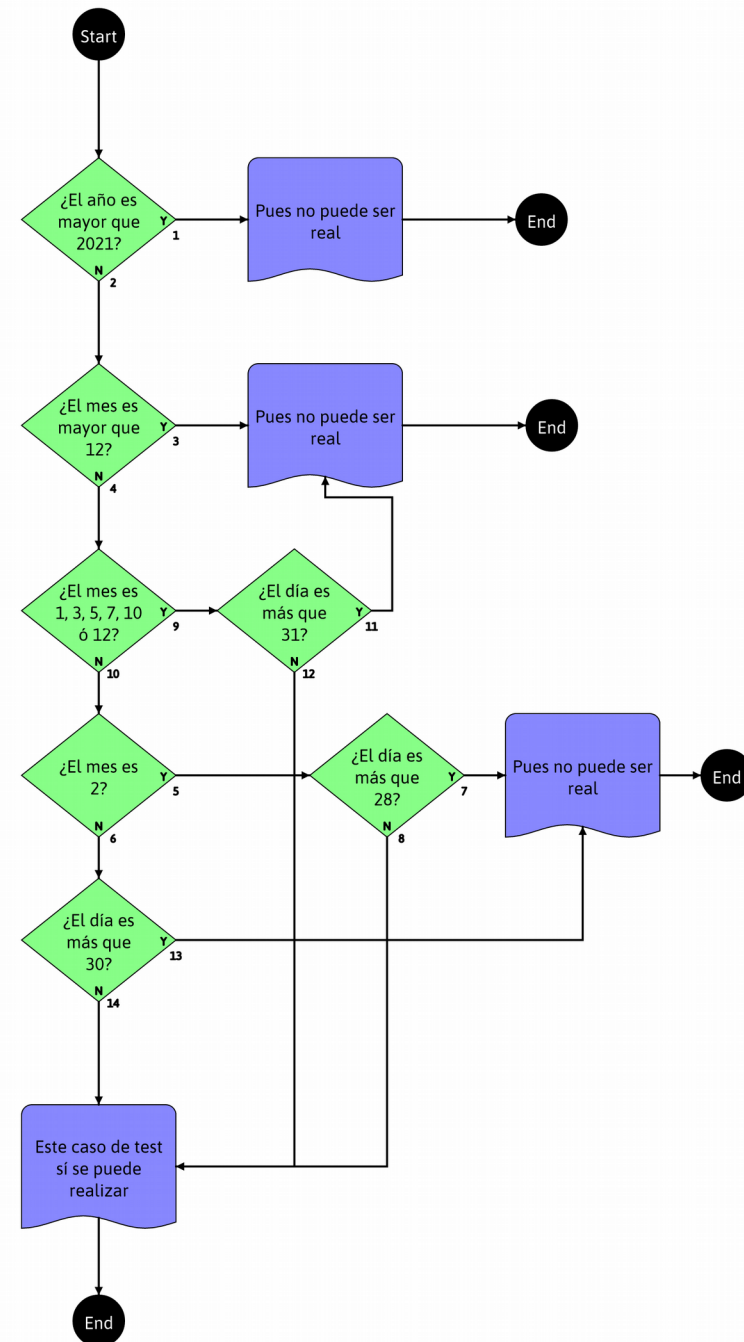


## MODELS: DEVELOPER APPROACH



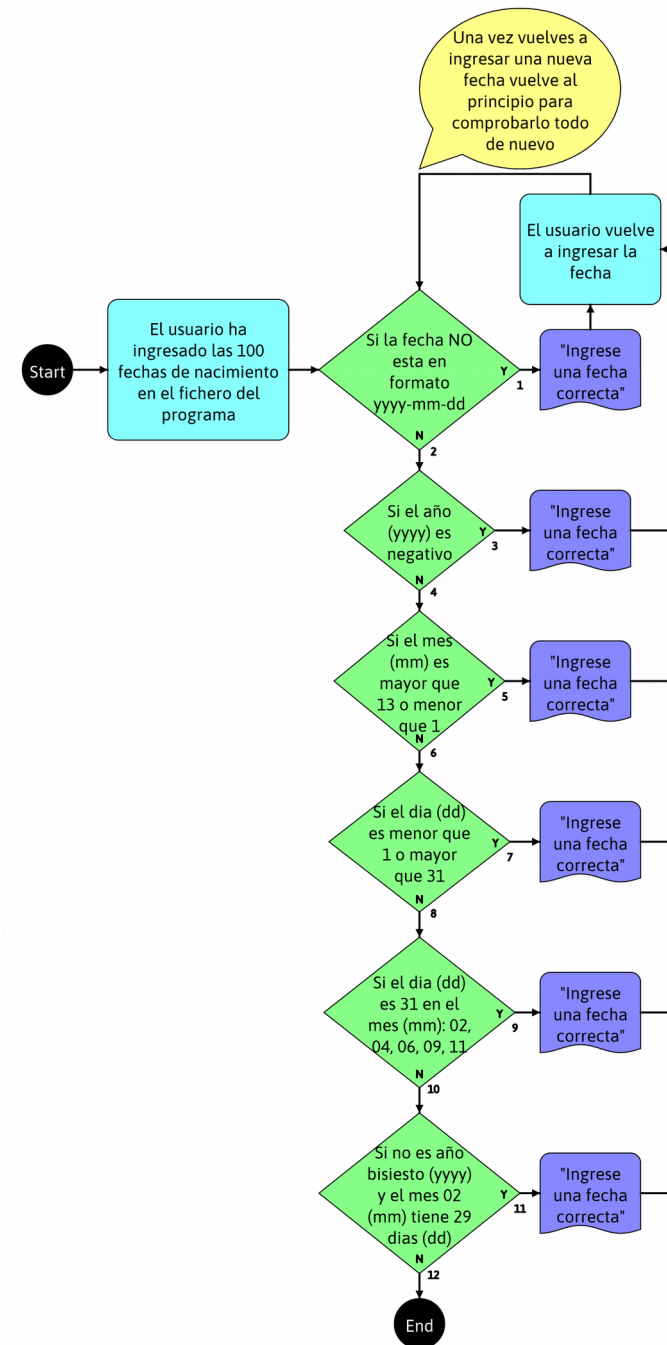


## MODELS: CONVERGENT TESTER APPROACH





## MODELS: DIVERGENT TESTER APPROACH



sensemaking in test  
case design



## IDENTIFIED PRACTICES

The identified practices ( $n = 40$ ). Students can use more than one practice, but the developer and convergent tester approach are mutually exclusive.

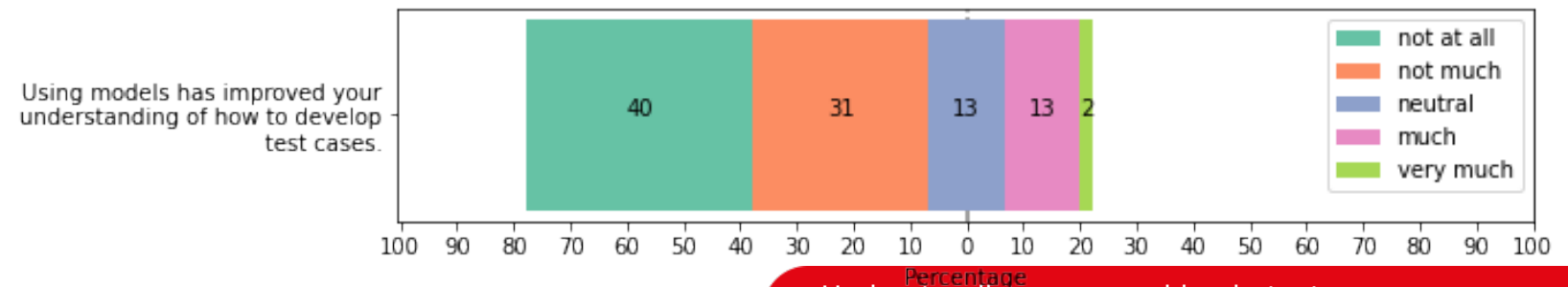
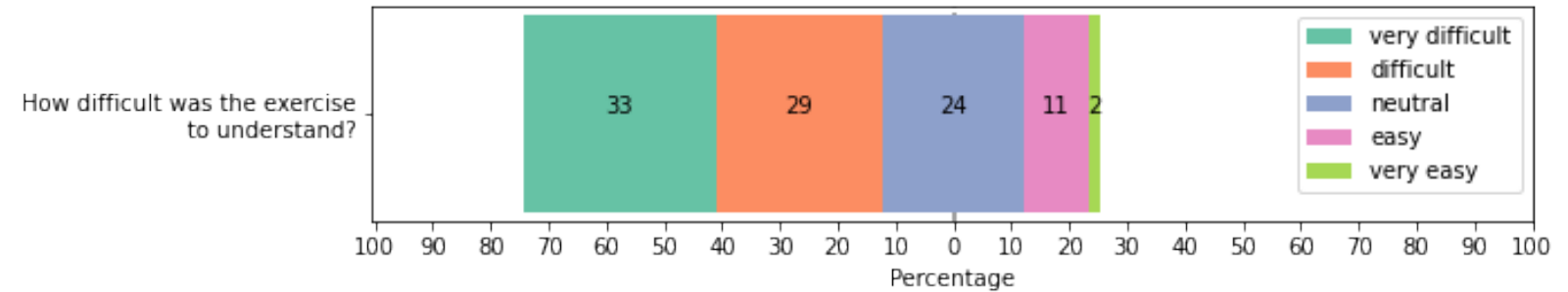
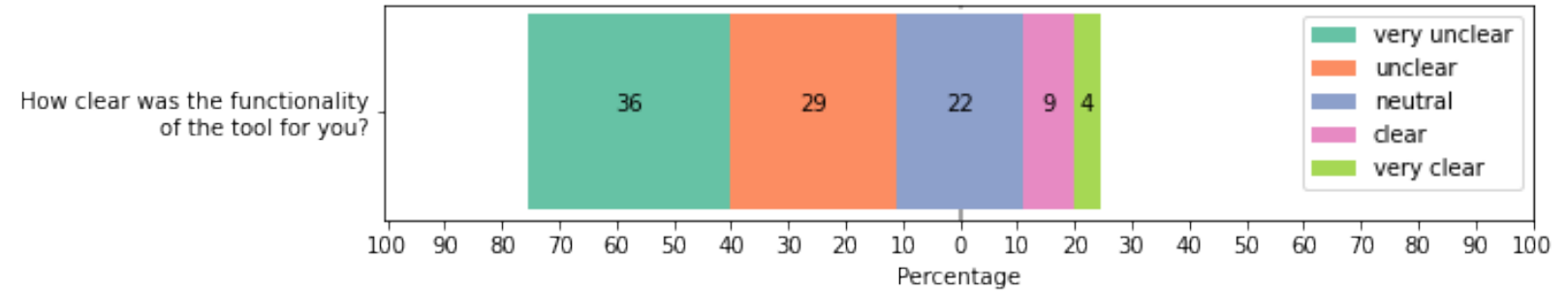
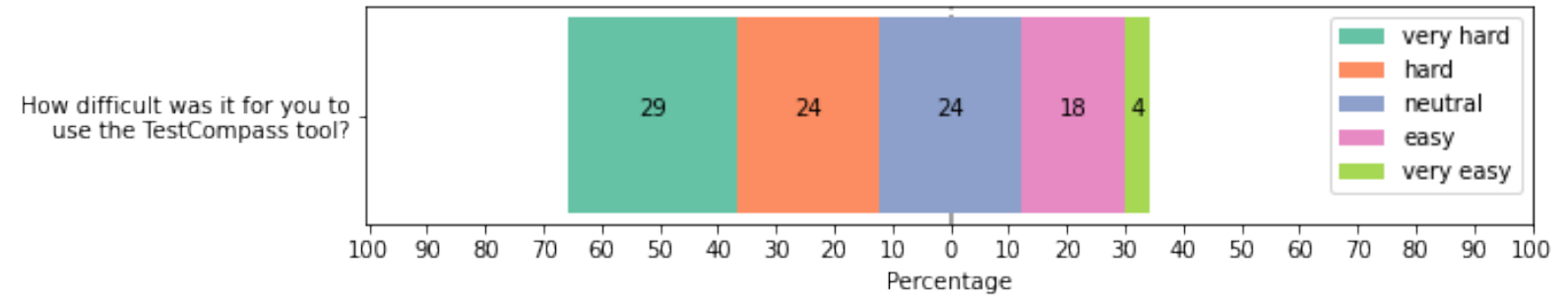
Identified practice	Number of students
Lazy student practice	2
Clueless student practice	3
Convergent tester approach	10
Developer approach	26
Divergent tester approach	5





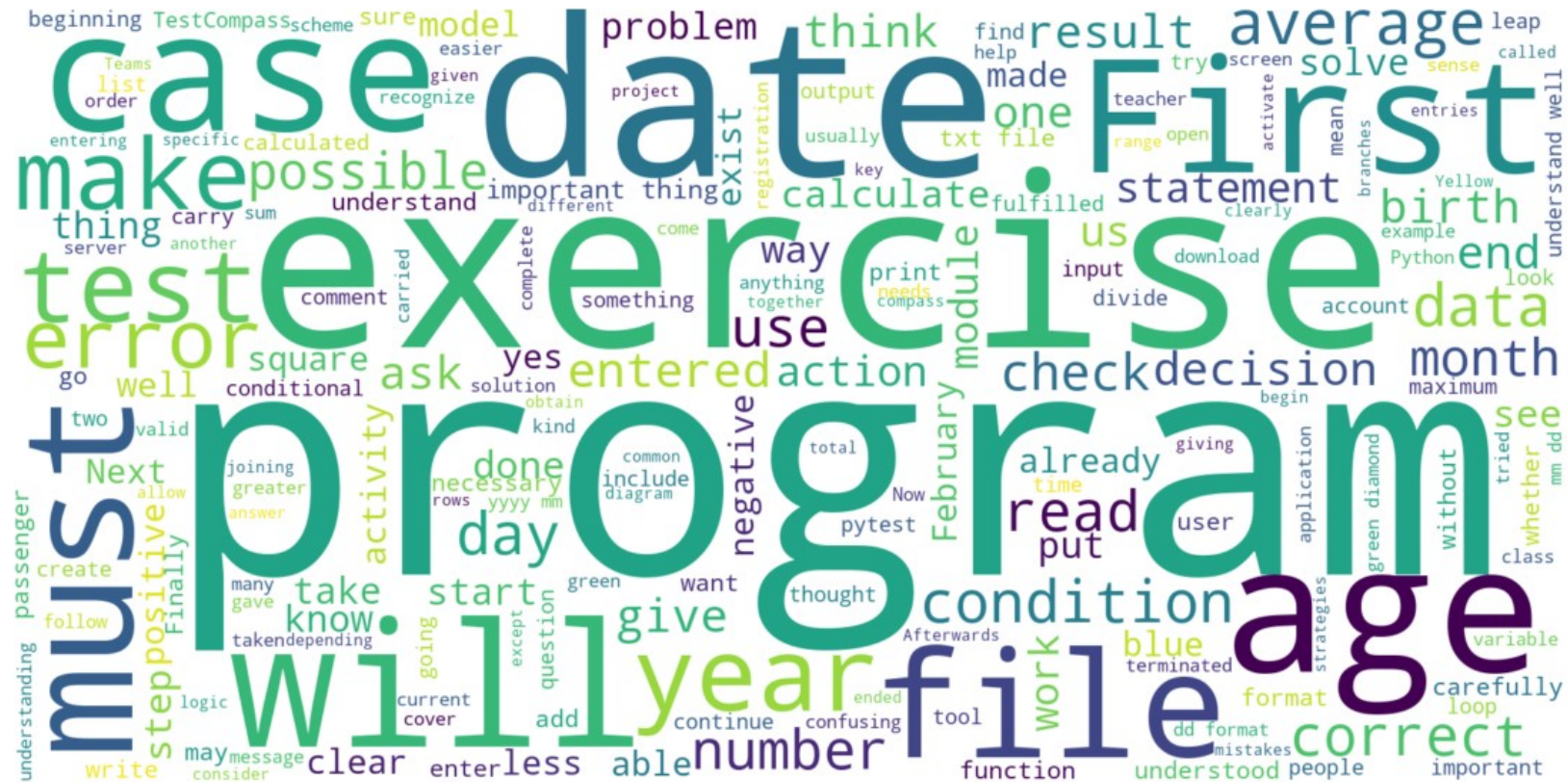
## PERCEPTION

Perception of the students



Understanding sensemaking in test case design

## CONNECTION WITH PRIOR KNOWLEDGE






## CONCLUSIONS

- Five approaches / practices
- We hypothesize: Move from rational to empirical paradigm
- We need this to effectively improve education





# We need to shift our teaching strategies

testing like an  
engineer solves  
a problem

testing like a doctor  
diagnoses a patient

focus on  
problem  
solving

from the  
**rational**  
paradigm

based on  
requirements and  
specifications

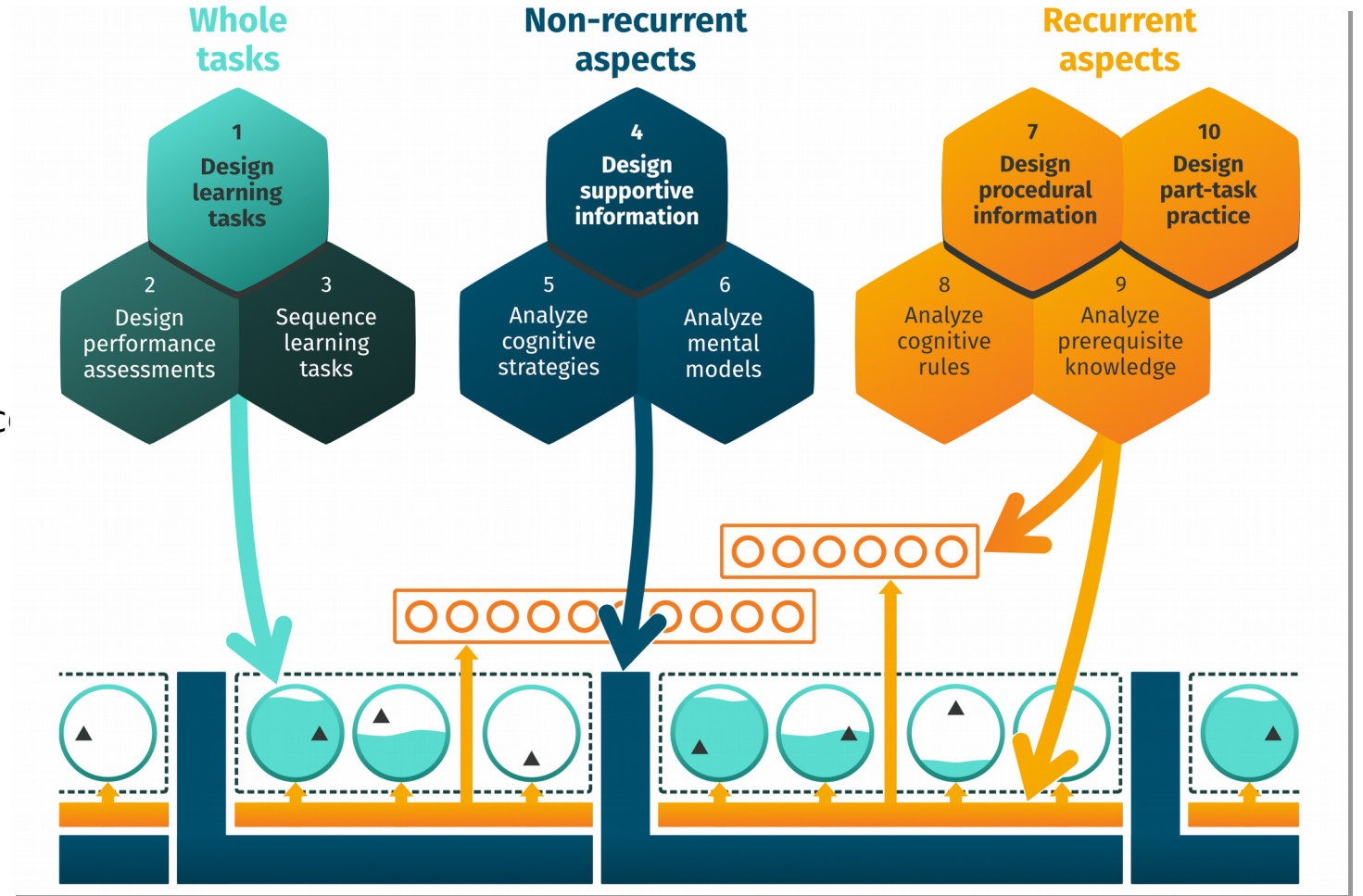
to the  
**empirical**  
paradigm

experimentation

looking for the  
unknown unknowns

# The way forward

- The 4c/id model
- Create Instructional Designs
- Study the effects in multiple educational c







# THIS IS NOT A THANK YOU SLIDE

NOS Teletext 117 21:04:08

KPN:storing kwam door softwarebug

KPN vermoedt dat de urenlange storing bij 112 en KPN gisteren is veroorzaakt door een softwarebug. Die zou op meerdere plekken tegelijkertijd zijn opgetreden, waardoor ook de backsystemen uit de lucht gingen.

Volgens de provider gaat het om een storing in het deel van het netwerk dat telefoongesprekken op de juiste bestemming aflevert.

KPN noemt het probleem uitzonderlijk, omdat het systeem "viervoudig is uitgevoerd". Als een deel van het netwerk ermee stopt, zouden er dus drie backsystemen klaar moeten staan om de taken over te nemen.

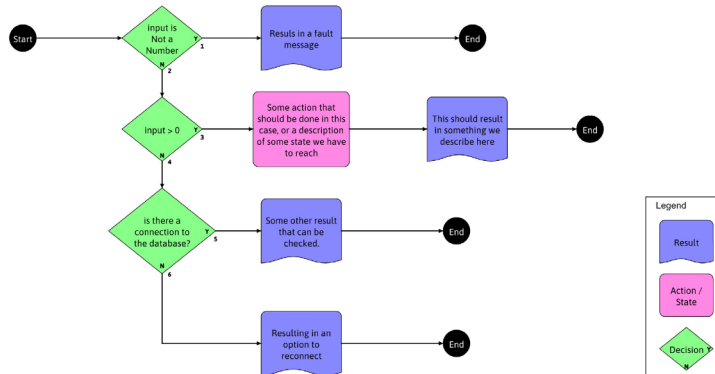
zie 108

volgende nieuws weer&verkeer sport

software failures should be avoided



we don't know how to teach testing

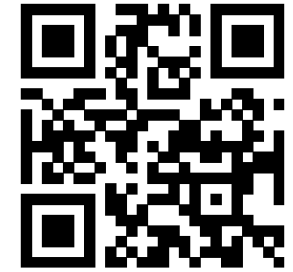


we did a study to identify sensemaking approaches

most students approach testing as a developer



@niels76@mastodon.online



edu.nl/utgcw

more more more

we need to shift our paradigm



Understanding sensemaking in test case design



## QUESTION 1

Is it a good idea to use a tool as TestCompass?



## QUESTION 2

What do you mean we don't know how to teach testing? Just do TDD and you are done.





### QUESTION 3

Sounds all really interesting, but what do you know about how experts test software?