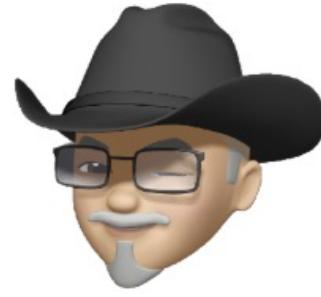


Teaching with Neurodivergentse Students

Michel Zam



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💻🌐🎭🎵💻
Ph.D CS
M.Sc. CS
M.Sc. Mech Eng

🎭🕹️🎮🎵💻
LightCode: Py
MyDraft.org
Asm C++ Java OO

💻🌐🎭🎵💻
Architecture, Evolution
MetaModels, MOPs

🎭🕹️🎮🎵💻
Corporate Coach
Agile, Craft
Teams of teams

🎭💻🎮🎵💻
EdTech
Greater good
KarmicSoft

**Customize Your Class for Anyone:
An AI-Aristotelian Gamified Approach
to Embrace Neurodiversity**



SIGCSE



Technical Symposium 2025



Goal: engage gamified learning



Today:



Co-funded by
the European Union

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CORPS
NSF Innovation Corps

NSF I-CORPS HUB
GREAT LAKES REGION

The story



🙏 SIGCSE'23 & Toronto

咡 Caring community

🧀 What if: sustainable *niche* 4 ND learners?

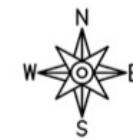
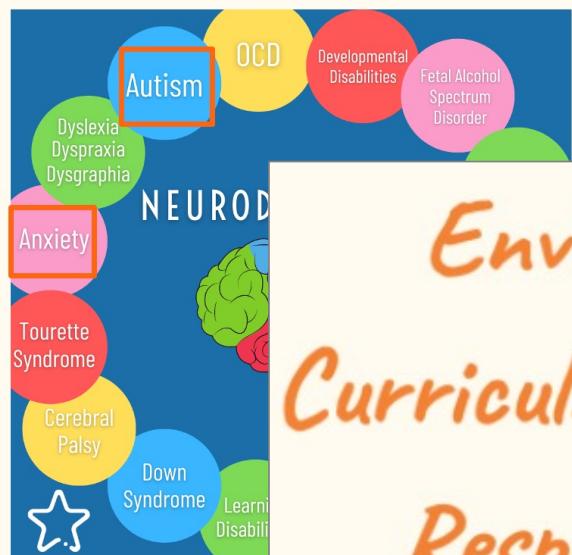
♃ How universal this could be ND ➡ NT?

📱⌚️ Attention span 💬 Texting: brb 👍 #tags





We learned more about ND & ... ourselves



Environment Matters
Curricular Design Matters
Responsiveness Matters

Traits, challenges & superpowers. And 3 things that matters.

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Inspired by classical drama 🎭🎭



Unity of place

Design & run your app in a **single process**: models@run.time



Unity of action

Focus on one consistent and meaningful **feature**, from start to end

#concept_to_teach



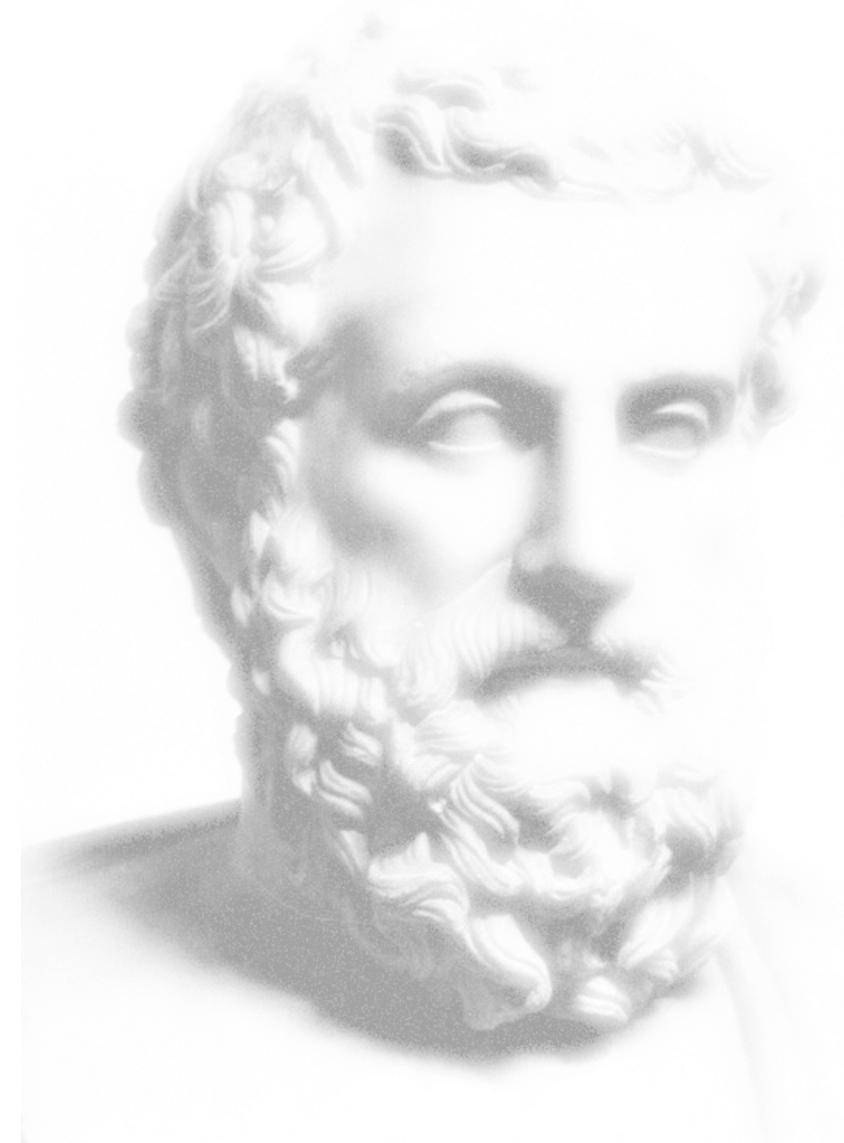
Unity of time

Run, design or code in **1-minute learning feedback loops**

Environment Matters

Curricular Design Matters

Responsiveness Matters



```
class HelloWorld {  
    public static void main(String[] args) {  
        System.out.println("Hello, World!");  
    }  
}
```

```
javac HelloWorld.java
```

```
java HelloWorld
```

```
Hello, World!
```

#1time #3places#15features

```
>>> print("Hello world")
```

```
Hello world
```

#1time #1place #2features

```
>>> "Hello world"
```

```
'Hello world' #1feature => print_text
```

```
>>> print("Hello world")
```

```
Hello world #1feature => function_call
```

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Episode 1 — Meet Timmy & Ari

This is [Timmy](#) and his new friend. They play with pets and functions. You can join them too. [?](#)

👋 Hi



Hi, I'm [Timmy](#). I ❤️ pets 🐱🐶

I wanna make them games so they can play when I'm not around.

I wanna try it by myself before I'll ask for help.

😱 [Timmy](#) struggles



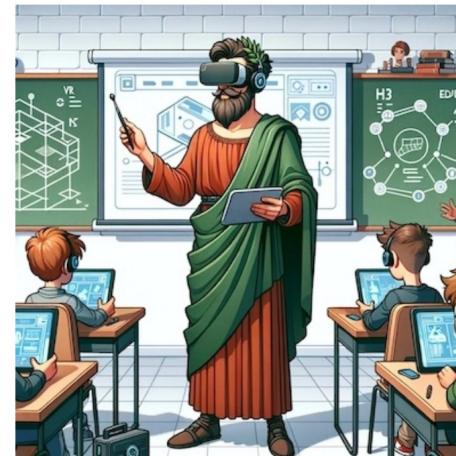
Now I'm stuck with **functions** 🐝

They look too complicated and so abstract 🤔

Please help me 🙏

➡ Help me

👋 Meet Ari



Hi, I'm [Ari](#). Your AI mentor. I'm a bit old, but I'm still learning 📖

Let's learn how games work, how they **function**.

Ready?

🎮 Functions



➡ All right. Let's play a song about **functions**.

"Lucky, fetch!" you call with glee,
Back he comes, 🐶 in teeth, happy as
So push the button with function's na
It returns a result, just like a 🐶 in

Image > Text, or letter components. Outside->In. Spin: pets

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Episode 1 — Meet Timmy & Ari

This is Timmy, and his new friend. They play with pets and functions. You can join them too. ☺

Hi



Hi! I'm Timmy. I ❤️ pets. 🐾🐾

Timmy struggles



Now I'm stuck with functions. 🤔

Meet Ari



Hi, I'm Ari. Your AI mentor. I'm a bit old, but I'm

Functions



All right. Let's play a song about functions.

Episode 2 Behind the scene

This is Timmy and Ari, behind the scenes. You can see their digital bones and muscles. ☺

Hi



Helping Timmy

```
Student Student(name='Timmy', age=15, _friend=None,
passion='pets', topic='python', struggles='learn about functions
to build games', mentor=Mentor(name='Ari', age=2532, _friend=None,
expertise='Engages gamified learning'), sad=True)

Learner

age int 15

icon str '😺\u200d🎓'

mentor Mentor

name str 'Timmy'

passion str 'pets'

sad bool True

struggles str 'learn about functions to build games'

topic str 'python'

help_me method Assigns a mentor to help the student
```

This is Timmy from inside-out. Can you see he's sad? Maybe you can help him? Push the button to call the function, then watch the effect. ☺

Ari can help!

Help me

Hi, this is Timmy. He loves pets. 🐾🐾 He wanna make them games so they can play when he's not around. From behind the scene, you might not see all the colors, but you can discover secrets. ☺

Ari's age

```
Mentor Mentor(name='Ari', age=2532, _friend=None,
expertise='Engages gamified learning')

Mentor

age int 2532

expertise str 'Engages gamified learning'

icon str '😺\u200d🎓'

name str 'Ari'
```

Here is Ari, Timmy's new AI mentor. Can you tell exactly how much old is he?

15 2023 2532 2517

Guess

Yay!! You won 10 points! 🌟🌟

You might need to store them to use them later. ☺

Call functions as dogs

```
Dog Dog(name='Lucky', icon='🐶', friend=None, reward='🦴🦴🦴🦴🦴🦴')

Dog

name str 'Lucky'

icon str '🐶'

reward str '🦴🦴🦴🦴🦴🦴'

fetch method Fetches the ball and doubles the reward
```

And this is lucky. We can call it like a **function**. Returns: ☺ And now the reward is 🦴🦴🦴🦴🦴🦴

Fetch

Mental model != experience => learning occurs

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Episode 3 — Moods & behaviors

What if the whole story was build from bottom-up, outside-in and from the future? You can start by exploring, take challenges, collect rewards. Then you can sketch a solution and let your app prove the goal. ☺

❤️ Timmy's moods



❤️ States are heartbeats regulating Timmy's mood

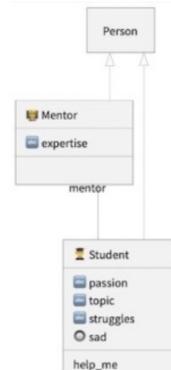
💻 State machine diagrams map behaviours to states

👤 Behavior

💻 Behavior is implemented with functions

```
def help_me(self):
    self.mentor = self.friend
    self.sad = self.mentor is None
```

🔥 Models & magics



➡️ Outside-in

💻 To make it more accessible, we start with the screen. 🌐 Under the hood, we discover key parts.

📋 Requirements

Feature: Timmy and Ari

As a learner
I want to learn about functions
So I can build games for my pets

Scenario: Timmy needs help

Given Timmy struggles and is sad
When his mentor helps
Then Timmy learns to call a function
And his pet receives a reward
And he becomes confident

💡 Requirements can be written in plain English and even generated from your interaction with the app.

⬅️ From the future

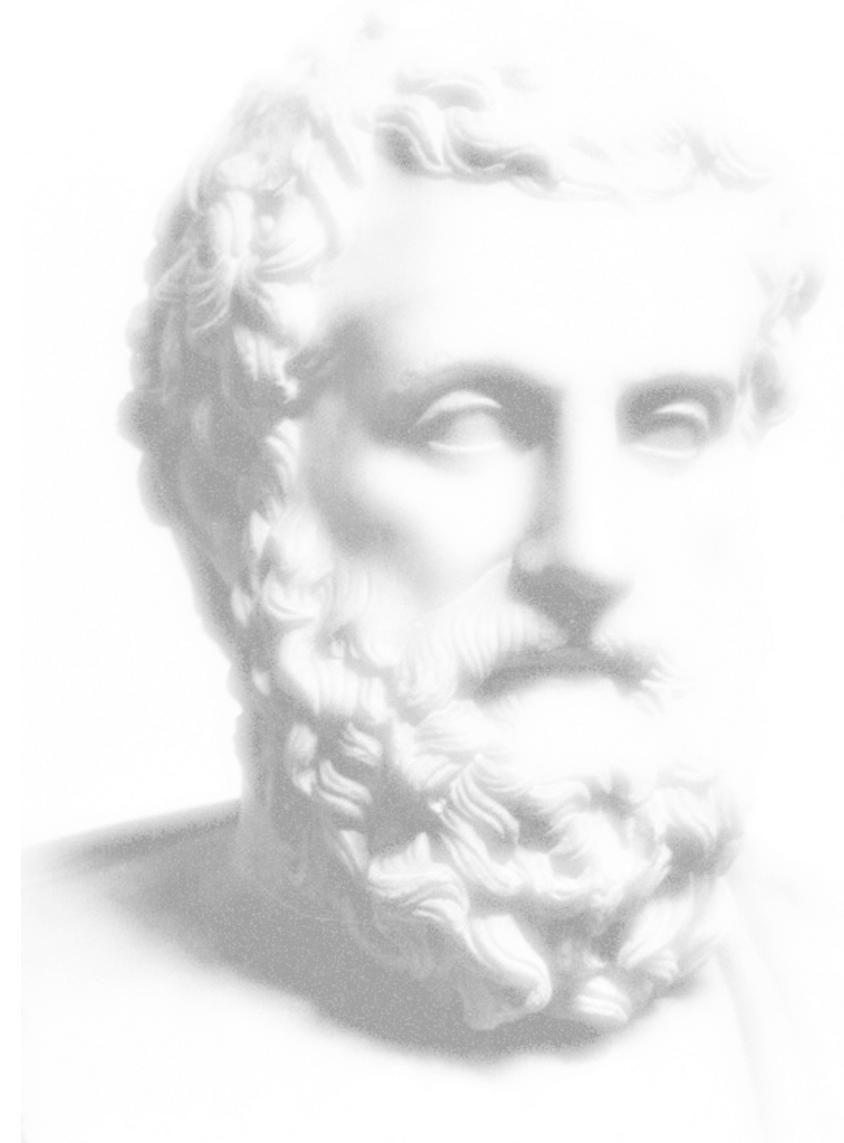
More about [From the future](#)

🎵 Celebrating song



Calling a function is as easy and memorable as: ??

clicking a button, calling a dog or playing a song. Enjoy! ☺



Inspired by classical drama ?

Unity of place

Design & run your app in a single process: models@run.time

Bottom-up: Instances before models & metamodels

Example: introduce Timmy & Ari **before** Person & Mentor and way **before** class & inheritance.

Unity of action

Focus on one consistent and meaningful feature, from start to end

Outside-in: Interactive behavior before inner design

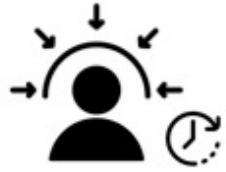
Example: play with Timmy & Lucky like an end-user **before** you discover design & code.

Unity of time

Run, design or code in 1-minute learning feedback loops

From the future: Build the app before specs & model

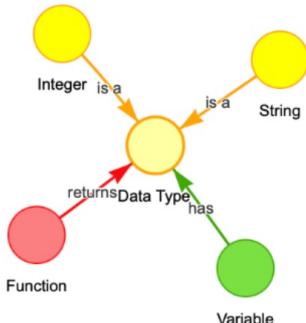
Example: play with your evolutionary app. When ready, generate evidence-driven specs.
Harvest knowledge from your own personal experience & memorable interaction.



Deep, Intrinsic Interests
(Spins)



Comment



Charlie

Hi, I'm Charlie. I might need your help...

Charlie

Hot chocolate

Blond hair, blue eyes, wearing glasses, 16 yo young boy, neuro-divergent learner

My Python concepts for Charlie

Custom Python concept for Charlie.

Isomorphism

Isomorphism

Integer

String

Function

Variable

Comment

my Integer

my String

my Function

my Variable

origin

is a

returnsDataType

has

is a

has

is a

has

is a

has

origin

Comment

my Comment

Garrett II

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Nathan I, soon 🎓



From Garrett to people who care



Call 4 challenge



What CS topic, hard to grasp for your students, do you want to explore?



How Universal is all this?



Teaching with
Neurodiverse
Students
Thank you!

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Call: customize / hack your CS Topic



(SIGCSE TS 2025 (series) / Tutorials /

Tutorial 402: Customize Your Class for Anyone: An AI-Aristotelian Gamified Approach to Embrace Neurodiversity



Michel Zam
Paris-Dauphine University
& KarmicSoft
France



Tara Bogart
KarmicSoft
United States



Kate Siekman
Director of Learning and
Outcomes at Islands of
Brilliance
United States



2

Open to
collaborations:
cohorts of
SplNs, tests,
grants ...



<https://www.islandsofbrilliance.org>

You can apply for mini-grant

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More



Thirteen years on an island | Mark Fairbanks ...

YouTube · TEDx Talks

Oct 22, 2014 <https://youtu.be/9UBoCmnSFkA?si=b4oYJSoHDhoOu2pw>



The Aristotelian Way <https://youtu.be/fLoV7TiLlew>

Teaching Modeling to Anyone the
Aristotelian Way: Anyone can cook a...

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