

what is  $x$ ?

# How do students explain and understand different variables?

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# Research question

- Overarching research question was  
“How do students explain and elaborate on their understanding of variables?”

# Theoretical background

- Placeholder (An arithmetic identity with a hidden number Kieran, 1981)
  - “swap the side swap the sign” or “do the same on both sides” (Andrews & Öhman, 2019).
- Relations between sizes or number(Function relationships)
- General Identity (An identity *is an equality that holds true regardless of the values chosen for its variables*).

Used as a framework in the interview guide

# Method

- Five 9<sup>th</sup> grade students
- From one boarding school (Efterskole)
- Selected by their teacher (Voluntary and parents' consent)
- Semi structured interview
- Interview guide based evaluated by researchers from VIA University

Selected on student "Clara"  
for this presentation



# Coding proces

- Separately
- Codebook
- Discussion about findings or disagreements – together with senior researcher

<i>Spørgsmål intro 1.3</i>				
ligevægts forståelse: y og x skal være det samme tal → dynamisk i forhold til lighedstegnet	ubekendt: x og y er en betegnelse for noget man ikke ved hvad er ligevægts forståelse: x og y er det samme, navnet er underordnet	Taleksempel To forskellige bogstaver, to forskellige tal - x og y er forskellige Hun har et forhold mellem dem, og fastholder dette → statisk forståelse af lighedstegnet	Variabler/konstante r → ved ikke hvad begreberne betyder y og x: man ved ikke hvad de er, det kan ikke regnes ud. De afhænger af hinanden Ligevægts forståelse: samme tal på hver sin side	Ubekendt og pladsholder: man ved ikke hvad x og y er Ligevægts forståelse: x og y er det samme

Look at two tasks

$$2x + 15 = 31 \text{ and } 2x + 15 - 9 = 31 - 9$$

Are the results the same? Or different?

Why would it be the same

See, this is equal to 31 and this is equal to 31 minus 9... So this must be two different things... or this is  $x$  and it will be the same

Because here you minus with 9 on both sides. You don't do this here. This means this means ... no wait a minute... Okay this makes 16 right? Yes this gives 16 and this must be 8 so... It is not the same result

Confusion  
What is the results?  
Equal sign



Can you explain this  
expression

$$y = x.$$

Confusion  
Different letters means different  
numbers

y is equal to x... This means  
for example if y is 1 then x  
is 3 and if y is 2 then x is 6

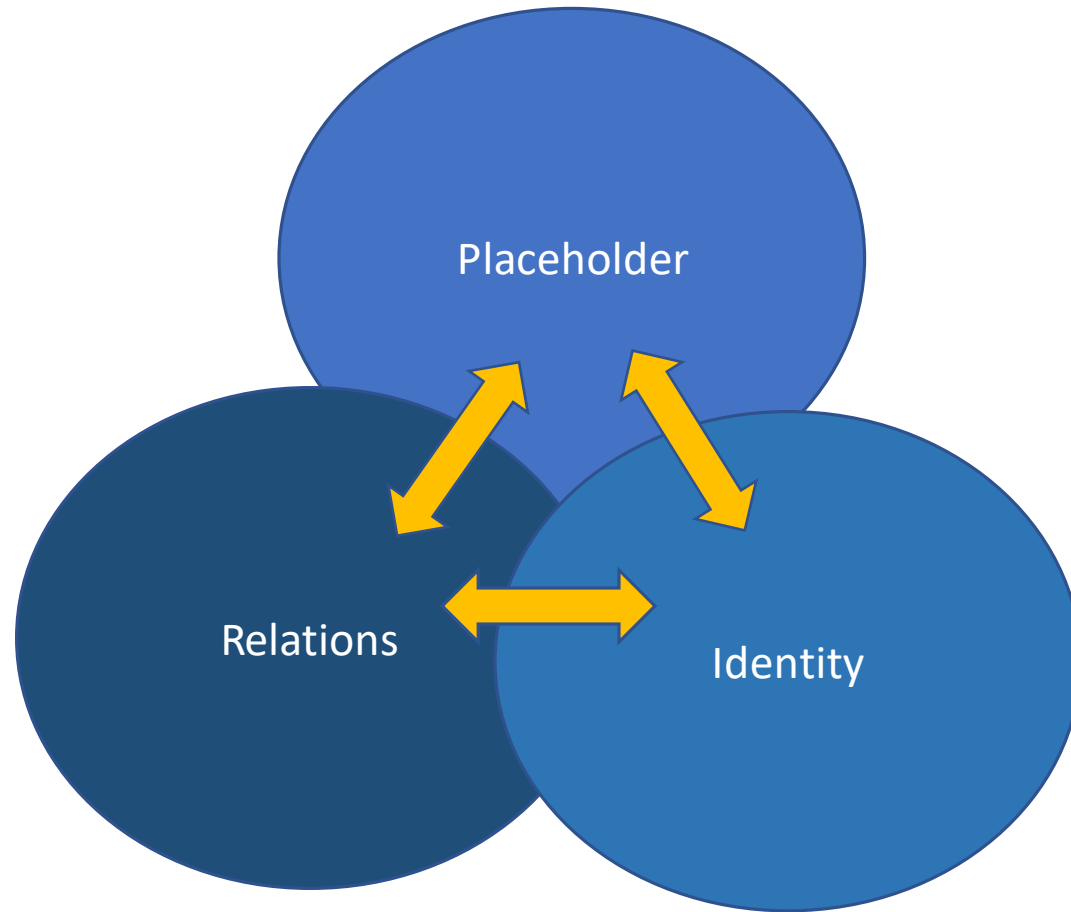


# Results

- The understanding of the equal sign needs to be addressed—that is, the student needs to develop the understanding of the symmetric property (e.g.,  $a = b$  and  $b = a$ ).
- Understanding of different letters can represent the same value (bias from natural numbers)

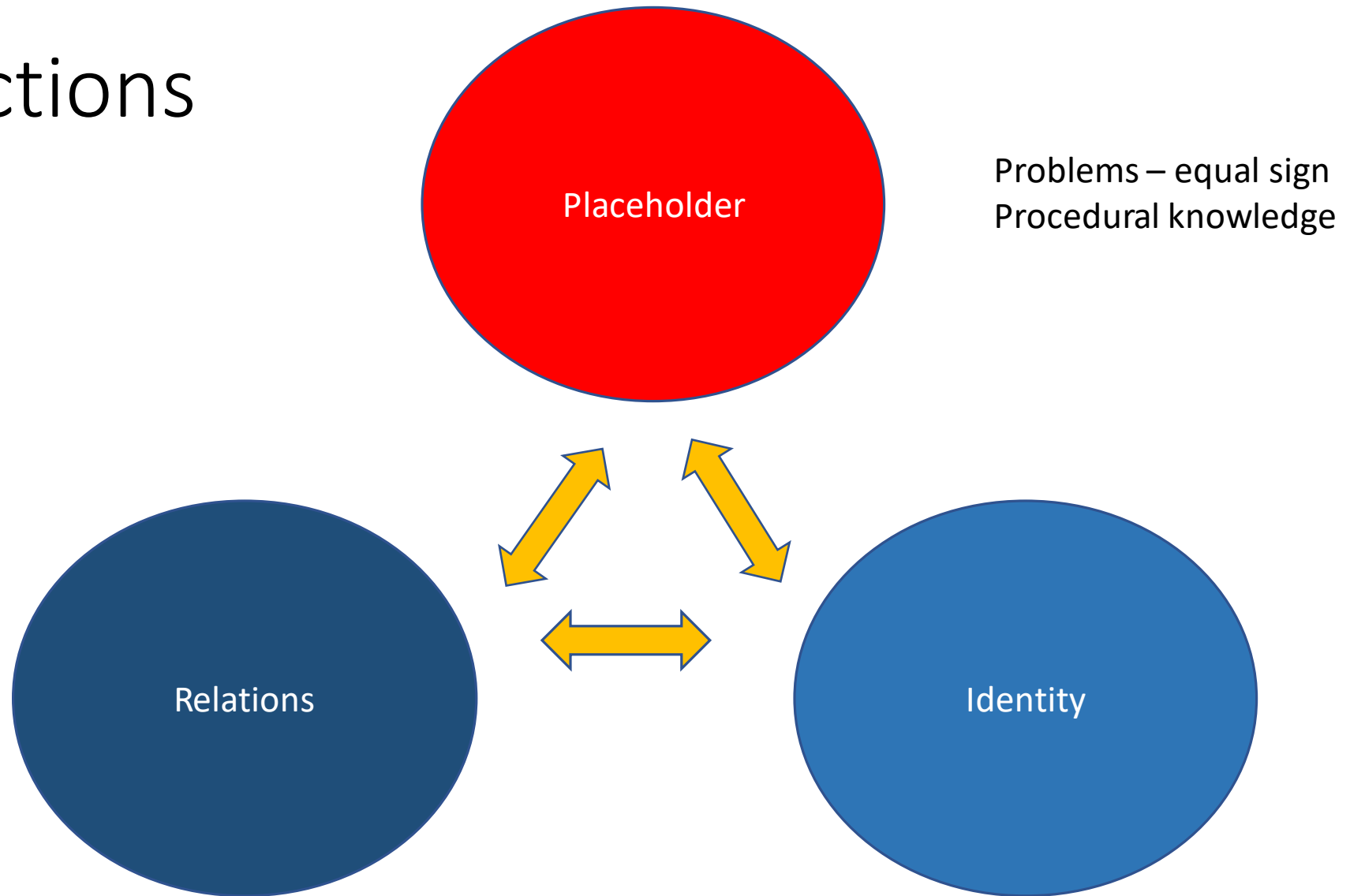


# Connections



- Conceptual understanding - network

# Connections



# Reference

- Andrews, P & Öhman, S. (2019). Swedish upper secondary students' understanding of linear equations: An enigma?. *Acta Didactica Napocensia*, 12(1), 117-129
- Dahl, M. T. & Jørgensen, P. B. (2022): Variable i matematik. Bacheloropgave, VIA University College
- Kieran, C. (1981). Concepts Associated with the equality symbol. *Educational Studies in Mathematics*, (12), 317-326