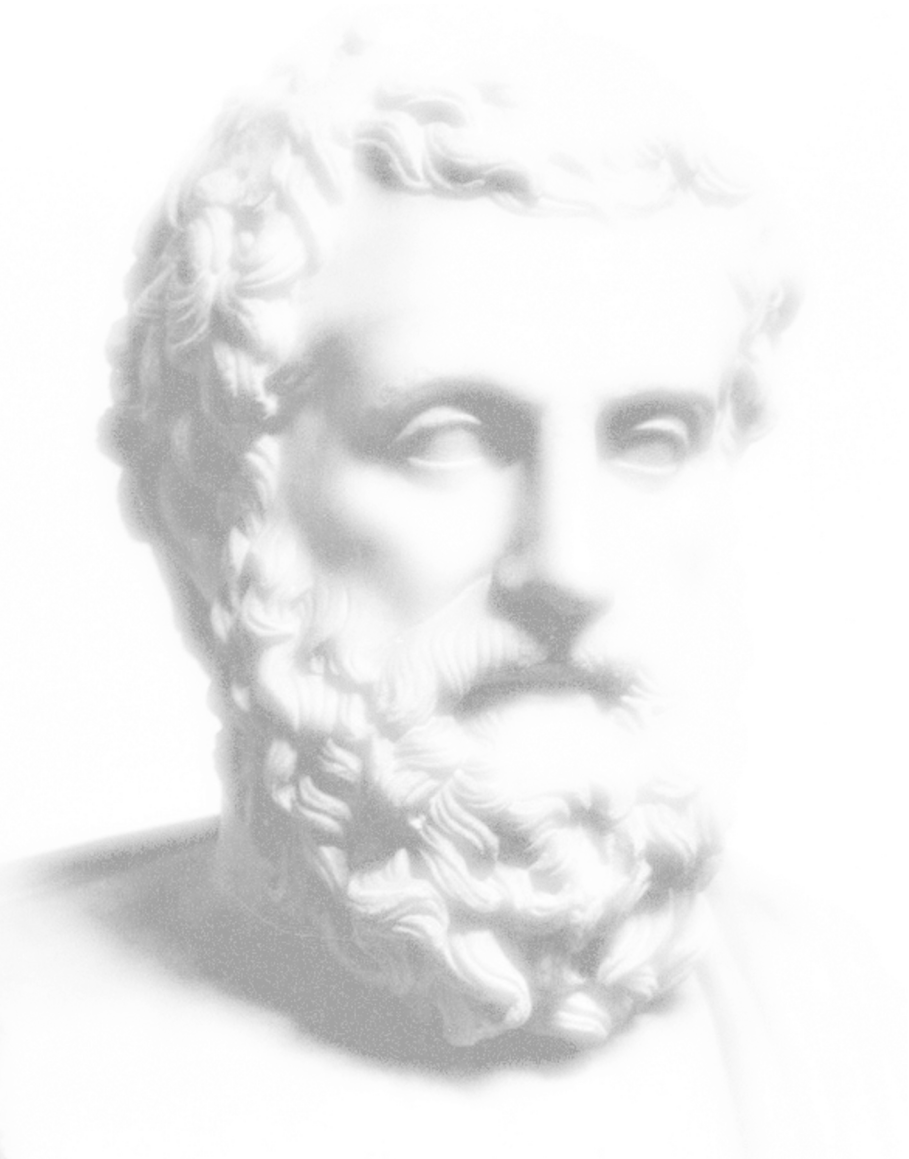




Teaching with Neurodivergentse Students

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
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CORPS
NSF Innovation Corps



NSF I-CORPS HUB
GREAT LAKES REGION

The story



SIGCSE'23 & Toronto



Caring community



What if: sustainable *niche* 4 ND learners?



How universal this could be ND ↔ NT?



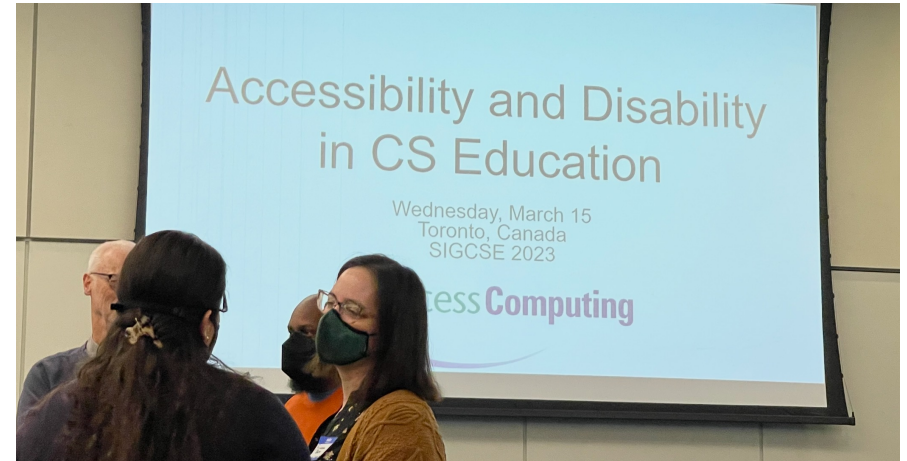
Attention span



Texting: brb

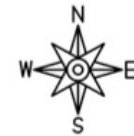


#tags



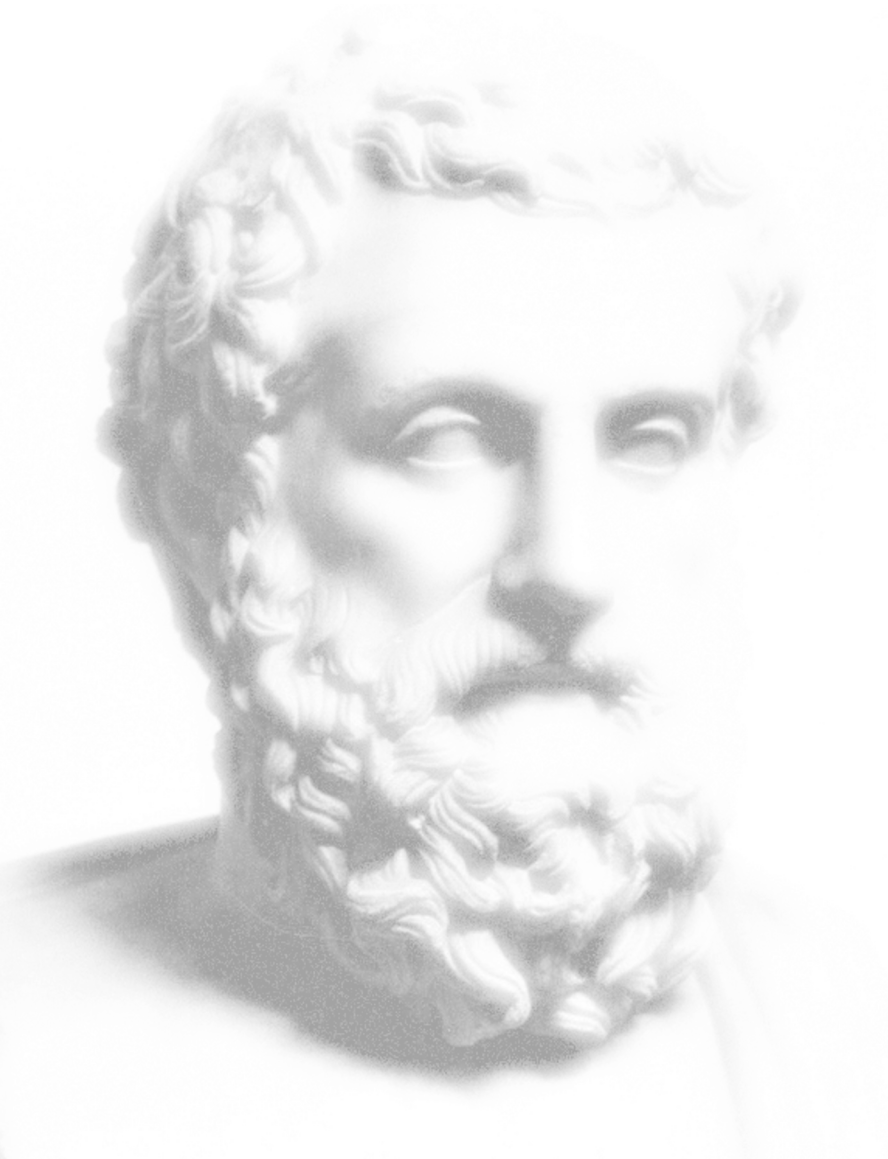


We learned more about ND & ... ourselves



Environment Matters
Curricular Design Matters
Responsiveness Matters

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



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

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ACM MoDELS'22 Educators Symposium



```
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



Timmy struggles



Meet Ari



Functions



Hi, I'm Timmy. I love 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.

Now I'm stuck with functions.

They look too complicated and so abstract.

Please help me.

Help me

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?

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 i

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

Episode 1 — Meet Timmy & Ari

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Hi, I'm Timmy. I love 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



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.

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 '\u2080d'
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

Ari's age

Mentor	
age	int 2532
expertise	str 'Engages gamified learning'
icon	str '\u2080d'
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

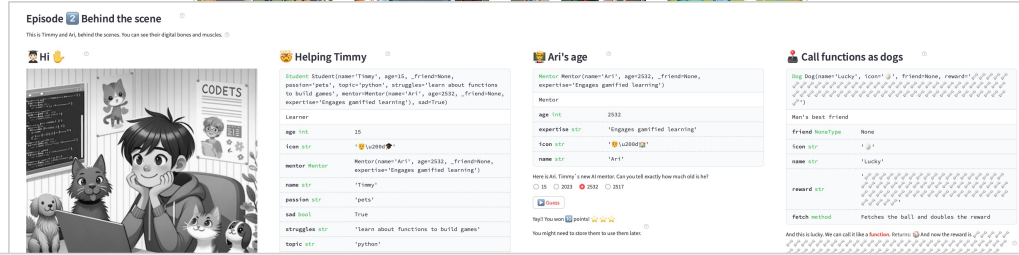
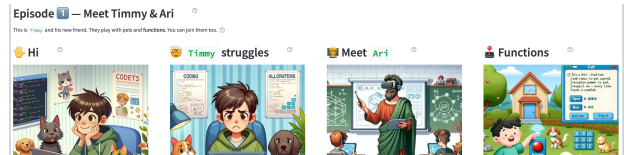
Dog	Dog(name='Lucky', icon='🐾', _friend=None, reward='')
Man's best friend	
friend	NoneType None
icon	str '🐾'
name	str 'Lucky'
reward	str ''
fetch	method Fetches the ball and doubles the reward

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 proce the goal.

Timmy's moods



- States are heartbeats regulating Timmy's mood
- State machine diagrams map behaviours to states

Behavior

Behaviour 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

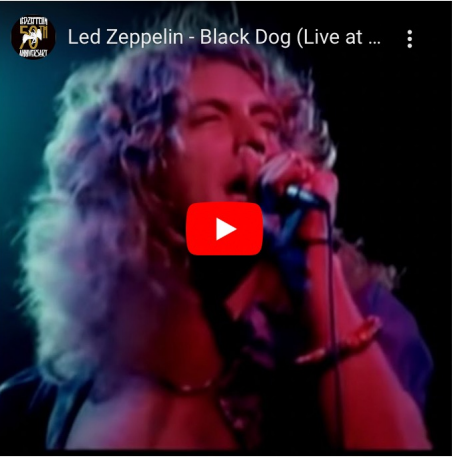
Scenario: Timmy needs help
Given Timmy struggles and is sad
When his mentor helps
Then Timmy learns to call a function
And his pet receives a reward
And he becomes confident

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

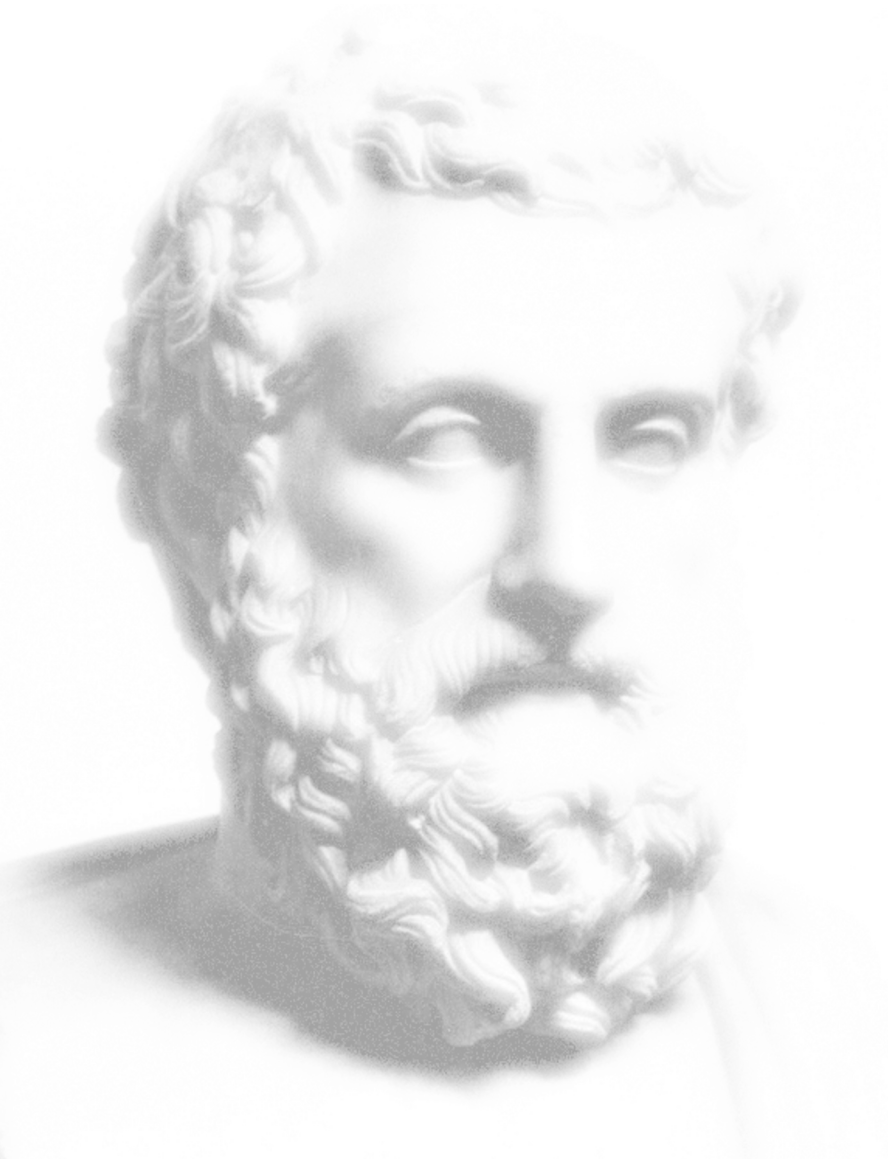
From the future

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**

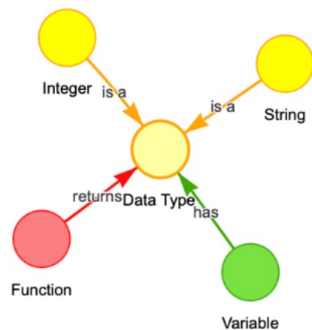
Example: play with Timmy & Lucky like an end-user **before** you discover design & code.

🕒 **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.



Charlie

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

Hot chocolate

Description

Blond hair, blue eyes, wearing glasses. 18 yo young boy, neuro-divergent learner.

What

Learn to code

Fun

Boring classes, cryptic error messages. No tutor available.

Score

1

Image

charlie.png

without photo with photo

Generate image Discard image

My Python concepts for Charlie

Description

Custom Python concepts for Charlie.

standard customized

Graph Graphs Customize

Test

I'm like your favorite mug—I hold the hot chocolate, but you decide what's inside. What am I?

Answer

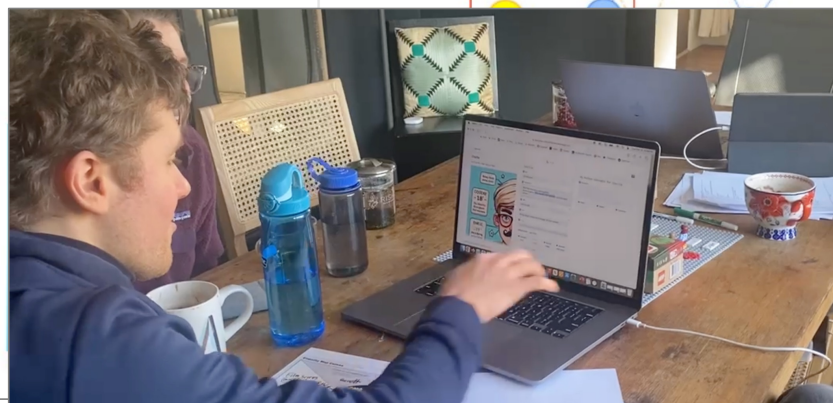
Choose an option

standard customized

Check answer

Island

Isomorphism



Garrett II

Nathan I, soon 🎓🎓

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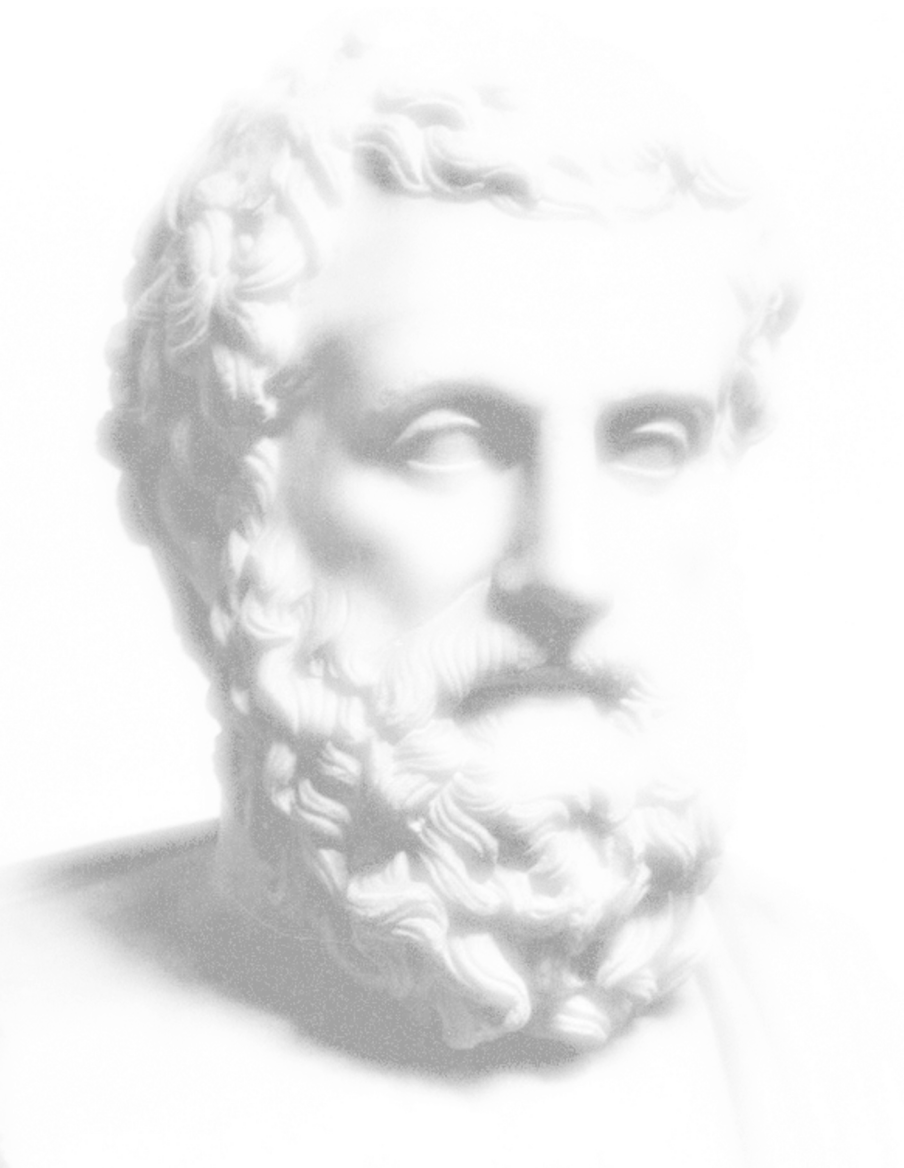
🗨️ From **Garrett** to people who care



🏆 **Call 4 challenge**

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

🪐 How **Universal** is all this?



Teaching with
Neurodivergentse
Students

Thank you!



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



You can apply for mini-grant

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



<https://www.islandsofbrilliance.org>

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>

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Aristotelian Way: Anyone can cook a...