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PBL Teachers' Perceptions of Education and Learning Based on Educational Background

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Abstract

This study investigates how teachers' own educational backgrounds shape their perceptions of education and learning within a problem- and project-based learning (PBL) environment. Drawing on a large-scale survey of 895 teaching staff at Aalborg University, we identify a consistent yet modest pattern: AAU-educated staff place slightly greater emphasis on project-based and collaborative learning, whereas colleagues educated elsewhere assign comparatively more weight to coursework, theoretical grounding, and individual study. These differences suggest that teachers' prior educational experiences inform pedagogical beliefs. We discuss these results in light of the idea that "teachers teach the way they were taught" and of research showing that teacher beliefs emerge from a complex interplay of prior learning experiences, disciplinary cultures, institutional norms, and workplace conditions. By situating educational background within this wider context and

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making these perspectives visible, the study adopts a nuanced view and contributes to discussions on faculty onboarding and diversity of teaching practices in pedagogically specific institutions, offering actionable insights for faculty development, onboarding design, and the cultivation of pedagogical cultures capable of leveraging diversity.

Keywords: Teacher Beliefs; PBL; Educational Background

Introduction

In this article, we focus on educators' perceptions of education and learning and examine whether their own educational experiences as students influence their perceptions as teachers. More specifically, we investigate the differences and similarities in perceptions between teachers at a project- and problem-based learning (PBL) university who have received education in this specific environment and those who do not possess an educational background from the same institution. Research on both teacher identity development and faculty teaching practices suggests that teacher beliefs and approaches to teaching are shaped by prior experiences, both as students and as teachers (Flores & Day, 2006; Oleson & Hora, 2014). Former teachers have a strong socialising effect by serving as models of what to do (or not do), and personal learning experiences serve as a lens through which teachers assess new pedagogical ideas (Flores & Day, 2006). Faculty are significantly influenced by their student experiences, which contribute insights that aid in the development of their pedagogical toolkit. Similarly, their personal study habits and learning preferences shape how they engage with students and influence their behaviour in the lecture hall (Oleson & Hora, 2014). While these influential studies establish clear connections between personal histories and teaching practices, fewer have connected such findings to broader beliefs about practising education at an institutional level and to the potential tensions between teachers' personal beliefs and alignment with specific institutional pedagogical models such as PBL. Furthermore, existing research has largely relied on small-scale and in-depth qualitative methods covering personal narratives and case studies (Beijaard et al., 2004; Yan, 2024), which have uncovered the complexities of teacher identity development but have been limited in terms of the generalisability of findings. This study aims to complement existing research using a large quantitative data set. The study is based at Aalborg University (AAU) in Denmark, which, since its establishment in 1974, has been characterised by a project- and problem-based model that is practised and continuously developed throughout the university. The dataset is part of the PBL-future project (2017-2020), a strategic development initiative involving

researchers from various faculties to develop new research-based directions for PBL in a digital age (Kolmos & Ryberg, 2023).

At the beginning of the project, a survey was distributed to establish a baseline for any changes, focusing on staff and students' perceptions of the practices of PBL. An exploratory analysis of the staff survey data from the baseline study revealed significant differences between staff educated at AAU (AAU educated) and staff without an educational background from the institution (non-AAU educated). In this article, we aim to investigate these differences further, guided by the research question:

What are the differences in perceptions of education and learning between teachers who have an educational background from AAU and those educated elsewhere?

The AAU PBL model

To contextualise this study, it is important to briefly introduce the educational model at AAU, since the teachers' perceptions are examined in relation to this framework and help readers to interpret the findings.

Since AAU's inception in 1974, the systemic problem-based group project model has provided the foundational framework. AAU was founded after a wave of student protests in 1968, driven by students' demands for greater influence and control over their education. Inspired by a Marxist critique of bourgeois education, these protesters rejected the traditional professorial model (Servant-Miklos et al., 2019). This critique, along with a steep rise in the number of university students, led to the establishment of Roskilde University Centre in 1972 and AAU in 1974. Both universities were founded on the ideals of a pioneering educational experiment rooted in Illeris' (1974) pedagogical ideas of problem orientation and participant direction, where students start with a self-chosen, authentic, and exemplary problem for their group projects. The AAU model has been developed continuously since then, with shifts in theoretical focus from Marxist influences to theories that emphasise learning as experience and social learning (Kolmos et al., 2004; Servant-Miklos et al., 2019).

Emphasising the problem-based project work in groups, AAU students collaborate in smaller teams, typically comprising 4 to 6 members, on an authentic and exemplary problem. Most project periods begin with a group formation workshop in which the students are either assigned to groups or organise themselves based on interest in overarching themes, either suggested by the faculty or by the students (Bundgaard et al., 2021). In a relatively recent survey of students across all educational programs and semesters at AAU, more than 75% of the respondents reported having extensive or full self-determination during the team-formation process (Clausen & Kolmos, 2019b).

The problem at the outset of the project is typically defined within the scope of a broad thematic framework, and its exemplary nature ensures that the project outcomes apply to similar situations and can be utilised in broader contexts beyond the specific project. As a general rule, the semester comprises 50% project work and 50% coursework, with course activities designed to support students' project work, including introductions to relevant theories and methodologies (Kjaersdam & Enemark, 1994). AAU students report working on projects in more than 90% of semesters, and 70% of students surveyed in a recent study reported spending more than 50% of their study time on project work (Clausen & Kolmos, 2019b). Typically, the students work on a single project each semester, which spans approximately 3 to 4 months. During this period, students engage in various forms of inquiry, such as identifying, defining, and analysing problems; collecting and analysing data; and discussing current results. The results are usually documented in a shared project report, which serves as the basis for an oral group examination (Barge, 2010; Kolmos et al., 2004, 2019). During project work, the group is assigned a supervisor who provides both academic and procedural guidance and who, in collaboration with the group, directs its efforts (Boelt & Clausen, 2023; Illeris, 1981). As in other implementations of PBL, supervisors in AAU PBL generally encourage the students to take on a continuously larger portion of the responsibility and direction while they gradually take on a more facilitative role (Dolmans & Schmidt, 2000; Kolmos et al., 2008; Loyens et al., 2008; Olsen & Pedersen, 2018). The organisation and implementation of this pedagogical approach vary across the university, tailored to suit different programs and contexts. Variations may pertain to project duration, the initial selection and formulation of the problem, and work organisation. A common element is the high level of participant control and student autonomy. Students, given significant autonomy, manage their project activities and collaboration, choosing meeting locations, timing, and methods. An ethnographic study reveals a significant diversity in students' orchestration of group work (Sørensen, 2022; Sørensen et al., 2023). Students organise and manage their work in diverse ways, including meeting frequency, locations, routines, and task division, often balancing social and academic needs. Students adapt practices, finding what works best through ongoing negotiation, combining planning and improvisation, and striking a balance between independence and collaboration.

Previous research on the outcomes of studying in an AAU PBL environment has shown that students become increasingly inclined towards self-direction in learning during their first years at AAU, initially becoming more proficient in self-regulating and subsequently becoming increasingly confident in their ability to direct and influence their success (Clausen, 2021). Another study, albeit exclusively on engineering students, showed that AAU students, when

compared to all other Danish engineering students, self-report a higher level of preparedness for using generic and contextual competences but a lower level of preparedness for using competences more closely related to their natural science domain (Kolmos et al., 2021). Widening the scope, research suggests that PBL can help students become more self-reliant and develop flexible understandings (Hmelo-Silver, 2004), better library skills and study strategies (Blumberg, 2000), and enhance their deep learning (Dolmans et al., 2016).

Methodology

Research design

For this paper, an analysis of a cross-sectional survey study was conducted, drawing on the PBL-future baseline questionnaire distributed to all academic staff at AAU in 2018. As part of the PBL-future initiative, researchers sought to establish a statistical benchmark or baseline prior to experimenting with several strategic teaching interventions. This paper presents the results of an analysis conducted on the staff baseline data, examining differences between staff who reported having completed an education at AAU and those who did not.

Participants

The questionnaire was distributed to 2545 scientific and teaching personnel in May 2018 via SurveyXact (Rambøll Management Consulting, 2018), with two reminders distributed over a two-and-a-half-month collection window. Participation was voluntary, and all participants were synonymised throughout. The email invitation described the purpose, estimated completion time (~15 min) and data protection compliance. In total, 1159 staff responded (45.5 % overall response rate), of whom 1057 confirmed they had taught or supervised within the previous four years. Responses from staff who indicated no teaching activity in the last four years (n = 102) were excluded to ensure current PBL experience. Of those, 895 respondents answered the question "Have you completed an education at Aalborg University?" and as such comprise our sample for this analysis:

Group	**n**	**%**	**Mean age (years)**	**Female %**
Educated at AAU	508	56.8 %	42.5	38.2
Not educated at AAU	387	43.2 %	50.5	35.7

Table 1. Respondent answer to the question: "Have you completed an education at Aalborg University?"

Age and gender profiles follow the general AAU staff population (Clausen & Kolmos, 2019a). The overrepresentation of younger academics within the AAU-educated group is addressed in the limitations section.

Survey construction

The staff baseline questionnaire was co-developed by researchers from all five PBL-future sub-projects. The questionnaire was developed in part to service the entirety of the PBL-future project and was validated and piloted internally in the project. The list of competencies was adapted from previous competency frameworks developed by OECD and UNESCO, previously applied in the PROCEED-2-WORK project, with additional competencies suggested by project participants, reflecting the aims of the project and AAU's digital-age PBL agenda (Clausen & Kolmos, 2019a; OECD, 2014; UNESCO, 2016). After bilingual forward–backwards translation, the questionnaire was offered in Danish and English; respondents could switch language at any point. For additional information on the background, construction, distribution and results from the survey, see Clausen & Kolmos (2019a).

Statistical analysis

All analyses were conducted in SPSS 29 (IBM Corp., 2025). After verifying normality and homogeneity assumptions, we compared AAU educated and non-AAU educated staff on each survey item using independent samples t-tests. The analysis relies on two different results that each provide a statistical answer for their own specific questions, and one qualifies the relevance of the other. Initially, to determine whether there is a difference in answer tendencies between the two populations beyond what can be statistically attributed to chance variance, we provide p-values. The p-values are interpreted in line with commonly applied thresholds for significance testing ($p < 0.05$, $p < 0.01$, $p < 0.001$). Subsequently, to access the magnitude of the relationship, or rather to answer how large the differences we have identified as statistically significant are, we calculate effect sizes using Cohen's d. While p-values indicate whether a difference is unlikely to be due to chance, an effect size indicates how large the difference is in units of the overall spread of the data. Cohen's d is calculated as the difference between group means divided by the pooled standard deviation, so while d=0 means there are no differences between the groups, d=0.5 means that the group's mean is half a standard deviation higher than the second group's. A positive d means the AAU educated group has a higher mean than the non-AAU educated group on that particular question (and a negative d the reverse). As a rule of thumb, $d = 0.20$ reflects a small, $d = 0.50$ a moderate, and $d = 0.80$ a large difference in many psychological experimental contexts (Cohen, 1969). In educational research, however, effects are often smaller, so smaller d-values can still be substantively meaningful (Kraft, 2020, 2023).

Cohen, who developed the measurement and benchmarks, stated that he would recommend his benchmarks only for cases where no better basis for assessing an effect size index could be established (Cohen, 1988). Cohen's benchmarks were derived from a handful of small, tightly controlled psychology lab experiments in the 1960s. In the last two decades, there have been substantial and relevant discussions about the interpretation of effect sizes in educational research, and several benchmarks have been proposed. Early work by Lipsey and Wilson (1993) suggested that the standardised benchmarks developed and revised by Cohen (1969) were appropriate, but later studies have suggested that substantially smaller effect sizes should be expected in educational research (Kraft, 2020, 2023). Kraft argues that educational research is very rarely conducted in environments as tightly controlled as those Cohen used, and that there is now sufficient cumulative evidence to suggest different, contextually specific benchmarks (Kraft, 2020). Based on this understanding and an empirical review of empirical educational studies, he therefore suggests benchmarks that are much more sensitive to smaller differences and thus classifies smaller differences as practically significant. We, however, prefer to exercise caution in this study and consequently employ benchmarks to interpret the effect sizes that fall between those proposed by Cohen and Kraft, as illustrated in Table 2. We also note that any practical inferences from effect sizes should be tempered by contextual factors and ideally substantiated by multiple measurements/questions. Therefore, in this study, we do not base our conclusions on any single data point but rather discuss the overall tendencies revealed by the collective profiling of the questionnaire.

Considering the above-mentioned perspectives, we will in this study report ultimate effect sizes for all statistically significant differences identified, but for the sake of readability, we will apply the following definition of small, moderate and large effect sizes, merging the perspectives of Cohen (1969) and Kraft (2020):

	Cohen (1969)	**Kraft (2020)**	**Intervals applied in this study**
Small	0,2	< 0,05	< 0,1
Moderate	0,5	0,05 - 0,2	0,25 – 0,5
Large	0,8	> 0,2	> 0,5

Table 2. Standardised benchmark overview.

Analysis

For the sake of transparency, we have included all questions from the questionnaire batteries where significant differences were found in the analysis,

highlighting the variables that were both statistically significant (p-value) and practically relevant (effect size). The highlighted variables are, for the sake of readability, split into two colours: Blue for all the variables where the mean values are higher for the AAU educated group and orange for the variables where the mean values for the non-AAU educated group are higher.

Included questions:

1. Please indicate to what extent you agree or disagree with each statement.
2. Please indicate how important you think the following competencies are for students' future work.
3. Here are some statements about project supervision. Please indicate to what extent you agree or disagree with each statement.
4. Which of the following elements do you think should be important priorities in the development of the AAU model of the future?
5. Here are a few questions about the students' learning in the group-based project work. Please indicate to what extent you agree or disagree with each statement.
6. To what extent do you think the following activities help to make the students ready for their future work?

Please indicate to what extent you agree or disagree with each statement 1: Completely disagree - 5: Completely agree				
	AAU?	Mean	Significance	Effect size (Cohens d)
Courses are the basis for project work	Yes	3.79	*	-154
	No	3.94		
There is too much project work for the students to learn enough disciplinary knowledge	Yes	2.11	***	-491
	No	2.69		
Projects are the primary source of the students' learning	Yes	3.65	***	305
	No	3.34		
It is primarily through courses that students learn theoretical knowledge	Yes	3.06	***	-239
	No	3.33		
The use of digital media (video, soundbites, podcasts e.g.) is important for my courses	Yes	3.00		
	No	2.96		
There is a good correlation between the contents of the courses and the students' projects	Yes	3.66		
	No	3.65		
It is crucial that there is a connection between projects and courses	Yes	4.22		
	No	4.34		

Table 3. AAU/Non-AAU educated teaching staff "Please indicate to what extent you agree or disagree with each statement". N=882-890. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

Across the seven course-versus-project statements (5-point agreement scale), four showed statistically significant group differences. AAU educated staff agreed more that **"Projects are the primary source of the students' learning"** (M = 3.65 vs 3.34, $p < .001$, $d = 0.31$, moderate). In contrast, non-AAU educated staff agreed more that **"Courses are the basis for project work"** (3.79 vs 3.94, $p < .05$, $d = –0.15$, small), **"There is too much project work for the students to learn enough disciplinary knowledge"** (2.11 vs 2.69, $p < .001$, $d = –0.49$, moderate), and **"It is primarily through courses that students learn theoretical knowledge"** (3.06 vs 3.33, $p < .001$, $d = –0.24$, small–moderate).

For the remaining statement, no significant mean differences emerged. Overall, the pattern suggests that staff who have themselves experienced AAU's problem-based learning environment as students favour project-orientation and less so courses in their pedagogical beliefs, with effect sizes of the group differences ranging from small to moderate.

Please indicate how important you think the following competencies are for students' future work 1: not at all important – 5: extremely important				
	AAU?	Mean	Significance	Effect size (Cohens d)
Ability to perform experiments	Yes	3.51		
	No	3.43		
Business knowledge	Yes	3.57		
	No	3.46		
Knowledge of social issues	Yes	3.70		
	No	3.80		
Creativity	Yes	4.04		
	No	4.00		
Design	Yes	3.18		
	No	3.11		
Theoretical analysis	Yes	3.94		
	No	4.02		
Discipline specific methods	Yes	4.18		
	No	4.17		
Ethics	Yes	3.75		
	No	3.85		
Knowledge of global contexts	Yes	3.59		
	No	3.62		
Lifelong learning	Yes	4.06		
	No	3.97		
Problem solving	Yes	4.67	***	255
	No	4.51		
Knowledge of sustainability	Yes	3.39		
	No	3.42		
Social responsibility	Yes	3.69		
	No	3.77		
Communication	Yes	4.38	*	148
	No	4.27		
Teamwork	Yes	4.44	***	262
	No	4.26		
Innovative thinking	Yes	4.08		
	No	3.98		
Planning	Yes	4.17		
	No	4.14		
Knowledge sharing	Yes	4.20	*	158
	No	4.09		

Management	Yes	3.54		
	No	3.51		
Adaptability to changing tasks	Yes	4.12		
	No	4.03		
Adaptability to changing work forms	Yes	3.96		
	No	3.91		
Strategic thinking	Yes	3.83		
	No	3.85		
Networking	Yes	3.81		
	No	3.75		
Problem analysis	Yes	4.42		
	No	4.41		
Problem formulation	Yes	4.11		
	No	4.13		
Critical thinking	Yes	4.56	**	208
	No	4.43		

*Table 4 - AAU/Non-AAU educated teaching staff * "Please indicate how important you think the following competencies are for students' future work". N=882-890. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

Across the 26 competencies listed (5-point importance scale), AAU educated staff rated five competencies significantly more important than did their non-AAU educated colleagues:

- **"Problem solving"** (M = 4.67 vs 4.51, $p < .001$, $d = 0.26$, moderate)
- **"Teamwork"** (4.44 vs 4.26, $p < .001$, $d = 0.26$, moderate)
- **"Critical thinking"** (4.56 vs 4.43, $p < .01$, $d = 0.21$, small–moderate)
- **"Knowledge sharing"** (4.20 vs 4.09, $p < .05$, $d = 0.16$, small)
- **"Communication"** (4.38 vs 4.27, $p < .05$, $d = 0.15$, small)

No competencies were rated significantly higher by the non-AAU educated group, and no other competencies showed statistically significant differences. Taken together, the pattern indicates that staff who previously experienced AAU's PBL environment place moderately greater value on generic, collaboration-oriented, and higher-order cognitive abilities, whereas views on technical or discipline-bound skills remain comparable across groups.

Here are some statements about project supervision. Please indicate to what extent you agree or disagree with each statement 1: Completely disagree – 5: Completely agree				
	AAU?	Mean	Significance	Effect Size (Cohens d)
As a supervisor, I consider it a very important task to get students to think about their work processes	Yes	4.39		
	No	4.33		
Students' learning of the process is more important than the product of the project	Yes	3.91	*	156
	No	3.75		
There is too little time to complete qualified supervision	Yes	3.30		
	No	3.29		
Projects are often theoretically weak when theory is selected on the basis of a problem	Yes	2.30	***	-264
	No	2.61		
It is difficult to formulate project proposals with real-world problems	Yes	2.14		
	No	2.30		
It costs me less resources to give course lessons than to supervise projects	Yes	2.64		
	No	2.69		
It is important that the students work with real-world problems	Yes	4.26	**	218
	No	4.05		
It is easier to involve my research in project supervision than in courses	Yes	3.21	**	230
	No	2.94		
Broad project frameworks make projects more difficult to supervise	Yes	2.77		
	No	2.93		
It is important for me to work at an educational institution with problem-based learning	Yes	4.15	***	396
	No	3.72		

Table 5. AAU/Non-AAU educated teaching staff "Here are some statements about project supervision. Please indicate to what extent you agree or disagree with each statement". N=882-890. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

Across the ten statements on project supervision (5-point agreement scale), five showed statistically significant group differences. Compared with colleagues who had not studied at AAU, AAU educated staff agreed more that **"Students' learning of the process is more important than the product of the project"** (M = 3.91 vs 3.75, $p < .05$, $d = 0.16$, small), **"It is important that the students work with real-world problems"** (4.26 vs 4.05, $p < .01$, $d = 0.22$, small), **"It is easier to involve my research in project supervision than in courses"** (3.21 vs 2.94, $p <$

.01, d = 0.23, small), and that **"It is important for me to work at an educational institution with problem-based learning"** (4.15 vs 3.72, p < .001, d = 0.40, moderate). They were less inclined to agree that **"Projects are often theoretically weak when theory is selected on the basis of a problem"** (2.30 vs 2.61, p < .001, d = –0.26, moderate).

The remaining five statements showed no statistically significant mean differences. Taken together, these results suggest that staff educated at AAU hold stronger process-oriented, contextually grounded, and research-integrative supervision beliefs and express less concern about theoretical dilution.

Which of the following elements do you think should be important priorities in the development of the AAU model of the future? 1: Not at all important – 5: Extremely important				
	AAU?	Mean	Significance	Effect Size (Cohens d)
More group-based project work	Yes	3.30	***	438
	No	2.83		
Increased interdisciplinarity across faculties	Yes	3.27		
	No	3.15		
More interaction with companies and institutions	Yes	3.53	*	159
	No	3.38		
Greater integration of practice-based elements	Yes	3.42		
	No	3.34		
Strengthening of theoretical disciplines and relation to research	Yes	3.65	*	150
	No	3.77		
An increase in individual study work	Yes	2.41	***	-453
	No	2.86		
Incorporation of new IT-based teaching methods	Yes	2.96		
	No	2.82		
A better link between course teaching and projects	Yes	3.69		
	No	3.71		
Greater integration of digital group work	Yes	2.63		
	No	2.73		

*Table 6. AAU/Non-AAU educated teaching staff * "Which of the following elements do you think should be important priorities in the development of the AAU model of the future?". N=882-890. * p < 0.05, ** p < 0.01, *** p < 0.001.*

Across the nine proposed priorities in Table 6 (5-point importance scale), four showed statistically significant differences. AAU-educated staff placed a higher priority on **"More group-based project work"** (M = 3.30 vs 2.83, p < .001, d =

0.44, moderate) and **"More interaction with companies and institutions"** (3.53 vs 3.38, $p < .05$, $d = 0.16$, small). Conversely, non-AAU educated staff gave greater weight to **"Strengthening of theoretical disciplines and relation to research"** (3.65 vs 3.77, $p < .05$, $d = –0.15$, small) and **"An increase in individual study work"** (2.41 vs 2.86, $p < .001$, $d = –0.45$, moderate).

No statistically significant differences emerged for the five remaining items. Overall, AAU alumni favoured expanding collaborative, externally engaged project work, whereas colleagues educated elsewhere emphasised bolstering theoretical coursework and individual study time.

Here are a few questions about the students' learning in the group-based project work. Please indicate to what extent you agree or disagree with each statement 1: Completely disagree – 5: Completely agree				
	AAU?	Mean	Significance	Effect Size (Cohens d)
The students learn the most with very broad project frameworks	Yes	2.95		
	No	2.86		
The knowledge the students gain through project work is too specialized	Yes	2.02	***	-339
	No	2.37		
Project examination is suitable as a form of student evaluation	Yes	4.20	***	332
	No	3.88		
Too many students can "hide" in the group work and therefore get through their studies too easily	Yes	2.86	***	-392
	No	3.32		
Project work promotes student learning of collaboration and communication	Yes	4.61	***	374
	No	4.36		
Project work promotes important skills for lifelong learning	Yes	4.37	***	449
	No	4.00		
Project work prepares the students for their future work life	Yes	4.56	***	400
	No	4.27		
Project work promotes student learning of project leadership and management	Yes	4.30	***	259
	No	4.10		
Access to group rooms is essential for student study intensity (how much time they spend on their studies)	Yes	3.99	***	346
	No	3.64		
Access to group rooms is crucial for student learning	Yes	3.93	***	290
	No	3.63		

*Table 7. AAU/Non-AAU educated teaching staff * "Here are a few questions about the students' learning in the group-based project work. Please indicate to what extent you agree or disagree with each statement". N=882-890. * p < 0.05, ** p < 0.01, *** p < 0.001.*

Across the ten statements on students' learning in group-based project work (5-point agreement scale), nine showed statistically significant differences. AAU educated staff expressed stronger agreement that **"Project examination is suitable as a form of student evaluation"** (M = 4.20 vs 3.88, $p < .001$, $d = 0.33$, moderate), **"Project work promotes student learning of collaboration and communication"** (4.61 vs 4.36, $p < .001$, $d = 0.37$, moderate), **"Project work promotes important skills for lifelong learning"** (4.37 vs 4.00, $p < .001$, $d = 0.45$, moderate), **"Project work prepares the students for their future work life"** (4.56 vs 4.27, $p < .001$, $d = 0.40$, moderate), **"Project work promotes student learning of project leadership and management"** (4.30 vs 4.10, $p < .001$, $d = 0.26$, moderate), **"Access to group rooms is essential for student study intensity (how much time they spend on their studies)"** (3.99 vs 3.64, $p < .001$, $d = 0.35$, moderate), and **"Access to group rooms is crucial for student learning"** (3.93 vs 3.63, $p < .001$, $d = 0.29$, moderate).

By contrast, non-AAU educated staff agreed more that **"The knowledge the students gain through project work is too specialized"** (2.02 vs 2.37, $p < .001$, $d = –0.34$, moderate) and that **"Too many students can 'hide' in the group work and therefore get through their studies too easily"** (2.86 vs 3.32, $p < .001$, $d = –0.39$, moderate)

No significant difference emerged for the statement **"The students learn the most with very broad project frameworks"**. Overall, staff who have experienced AAU's PBL environment as students view project work as a more potent and broadly beneficial learning medium, whereas colleagues educated elsewhere express greater concern about over-specialisation and free riding. The observed contrasts are uniformly moderate in magnitude.

To what extent do you think the following activities help to make the students ready for their future work? 1: Not at all – 4: To a great extent				
	AAU?	Mean	Significance	Effect Size (Cohens d)
Internship (more than a month)	Yes	3.26		
	No	3.23		
Cooperation with external partners	Yes	3.36	*	143
	No	3.26		
Project work on bachelors level (3rd - 6th semester)	Yes	3.21	*	166
	No	3.08		
Project work on masters level (7th - 9th semester)	Yes	3.58	***	248
	No	3.43		
Master project	Yes	3.51		
	No	3.48		
Group-based project work	Yes	3.65	***	491
	No	3.36		
Individual project work	Yes	2.74	***	-264
	No	2.95		
Basic courses (across disciplines)	Yes	2.85		
	No	2.93		
Subject-specific theoretical courses	Yes	3.23		
	No	3.30		

*Table 8. AAU/Non-AAU educated teaching staff * "To what extent do you think the following activities help to make the students ready for their future work?". N=882-890. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

Across the nine curricular-activity items (4-point contribution scale), five showed statistically significant group differences. AAU educated staff regarded four activities as more helpful for preparing students for future work: **"Group-based project work"** (M = 3.65 vs 3.36, $p < .001$, $d = 0.49$, moderate), **"Project work on masters level (7th – 9th semester)"** (3.58 vs 3.43, $p < .001$, $d = 0.25$, small–moderate), **"Cooperation with external partners"** (3.36 vs 3.26, $p < .05$, $d = 0.14$, small), and **"Project work on bachelors level (3rd – 6th semester)"** (3.21 vs 3.08, $p < .05$, $d = 0.17$, small). Conversely, non-AAU educated staff rated **"Individual project work"** higher (2.95 vs 2.74, $p < .001$, $d = –0.26$, moderate).

No significant differences emerged for the remaining items. Overall, the pattern indicates that alumni of AAU's PBL environment place greater value on collaborative, externally engaged project formats, whereas colleagues educated elsewhere see more benefit in solitary project work.

Summary of findings

Before interpreting the findings, it is essential to stress that the difference observed between AAU educated and non-AAU-educated teaching staff is relative, modest and situated in a pedagogically specific environment. Although statistically significant differences appear across several domains, the effect sizes are primarily small to moderate, and both groups of teachers demonstrate substantial support for PBL. The pattern presented should therefore be understood as subtle shifts in emphasis rather than sharply delineated pedagogical orientations.

Within this caveat, our analysis reveals a consistent set of tendencies. Educators who completed their studies at AAU tend to place greater emphasis on project work, collaboration, engagement with problems and process-oriented supervision. They also place greater value on competencies such as problem-solving, teamwork, and communication. In contrast, colleagues educated elsewhere display comparatively higher endorsement of coursework, theoretical grounding, and individual study activities, and express stronger concerns about overspecialisation and free-riding in group-based project formats. To illustrate these differences, Figure 1 positions the two groups along two intersecting axes: (1) Individual work versus Collaborative work and (2) Coursework versus Problem-based project work. Both groups cluster near the centre of the same pedagogical space, with the AAU educated group leaning toward collaborative, project-based orientations and the non-AAU-educated group leaning comparatively toward individual and course-oriented practices.

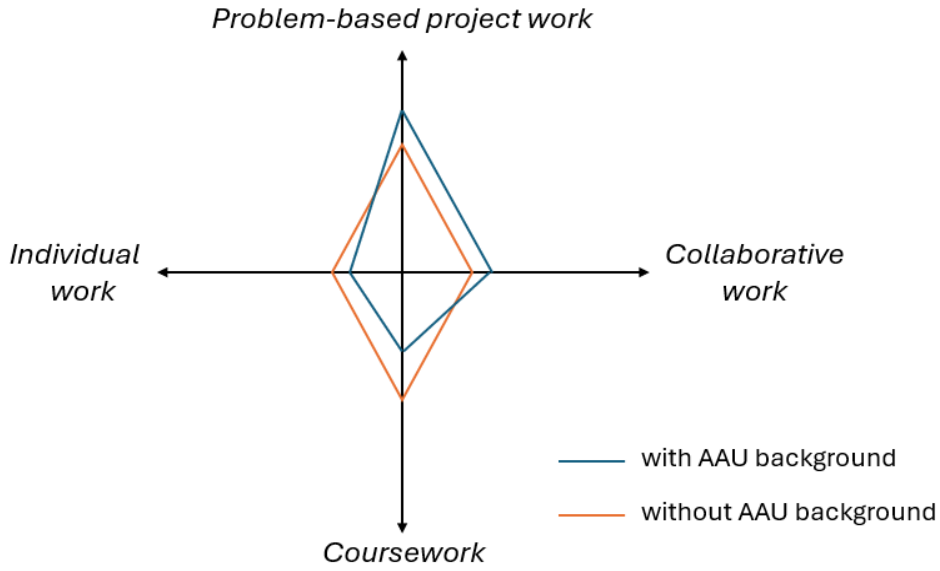

Figure 1. Generalised Illustration of differences in profiles of AAU and non-AAU educated teaching staff. The figure does not depict absolute positions; instead, it visualises the relative shift in emphasis between the two groups.

Discussion

The role of educational background: Teaching the way they were taught?

One possible explanation for the observed tendencies relates to the influence of personal learning histories on teachers' beliefs. As outlined in the introduction, previous research has shown that educators' perceptions of teaching are shaped by their experiences as students (Flores & Day, 2006; Oleson & Hora, 2014). Against this backdrop, it is plausible that AAU alumni, having been educated within a systemic PBL model, place greater value on project-based and collaborative learning activities. Staff without an AAU educational background likewise express support for the core principles of PBL pedagogy, potentially even more strongly than peers from their original institutions, although this remains an open question for future research. One plausible explanation for the differences observed could be the influence of AAU's onboarding practices, peer influence and ongoing pedagogical development initiatives. Our findings can therefore invite consideration from two perspectives: one that foregrounds the modest differences identified, and another that emphasises the broad areas of convergence between the two groups.

Nevertheless, our findings should not be interpreted as evidence of straightforward linear causality. The well-known adage that "teachers teach as

they were taught" serves as a useful heuristic; however, it is overly simplistic if regarded as a deterministic mechanism. Further investigation into teachers' perception of education and learning reveals that teachers' beliefs constitute a complex web of influences. Research has established links between teachers' perceptions of learning and various factors, including knowledge on the work environment, and the learning context (Flores & Day, 2006), disciplinary culture and their understanding of subject structure (Oleson & Hora, 2014; Lindblom-Ylänne et al., 2006), attitudes toward research, and perceptions of the academic setting, including teaching workload, class sizes, and departmental focus on student learning (Ramsden et al., 2007; Trigwell & Prosser, 2020). Moreover, Lyngdorf et al. (2022) found that professional staff development programs can influence teachers' ontological and epistemological beliefs about teaching, purpose and goals as a teacher, self-perceptions and definitions, and perceived action possibilities. At AAU, all senior staff are required to have completed a comprehensive professional development program, and such structured professional learning opportunities may help align teachers' beliefs and practices over time, regardless of their prior educational experiences. Our findings might also support explanations for "hidden curriculum practices" (Snyder, 1971) at pedagogically specific educational institutions such as AAU. If educational beliefs between staff and the institution are misaligned, it is likely that actual teaching and learning practices are affected, as teachers may be less inclined to enact practices that they do not believe in. While Kirkpatrick & Kirkpatrick (2006) do not address teacher beliefs, their evaluation model emphasises that learning, or understanding, does not automatically translate into behavioural change. In this sense, their work supports the broader idea that beliefs and actual practices do not necessarily align, which must be kept in mind when drawing conclusions from this study. In line with this broader perspective, our results indicate that educational background is a relevant factor, but it operates within a complex, interdependent ecology of contextual influences that shape teachers' beliefs. The findings of this study also elucidate how variations in educational pathways can manifest nuanced differences in emphasis and priorities.

It is not the aim of this study to problematise the diversity of beliefs about education or stigmatise either of the two groups described; instead, it aims to provide insights and foster awareness. Such insights may be valuable for designing onboarding procedures, faculty development initiatives, and dialogues concerning shared pedagogical values, as well as for effectively leveraging teacher diversity. Lyngdorf et al. (2022) emphasise that professional development initiatives can encounter cultural resistance, serving as either a catalyst or a barrier to learning, depending on how individuals understand and relate to cultural community norms. In such situations, perceived or assumed differences in educational beliefs may lead some teachers to resist adopting new

pedagogical beliefs, while others may take an oppositional stance toward the local norm, using contrast as a basis for redefining their own practice. In this connection, this study might provide a starting point for dialogue about possible differences and similarities, and for engaging with cultural resistance. Taken together, the results of this study have possible implications for practice. First, the variation in pedagogical beliefs can be seen as a resource that broadens the institutional pedagogical repertoire; newcomers who bring alternative pedagogic knowledge and practices can enrich local interpretations of PBL. Conversely, the results can also be useful for change management in institutions seeking greater coherence in teaching practice. Second, onboarding and professional development activities should assume different starting points. By recognising the differences, programs can begin with brief diagnostic sessions to explore participants' starting points. This could be used to offer differentiated and more culturally responsive pathways. Third, awareness of differences in beliefs can make tacit beliefs and "hidden curriculum practices" more visible and serve as a starting point for more transparent dialogues about pedagogical expectations and constructive pedagogical development and alignment, eventually leading to greater coherence across courses and programmes.

Conclusion

This study supports the view that teachers' perceptions of teaching and learning are shaped by their own educational backgrounds and experiences, particularly when these stem from pedagogically distinctive institutions such as Aalborg University. Our analysis showed that, relative to their colleagues educated elsewhere, as illustrated by figure 1, AAU educated staff place comparatively greater emphasis on project-based, collaborative, and contextually grounded learning. Conversely, staff without an AAU educational background place relatively greater importance on coursework, theoretical grounding, and individual study. A strength of the study is the noteworthy consistency between the two profiles as they relate to the features of AAU PBL.

Importantly, the findings point to the lasting influence of studying in a systemic PBL environment, which appears to continue shaping educational beliefs and practices long after graduation.

While the patterns found between the two groups in this study should not necessarily be interpreted as reflections of broader trends in the general population, a contribution of the study is the large-scale quantitative design, which complements earlier qualitative research on teacher identity development. For higher education institutions strongly committed to particular pedagogical models such as PBL, these insights raise important

considerations for faculty onboarding, professional development practices, and discussions about fostering coherent and pluralistic teaching cultures.

Limitations

It is essential to stress that our findings do not imply that teachers without an educational background from AAU do not value PBL or assign it little importance. What we have demonstrated is simply that statistically and practically significant differences exist between the two groups relative to each other. Our results do not address how these differences are relative to the general population, and as such, both groups might, relative to everyone else, value PBL greatly. The differences we have identified offer insights into the potential impact of having completed an education at AAU, or not, prior to teaching at AAU. Additional methodological and contextual limitations should be considered and temper the interpretation of our findings:

- The AAU educated group was, on average, approximately eight years younger ($M = 42.49$ years) than the non-AAU educated group ($M = 50.54$ years). Across a sample as large as ours, this is quite a large difference, and given that age often covaries with career stage, pedagogical training opportunities and exposure to educational reforms, it could thus moderate or mediate the relationship between educational background and teaching perceptions. Future studies should attempt to disentangle this effect by examining career stage, previous places of employment, and so on.
- In the non-AAU educated group, the proportion of self-reported professors was noticeably higher than in the AAU educated group (14.7% vs. 8.5%). Although some statistically significant differences emerged when comparing professors' perceptions with those of other respondents, these patterns did not align with the group differences identified in our study. Consequently, while these distinctions may be of independent interest, they do not account for or explain the differences observed between AAU educated and non-AAU educated staff.
- With a 45% response rate, it is possible that some elements of social desirability have affected the results or that staff who feel strongly about PBL, be it positively or negatively, were more likely to participate. Moreover, given AAU's institutional commitment to project-based learning, respondents might overstate the perceived value of PBL-aligned practices.

Taken together, these limitations mean that the differences reported here should probably be interpreted as upper-bound estimates of the true

differences attributable to having studied in an AAU PBL environment until supported by further findings in the future. In light of these considerations, we have exercised caution and adopted effect size interpretations that generally underestimate differences relative to the guidelines established in the field, as outlined in the methodology section.

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