

Thank you to the reviewers for their thorough and constructive feedback that will help strengthen the UnFoLD project even further.

We have chosen to address comments on the following points:

- AI-fueled qualitative feedback on student work
- Value creation within the consortium
- Risk-assessment
- AI-competencies within the consortium and subcontractor relations.

AI-fueled qualitative feedback on student work

The AI-fueled qualitative feedback (AIFQA) will build on SoA as well as leveraging the current use of AI, NLP & ML on the CanopyLAB platform.

The theoretical foundation for AIFQA is in part based on following articles amongst others:

(1) *Cluster Based Feedback Provision Strategies in Intelligent Tutoring Systems* (International Conference on Intelligent Tutoring Systems ITS 2012: Intelligent Tutoring Systems pp 699-700| Cite as)

(2) *Learning Program Embeddings to Propagate Feedback on Student Code* (<https://web.stanford.edu/~cpiech/bio/papers/programEncoding.pdf>) which lays out tested strategies in both automated grading, and a foundation for delivering feedback from clustered data. The latter has been tested on a programming course with replicable results.

Providing feedback, including assessing final work and helping students in the process, is difficult for open-ended assignments in massive online classes.

We introduce a neural network method to encode programs as a linear mapping from an embedded precondition space to an embedded postcondition space and propose an algorithm for feedback at scale using these linear maps as features. We apply our algorithm to assessments from the Code.org Hour of Code and Stanford University's CS1 course, where we include human comments on student assignments to magnitude more submissions.

NLP will be used to build linguistic models to assess written assignments. All automated feedback on the market today uses AI, NLP and semantic/syntactic analysis to automatically grade written assignments, but none delivers automated, qualitative feedback. This is the novelty of the UnFoLD project as a research and development project.

Value creation

We address the need to be more explicit about the value creation for the additional project partners (minus CanopyLAB, which was deemed adequately explained):

UCN and AAU

1. The project's advances in digital learning enable the institutions to work with ECLs digitally for the first time. In light of the current COVID-19 crisis, this has never been more important, as learning modalities for students stuck at home are currently very limited.
2. Strategically, UCN and AAU are working towards becoming a global lighthouse in Problem-based learning and Megaprojects, the new tools and the research and experiments within the project will help realize this ambition

Arla

Arla faces a period of rapid transformation, investing in the use of new technologies such as blockchain and ML. Despite iterations around corporate learning strategy, none of the learning systems used provide actionable insights about ROI. Arla currently does not have the tools to even map the collective intelligence of our people. Through the UnFoLD project, Arla aims to 1) map the skills and competencies of the workforce 2) increase the right match between learning opportunities offered and employees by 20%. 3) reduce costs on training by 28%, through more targeted feedback.

POA

POA has launched an ambitious vision and development plan for developing POA to become an intelligent port and a modern business park through broad collaboration and intelligent solutions across the entire logistics chain. These solutions require increased skill development and inter- or cross-organisational learning with the businesses within POA, and beyond. Innovative learning infrastructures pioneering ECL pedagogies, collaboration and feedback at scale are crucial in this regard.

Risk

Assessment

In addition to the initial risk analysis already included in the proposal, the consortium will conduct ongoing risk analyses, monitoring and mitigations planning for the whole project duration as part of WP 7. This includes setting up appropriate period risk reporting mechanisms including go/no-go milestones and frequent check of risk status, as well as identifying potential new risks.

AI-competencies within the consortium and subcontractor relations.

The consortium is experienced at working with subcontractors. The benefit of working with subcontractors such as Damvad Analytics is their experience in supplying ML algorithms for the educational sectors, an area which they specialize in. CanopyLAB also has an existing relationship with Linkedai, which specializes in synthetic data. When working at the forefront of innovation, it can be beneficial to include synthetic data in the development of the algorithms and learning paths.

As mentioned in Appendix C, CanopyLAB already has AI, NLP and ML experts:

- Chuong Nguyen is a highly skilled data engineer
- Christian Jensen and Sahra-Josephine Hjorth have been training in ML & AI.
- SJH works as an expert in Silicon Valley teaching about AI and education at the NASA Ames research center.
- Since the application was submitted, the team has been extended to include An Nguyen, who is another highly skilled AI-expert.

At the moment Arla cannot measure ROI in regards to corporate learning. Arla currently don't have the tools to even map the collective intelligence of our people. With the UnFoLD platform, Arla will be able to:

1. Map the skills and competencies of employees to design focused learning and development.
2. Increase the right match between learning opportunities offered and the Arla employees by 20%
3. Reduce costs on training by 30%, through more targeted feedback.
4. Increase employee engagement by X %
5. Through efficient upskilling and reskilling on the UnFoLD platform, Arla expects to reduce costs due to turnover by X%.

6. Implement a personalized, focused digital learning platform to upskill employees to take on the digital challenges, the company faces.

At the moment Arla cannot measure ROI in regards to corporate learning. Arla currently does not have the tools to even map the collective intelligence of our people. With the UnFoLD platform, Arla will be able to:

1. Map the skills and competencies of employees to design focused learning and development in a global online learning platform.
2. Through a personalized match between learning opportunities and the Arla employee, the success rate of learning outcome will increase by 20%.
3. Reduce costs on training and travel by 20%, through more targeted feedback.
4. Increase overall employee engagement by 15% in the yearly Barometer Survey, specifically in the questions around Personal Growth and Employee Engagement.
5. Through efficient upskilling and reskilling on the UnFoLD platform, Arla expects to reduce costs due to turnover by 15%.
6. Implement a personalized, focused digital learning platform to upskill employees to take on the digital challenges, the company faces and to upskill employees in learning methodologies.