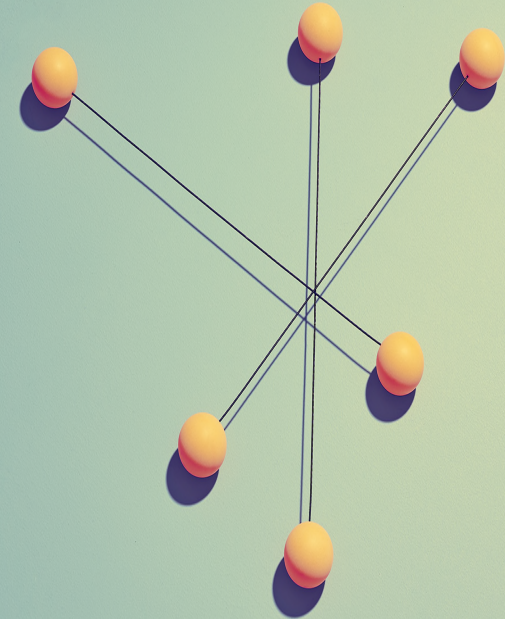


# Co-constructing the Plurilingual Experience: From EAP Pathway Program to Undergraduate Studies in STEM

Jane Karanassiou

Renison University College (UWaterloo)

University of Toronto



# First things first...

Curriculum Manager and  
instructor  
Renison University College  
(University of Waterloo)



Teach and develop curriculum  
for UWaterloo's undergraduate  
language pathway programs

PhD Candidate - Dept. of  
Curriculum, Teaching and  
Learning:  
University of Toronto

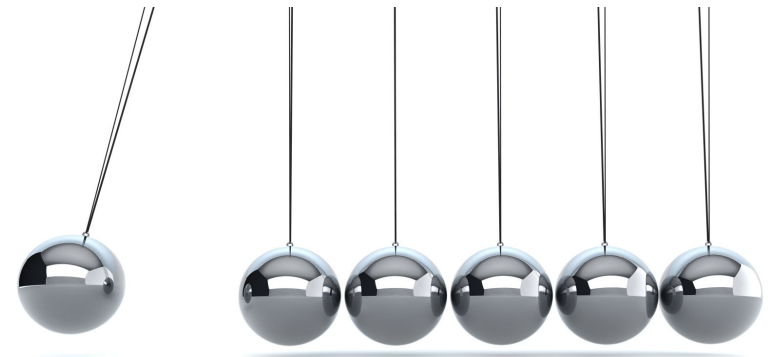


Exploring undergraduate use of  
plurilingualism in STEM

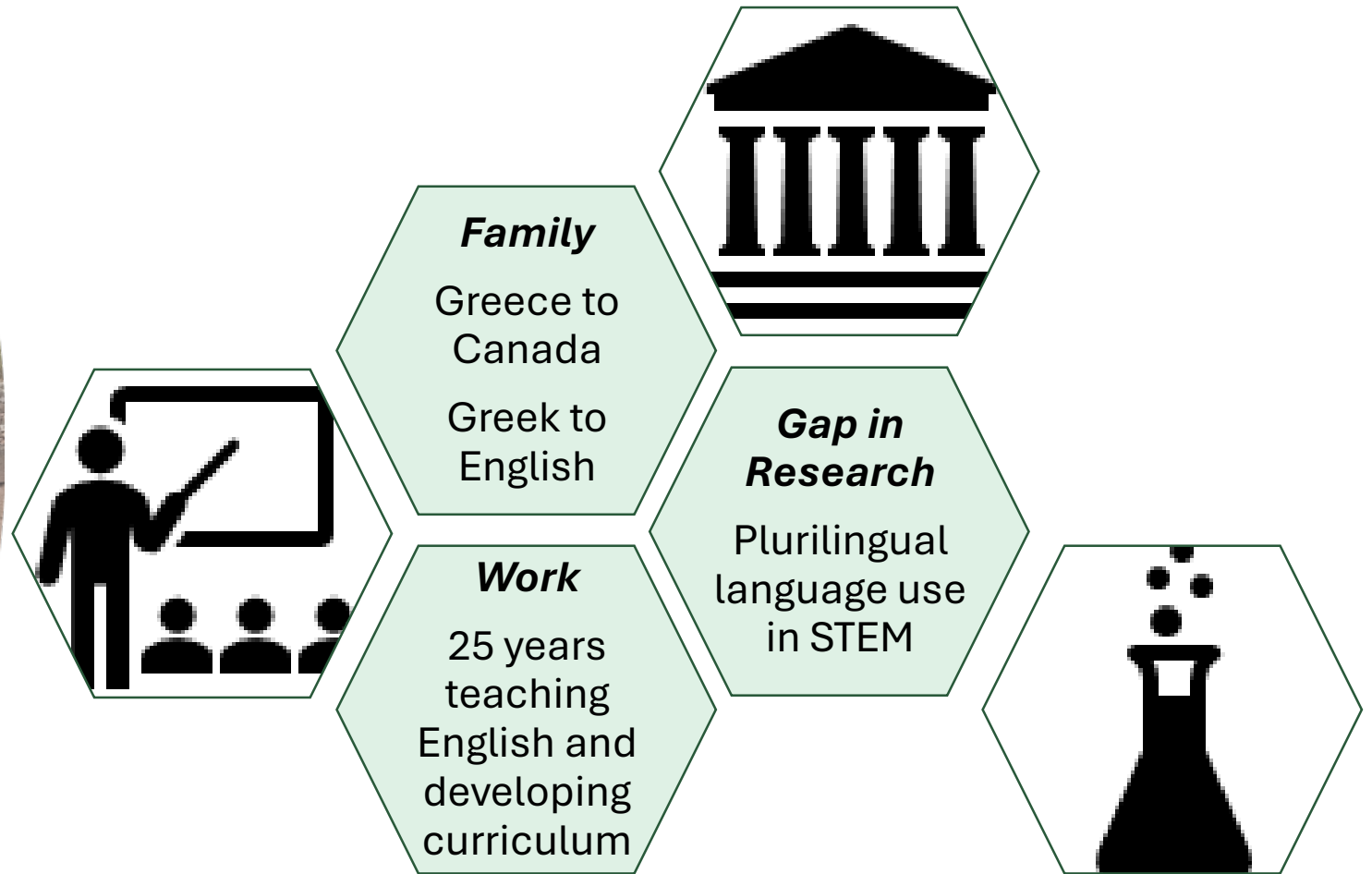


# Aim of research...

- To better understand how undergraduate plurilingual students think about and use their languages in STEM
- To inform practices to support student progress in STEM



# The motivation...



# Research questions

Research Questions	
<b>RQ1</b>	How participants perceive their plurilingualism in STEM
<b>RQ2</b>	How participants experience their plurilingualism when completing tasks in STEM

# Agenda

1

## Research Design

- Research Approach
  - Complexity Theory
  - Poststructuralism
  - Interpretative Phenomenological Analysis (IPA)
- Context and Participants

2

## Findings

- Plurilingualism in STEM: Change over time
- Barriers to Engaging through English
- Significance of Findings

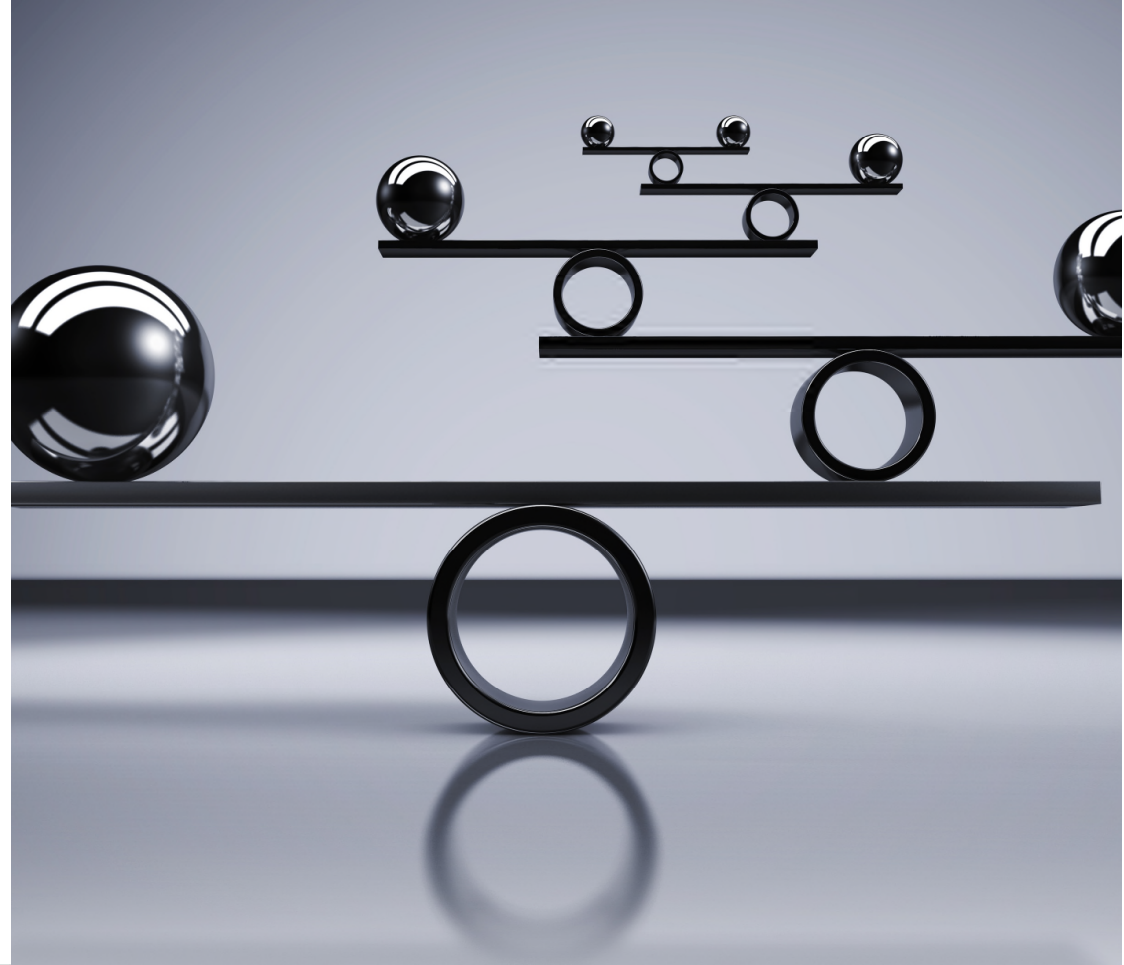
3

## Recommendations

- Repositioning English in STEM
- Collaborations across communities



# Research Approach



# Research Approach

## Theoretical Background

Complexity Theory

Plurilingualism

Poststructuralism

## Methodology

Interpretative Phenomenological Analysis

## Research Questions

Perceptions of plurilingualism

Experiences of plurilingualism

Agency through awareness of plurilingual self

## Methods

Interviews  
Vignettes  
Analytic Memo

Think Alouds  
Retrospective Reports  
Interviews

Interviews  
Vignettes  
Analytic Memo



# Complexity as a guide to research design

## Concepts of Complexity Guiding Research

### Openness

Dynamic interactions of systems with their environment

(Hiver & Al Hoorie, 2020)

### Feedback loops

Solidify or dismiss system behaviours

(Ellis & Larsen-Freeman, 2009)

### Nonlinearity

Rhizomatic and unpredictable trajectories

(Mercer, 2011; Larson-Freeman & Cameron, 2008)

### Emergence

Adaptation as system reorganizes

(Larson-Freeman & Cameron, 2008)

### Attractors

Preferred states towards which a system moves

(Juarrero, 1999)

### Change over time

Dynamic systems always in flux

(Cameron, 2015; Piccardo, 2017)

# Poststructuralism as Intellectual Strategy

<b>Tenets of Poststructuralism</b>	
<b>The rhizome</b>	<ul style="list-style-type: none"><li>• Directions in motion</li><li>• Non- hierarchical, nonlinear conception of growth</li></ul> <p>(Deleuze &amp; Guattari, 1987)</p>
<b>Deconstruction</b>	<ul style="list-style-type: none"><li>• Meaning cannot be fixed</li><li>• Contingent on context</li></ul> <p>(Cilliers, 2005).</p>
<b>De centering the subject</b>	<ul style="list-style-type: none"><li>• Not a core presence</li><li>• Exists through the interaction of traces</li></ul> <p>(Derrida, 1982; May, 2005)</p>



# Interpretative Phenomenological Analysis: IPA



The researcher is trying to make sense of the participant trying to make sense of what is happening to them

(Smith, 2011, p.10)

# Interpretative Phenomenological Analysis: IPA



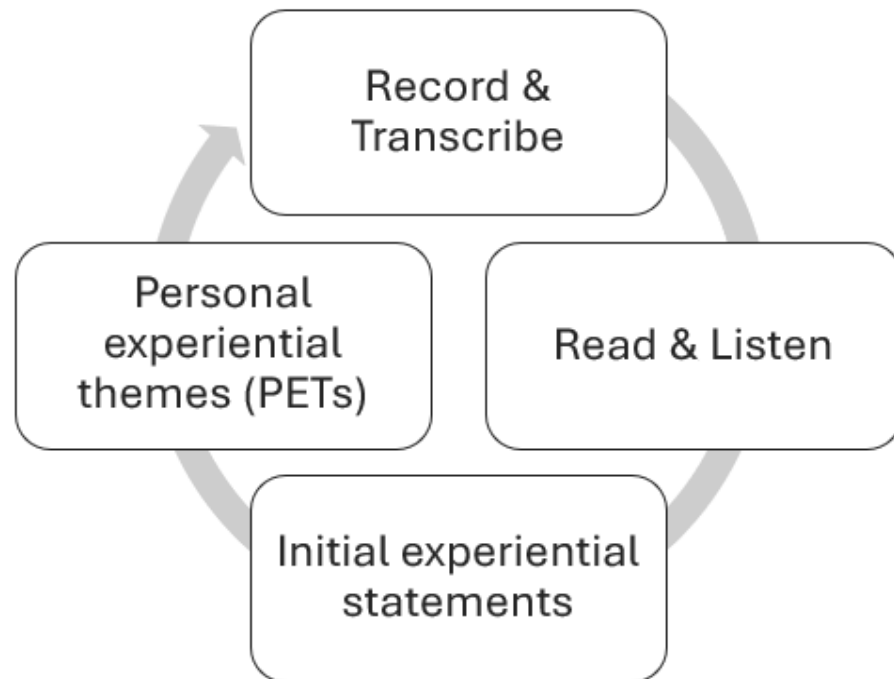
**Phenomenology:** Being in the world

**Hermeneutics:** To surround words with analyses

**Idiography:** Fine grained focus on the individual

**Understanding co-created by subject and researcher**

# IPA Process



Idiographic interpretation + analysis



Group experiential themes



Detailed narratives + reflective commentary

# Research Context & Participants

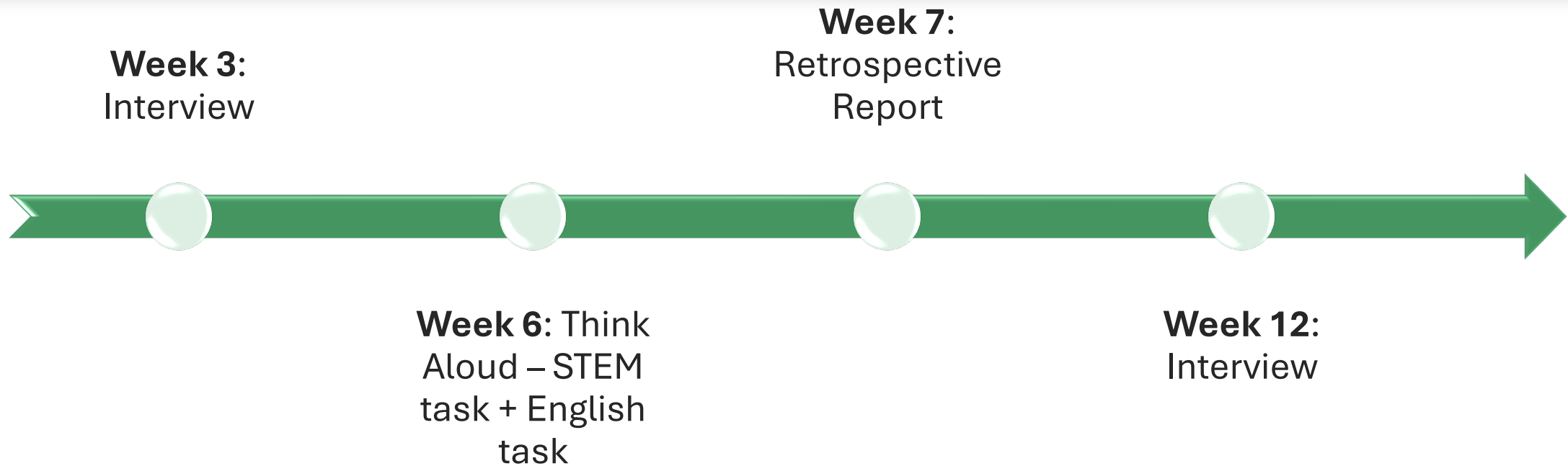
## Study Participants:

14 former language pathway  
students

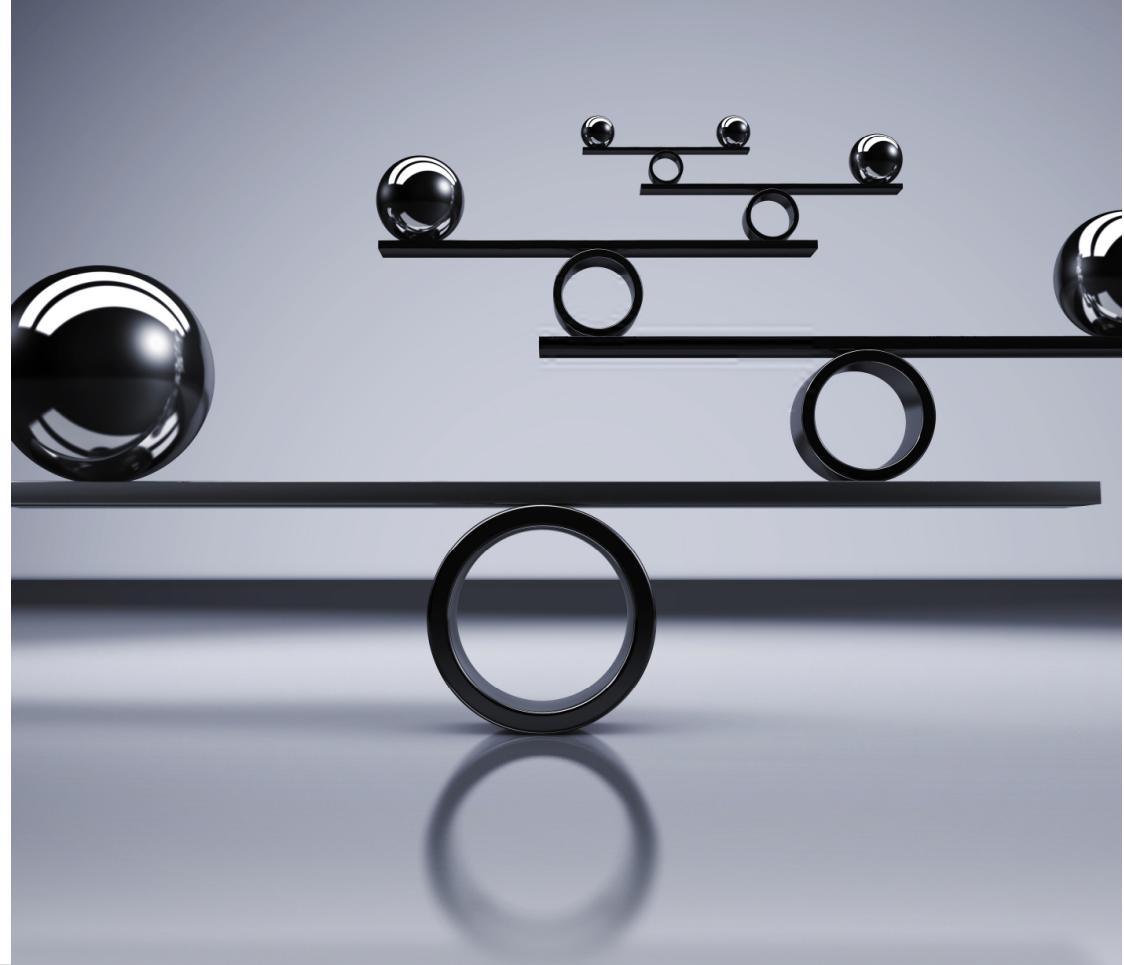
Currently enrolled in  
undergraduate STEM programs

	Math	Science	Engineering
1 <sup>st</sup> Year	Kyson	Ann Cleo Ronan	Dianne Sam
2 <sup>nd</sup> Year	Faye Lucas	Emily Lina Remi	Petra
3 <sup>rd</sup> Year			June Oliver

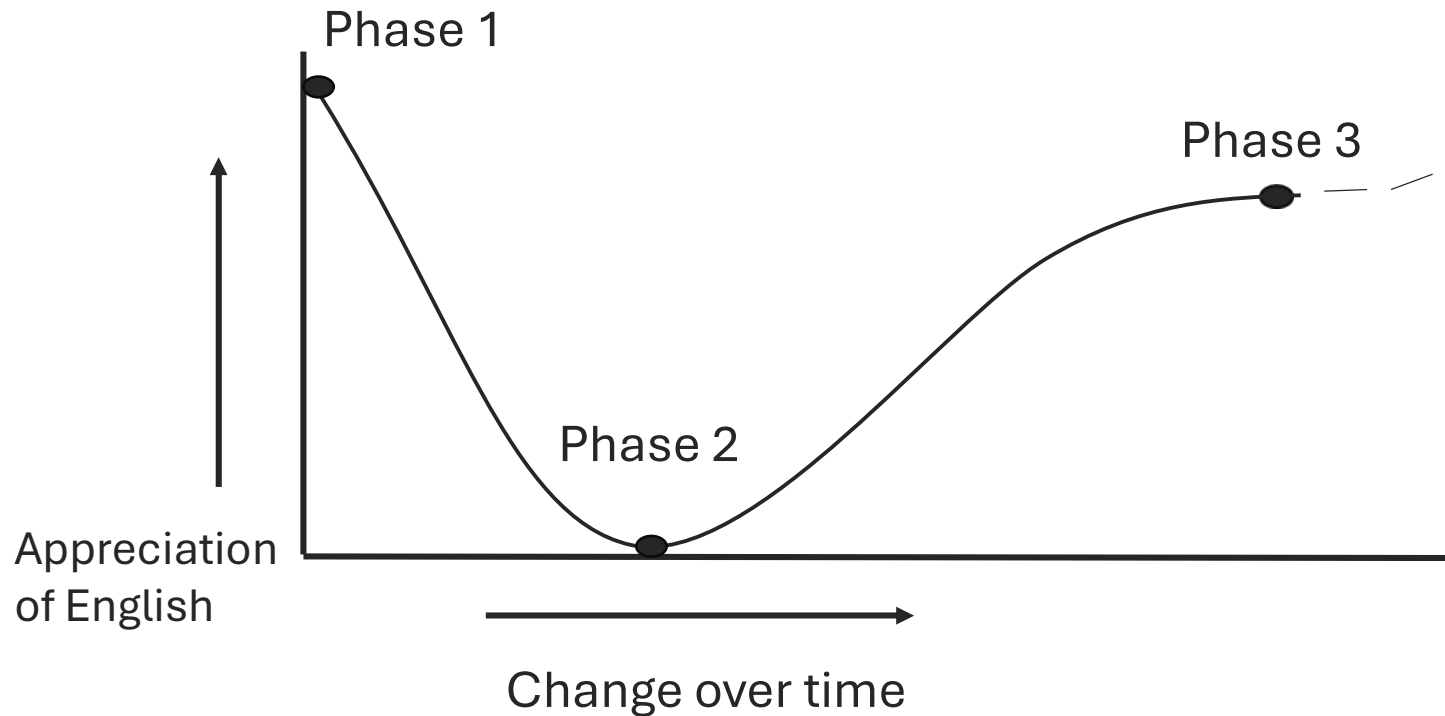
# Data Collection: Fall Semester



# Findings



# Participant Perceptions of Plurilingualism: Changes over time



**Phase 1:** Aspirational  
**Phase 2:** Instrumental  
**Phase 3:** Emerging appreciation of plurilingualism

# Phase 1: Starting out - Aspirational behaviours

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## Avoiding L1

- I must think logically in English to avoid troubles in the future (Ann)

## Making Connections

- I want to understand different culture more and learn something more deeply between our countries (Cleo)

## Emerging Identities

- I can say two to the power of six / limit X goes to minus 1 – I learnt this! (Kyson)



# Phase 2: Hanging on – An Instrumental Approach

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## Speed and efficiency

- Learning words is a waste of my time (Sam)
- I don't care about what's the language I used. I just think about finish the homework (Ronan)

## Translating

- If you don't have a translator to help you to understand, then you are kind of blocked at that stage ... you can never learn. English is not that helpful because you don't understand what they're talking about (Oliver)


# Phase 3: Finding balance – Using English

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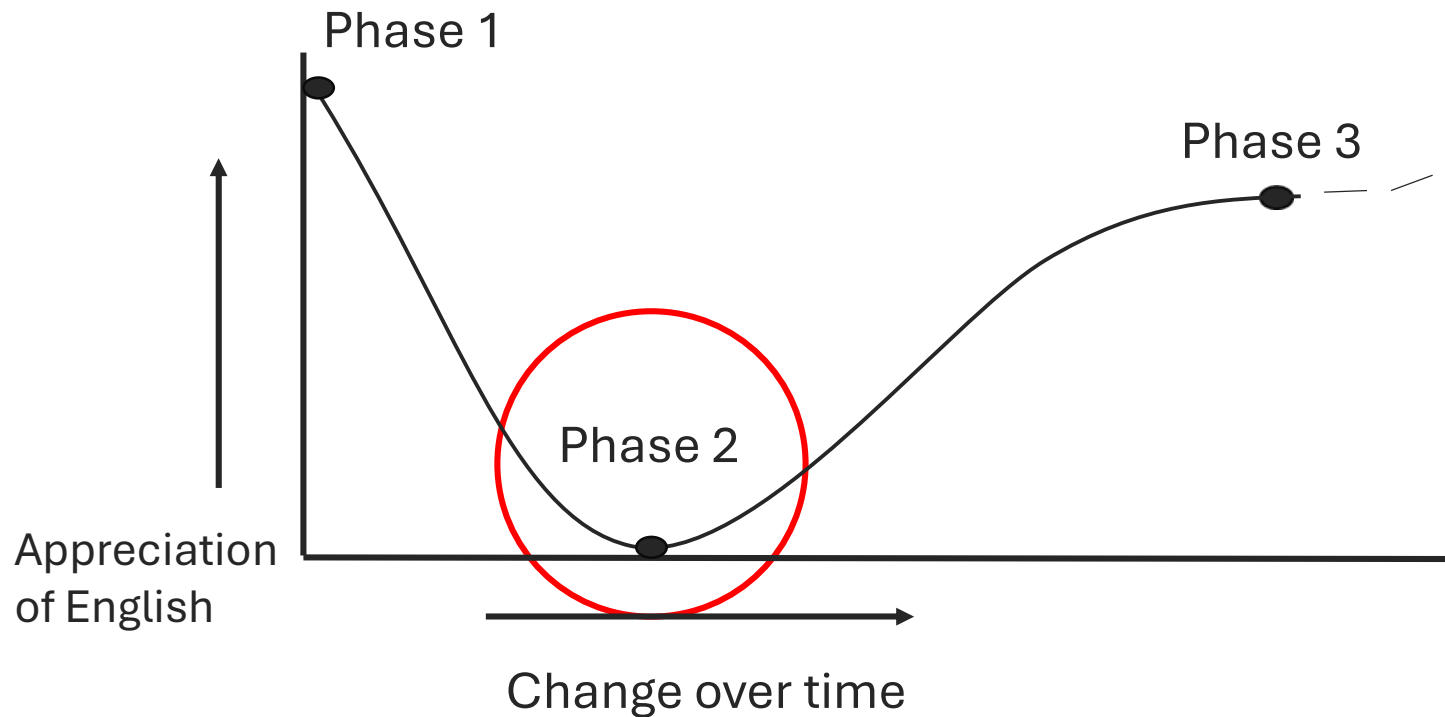
## **Beyond terminology**

- The way that we think is more important than the words we use (Remi)

## **A plurilingual approach**

- Something we think in just a straight way...if you understand with another language, maybe it's a curve (Ann)
  - An English mindset makes you become more logic when you are explaining different kinds of things (Faye)
  - The logical system just slightly switched from your original language to the new language (Petra)
- 

# Participant Perceptions of Plurilingualism: Changes over time



**Phase 1:** Aspirational  
**Phase 2:** Instrumental  
**Phase 3:** Emerging appreciation of plurilingualism

# Barriers to Engaging through English in STEM

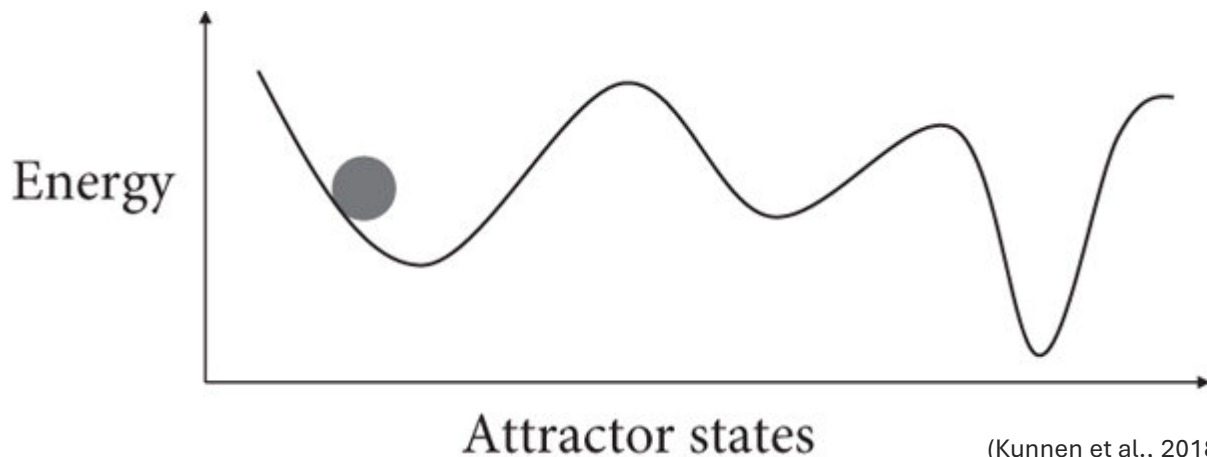
**All participants want and expect to develop their English as a result of their studies**

1. Linguistic agency and lack of incentive
2. STEM education as impediment to English language development



# 1. Linguistic agency: Language development as a Complex System

L1 as an attractor state - stable pockets of behaviours towards which a dynamic system naturally evolves.



## Quotes:

an invisible barrier in my brain (June)  
very adjusted on one language (Emily)  
I can't control myself (Sam)  
very hard to convert (Oliver)

**A need for external incentives and support to disrupt the attractor states**

## 2. STEM as barrier to language development

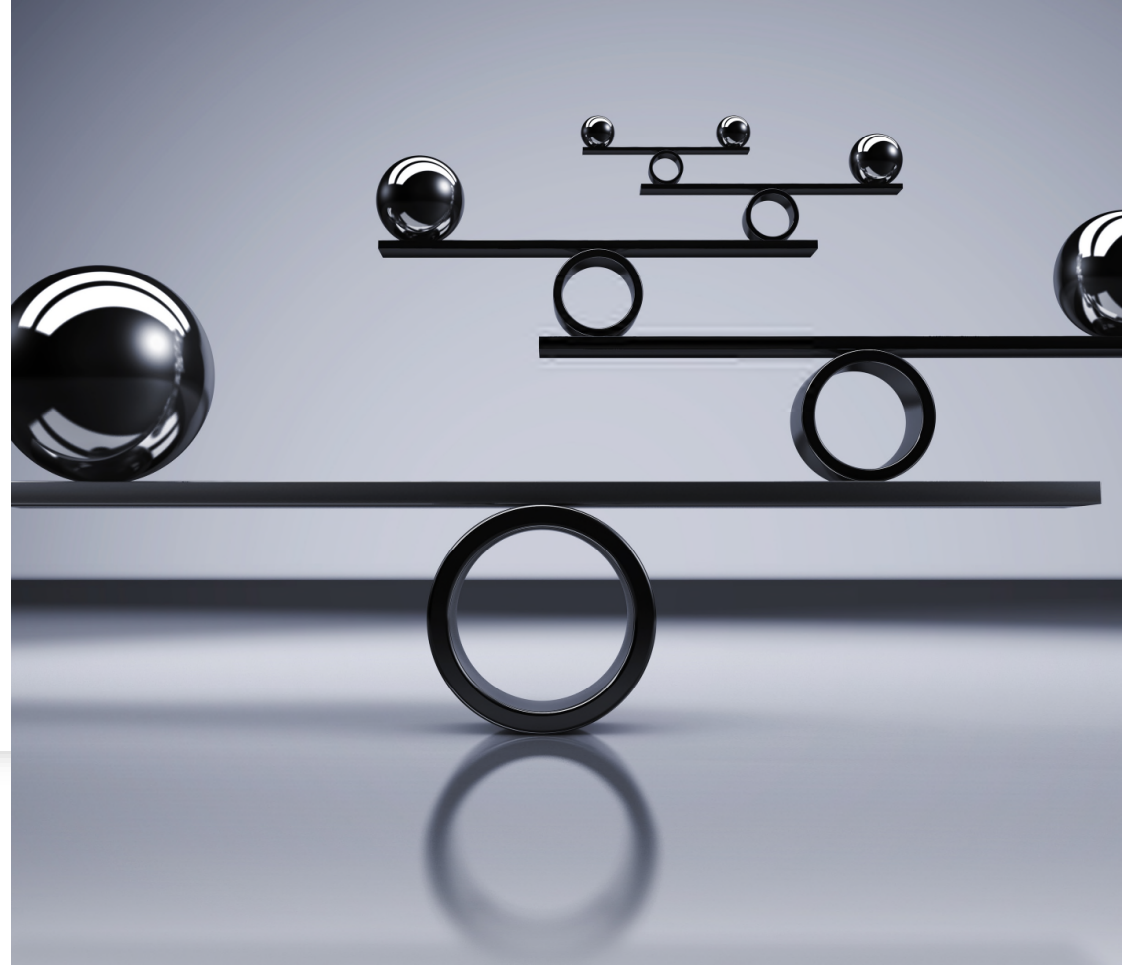
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1. Minimal need to engage with language
  - Math and physics is in their own language ... . I will start thinking about [a problem] in a maths or physics way (Oliver)
  - I don't really use language to think (Lina)
2. Disconnected from the broader linguistic environment
  - I seldom to communicate with others and so languages is not a matter for me right now (Ronan)

## 2. STEM as barrier to language development

Progress in STEM	Progress in English
Linear Logical • Reading • Memorisation • Practice  Evaluated through tests and exams	Non-Linear Fluid • Ambiguous • Unpredictable  Less tangible rewards

# Significance of Findings



# Why engagement through English matters for students:

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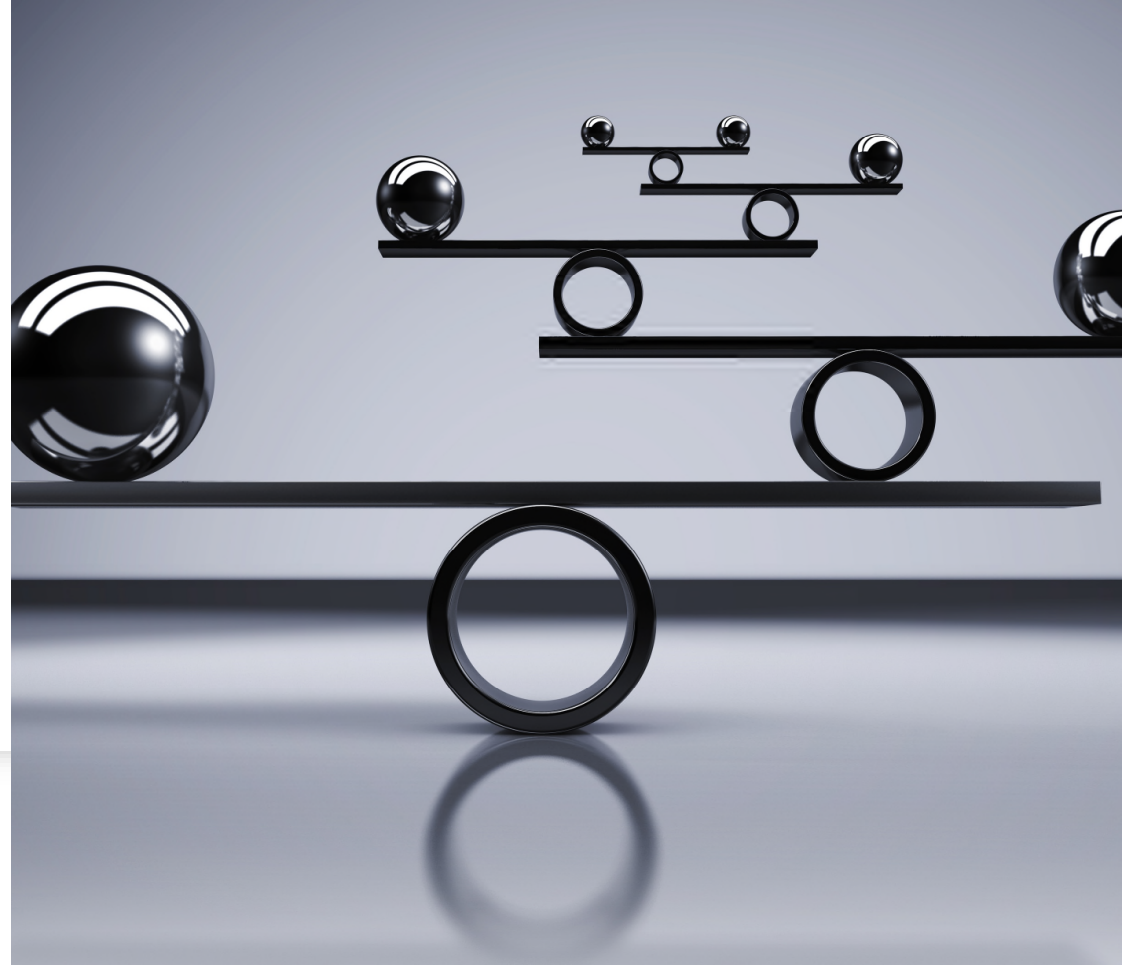
1. **Personal growth & expected outcomes:** All participants want and expect to develop their English
2. **Belonging:** The language and culture of the discipline are deeply intertwined with the learning context (Bond, 2020)
3. **Future safeguards:** Increasing discursive demands in math-based courses (Barton et al., 2005)

# Why engagement through English matters for institutions

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- 1. Student persistence in STEM:** 31% of those entering STEM graduate after 4 years (The Conference Board of Canada, 2024)
- 2. Language outcomes:** Lower post-graduation earnings of international students attributed to English language proficiency (Blit et al., 2024)
- 3. Attracting international students:** Since 2019, 43% growth in the number of English taught programs (ETPs) offered in non-English speaking countries (British Council, 2024)

# Recommendations



# Action: Repositioning Language in STEM

**“English language development should be viewed as the core business of any university where courses are delivered in English”**

(Humphreys, 2022, p.6).

Language development integrated into all STEM courses for ***all*** students

- Repositioning communication as central – not an optional extra
- Connecting learners to discipline through incentivising language development

# Action: Repositioning Language in STEM

**Disciplinary experts** - little awareness of how they learned the language of their discipline (Bond, 2020)

**EAP practitioners** to collaborate those delivering content knowledge

- Lift specialist out of their discourse (Jacobs, 2025)
- Teaching shared and open to feedback (Airey, 2011)



# Action: Preparing Students for STEM in EAP programs

## **Undergraduate STEM: Language as mediation**

- Cognitive flexibility
- Ability to learn through English

## **Undergraduate STEM: Learning through Lectures**

- Repetition of terminology and equations
- Connecting terminology to visuals and demonstrations

## **Undergraduate STEM: Laboratory Work**

- Collaboration with diverse peers
- Common purpose + set timeframe
- Use of “general words” and scientific terminology

## **EAP**

Content selection:  
Unknown themes

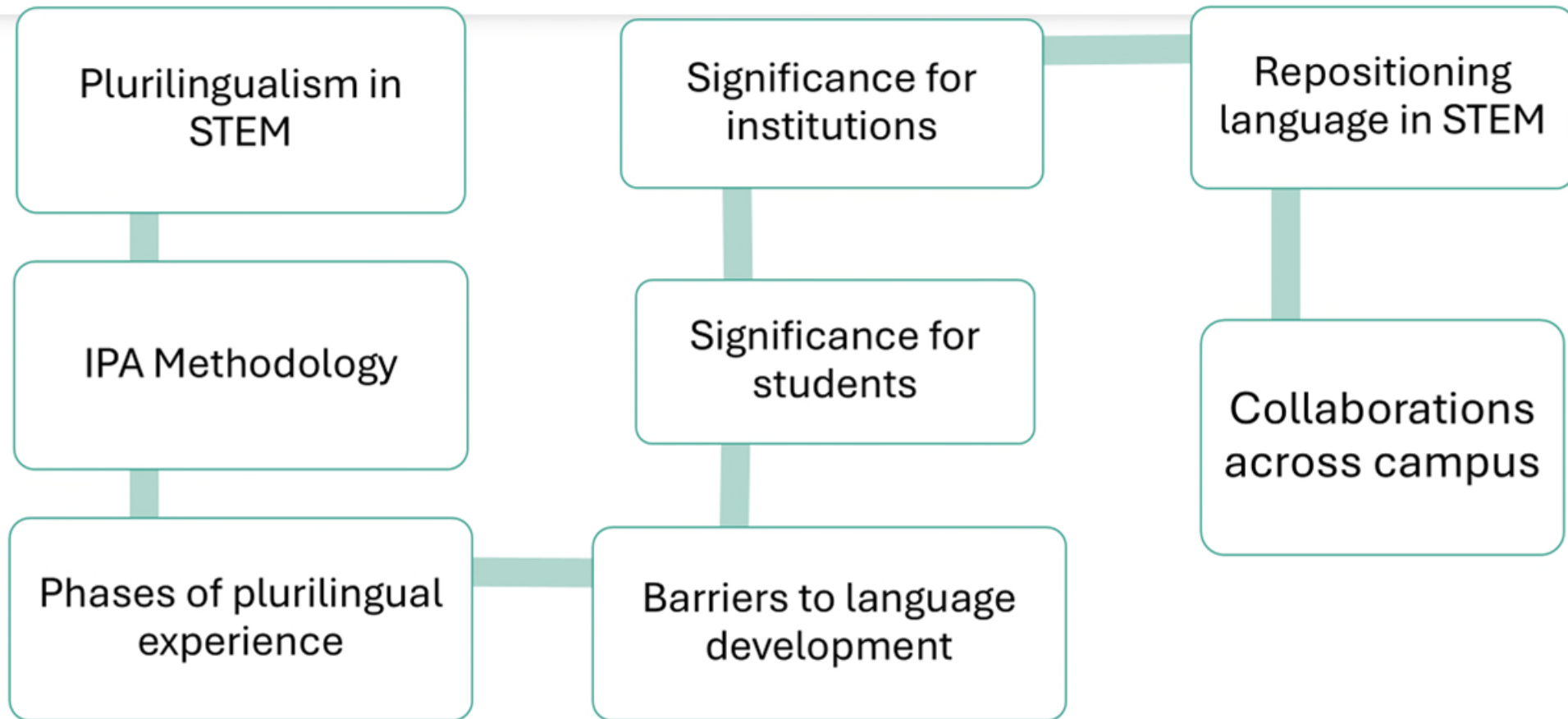
## **EAP Collaborations**

- Teacher Assistant training
- Resume building opportunities

## **EAP**

- Action oriented tasks
- Design Sprints
- Mini labs

# Recap





Thank you!

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