Understanding novice students' perceptions of "Authentic" Programming Tools

CARYN TRAN & ELEANOR O'ROURKE | Computer Science and Learning Sciences, Northwestern University

Northwestern | McCORMICK SCHOOL OF ENGINEERING
SCHOOL OF EDUCATION AND SOCIAL POLICY
DELTALAB

HOW DO STUDENTS THINK ABOUT "REAL PROGRAMMING"?

We probe how novice high school students define & evaluate the *authenticity* of programming tools using theories of **multi-dimensional** [1] and **perceived** [2] authenticity in learning.

INTRODUCTION

- **Tension between authenticity and scaffolding:** Students want to do "real", authentic, programming but need a simplified introductory environment to scaffold learning because traditional programming is difficult & intimidating [3].
- **Need to understand authenticity in CS:** We want to design programming tools that are scaffolded yet feel authentic. But first we must understand authentic learning in CS. Theories of authenticity say it is a multi-dimensional [1], subjective quality perceived by a student [2].

RESEARCH QUESTIONS

- What do students mean by "real programming"?
- Do theories of authenticity accurately model students' perception of authentic programming?
- How do students assess the authenticity of educational programming tools?

METHODS

- Pilot Study
- 10 high school students with one or less years of high school CS experience
  - 4 male, 6 female
  - From 6 schools in U.S.
- Survey
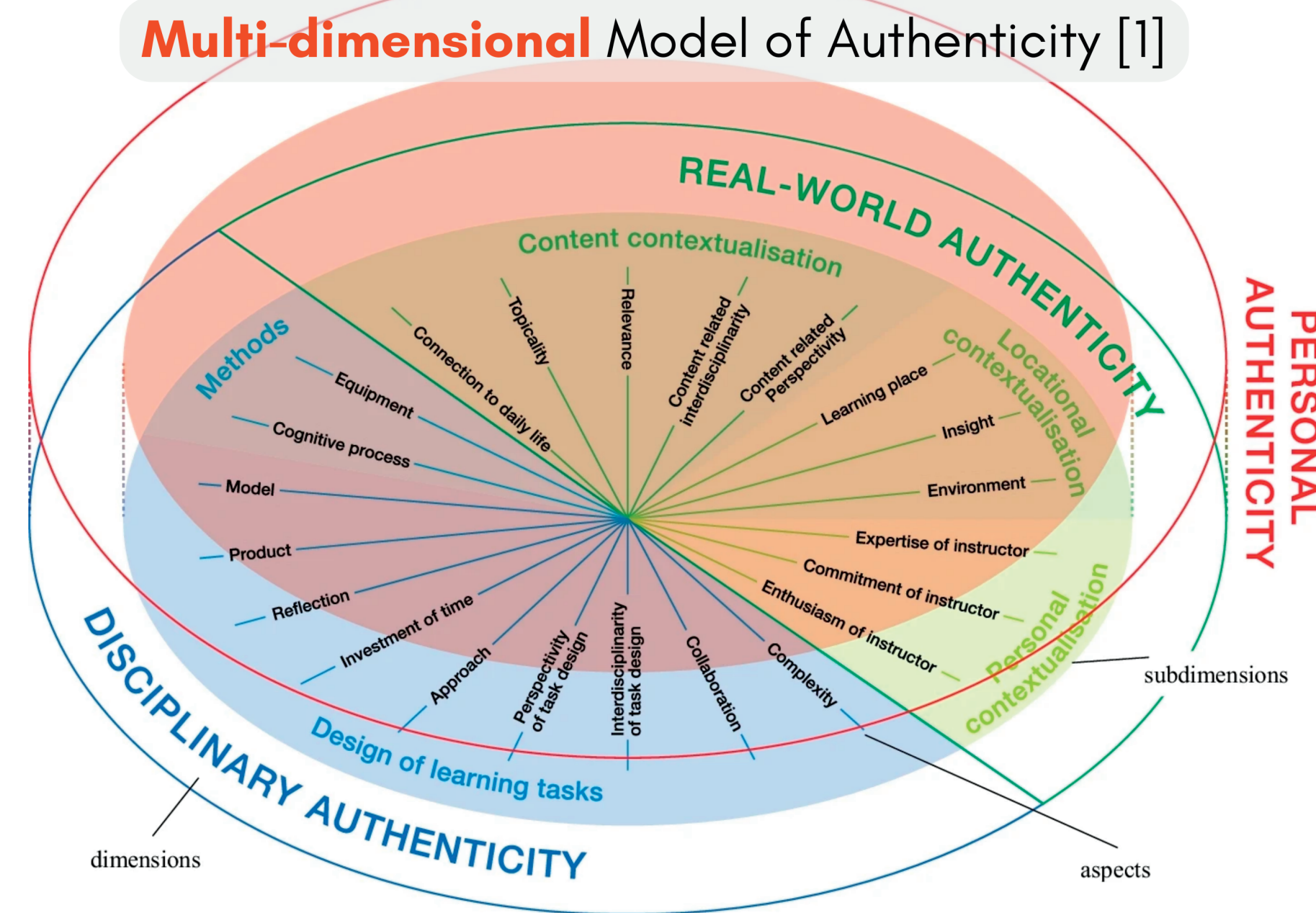- Optional Semi-Structured Interview

PILOT RESULTS

- Students want to do "real programming" but have varying definitions and perceptions of what is "real"
- Highly valued aspects are: similarity to professional **equipment** (language, editor, modality); support for **cognitive processes** or techniques used by professionals (debugging, memorizing syntax); supports students' personal **interests** (Roblox, cosmology)
- Positive relationship found b/w adapted multi-dimensional model and perceived authenticity of tools

ONGOING WORK

- **Iteration on model** of authenticity in CS education – collapsing, expanding, adding aspects
- Interviews and qualitative analysis to **understand students' beliefs** behind their perceptions
- Collecting and analyzing data to understand how factors such as **identity, background, and experience** affect perceptions of authenticity
- Interface probes and analysis of results to **find design opportunities**

[1] SCHRIEBL, D., MÜLLER, A. & ROBIN, N. MODELLING AUTHENTICITY IN SCIENCE EDUCATION. SCI & EDUC (2022)
[2] BETZ, A., FLAKE, S., MIERWALD, M., & VANDERBEKE, M.MODELLING AUTHENTICITY IN TEACHING AND LEARNING CONTEXTS. SINGAPORE: INTERNATIONAL SOCIETY OF THE LEARNING SCIENCES. (2016).
[3] WEINTROP, D.,& WILENSKY, U. TO BLOCK OR NOT TO BLOCK, THAT IS THE QUESTION: STUDENTS' PERCEPTIONS OF BLOCKS-BASED PROGRAMMING. IN PROCEEDINGS OF THE 14TH INTERNATIONAL CONFERENCE ON INTERACTION DESIGN AND CHILDREN.(2015)

THEORY

Multi-dimensional Model of Authenticity [1]

SURVEY INSTRUMENT

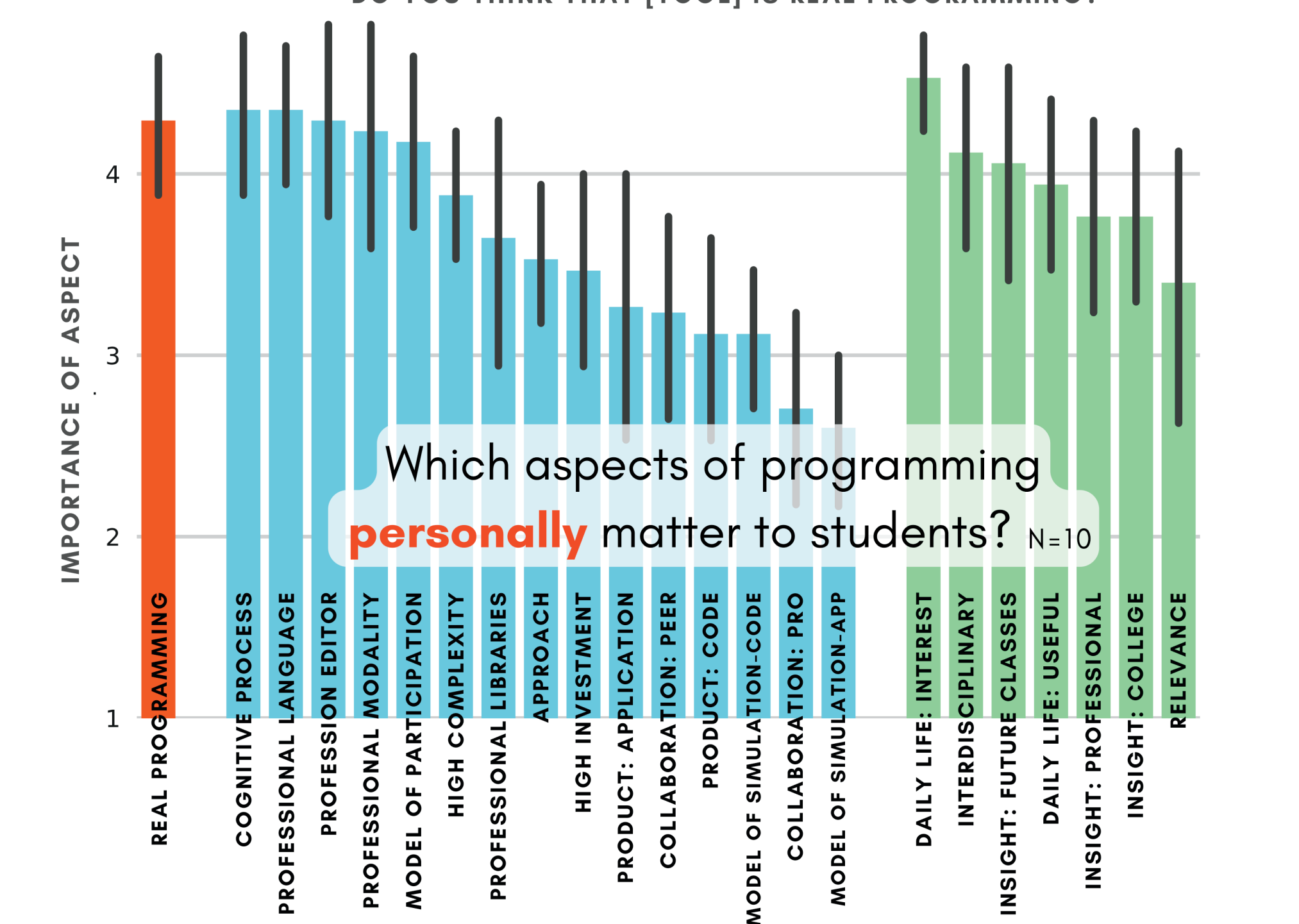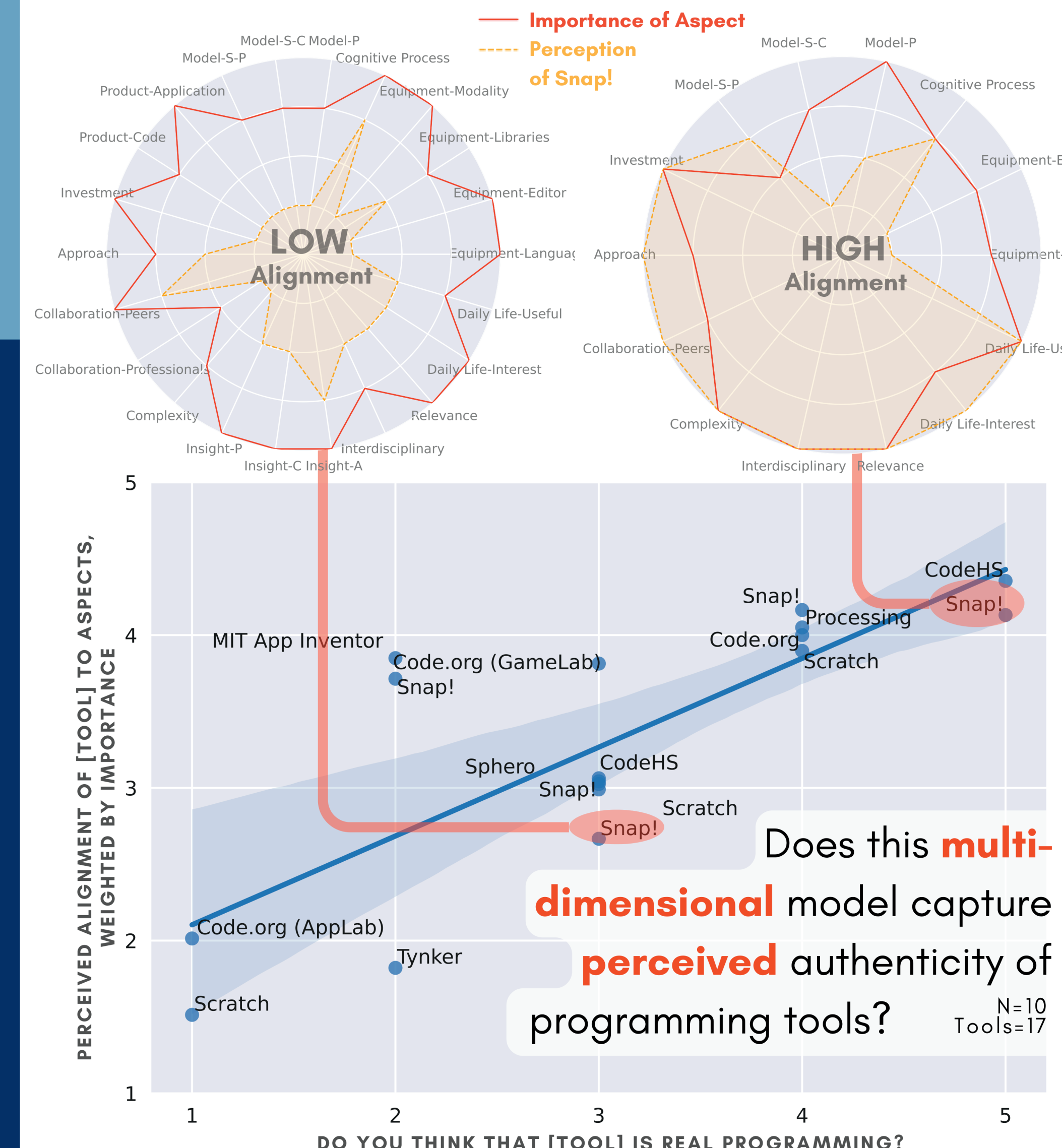|	Type	#Qs	Sample Question
Importance / Personal Authenticity	Perceived Authenticity	3	What is real programming? How important is it for you to be learning real programming? Why?
	Disciplinary Aspects	15	(How important is) using a programming language that a professional would use?
	Real-World Aspects	7	(How important is) creating programs about topics that are interesting to you?
Tool Evaluation	Perceived Authenticity	2	Do you think that [Tool] is real programming? Why?
	Perceived Disciplinary Aspects	<=15	(How much do you agree/disagree) [Tool] is a programming language that a professional would use.
	Perceived Real-World Aspects	<=7	(How much do you agree/disagree) [Tool] allows me to create programs about topics that are interesting to me.

> **REAL PROGRAMMING IS REALLY IMPORTANT TO ME TO LEARN ...IT'S MORE REFLECTING WHAT I'M GOING TO DO IN MY FUTURE AND IN THE REAL WORLD. SO I GET MORE EXCITED AND MORE MOTIVATED WHEN IN MY CLASSES I'M LEARNING REAL CODING.**

> **BLOCK CODING HAS SOMETHING UNDERNEATH IT, AND THAT MAKES IT LESS FLEXIBLE.**

> **YOU CONVERTED THE BLOCKS TO JAVASCRIPT...I FEEL KIND OF DISAPPOINTED ...BECAUSE IT WAS NOT FULLY BLOCKS [CONTROLLING] THE ARCADE [GAME].**

> **FOR PROGRAMMERS THEY JUST HAVE A KEYBOARD AND THEIR BRAIN, AND THEY CAN MAKE ANYTHING FROM THAT.**

SURVEY PILOT

Does this **multi-dimensional** model capture **perceived** authenticity of programming tools?   N=10 Tools=17

Which aspects of programming **personally** matter to students?   N=10