

Workshop: Learning that Makes a Difference – Cross-Disciplinary Student Projects With a Real Impact

Jens Myrup Pedersen¹, Natascha van Hattum-Janssen², Mateus Halbe Torres¹, Anabela Carvalho Alves³, Diana Mesquita⁴, Dianne Viana⁵, Simone Borges Simão Monteiro⁵.

¹ Cyber Security Group, Department of Electronic Systems, Aalborg University, Denmark

² Saxion Research & Graduate School, Saxion University of Applied Sciences, Enschede, the Netherlands

³ ALGORITMI Centre, Department of Production and Systems, School of Engineering, University of Minho, Guimarães, Portugal

⁴ Universidade Católica Portuguesa, Portugal

⁵ University of Brasilia, Brazil

Email: jens@es.aau.dk, n.vanhattum@saxion.nl, mhto@es.aau.dk, anabela@dps.uminho.pt, dmesquita@ucp.pt, dianne.magav@gmail.com, simone_simao@yahoo.com.br

DOI: <https://doi.org/10.5281/zenodo.14062957>

Abstract

Working on real-world cases increases the motivation for learning, and prepares engineering students to become problem solvers. This is even more so for projects that have the potential to create visible and lasting impact, e.g. related to problems of social or environmental sustainability. Such problems are usually open ended, and require students to work together across - which can also create stress and uncertainty, because the road to success is not known from the beginning. This presents an excellent fit with the conference theme: "Overcoming Uncertainty – Building Bridges Between Society And Learning In The Future". The workshop is centered around three main challenges that we have experienced during the Erasmus+ EGALITARIAN project, which is focused on having students solving problems together across borders and disciplines: 1) How to scope projects, so they fit learning objectives and at the same time supports a real case. Student projects and courses are often defined through learning objectives. When working with real-world challenges, this can be challenging, since the real cases are not "designed" around the learning objectives. 2) How to ensure projects are making real impact. Working with NGOs and other organisations, can be rewarding. However, such organisations often have limited time and resources available, so it is important that the solutions developed are useful and create value. On the other hand, student projects are not always reaching that level of maturity, because the learning is in focus rather than the result. 3) How to support the students throughout the journey? Working with multiple stakeholders can be challenging. The format of the workshop is highly interactive, and consists of: Short introduction, Group work, where each group should come up with 1-3 ways to address each challenge and add it on a digital board, Presentations from the groups in plenum.

Keywords: Ethics and sustainability in engineering education, Experiences on Active Learning and PBL in engineering education, Innovative experiences in engineering education.

1 Introduction

Problem Based Learning (PBL) comes with many advantages when it comes to engineering education. It is highly motivating for the students, and at the same time it facilitates the learning of other competences than the purely technical, including problem solving skills, teamwork and collaboration skills and project management skills (Kolmos et al., 2004). In the recent years, the authors have been working on expanding the traditional PBL model to include international collaboration through Erasmus+ projects such as EPIC (Pedersen et al., 2019) and COLIBRI (Pedersen et al., 2016). Other projects have focused more on sustainability, often in collaboration with local communities and/or NGOs to not only create a good learning experience for the students, but also to achieve real impact, e.g. (Pedersen et al., 2020). These efforts of international/global collaboration and sustainability are all integrated in the Erasmus+ EGALITARIAN project (EGALITARIAN, 2024), where students from Denmark, Portugal, the Netherlands and Brazil work together across countries, cultures and disciplines in order to solve sustainability challenges in Brazil, with a particular focus on improving the life

of waste pickers, who had their life impacted by the closing of the second largest dumpsite in the world, as described by Campos (2018).

There is no doubt that it is very rewarding for students to work on real problems with real partners, where their solutions can make a difference for real people, and at the same time the students acquire important problem-solving skills that will help them also in their future engineer careers. Moreover, their efforts can be used to create a more sustainable world, instead of “just” some assignment ending up on a shelf.

On the other hand, there are many challenges when interacting with the real world in this way: When communities and NGOs with already limited resources invest their already limited time and efforts in a project, they also need to see tangible results for the collaboration to be sustainable for them. This can create a dilemma from the university point of view, on how to balance the importance of the learning outcomes for the students with the importance of delivering a tangible outcome of the projects: For example, a supervisor might be less willing to see the students experimenting with a (not so promising) solution, from which they could learn a lot, take more control of the project, and lead them to a process that leads to a more ideal solution. Similar situations can arise regarding the learning objectives, and how they are balanced. Finally, supporting the students in operating in such complex environments also requires more from the supervisors – especially when it comes to the softer skills, which are already a challenging part of the supervision for many university faculty members. Given the high value of this kind of projects, it is important that the challenges are addressed, and this is exactly what this workshop searches to do: We hope to inspire other faculty members to take up this kind of highly rewarding projects, and we hope that together we can help finding solutions on some of the challenges that inevitable arises.

2 Activities

The first 15 minutes of the workshop will be spent on a short introduction to the EGALITARIAN project, highlighting main experiences, positive findings, and challenges. After this, the workshop participants are split in groups of four to spend 20 minutes on each of the questions:

- 1) How to scope projects, so they fit learning objectives and at the same time supports a real case? Student projects and courses are often defined through learning objectives. When working with real-world challenges, this can be challenging, since the real cases are not “designed” around the learning objectives, and it is often not clear before well into the project exactly what methods and tools are best suited to solve a particular problem. This point both relates to how learning objectives are defined (including the need for including cross-cultural aspects and communication), and to how projects are scoped (in particular keeping in mind that the approach should ideally be scalable and not rely too much on hand-held solutions).
- 2) How to ensure projects are making real impact? Working with NGOs and other organisations can be rewarding. However, such organisations often have limited time and resources available, so it is important that the solutions developed are useful and create value, so it becomes a positive investment for the collaboration partners, and not an activity that drain them from already limited resources. On the other hand, student projects are not always reaching that level of maturity, because the learning is in focus rather than the result.
- 3) How to support the students throughout the journey? Working with multiple stakeholders can be challenging: The level of support and feedback may vary depending on other priorities, and sometimes strategies and scopes change, especially during long-term collaborations, which might lead to a desire to change the scope or even to a loss of interest in the project. This comes on top of some of the other challenges with supervision (i.e. handling collaboration challenges), and on top of a role that for some supervisors is already quite different than traditional lecturing tasks.

For every task, each group will have to come up with 1-3 ways to address each challenge and add it on a digital board. To focus on the group work – and thus the interactive part of the workshop – there are no joint presentations in-between these three phases.

For each of the groups, the participants are encouraged to consider also their own local and regional contexts. PAEE/ALE traditionally has a strong global representation, and since the challenges are often different in different cultures and regions, this will add a high value to both the discussions and the resulting conclusions/contributions.

At the end, the last 15 minutes is allocated for the groups to go over their suggestions.

3 Expected results

The expected results of the workshop are three-fold:

1. The participants will get inspiration and concrete didactical tools to work with real-world problems, in collaboration with the surrounding society and organisations including companies, communities and NGOs.
2. The participants will share experiences from supervision of student projects. Even reflections from different settings of supervision, and different ways of collaboration, are valuable.
3. The participants will contribute to solving some of the main challenges in this way of working with student projects through concrete ideas and suggestions. These can potentially be used in the Erasmus+ EGALITARIAN project, and thus the experiences will be later reported to a wider audience.

All tangible outcomes of the workshop will be shared with the participants afterwards. It will also be made available through the website of the EGALITARIAN project.

Acknowledgements

This work was partially developed in the context of project 2023-1-DK01-KA220-HED-00165709, “EGALITARIAN - Education, Digitalisation and Collaboration for Sustainability” which has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

4 References

- EGALITARIAN (2024). The Erasmus+ EGALITARIAN project website, <https://egalitarian.eu>.
- Kolmos, A., Fink, F., & Krogh, L. (2004). *The Aalborg PBL Model: Progress, Diversity and Challenges*. Aalborg University Press.
- Pedersen, J. M., Kuran, S., Frick, J., & Mank, L. (2016). Colibri: An International Blended Learning Experience based on Real-World Problems. *Proceedings of the PAEE/ALE'2016, 8th International Symposium on Project Approaches in Engineering* (s. 259-268). University of Minho. International Symposium on Project Approaches in Engineering Education (PAEE) <http://paee.dps.uminho.pt/proceedingsSCOPUS/PAEE2016+ALE%20proceedings.pdf>
- Pedersen, J. M., Kirkova, M., Kuladinithi, K., & Janssen, N. V. H. (2019). EPIC: Making Multinational Student Projects Happen. *International Symposium on Project Approaches in Engineering Education (PAEE)*, 9, 219-228.
- Pedersen, J. M., Mahmoud, R.-V., Liboriussen, C. H., Besford, J., & Swartz, M. (2020). PBL Student Projects and Sustainable Development Goals: A Case Study. *International Symposium on Project Approaches in Engineering Education (PAEE)*, 10, 398-406.
- Campos, H. K. T. (2018). Como fechamos o segundo maior lixão do mundo. *Revista Brasileira de Planejamento e Orçamento*, v. 8, n. 2, p. 204-253.