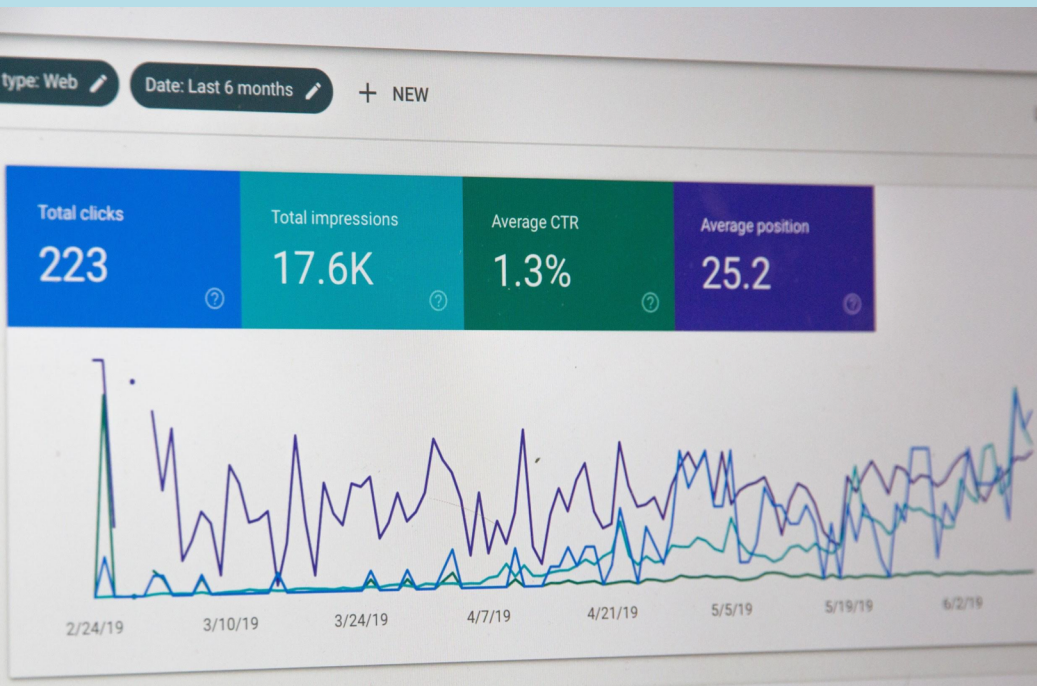


Harnessing Multimodal Learning Analytics in Computer-Supported-Collaborative-Learning (CSCL)



A collaboration with National Institute of Education (NIE), Nanyang Technological University (NTU), Singapore



Erasmus
University
Rotterdam



(Computer-Supported) Collaborative Learning

Visible and invisible dynamics
of interaction and collaboration



Who is (not) learning?

How to assess learning?

Where does learning take place?

Why Multimodal Learning Analytics?

We need to ...

- **Capture** learning traces in several modalities;
- **Assess** learning; and
- **Provide** (real time or post-hoc) feedback in a multimodal way.

Session Outline

Research Plan & Research Objectives

MMLA: Dispositional & Discourse Analytics

Demo 1: Speech to Text

Demo 2: OpenPose

Demo 3: Visualization of Feedback

Research Plan & Objectives

Two phases over a 3-year period (Sept 2019 – Sept 2022)

Phase I: Design, Enact and Analyse

- Identify collaborative activities in Knowledge Building classroom.

- Design research to employ multimodal technology to uncover visible and invisible dynamics of collaboration and interaction patterns.

- Enact across primary to secondary to tertiary classrooms.

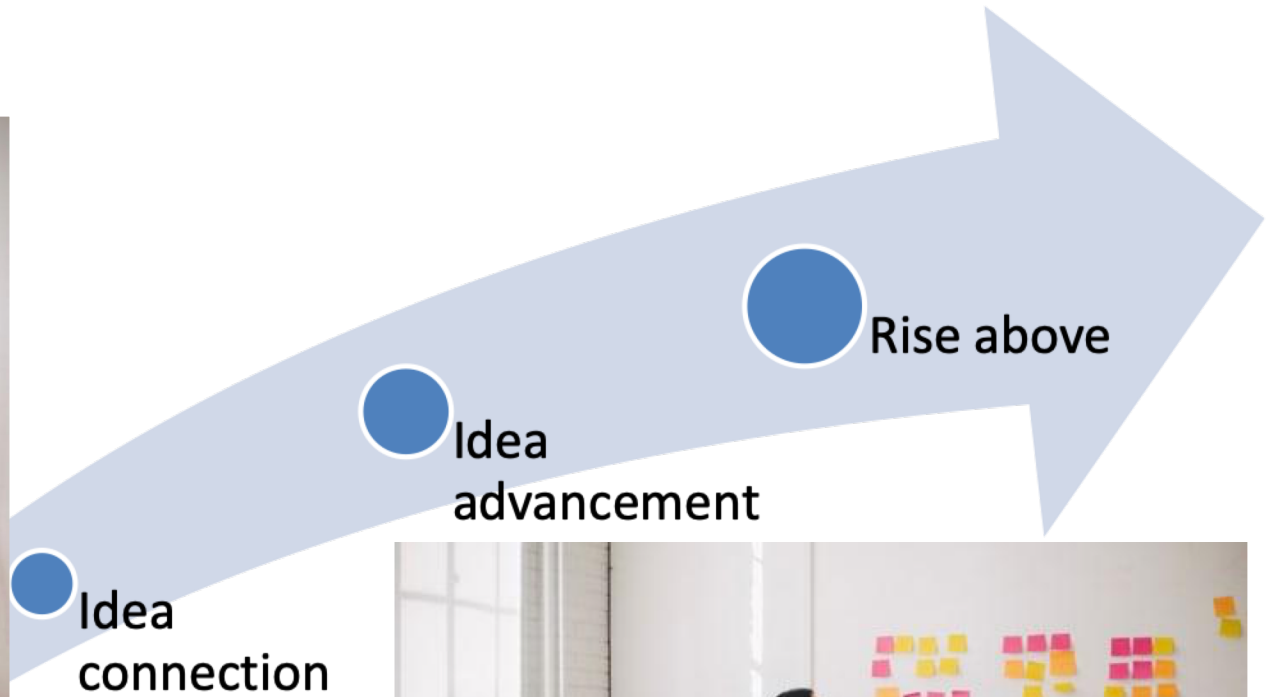
Phase II: Engage and Sustain

- Engage practitioners through a series of teachers' professional development & training.

- Design and enact a series of teachers' professional development courses to engage teachers in sustained CSCL practice with MMLA for formative assessment.

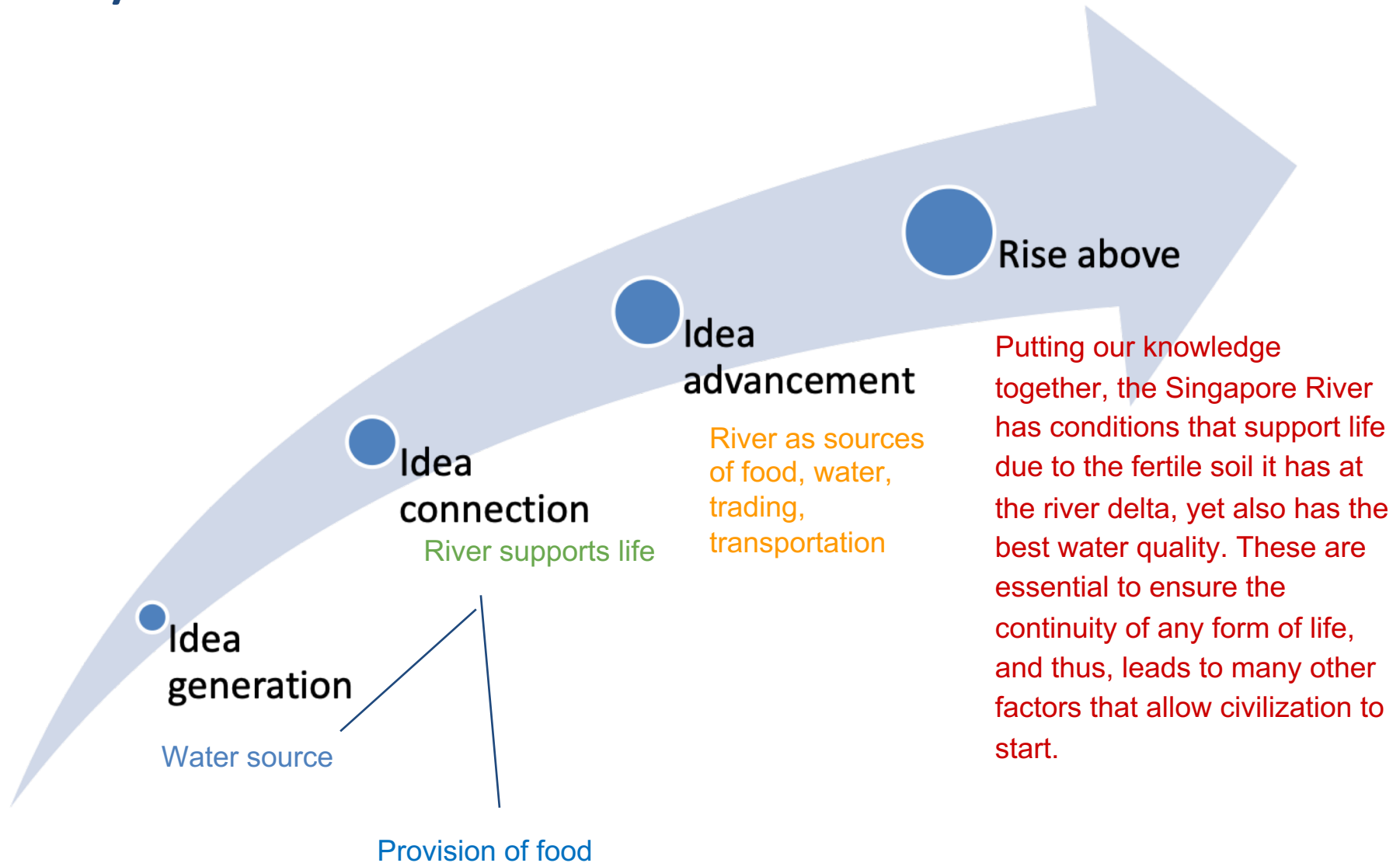
Collaborative Knowledge Building

knowledge is socially constructed ...



Collaborative Knowledge Building

Why does civilisation start at river mouth?



MMLA: What, Why & How?



What is MMLA?

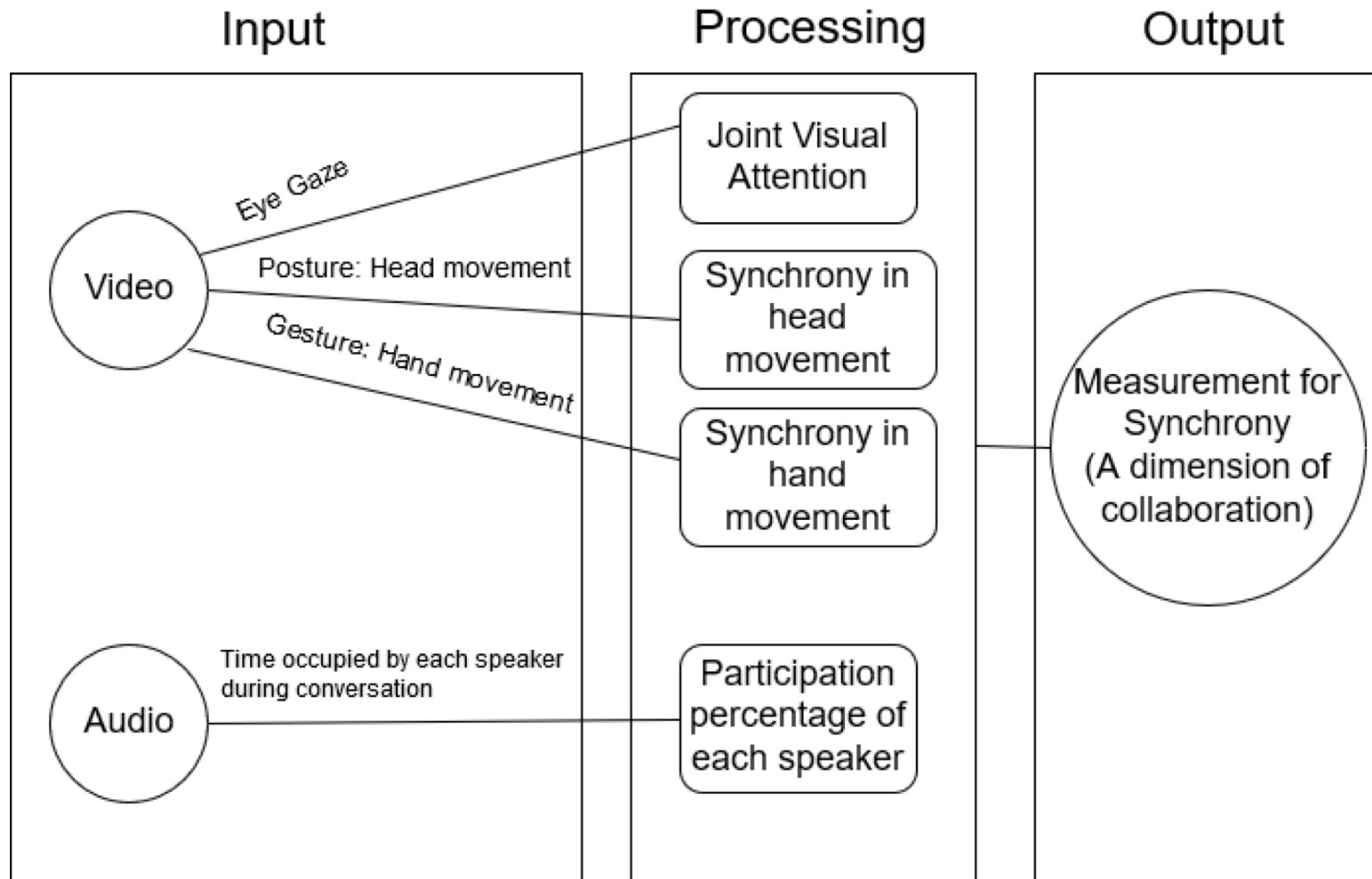


MMLA ...

Enrich the semantics with learners activity traces from **dispositional & discourse analytics** (Cukurova et al., 2017; Cukurova et al., 2018; Davidsen & Ryberg, 2017)

Enable **triangulation of indicators of collaboration** from **multiple data sources** (such as text, video, data logs, audio, physiological) (Tausch et al., 2014; Cukurova et al., 2017; Cukurova et al., 2018)

MMLA in Collaborative Learning Setting



Harnessing the potential of MMLA for **feedback provision** (real time & post-hoc)

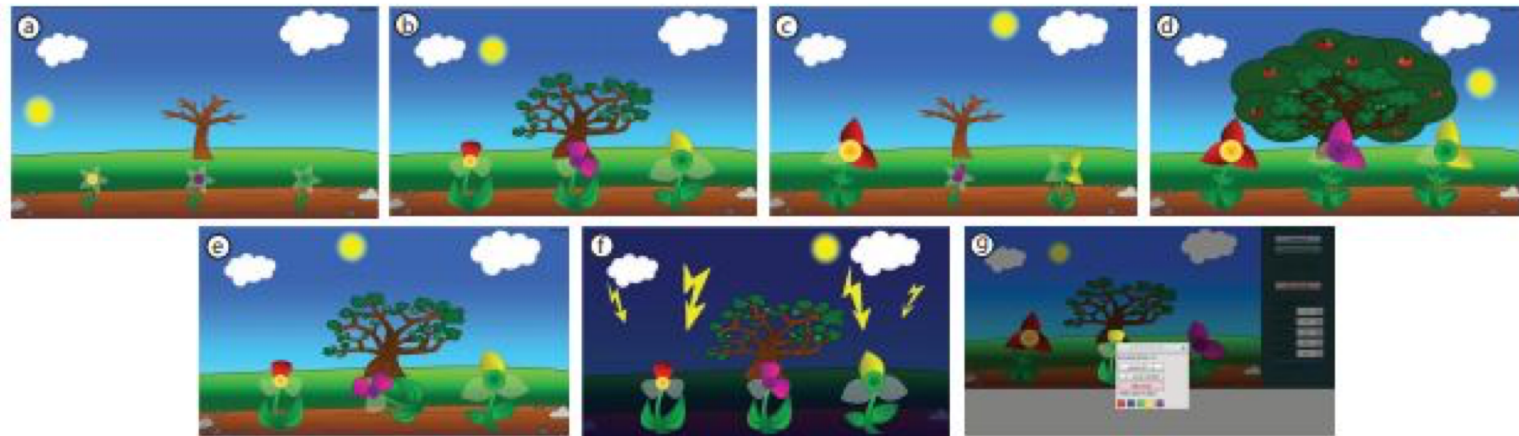
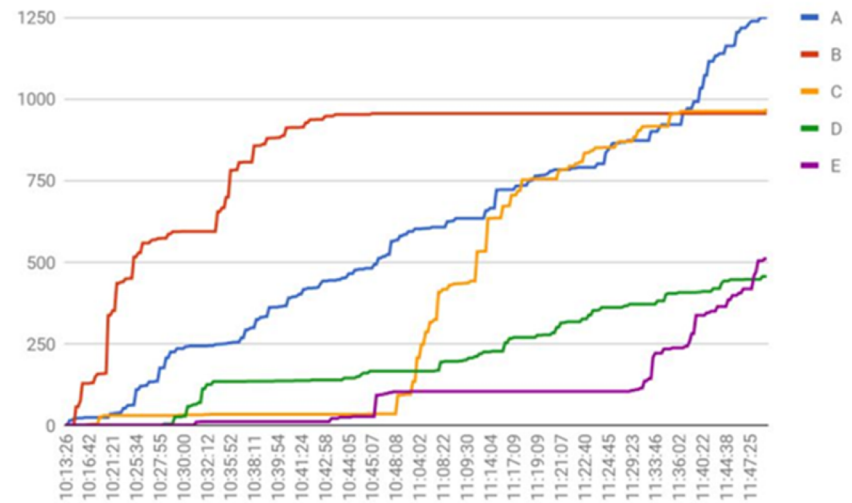
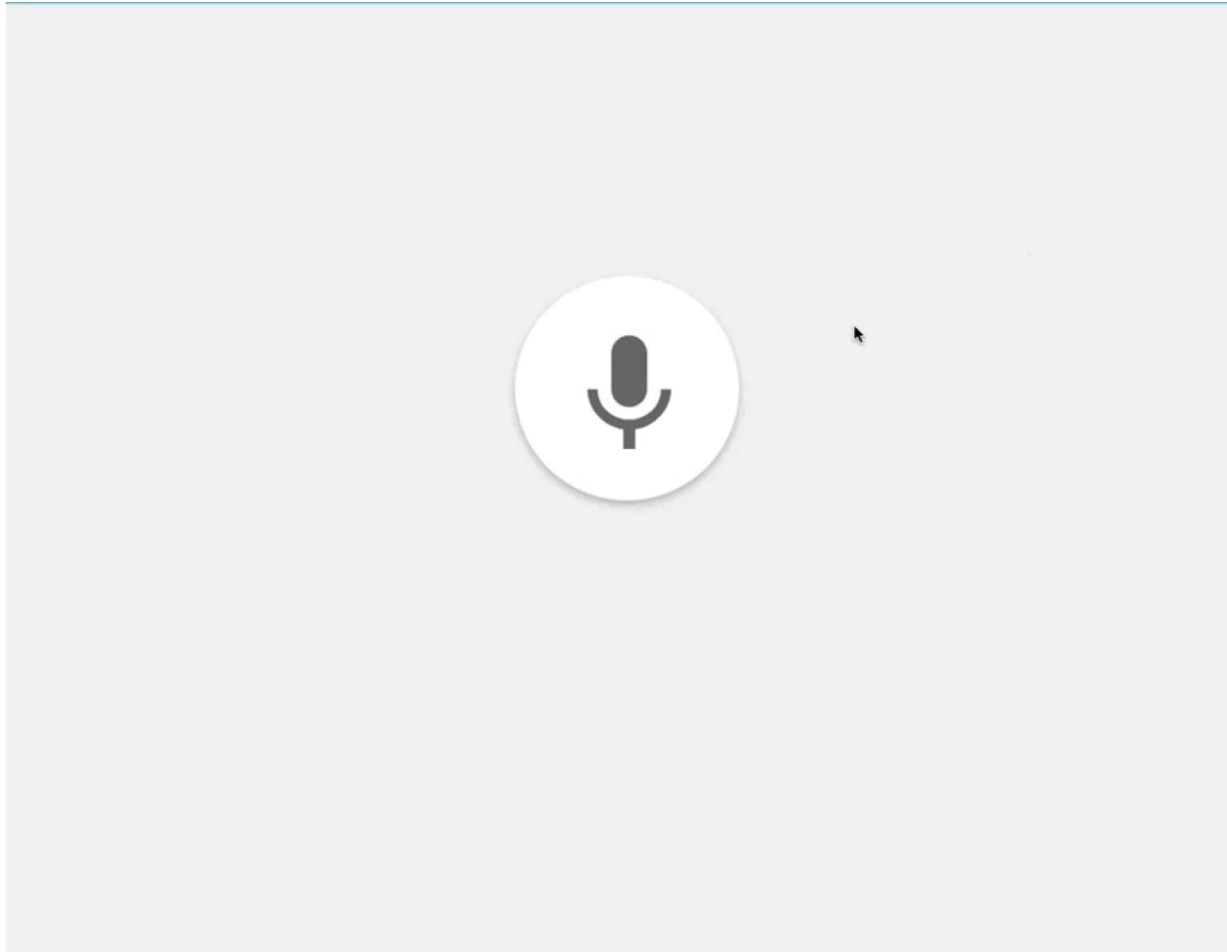


Figure 2. Different states of the group mirror: a) Status of the group mirror in the beginning of a brainstorming session with three participants, b) possible visualization during a brainstorming session, c) extremely unbalanced brainstorming session, d) balanced brainstorming session, e) individual warning, f) group warning and g) the control interface.

(Bachour et al., 2010; Praharaj et al., 2018; Tausch et al., 2014)

Speech to Text



Besides the audio modality...

- Need of other modalities like video or physiological signals
- Multiple modalities can help in the semantic enrichment
- For e.g., speaking time alone cannot be a good indicator of collaboration but combined with some gestures like pointing or typing in the laptop can help in understanding collaboration quality

MMLA in Collaborative Learning with Video modality

Research shows that **spontaneous body movements and actions** (micro-gestures) can reveal the **emotions and inner activities**.

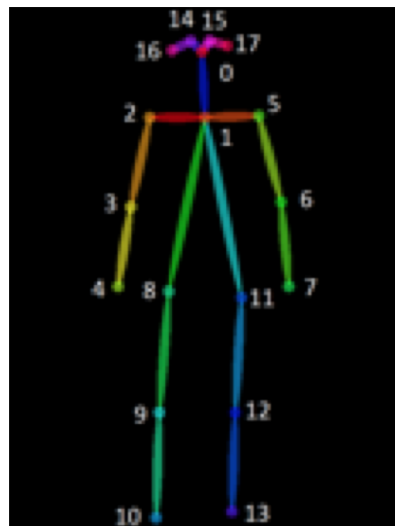


It can be utilized as **indicators** for assessing:
KB collaborative level

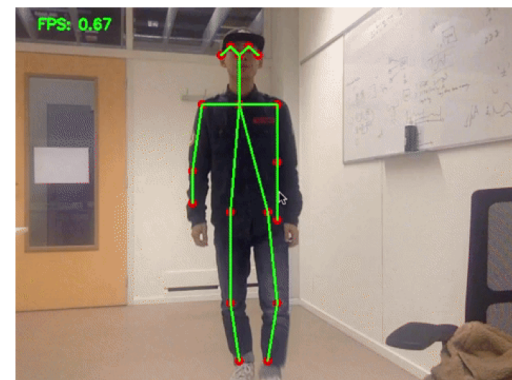
MMLA in Collaborative Learning with Video modality



360 Camera

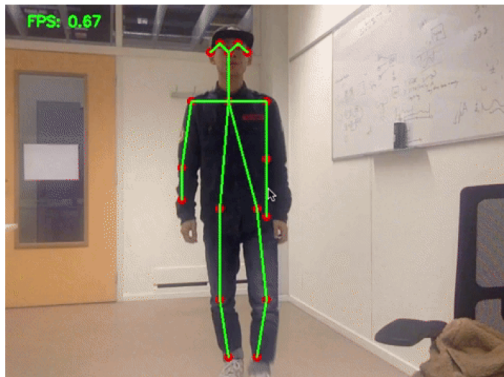


Real-time detection of Openpose

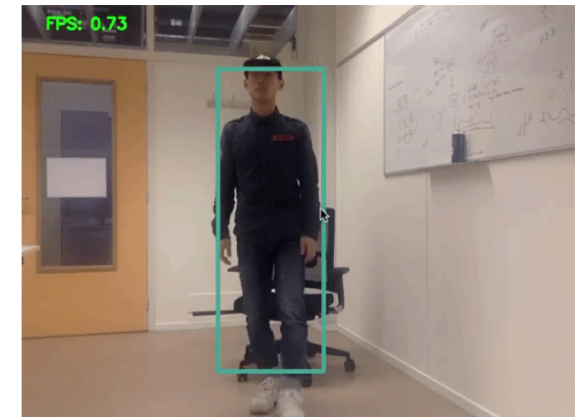
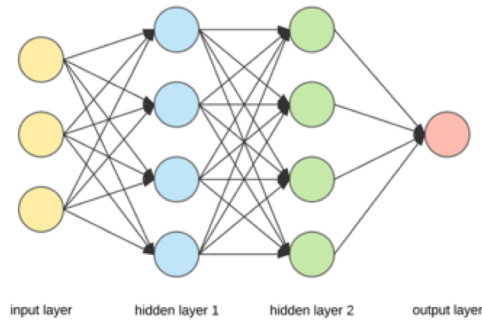


Real-time detection in real world scenario

MMLA in Collaborative Learning with Video modality



Real-time detection in real world scenario

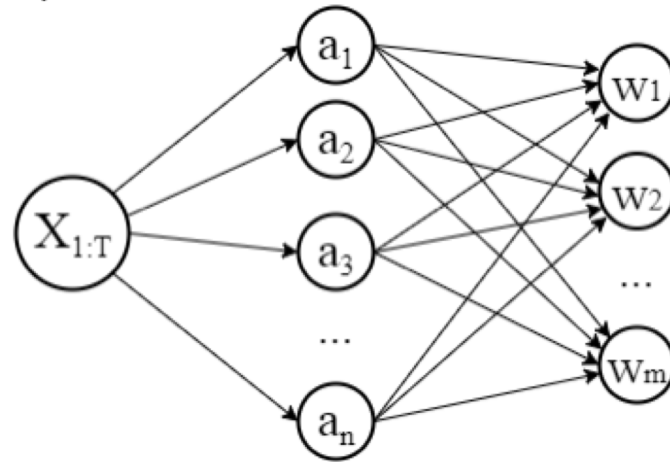


Realtime action recognition

MMLA in Collaborative Learning with Video modality

Different action patterns

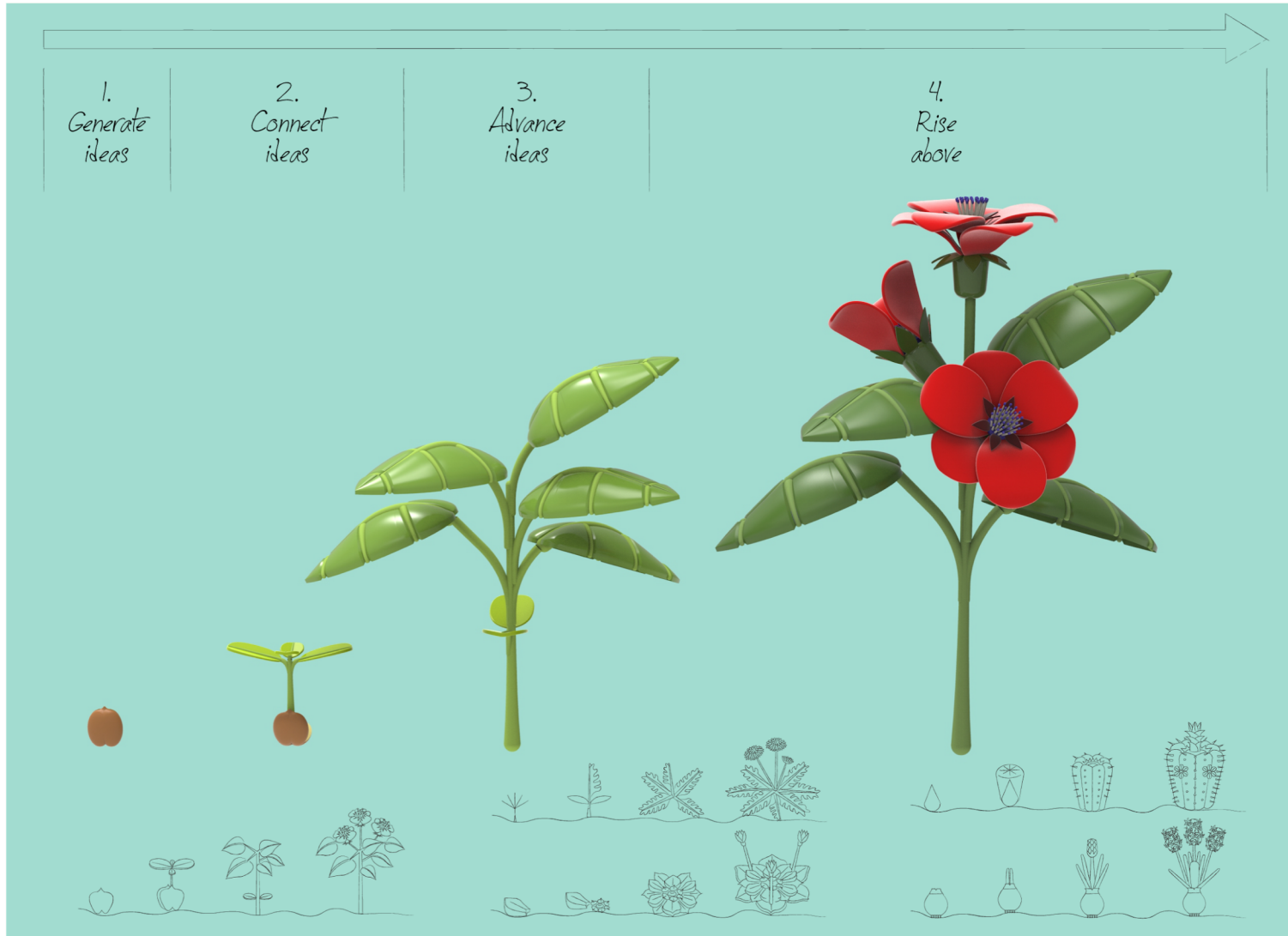
Observed sequences



Different KB collaborative level

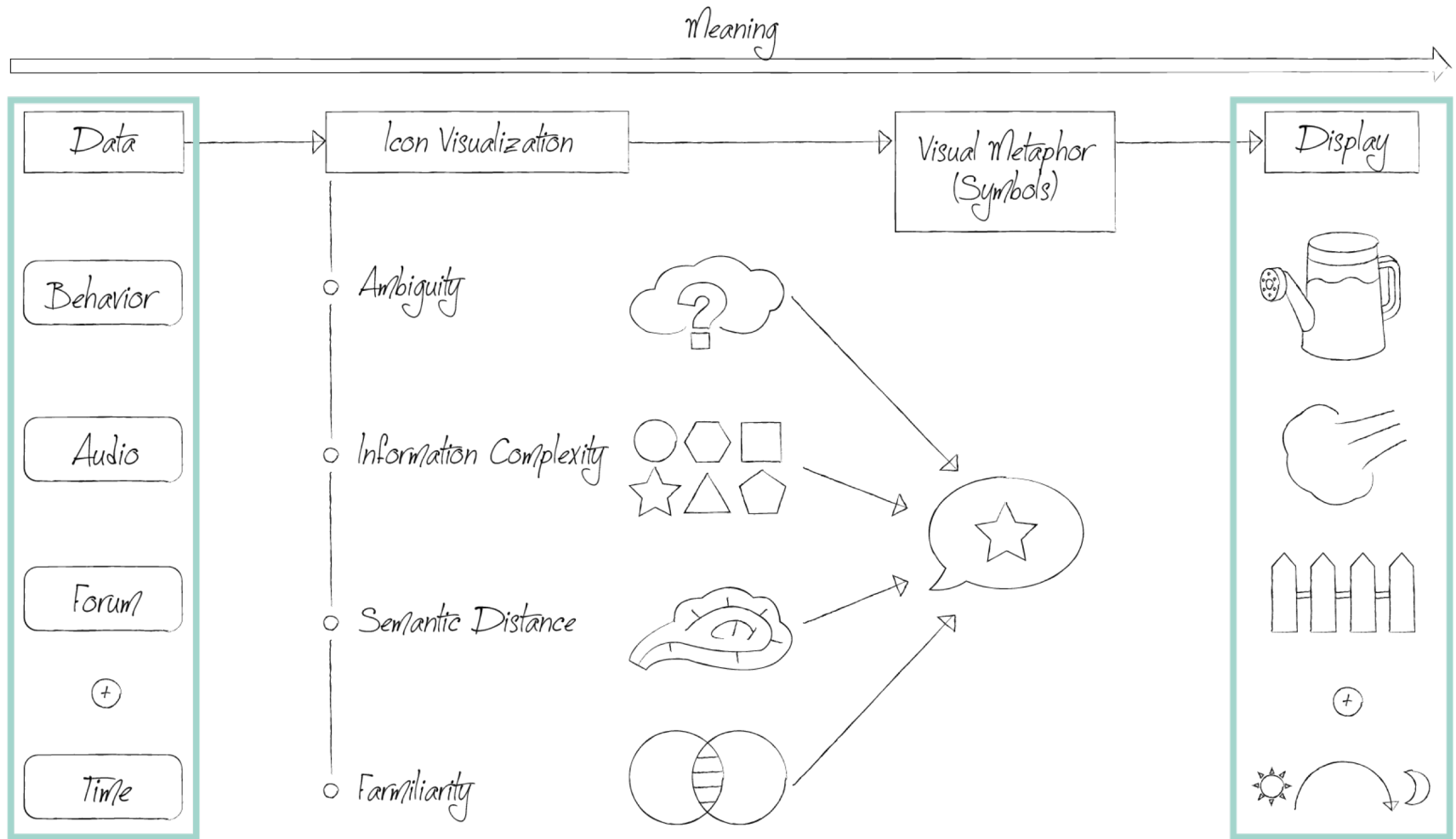
Using **Bayesian Neural networks** to infer the KB collaborative level.

Visualisation of Feedback



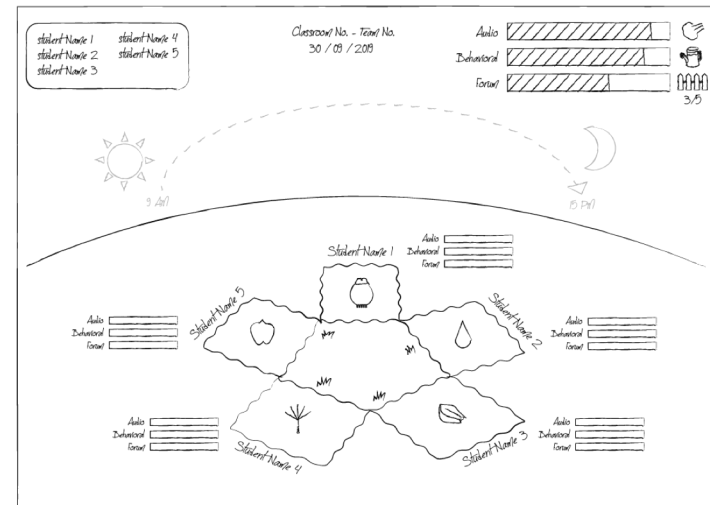
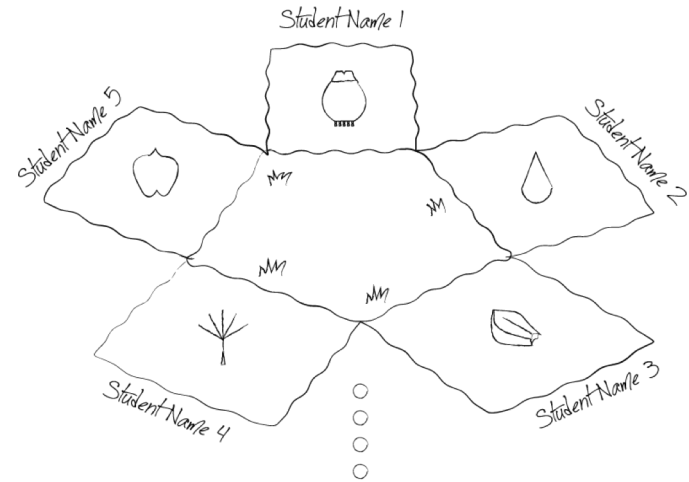
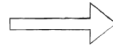
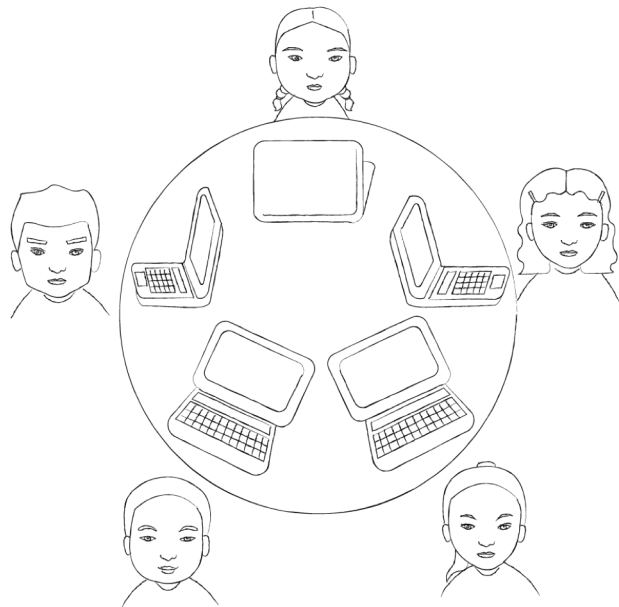
1. Concept: plant's growth following 4 stages of KB

Visualisation of Feedback



2. Icon Visualization (3 indicators+ time factor)

Visualisation of Feedback



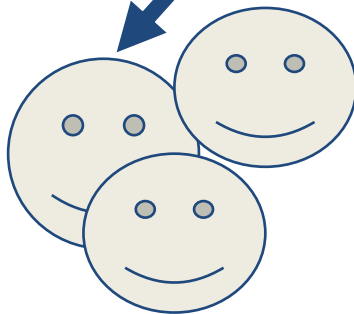
3. Interface Design for Student Collaboration

Next steps ...

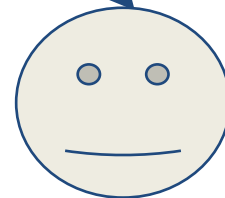
Pilot testing of prototype: across 3 different age group of learners (Pri, Sec & HE) to answer RQs.

Actionable feedback
(what, when, for who & how?)

Students
(ind/ gp)



Teacher



Thank you for your participation.
Q & A...