AALBORG PBL CENTRE

ANNUAL REPORT 2019

United Nations
Educational, Scientific and
Cultural Organization

AALBORG UNIVERSITET

Aalborg Centre for Problem Based Learning
in Engineering Science and Sustainability
under the auspices of UNESCO

ADVISORY BOARD MEMBERS

Professor Henrik Pedersen	Dean, Technical Faculty of IT and Design, Aalborg University, Denmark	Chair of Advisory Board
Dr Peggy Oti-Boateng	Director, Science Policy and Capacity Building, UNESCO	Representing Director-General of UNESCO
Professor Brian Figaji	Engineering Council of South Africa, formerly UNESCO Executive Board	Representing Member States
Professor José Ismael Peña Reyes	Professor of Engineering Faculty, Universidad Nacional de Colombia	Representing Member States
Professor Qidi Wu	Director, UNESCO ICEE, Tsinghua University, China	Representing Member States
Associate Professor Zheping Xie	UNESCO ICEE, Tsinghua University, China	Representing Member States
Professor Mogens Rysholt Poulsen	Dean, Faculty of Engineering and Science, Aalborg University, Denmark	Representing Aalborg University
Tine Herreborg Jørgensen	Head of Department of Planning, Technical Faculty of IT and Design, Aalborg University, Denmark	Representing Aalborg University
Adjunct Professor Xiangyun Du	Aalborg PBL Centre, Aalborg University, and Professor at Qatar University	Representing Aalborg University
Professor Frede Blåbjerg	Faculty of Engineering and Science, Aalborg University, Denmark	Representing Aalborg University
Associate Professor Henrik Brohus	Faculty of Engineering and Science, Aalborg University, Denmark	Representing Aalborg University
Professor Tony Marjoram	Aalborg PBL Centre, Aalborg University, Denmark	Staff
Professor Anette Kolmos	Director of Aalborg PBL Centre, Aalborg University, Denmark	Staff
Associate Professor Aida Guerra	Aalborg PBL Centre, Aalborg University, Denmark	Staff

TABLE OF CONTENTS

A SPECIAL THANK YOU TO OUR SPONSORS 2019

Dassault Systemes | The OBEL Family Foundation |
The Technical Faculty of IT & Design, Aalborg University |
Faculty of Engineering and Science, Aalborg University |
ERASMUS+ Strategic Partnerships

INTRODUCTION

We are very pleased and proud that the Aalborg PBL Centre (Aalborg Centre for Problem-Based Learning in Engineering Science and Sustainability under the auspices of UNESCO) has been prolonged until 2025. It is the result of five years of extensive activities worldwide, where we have been running workshops alongside the International Research Symposium on PBL (IRSPBL) in Malaysia, Spain, Colombia and China.

In 2019, a regional version of the IRSPBL was started by the first Regional Research Symposium on PBL (RRSPBL) in Hubli, India, to establish a network for PBL in Indian engineering education, including training. KLE Technology University and the Aalborg PBL Centre were the organisers of an event with over 200 participants from Indian institutions wishing to use more student-centred learning methods. In Africa, a comprehensive training programme led by Mona Dahms and Bente Nørgaard is being organised to develop capacity among African university employees. For many years, we have conducted training workshops, but change will only happen by establishing regional capacity on a more structured level. The global level is for sharing and inspiration, whereas the regional and local levels are for sharing, inspiration and action. Strategically, the regional level is extremely important, as any change in engineering education will depend on local policies and cultural conditions.

We are now looking forward to PBL week, which will be held at Aalborg University 16–21 August 2020. PBL week consists of both the IRSPBL2020 and the PBL2020, which is the conference run by the PAN-PBL society. The planning of this event has been quite comprehensive, as we will not only be responsible for the proceedings and review processes, but this time also the programme and all the practicalities involved, as we are hosting the event. Due to the coronavirus, there might be changes to the format for the entire PBL week and we do still not know exactly what will be the result.

During the year, we participate in several research networks, such as the European Society for Engineering Education (SEFI) activities, and Bente Nørgaard has the leadership of the working group Continuing Engineering Education and Life-Long Learning. Aida Guerra has joined the governing board for Research in Engineering Education Network (REEN), which is a global association for the development of engineering education research. We have become involved in the Colloquium on the Global State of the Art in Engineering Education, which had its first activities in April in Boston. This is a network for all the 16 universities mentioned as innovative universities in the Ruth Graham report, published in 2018. The 16 universities aim to point out new innovative directions for engineering education, which include active learning and the sustainable development goals (SDGs).

The SDGs are more important than ever, and we have developed projects and activities to facilitate the relationship between the SDGs and the engineering and science disciplines. A problem-oriented approach can facilitate the integration of the SDGs in technical science education. This work builds on the first studies in integrating sustainability into engineering education carried out in 2014.

Digitalisation is an important element in future engineering and science education, and therefore also in relation to PBL. The future learning landscape will be in blended modes, and it is important, for example, that students learn collaboration and project management in both a face-to-face and a virtual mode. During the year, we have focused more on research on how students apply digital tools in their collaborations and what could be the future competence needs, and this work will be continued during the coming years. Lykke Bertel has been involved in the development of digital learning in the Tech faculty and started the documentation of the new mega-projects at Aalborg University. Therefore, we have also focused on the conceptualisation of various types of problem and project to create a platform for PBL variation.

In October, we held our advisory board meeting at the UNESCO Headquarters in Paris. We had the privilege of having both the Assistant Director General for Science, Shamila Nair-Bedouelle, and the Director of Science Policy and Capacity Building at UNESCO, Peggy Oti-Boateng, join the meeting. This meeting gave a lot of inspiration for the 2020–2025 strategy plan which the Aalborg PBL Centre will be working on in spring 2020 and which will go for approval to the coming advisory board meeting.

Within lifelong learning in STEM (science, technology, engineering and mathematics), several applications have been sent to private foundations, and Annette Grunwald participates in a Master's programme for teachers in primary schools.

To support the international outreach activities, we continuously develop online training modules; a further one on supervision was completed in 2019, with free online access, developed by Pia Bøgelund and Virginie Servant-Miklos.

The role of the Aalborg PBL Centre internally at Aalborg University is increasing. Jette Holgaard has been coordinating the scope and development of the PBL progressive learning outcomes, where students will have to reflect on their development of PBL competences three or four times during their studies.

On the staff side, we have unfortunately had to say goodbye to the head of secretariat, Mia Christensen; we welcome Stine Randrup Nielsen, who took over in September. Bettina Dahl Søndergaard has reduced her position to 50 per cent, as she has a professorial position in mathematics education at Bergen University.

We look forward to an inspiring 2020.

Anette Kolmos

RESEARCH

DEVELOPMENT OF THE RESEARCH PROGRAMME

The Aalborg PBL Centre has developed a new research strategy during the last year entitled 'PBL and Future Engineering and Science Education'. We needed to highlight new research areas like digitalisation, the integration of SDGs, variation in PBL models and learning of PBL competences, which also became core research areas. Sustainability, including the SDGs, is seen as a holistic concept that includes principles, vision, ethics and values, involving more complex problem-solving and interdisciplinary approaches. Students working with SDGs need to have a solid and thorough understanding of the disciplines, as well as an interdisciplinary and holistic approach to problem analyses and problem solving. To facilitate integration of the SDGs in engineering and science education, there will be a focus on: 1) identifying how the disciplines contribute to the SDGs and complex problem-solving; and 2) study of the SDGs as a motivational factor for students' learning. The research is intended to support Aalborg University and other universities in becoming a driving force in education for sustainability and SDGs internationally, nationally and locally.

Research on PBL and the management of change in engineering and science education are core areas for the Aalborg PBL Centre. In particular, the management of change has been related to sustainability, PBL competence and digitalisation, as it involves curriculum innovation towards more student-centred learning and often an organisational approach. Retention, assessment, comparison of the effects of various learning methodologies, staff development methods, learning environment, design of projects, and progressive PBL learning objectives are just some of

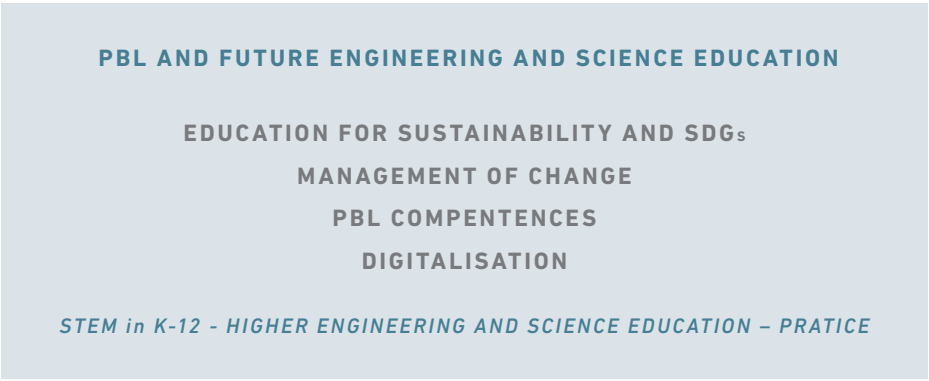


FIGURE 1. OVERVIEW OF RESEARCH AREAS

the researched topics in this area. There will be increasing research on variation in PBL models, problem types and project types to facilitate the integration of complex problem-solving in the engineering and science disciplines. This will also encompass new collaboration patterns and project management skills.

PBL competences refer to the fact that PBL involves both methods for learning scientific content and creating competences itself. As Aalborg University has taken initiatives to formulate the PBL competences explicitly throughout the curriculum, it gives a unique opportunity to establish frontier research on the progression of practice-based skills and competences in higher education, which is still unknown territory.

The use of digital tools has been an integrated part of educational practice for a long time, but recently with an increased focus on the interaction and potential re-enforcement of emergent digital technologies. In engineering education, there will be increasing use of digitalised learning of scientific content, as well as digital tools for collaboration and project management. Therefore, there will be a focus on the learning aspects in this transition, both in terms of student's learning and curricular change, as increased use of digital tools might invite new ways of organising the curriculum.

Finally, in relation to local, national and international partners, the research group has created a unique research profile which adds a PBL perspective to the STEM initiatives in primary and secondary schools, as well as in vocational and higher education. This research profile, with the research priorities, will form the foundation for the activities which will be undertaken.

VARIATION IN TYPES OF PROBLEM AND PROJECT

During the year, we have further conceptualised types of project work at Aalborg University. For many years, projects have had the same format, with semester projects for one project team and a variation of problems ranging from a simple single discipline to more complicated and sometimes complex interdisciplinary problems depending on the study programme and the stage of study. In several studies, there are experiments in working with bigger teams and sub-teams to deal with more complicated and complex problems. This has given inspiration to develop the conceptualisation of educational problems and projects in a new way.

Problems can be characterised in many ways, but one way is the Cynefin framework for simple, complicated, complex and chaotic problems. The simple is the discipline problem, the complicated is the combination of unknown problems and known solutions in new combinations and complex problems involve unknown problems and unknown solutions.

These distinctions can be reflected in a project typology which is based on two dimensions: 1) the scientific content and problem scoping, ranging from simple and complicated discipline problems to complex and interdisciplinary problems; and 2) the size and organisation of the team(s), im-

plicitly involving project management processes on varying levels. Combining these two dimensions results in four educational project categories: the discipline project and multi-projects, addressing single-discipline learning objectives on a scale from individual discipline teams to larger team clusters; and interdisciplinary projects and mega-projects, which cover contextual, complex and interdisciplinary learning outcomes on a scale from smaller interdisciplinary teams to larger 'teams of teams', or clusters in collaborative networks.

These four ideal types of project frame students' learning of various complex problem-solving competences such as problem identification, analysis and solving, collaboration skills and project management in different ways, all relevant in engineering education.

Mega-projects are a relatively new project type in education. It is difficult to bring these into education as students will not have the time and resources to work on huge mega-projects dealing with complex problems and real systems. However, the students can work on smaller problems as long as they are aware of the limitations and how the problems relate to other problems in a more comprehensive system. Furthermore, they can experience the project management and team aspects, which are very different from the experiences with a single project team. Coordination, communication and collaboration are all elements that become much more challenging as the teams and the projects get bigger—but this is one of the benefits, that students are been giving the opportunity to work in more agile systems which include both smaller teams and collaborations among teams.

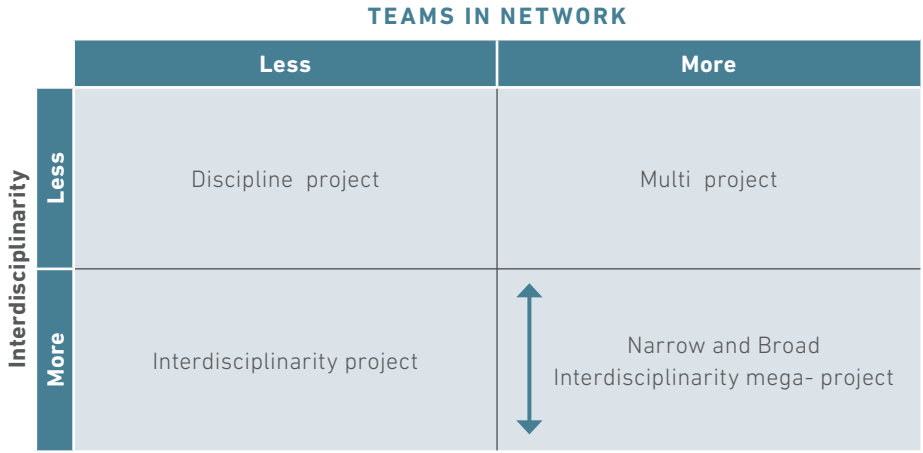


FIGURE 2: TYPES OF PROJECTS

SDGS IN ENGINEERING EDUCATION

PBL has proven to be a viable way of integrating sustainability into higher education, as students get the opportunity to work on problems and challenges. Climate change and other sustainability challenges are among the major competences future engineers and scientists will need to create more sustainable societies.

At the Aalborg Centre, there has for years been research on the integration of sustainability into engineering curricula. However, the increased political attention to the urgency and the more comprehensive approach made explicit in the SGDs have underlined the complexity of the challenge.

In a post doc position, Virginie Servant-Miklos has finished her research on students' approach to sustainability. One of the results indicates a new taxonomy of students' awareness of sustainability. This adds to the knowledge on students' reactions to sustainability challenges.

Based on a qualitative research approach, Virginie Servant-Miklos followed 16 PBL students across four engineering disciplines (mechanical engineering, electronic engineering, environmental planning and medialogy) during three semesters, using semi-structured interviews and an interpretivist framework. Students were asked to reflect on their awareness of and interest in sustainability issues in their first month of study, at the end of their first year, and in the middle of their second year.

There were changes in the students' sustainability awareness and interest during the process of acclimatisation within their engineering studies. It was found that in the first round of interviews the majority of students, with the expected exception of environmental planning students, were marginally aware of sustainability issues and not very interested in the subject. By the end of the study, a notable shift towards an overall increased awareness and interest was observed, which the study has explained and categorised of the students' changes.

The four identified categories are:

1. No interest and little general awareness, which indicates that students express no interest and very little knowledge or understanding of sustainability issues.
2. Little interest and basic general awareness, indicating that students have a little bit of interest in sustainability issues, usually triggered by postings on social media, and are curious enough to read up on the basics and some of the basic drivers of those issues like eating meat, flying, the consumption culture, etc. They understand that these issues are getting worse.
3. Basic interest, basic general awareness and advanced domain-specific awareness indicate that students have a basic interest in sustainability challenges. They are motivated by reading news to identify relevant issues when they are raised in their studies and to work with the issue in their PBL projects. They have a good basic awareness of the major sustainability crises; they

also have some advanced domain-specific awareness, usually tied to a specific PBL project.

4. High interest and advanced systemic awareness, which includes students actively interested in sustainability issues and actively trying to integrate these issues into their studies and their lives. These students show a good understanding and they have a 'systemic' awareness because they are aware of the systemic problems that cause systemic sustainability issues.

There is evolution of the responses over time, and the classical engineering students and Medialogy students start at a different level of awareness and interest from the Urban, Energy and Environmental Management (BEM in Danish language) students. We see an increase in awareness in the vast majority of students between R1 and R3 regardless of their starting position, although a minor percentage of the students did not change their position.

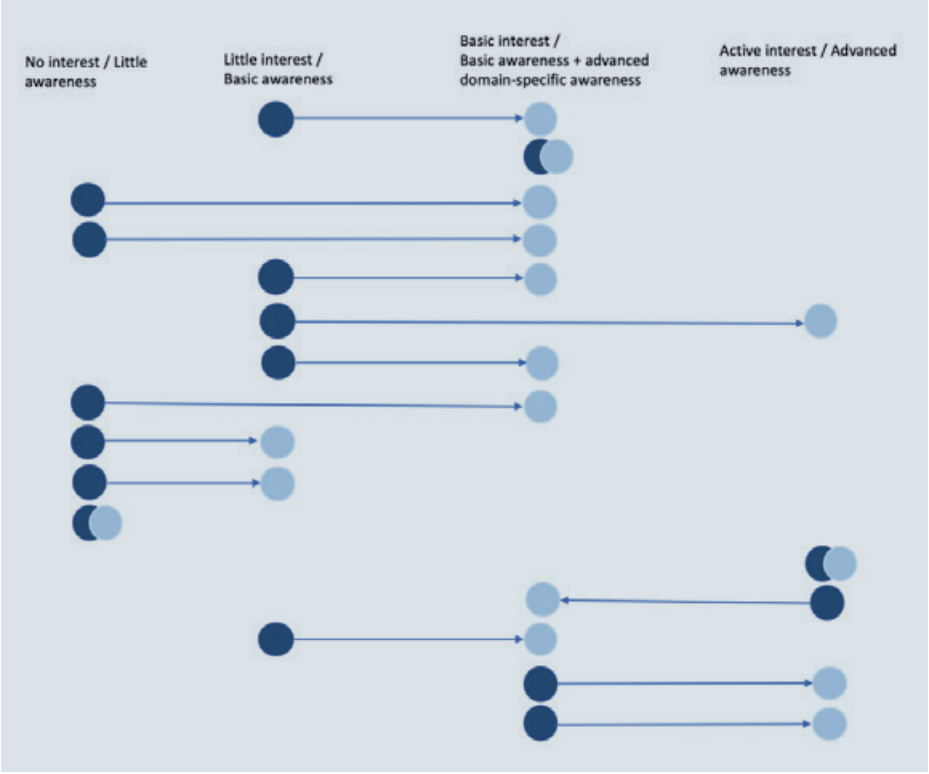


FIGURE 3. EVOLUTION OF SUSTAINABILITY INTEREST AND AWARENESS BETWEEN R1 (DARK BLUE) AND R3 (LIGHT BLUE)

GLOBAL NETWORK AND CAPACITY BUILDING

ENHANCING ENTREPRENEURSHIP, INNOVATION AND SUSTAINABILITY IN HIGHER EDUCATION IN AFRICA (EEIS-HEA)

Outreach, capacity-building and training are core activities at Aalborg UNESCO Centre. In 2019, Aalborg UNESCO Centre was involved in outreach and capacity-building activities in Africa and India.

Higher education institutions (HEI) in Africa face challenges such as weak links to the wider socioeconomic context, textbook-based curricula that do not address the local socioeconomic problems and needs, and outdated pedagogical methods.

The EEIS-HEA project is designed to reform Higher Education (HE) study programmes to ensure curricula that are highly relevant to the contemporary economic and social needs of Africa, equipping graduates with skills and competences for employability and self-employment. The project involves trans-African and trans-continental cooperation between HEIs in East and West Africa and in the EU, as well as local cooperation with external stakeholders. The project will contribute to the objectives of the African Union Commission Strategy, including the provision of higher education that matches the opportunities and requirements of local labour markets.

Project outputs will be five study programmes aligned with local, national and

FIGURE 4. PARTICIPANTS OF EEIS-HEA DURING A TRAINING WORKSHOP.

regional needs and priorities, partly or fully redesigned in close collaboration with external stakeholders to integrate entrepreneurship, innovation and ecological, social and economic sustainability into curricula, delivered through student-centred learning (SCL) approaches such as problem based learning, challenge-driven learning, team-based learning, etc.

These curricula will serve as 'best practice' examples within the HEI, and after project completion, each HEI will have a team of trainers who have the knowledge, skills and competences to train and assist colleagues in designing similar programmes. In this way, the project will impact on HE first in the institutions involved, and later at the national and regional levels.

REGIONAL RESEARCH SYMPOSIUM ON PBL (RRSPBL) IN INDIA

In November 21–23, 2019, the Centre for Engineering Education research, KLE Technological University, Hubli, in collaboration with the Aalborg UNESCO Centre, organised the first regional research symposium on PBL. With the aim of applying PBL in engineering education in India, 208 participants from 26 institutions representing seven different states in India participated. Bringing together researchers from all over India to exchange, learn and share knowledge of PBL practice in India, strategies on how to integrate PBL in engineering education in India were discussed and elaborated. With the integration of SDGs and interaction with society and industry, researchers from different institutions in India

FIGURE 5. MEMBERS FROM THE RRSPBL 2019 ORGANISING COMMITTEE (FROM LEFT TO THE RIGHT: PROF. JOSHI GOPALKRISHNA, DR. VIKAS SHINDE, PROF SANDIP INAMDAR AND PROF JANHAVI INAMDAR)

took the first step towards implementing PBL on a large scale in India.

Aalborg UNESCO Centre had five representatives participating in the symposium, giving workshops and keynotes on PBL and PBL in practice. By connecting leaders and teachers from different institutions in India, Aalborg UNESCO Centre has supported the improvement of engineering education in a part of the world where there has been a demand for further innovation in engineering education.

The regional research symposium in India will be a recurrent event, organised next time in 2021. In the meantime, continuous collaboration between Aalborg UNESCO Centre and Indian universities will be enhanced/maintained.

FIGURE 6. ASSOCIATE PROFESSOR JENS MYRUP, FROM THE AALBORG UNIVERSITY DELEGATION PARTICIPATING AT RRSPBL 2019

FIGURE 7. OFFICIAL OPENING OF RRSPBL 2019

TRAINING AND DISSEMINATION ACTIVITIES

Aalborg PBL Centre has had various training activities and we have developed and customised more or less each time. Therefore, we have developed a conceptual framework of their initiatives and activities for staff training (see Figure 4). The framework highlights progressive staff development regarding PBL, management of change and capacity-building.

There are three levels. The basic level is about information, knowing what new kinds of practice exist and getting inspiration. The next level is more competence and action-oriented to plan and carry out new PBL practices. The third level is the master level, with much more focus on both theoretical understanding and the change of practice by implementing plans and evaluations.

The Aalborg UNESCO Centre has produced a new brochure of training and capacity-building activities and initiatives. See more at www.ucpbl.net.

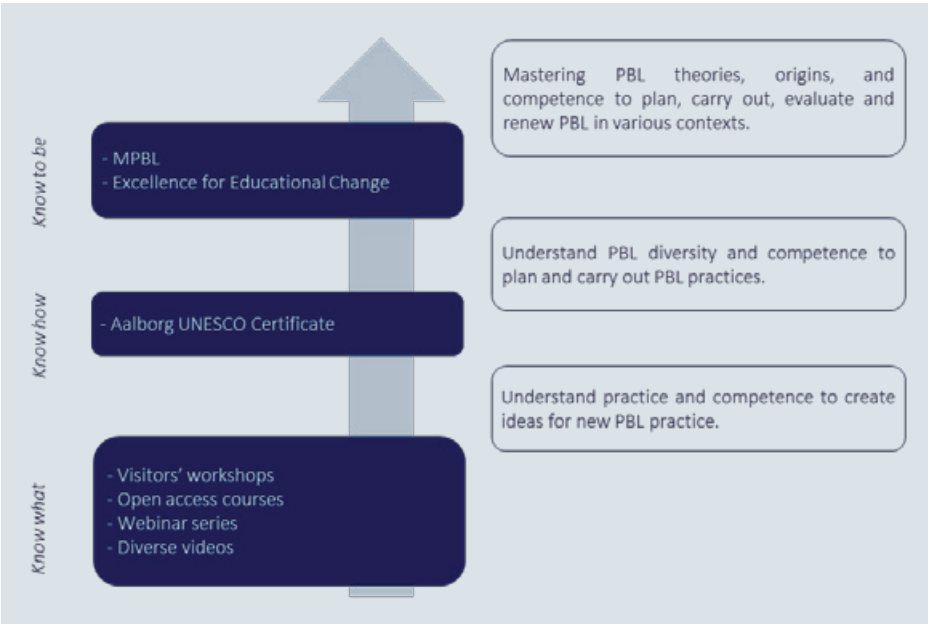
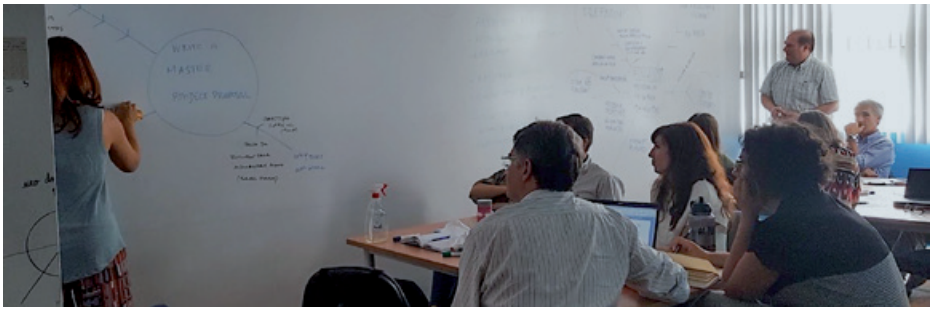


FIGURE 8. AALBORG UNESCO CENTRE TRAINING ACTIVITIES AND THEIR PROGRESSIVE LEVEL OF DEVELOPMENT

In August 2019, the Aalborg UNESCO Centre welcomed the second of group of teachers from Northeastern University (NEU), China, to participate in the Aalborg UNESCO Certificate on the Basics of PBL and Curriculum Change. The eight participants stayed in Aalborg for six months, attended different thematic workshops, carried out group work facilitated by a pedagogical supervisor and observed AAU PBL teaching and learning activities, resulting in concrete strategies to integrate PBL in their institutions.

The Aalborg PBL Centre has also delivered short, tailored workshops for international partners in Spain, Portugal and Bahrain. The workshops are developed to address different topics and according to needs of the educational institution and its staff members. Examples of topics addressed are an introduction to PBL principles and models, course and curriculum design, and PBL and collaboration with external partners.

UNIVERSITY OF BASQUE COUNTRY, SPAIN, 10–12 JULY 2019
FOUR WORKSHOPS (TWO DAYS' TRAINING)
GOAL: TO UNDERSTAND PBL, CURRICULUM CHANGE AND COLLABORATION WITH INDUSTRY



INSTITUTO SUPERIOR TÉCNICO, PORTUGAL, 1–2 JULY 2019
TWO WORKSHOPS (ONE DAY TRAINING)
GOAL: TO UNDERSTAND PBL AND INTEGRATION IN THE CURRICULUM

BAHRAIN POLYTECHNIC, KINGDOM OF BAHRAIN, 2–3 NOVEMBER 2019
THREE WORKSHOPS (ONE AND A HALF DAYS' TRAINING)
GOAL: AN OVERVIEW OF BASICS ASPECTS OF PBL, NAMELY CURRICULUM MANAGEMENT, FACILITATION SKILLS, AND PBL MODELS AND PRACTICES

VISITORS, ONGOING WORKSHOPS AND KEYNOTES

The Aalborg PBL model inspires educators around the world. Each year, many of them come to visit Aalborg and our centre. During 2019, we received more than 25 visits with participants from ten different countries: the UK, Russia, India, Poland, Sweden, the USA, Kuwait, China, Australia and the United Arab Emirates.

Twice a year, during spring and autumn, a visitors' workshop on PBL is organised to accommodate the needs of some of these visitors. Our visitors' workshop took place in March and November with participants from Poland, Kuwait and Dubai. Furthermore, our visitors expressed their satisfaction with these workshops.

Besides the visits received, the Aalborg UNESCO Centre has been invited to present keynotes and workshops at international conferences and meetings.

The development of free online resources on aspects of PBL and sustainability has been a priority. These resources are standalone courses, so we develop them and put them online, and we are only in dialogue with participants if the standalone courses form part of one of the training courses. Online open courses are also considered a central part of our ongoing activities for internal AAU activities, especially for new staff members at the two technical faculties at Aalborg University, the Technical Faculty of IT and Design (TECH) and the Faculty of Engineering and Science (ENG). These courses serve as core pedagogical resources when new academic staff start working as supervisors at TECH and ENG.

We have now the following courses ready:
- Online PBL introduction course
- Problems in PBL

https://ucpbl.moodle.aau.dk/

ONLINE COURSE ON PBL AND SUPERVISION

This year, we have finished another course on project supervision and we have initiated and completed a full online course on PBL and supervision, which can be used for both external and internal academic staff at AAU technical faculties. The online course addresses themes like the supervisor's role, group collaboration, organisation of exams, learning process of PBL, and conflict management. These themes are addressed within engineering and science education perspectives, aiming to foster discussion and reflection among new staff members. As part of the course, additional literature and exercises are included for further development with more engaged colleagues and pedagogical supervisors.

SELECTED PUBLICATIONS 2019-EARLY 2020

Bertel, L. B., Brooks, E. & Dau, S., 2019. Developing robot-supported inclusive education (ROSIE): a play-based approach to stem teaching and inclusion in early childhood education. *Proceedings of the 13th Conference of the European Science Education Research Association (ESERA).* University of Bologna.

Chemi, T., Wang, L. & Du, X., 2019. Reframing the arts and creativity in Chinese education. In Chemi, T., Wang, L. & Du, X. (Eds.), *Arts-based Education: China and its Interaction with the World.* Leiden, Holland: Brill.

Chen, J., Kolmos, A. & Du, X., 2020. Forms of implementation and challenges of PBL in engineering education: a review of literature. *European Journal of Engineering Education.* doi:10.1080/03043797.2020.1718615

Chen, J., Kolmos, A., Guerra, A. O. P. D. C. & Zhou, C., 2019. Aalborg UNESCO certificate: staff development and challenges in PBL training programme. *Journal of Engineering Education Transformations (JEET),* 33(1).

Dahl, B. & Holgaard, J. E., 2019. La réforme de la pédagogie universitaire au Danemark: le cas de l'apprentissage par problèmes. *Revue internationale d'éducation de Sèvres,* 80, pp. 125–134.

Davidsen, J., Emtkjær, P. B., Holgaard, J. E., Therkildsen, H. F. & Telléus, P. K. K., 2019. *Study Competencies: Communication, Motivation, Resilience, Study Technique and Learning.* Aalborg, Denmark: Aalborg University.

Guerra, A. O. P. D. C. & Holgaard, J. E., 2019. Contextual learning for sustainability. In Leal Filho, W. (Ed.), *Encyclopedia of Sustainability in Higher Education.* Springer. https://doi.org/10.1007/978-3-319-63951-2_340-1

Guerra, A. O. P. D. C. & Smink, C. K., 2019. Students' perspectives on sustainability. In Leal Filho, W. (Ed.), *Encyclopedia of Sustainability in Higher Education.* Springer. https://doi.org/10.1007/978-3-319-63951-2_340-1

Grunwald, A., 2019. *Samarbejdet om den åbne skole: veje til fornyelse af undervisning i naturfag, teknologi og engineering.* 1. udgave 2019 udg. Samfundslitteratur.

Hadgraft, R. G. & Kolmos, A., 2020. Emerging learning environments in engineering education. *Australian Journal of Engineering Education.* doi:10.1080/22054952.2020.1713522

Kolmos, A., Bøgelund, P. & Spliid, C. M., 2019. Learning and assessing problem-based learning at Aalborg University: a case study. In Hung, W., Moallem, M. & Dabbagh, N. (Eds.), *The Wiley Handbook of Problem-Based Learning.* Boston, MA: Wiley-Blackwell.

Nørgaard, B., 2019a. Implementing real-life engineering problems as a means of learning in part-time engineering Master's pro-

grammes. In Abdulwahed, M., Bouras, A. & Veillard, L. (Eds.), *Industry Integrated Engineering and Computing Education: Advances, Cases, Frameworks, and Toolkits for Implementation.* Switzerland: Springer.

Nørgaard, B., 2019b. Implications of facilitated work-based learning implemented as an approach to continuing engineering education. *European Journal of Engineering Education,* 44, pp. 629–642.

Servant-Miklos, V. F. C., 2019a. From Flexner to Rogers: an inquiry into the intellectual origins of problem-based learning at McMaster University Medical School. *Health Professions Education,* 5(2), pp. 93–102.

Servant-Miklos, V. F. C., 2019b. Problem solving skills versus knowledge acquisition: the historical dispute that split problem-based learning into two camps. *Advances in Health Sciences Education,* 24, pp. 619–635.

Servant-Miklos, V. F. C. & Noordegraaf-Eelens, L., 2019. Toward social-transformative education: an ontological critique of self-directed learning. *Critical Studies in Education,* 6. doi:10.1080/17508487.2019.1577284

This annual report will only report on selected activities.

On our web site, you can find a pdf version
of the annual report, containing a more
comprehensive portfolio ofactivities.

All our annual reports throughout
the years are available here:
https://www.ucpbl.net/about/brochures-annual-reports/

THIS ANNUAL REPORT CONTAINS HIGHLIGHTS
FROM UCPBL 2019 PLEASE FIND MORE INFORMATION ON
WWW.UCPBL.NET

United Nations
Educational, Scientific and
Cultural Organization

AALBORG UNIVERSITET
Aalborg Centre for Problem Based Learning
in Engineering Science and Sustainability
under the auspices of UNESCO