

ARTICULATE: Science in your Own Language

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Abstract

The ARTICULATE project is an ambitious and interdisciplinary initiative funded by the CHIST-ERA call 2025. Its vision is to revolutionize science education and democratize scientific knowledge beyond academia and English-speaking audiences through the integration of AI with self-regulated learning. The aim is to translate science not just across language but across language style, to create engaging spoken digital experiences. We present an introduction to this project, an overview of the consortium and research approach, and a number of expected impacts.

1 Introduction

A major barrier to disseminating and democratising scientific advances is access to languages that dominate scientific content but also the mismatch between the formal language of scientists and the everyday expressions understood by the general public. The ARTICULATE project aims to translate science, not just across language but across language style, not just to the written form but to an engaging spoken form. We have made enormous advances in machine translation (MT), Large Language Models (LLMs) and Speech technology. The current challenge for the research community is to integrate these technologies with other innovative techniques and research to produce engaging and compelling use cases (Aylett and Romeo, 2023). In this project, we regard a text translation of science material as a starting point. Our challenge is reframing this material into speech and an engaging dialog, producing a delightful multilingual solution which can translate science into everyday language that can be more accessible.

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Fictive dialogs are an approach where an idea is communicated by turning it into a conversation. Previous work has shown that dialogs can communicate information more effectively and be more persuasive (Aylett et al., 2024). We aim to generate interactive fictive dialogue across multiple multi-lingual science texts, in order to make a concrete contribution to educational services, as well as to increase engagement from groups who may be marginalised by background or less mainstream native languages. Just as Plato used fictive dialogs to bring to life the work and philosophy of Socrates, we aim to bring modern science to life for citizens, undergraduates and postgraduates across Europe.

2 Project Description

2.1 Duration & Partners

The ARTICULATE project will be completed over a 24-month period, from March 2026 to 2028. The Partners involved are the following:

- Heriot-Watt University, Edinburgh, UK
- University College Dublin, Ireland (UCD)
- University of Oulu, Finland

2.2 Approach and Research Method

Our primary goal is to develop ARTICULATE, a platform that supports Self-Regulated Learning through the use of an ensemble of Peer-like Conversational AI Agents speaking the language of science learners. Figure 1 outlines a typical fictive dialogue scenario with ARTICULATE. Two Conversational AI agents (Expert and Peer) engage in a peer-to-peer dialogue over a scientific topic, while the human Learner is actively listening and participating. The tone and dialect is dynamically adjusted to accommodate for different learning profiles and engagement of the Learner.

Following Vygotsky’s concept of the Zone of Proximal Development (ZPD) (Vygotsky and Cole, 1978), which suggests that *learning must*

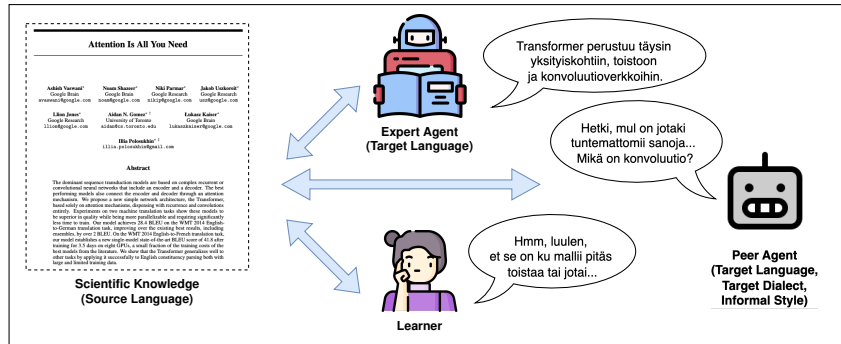


Figure 1: Typical ARTICULATE fictive dialogue in Finnish. The Expert Agent (translation in English: “Transformer is based solely on attention mechanisms, abandoning recurrence and convolutions entirely...”) discusses with the Peer Agent (translation in English: “Wait, I have some unknown words... What is recurrence?”) in their target native language about an input scientific knowledge, in this case a scientific paper on Natural Language Processing ((Vaswani et al., 2017)). The Expert Agent uses more sophisticated language, whereas the Peer Agent uses dialectical language. The Learner (translation in English: “Hm... I think it’s when the model has to repeat or something...”) who studies the paper interjects with their view also in the target language.

be facilitated by support that is tailored to the learner’s current abilities, the interaction with the Learner is not driven by the AI Expert agent, but is offered as guidance in the form of a dialogue with the less knowledgeable Peer agent. The aim is to create a learning context in which a learner can co-create science knowledge by joining the conversation with their own questions, remarks, and ideas.

2.3 Project Objectives

There are four key project objectives:

- 1) Enable Multilingual and Inclusive Science Learning through High-Quality Document-Level Machine Translation and develop accurate and context-sensitive translations of scientific materials into low-resource and dialectal languages.
- 2) Create two role-based AI agents (Expert and Peer) that engage learners in authentic, co-constructive science dialogues by grounding their responses in translated scientific documents and adapting language tone and style to suit learners’ profiles.
- 3) Implement robust safety mechanisms to prevent misinformation and harmful content while maintaining factual scientific accuracy.
- 4) Build animated, speech-capable avatars that communicate in the target dialect, integrating advanced Automatic Speech Recognition (ASR), Text-to-Speech (TTS), and avatar.

3 Expected Impacts

The expected impacts of the ARTICULATE project are both educational and technological:

- Enhanced Access to Science Education in Low-Resource and Dialectal Languages (Educational, Societal).

- Empowered, Active Science Learners through Conversational AI (Educational, Technological).
- Advancement of Safe and Responsible AI in Education (Technological).
- Technological Breakthroughs in Multimodal, Multilingual AI Systems (Technological).
- Cross-Disciplinary Impact and Model for Collaborative AI Research.

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References

- [Aylett and Romeo2023] Aylett, Matthew Peter and Marta Romeo. 2023. You don’t need to speak, you need to listen: Robot interaction and human-like turn-taking. In *ACM CUI ’23*, pages 1–5.
- [Aylett et al.2024] Aylett, Matthew Peter, Shiyi Tang, Xuanchen Li, Xinyang Liu, Chengcheng Liu, Ruiqing Li, Chenxi Meng, Zewen Qu, Sirui Wang, and Zechen Yang. 2024. Developing fictive dialogs for a classroom language learning conversational interface. In *ACM HAI ’24*, pages 323–325.
- [Vaswani et al.2017] Vaswani, Ashish, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N Gomez, Łukasz Kaiser, and Illia Polosukhin. 2017. Attention is all you need. *Advances in neural information processing systems*, 30.
- [Vygotsky and Cole1978] Vygotsky, Lev Semenovich and Michael Cole. 1978. *Mind in society: Development of higher psychological processes*. Harvard university press.