

# Teacher's agency in education for sustainable development: an East-West collaborative Erasmus programme using Q methodology

Teacher's  
agency in  
education

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## Abstract

**Purpose** – The integration of ESD is a complex problem. It calls for an innovative, student-centred curriculum, as well as professional learning and agency, by which university teachers feel empowered to change their practice and direct their peers and institutions towards ESD. This study aims to explore what university teachers consider to be the most important attitudes in supporting their agency to deliver Education for Sustainable Development (ESD) via a Problem Based Learning (PBL) programme.

**Design/methodology/approach** – This study presents a theoretical framework for professional agency comprising three domains: intrapersonal, action and environmental. A Q methodology is adopted to explore university teachers' perceptions of the most important environmental factors in supporting their ability to deliver ESD via a problem-based learning (PBL) programme. Twenty-eight participants from six Southeast Asian universities took part in a PBL-based professional development programme designed to improve teachers' ESD- and PBL-based skills and competencies.

**Findings** – The results indicate that the participants were confident in their ability to implement PBL and saw PBL as an approach suitable for addressing current educational, professional and societal challenges. This study offers a series of recommendations to help university teachers develop their ESD and PBL practices.

**Originality/value** – Although the literature on human agency is extensive, research surrounding teachers' professional agency in the context of ESD and PBL in higher education is lacking. The present study addresses this gap by capturing individual teachers' beliefs, perceptions and views and by using Q methodology to examine the subjectivity of study participants.

**Keywords** Education for sustainable development, PBL, Professional agency, Q methodology, Erasmus program, Southeast Asian universities, Environmental assessment

**Paper type** Research paper

## 1. Introduction

The role of the teacher as a key actor in shifting education towards sustainability is widely recognised (e.g. Target 4.C of the “teacher qualification” section in *Quality of Education*, the

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UN's Sustainable Development Goal No. 4) (UNESCO, 2021). In the context of education for sustainable development (ESD), teachers must exert agency so they can influence their peers, institutions and society more broadly (Barth and Rieckmann, 2012; Mifsud, 2017). Professional agency is a well-established concept in the educational sphere. Scholars have examined, for example, the connection between individual agency and the emancipation of the social collective through adult learning (e.g. Freire, 1973). Research has also explored active and agentic roles in the construction of personal knowledge and identity through social participation in different communities (e.g. Eteläpelto *et al.*, 2013). When they have agency, individuals can take action that shapes social interactions, structures and systems in the direction of a more sustainable future in which everyone can benefit (Emirbayer and Mische, 1998; Bandura, 2006). Although the literature on human agency is extensive, teachers' professional agency in the context of their professional development for ESD in higher education is scant (e.g. Emirbayer and Mische, 1998; Bandura, 2006; Du *et al.*, 2022).

The professional development and learning of teachers is critical in preparing teachers to be educators for sustainability, while empowering them to be agents of change in various contexts (i.e. classroom, institution and society). The literature on professional development for ESD argues for programmes with complementary and integrated training strands: for example, one strand related to sustainable development (SD) competence, and another related to pedagogical competence (Barth and Rieckmann, 2012; Du *et al.*, 2022; Martínez Valdivia *et al.*, 2023). Barth and Rieckmann (2012) explore the implementation of an academic staff ESD programme at Universidad Técnica del Norte (Ecuador). They suggest that programmes should provide training in two strands, SD content and pedagogy competence, while promoting collaborative and social learning and driving organisational change towards ESD. Mifsud (2017) points out that educating a workforce in ESD requires rigorous and consistent training and skills development; participatory approaches that enable participants to identify their own challenges, needs and problems; participant engagement in the design of training programmes; empowerment and agency. Bascopé *et al.* (2019) identify three cornerstones of ESD (that it is action driven, community based and value oriented) and three appropriate pedagogical approaches, one of which is problem-based learning (PBL).

PBL has been described as problem oriented, contextual, collaborative, self- and participant-directed, project- or case-organised, exemplary and interdisciplinary, qualities which are well aligned with the characteristics of ESD (e.g. problem oriented, collaborative, participatory, transformative, contextual and empowering) (Guerra 2017). Indeed, PBL has been widely applied in engineering education for SD (Guerra 2017; Gamage and de Silva, 2022), where it has been used to cultivate the requisite (interdisciplinary) competencies for ESD, including systems and critical thinking, problem-solving and collaborative skills (Rieckmann *et al.*, 2017). However, educational reforms tend to reinforce scripted, narrowed curricular perspectives and teachers are evaluated based on students' academic achievements as measured through annual standardised test scores. This threatens high-order learning and creativity, and leads to a loss of professional agency, which is a need to educate teachers for ESD (e.g. Milner, 2013).

In summary, change-oriented professional development is complex; it involves much more than simply equipping teachers with knowledge. Values, beliefs, self-efficacy, motivation and the relationships cultivated by teachers with students, peers and the surrounding environment are equally important (UNECE, 2012). Consequently, professional development programmes should take all of these into account. They should also be participant-centred, providing teachers with meaningful and transformative learning experiences (Du and Lundnerg, 2021; Nguyen *et al.*, 2022), encouraging them to take their

students' perspectives into consideration, giving them space to identify, reflect upon and address their own teaching and learning challenges and needs and supporting them to develop professional agency (Du *et al.*, 2022; Eteläpelto *et al.*, 2013). They should enable teachers to enact their agentic behaviour towards their practice and for sustainability.

Although the literature on teachers' pedagogical development for ESD has grown in the past two decades, studies on how ESD programmes should be designed, implemented and evaluated, their impact on teacher professional agency and the chief principles and characteristics they should adopt remain limited (Ryan and Tilbury, 2013; Mulà *et al.*, 2017; Du *et al.*, 2022; Martínez Valdivia *et al.*, 2023). Research on teachers' professional development for ESD has mainly focused on teacher competence development (e.g. Corres *et al.*, 2020; Scherak and Rieckmann, 2020; Thao *et al.*, 2022) neglecting to explore the ways in which training programmes can lead to the development of professional agency for ESD and the implementation of problem-oriented pedagogies such as PBL (Nguyen *et al.*, 2022). Teacher training programmes that are capable of fostering transformative learning and agentic behaviour are of outmost importance in the field of ESD in higher education, in which teachers become change agents for SD. In addition, the literature emphasises that such processes are enabled by the use of student-centred, problem-oriented, collaborative and contextual pedagogies such as PBL.

PBL is, thus, positioned as a suitable learning approach to equip teachers with knowledge of SD and pedagogical competence, to develop their agentic behaviour for change towards ESD. Although studies exist that report on the suitability of PBL-based professional development programmes to enact teachers' professional agency for curriculum change, studies reporting the suitability of PBL to enact professional agency for ESD are limited (Du *et al.*, 2022).

The present study addresses these gaps by investigating the following research question:

*RQ1.* What do university teachers consider to be the most important attitudes in supporting their agency to deliver ESD via a PBL-based programme?

We begin with a discussion of the theoretical framework of this study, including professional agency, PBL and ESD, followed by a description of the Q methodology used in the empirical study.

## **2. Theoretical framework of teachers' professional agency for problem-based learning and education for sustainable development**

Bandura's (2006) theory of human agency, that of recognising relational and actor-situational transactions, was an important point of departure in the definition of human agency. For Bandura (2006), agency is "the power to originate action", and it relies upon both personal factors and contextual influences. He conceptualises agency using four core dimensions:

- (1) intentionality (e.g. motivation, interests and beliefs);
- (2) forethought (e.g. setting goals and anticipating the future);
- (3) self-reactiveness (e.g. plans, actions and implementation monitoring); and
- (4) self-reflectiveness (e.g. self-awareness, evaluation and reflection).

Agents are, thus, simultaneously planners, fore-thinkers, self-regulators and self-examiners.

The social-cognitive perspective on human agency highlights the interrelated influences of individual agentic behaviour and the individual's surroundings, including what they

envision and the ways that they proactively set, plan, evaluate, establish relations, interact and act to achieve this. Individual agentic behaviours are driven by intentions, values and beliefs that are delimited by time (i.e. past, present and future) and are culturally- and socially-bounded (Emirbayer and Mische, 1998; Bandura, 2006; Du *et al.*, 2022; Eteläpelto *et al.*, 2013). Du *et al.* (2022) propose three intertwined dimensions for professional agency in the context of PBL: intrapersonal, action and environmental. This threefold perspective enables a complex and systemic perspective on university teachers' professional agency in a PBL environment. This framework is used herein to explore the participants' agentic behaviour in their endeavours to shape a socio-constructivist, student-centred curriculum and the complex learning processes involved; namely, changes in their roles, identities, beliefs and practices as they become facilitators of, and for, learning towards sustainability.

### *2.1 The intrapersonal dimension of professional agency*

The intrapersonal dimension includes personal factors such as knowledge, skills, beliefs, self-efficacy, motivation, interest, attitude, appreciation and intentions. University teachers' belief in the importance of educating students about SD is fundamental to their agentic behaviour (UNESCO, 2021; Sinakou *et al.*, 2022). A mindset conducive to development of ESD teaching skills includes a commitment to deep and transformative learning, and the analysis and interpretation of information for decision-making and active citizenship. Teachers should revisit their teaching philosophies and practice and align them with the UN's Sustainable Development Goals (SDGs), thus, enabling them to shape the future they envision for themselves, their students, their institutions and society in general (Hermes and Rimanoczy, 2018). A lack of agentic behaviour and of transformative learning might lead to greenwashing, which ultimately means that ESD practices will have no meaningful impact (Sterling, 2004).

### *2.2 The action dimension of professional agency*

The action dimension is characterised by behavioural elements, such as actions in practice and interactions with students, colleagues, institutional managers and administrators and external stakeholders (e.g. industry representatives, employers, local communities and non-governmental organisations). Interactions within the institution can support ESD and pave the way for organisational transformation (Sterling, 2004), while collaborations with external stakeholders through participation in policy- and decision-making processes will allow for the exchange and absorption of non-academic, interdisciplinary and transdisciplinary knowledge (e.g. through governmental agencies at national, regional and local levels) (Gulikers and Oonk, 2019). Both involve social learning among peers and across institutions (Trencher *et al.*, 2013; Kumari *et al.*, 2020). When the action dimension is lacking, teachers might feel demotivated and alienated and could fall back into more conventional or familiar practices (UNESCO, 2021).

### *2.3 The environmental dimension of professional agency*

The environmental dimension encompasses institutional policies, facilities and prospects. These can accelerate institutional transformation by rewarding and recognising good practice. ESD can be driven from the top down, but meeting the requirements of international and national policies requires a bottom-up approach driven by teachers and researchers who are capable of implementing them (Sterling, 2004; Ryan and Tilbury, 2013). To this end, reward systems and recognition can be used (Hernández-Díaz *et al.*, 2021), targets can be laid down through, for example, the UN's SDGs and challenges and gaps can be analysed to seek improvements (UNESCO, 2021).

### 3. Methodology

#### 3.1 *Research context and participants: the strategic environmental assessment project*

The present study was carried out as part of the four-year Erasmus+ Strategic Environmental Assessment (SEA) for Capacity Development in Higher Education in Asia programme, whose partners comprise six Asian universities – which we will refer to as *A University*, *B University*, *C University*, *D University*, *E University* and *F University* – in collaboration with three European universities – *University of Gothenburg (Sweden)*, *University of Lisbon (Portugal)*, and *Aalborg University (Denmark)*. These institutions are working together to strengthen SEA in Bangladesh, Laos and Vietnam. The overall aim of the programme is to strengthen the ability of the universities involved to carry out high-quality higher education in SEA by integrating environmental concerns into planning and decision-making, using PBL as a primary driver. All six of the participant universities in southeast Asia are in the early stages of implementing ESD and PBL, which means designing or re-designing SEA courses. In contrast, the European partners have relevant research profiles supplementing work on SEA, ESD and PBL.

The project began on 1 November, 2019 and ended on 14 November, 2023. Due to the COVID-19 pandemic, however, all related activities (e.g. PBL lectures and workshops, developing SEA curricula content, literature guidance and joint reading seminars) were conducted online between February 2020 and September 2022. In 2021–2022, *Aalborg University* initiated online workshops identifying challenges and opportunities for PBL, engaging with each country every second or third week over six months. These workshops explored themes such as mini-projects, stakeholder engagement and problem identification. These activities enable the partner institutions to explore ways to integrate SD knowledge and competence, such as SEA, into the curriculum.

In September 2022, the consortium met in person at *University of Gothenburg*. This was followed by a study visit to *Aalborg University*, the main objective of which was to allow partner universities to experience a PBL-oriented university and participate in a PBL-based professional learning programme. This visit was a key component in the development of PBL teaching methods to be implemented in the partner universities shortly after they completion of PBL-based professional learning programme. Participants were involved in the project and its activities throughout the duration of the project, for four years. The demographic information of the participants is shown in [Table 1](#).

#### 3.2 *Research design: Q methodology*

Q methodology has been used previously in field of ESD to explore topics such as how a group of professors conceptualise sustainable universities (*Sylvestre et al., 2014*), researchers' priorities when pursuing sustainability transformation (*D'Amato et al., 2019*) and teachers' development of readiness for ESD through participation in a problem-orientated and collaborative professional development programme. This methodology was selected as a fitting approach in each of these cases because it enables researchers to capture individual beliefs, perceptions and views and to examine the subjectivity of study participants (*Brown, 1980*). Since professional agency is a complex concept involving multiple dimensions and uncertain aspects of human subjectivity, Q methodology was also determined to be the most appropriate approach in the present instance (*Brown, 1980*). While integrating both quantitative and qualitative characteristics, Q methodology minimises the pitfalls of social desirability issues and facilitates insights into complex interactions regarding professional agency (*Fluckinger, 2014*). It, thus, offered a useful approach to exploring university teachers' perspectives on their professional agency in the context of ESD.

**Table 1.**  
Participants'  
demographic  
information

Variables	No.
<i>Gender</i>	
Male	18
Female	13
Other	2
<i>University and country</i>	
A University, Bangladesh	4
B University, Bangladesh	4
C University, Laos	7
D University, Laos	5
E University, Vietnam	5
F University, Vietnam	8
<i>Teaching subject area</i>	
Environment	19
Agriculture and Forestry	9
Chemistry	3
Natural resources	2

**Source:** Authors' own creation/work

Following a standard Q methodological procedure described by [Watts and Stenner \(2012\)](#):

- concourse and Q-set construction;
- P-set selection;
- Q sorting and post-sorting activities; and
- Q factor analysis and interpretation.

In the language of Q methodology, a concourse refers to a set of statements about the research topic ([Brown, 1980](#)). Developing a concourse always requires significant knowledge in the specific field and reflection on the contextual nature of subjectivity ([Brown, 1980](#)). In the current study, the concourse was developed based on the literature review and the authors' previous empirical studies on professional agency, PBL and ESD, as well as their own experience of PBL implementation ([Du et al., 2022](#); [Guerra et al., 2022](#)). The first and third authors, who are both experienced experts in professional agency research, SD studies and PBL implementation, worked together on the initial concourse with the guidance of the framework of professional agency in PBL for ESD discussed in Section 2.

An initial list of 83 statements was proposed. These statements covered a range of relevant topics, including teachers' intrapersonal values regarding professional agency, teaching and learning behaviours and environmental factors impacting professional agency. While the concourse development process is guided by the theoretical framework of professional agency with three interrelated dimensions as a deductive starting point, the Q set construction process also allows for the inductive emergence of new theories ([Du and Lundberg et al., 2021](#)). To enhance the validity of the current study, and starting from the initial Q-set draft, three international experts on ESD and PBL, including the fourth and fifth authors in the study, were invited to review the content of the statements. Two Q methodology experts were also invited as consultants and external monitors, for an editing process that resulted in a 47-item Q set. In addition, two rounds of pilot studies were conducted to obtain feedback on the statements from participants and to assess item

formulation and instrument content validity. After the expert review, pilot studies and research team discussions, several adjustments were made and 16 items were deleted, resulting in a final version of 31 items. Figure 1 illustrates the concourse development and Q-set construction.

**3.2.1 P-set.** The set of participants is called the P-set in Q methodology. In this study, purposeful sampling was conducted to collect various viewpoints of teachers' professional agency via an international pedagogical learning program. P-set sizes in Q studies usually range from 25 to 50 participants (Lundberg *et al.*, 2020). All 28 participants in the Erasmus+ SEA programme from the six Asian universities were invited to voluntarily participate in this Q study, and the response rate was 100%.

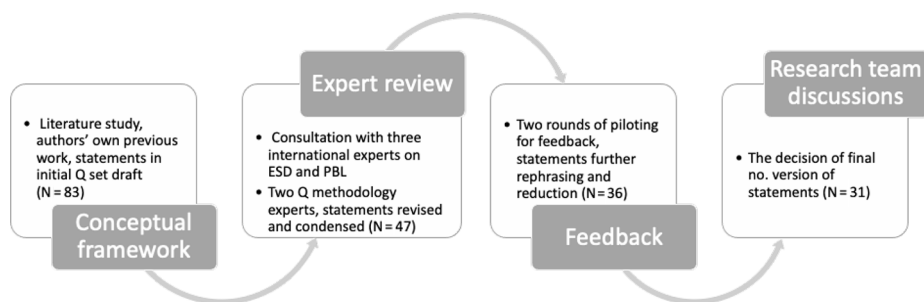
**3.2.2 Q Sorting and post-sorting activities.** After ethical approval was obtained from the host institution, the Q sorting process was administered. All participants were invited to conduct the Q sorting physically. An informed consent form that elaborated on the present study's research aims, format, procedure and data management strategies was provided to participants, so they could decide whether or not to join the study.

The participants were asked the following question:

*Q1.* Through your participation in the Erasmus+ SEA programme, what would be the most important way you could be supported in your preparation for ESD using PBL?

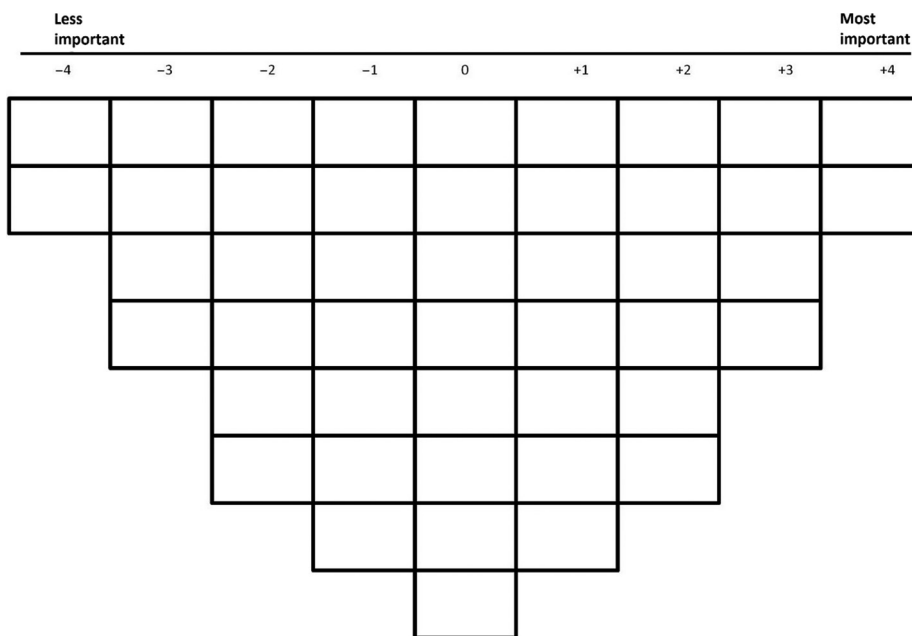
Participants were asked to rank the statements individually according to their previous experience, or based on what they thought they might experience. As Figure 2 shows, all 31 statements were assigned hierarchical values from -4 to +4, from *less important* to *most important*. Each position in the grid could only be occupied by one statement, which encouraged participants to compare the statements and apply their subjective views of their professional agency in a PBL-based professional learning programme.

Post-sorting activities are used to understand the participants' for their choices, and usually take the form of interviews or written responses (Watts and Stenner, 2012). In this study, post-sorting activities were designed to provide the research team with additional qualitative information via written responses. Participants were asked, through three open-



Source: Authors' own creation/work

**Figure 1.** Process illustrating the construction of Q statements, starting from concourse development (i.e. the first set of Q statements based on the literature and the authors' previous empirical work) and leading to the final Q-set (i.e. final set of Q items that participants will sort)



**Figure 2.**  
An example of the grid used for participants to sort Q items from most important (+4) to least important (-4)

**Source:** Authors' own creation/work

ended questions, to elaborate on (1) why they chose the two statements they considered to be the most important; (2) why they chose the two they identified as least important; and (3) if they had any other suggestions about how they might be helped when applying PBL for ESD. During the data collection process, the research team provided individual support by explaining the research procedure and answering any questions participants asked. The participants' written responses were quoted in the descriptions of factor arrays when the statements in the collective factor array were consistent with their choices.

*3.2.3 Q factor analysis and factor interpretation.* To conduct the Q-sort correlations and inverted factor analysis, raw data from the paper Q-sorting activity were entered and checked by the second and third authors separately. The data were then imported into KADE, a Q analysis tool that condenses data and identifies the most informative factor solution via Centroid analysis and Varimax rotation (Banasick, 2019). In Q methodology, the decision of a factor solution (number of factors) is based on four principles (Watts and Stenner, 2012):

- (1) eigenvalue > 1.00 and accounting for as much of the variance observed in the study as possible;
- (2) two or more significantly loading participants per factor;
- (3) the cross-product of the two highest loadings in one factor exceeds twice the standard error ( $1/\sqrt{\text{No. of items}}$ ); and
- (4) theoretical significance and qualitative values.

Using the theoretical framework for professional agency (see Section 2), five factors were selected based on the statistical results (Watts and Stenner, 2012) as well as participants' qualitative elaboration on their choices. The research team discussed the participants'



choices several times before reaching an agreement on the theoretical significance of the factors and the most informative solution (Lundberg *et al.*, 2020).

Twenty-one of the 28 participants leaned significantly towards one of the five factors. Seven responses were non-significant [factor loading  $< 0.46 = 2.58 * (1 \div \sqrt{\text{no. of statements in the Q-set}})$ , Brown, 1980]. There were no confounded sorts (a term referring to a pair of significantly-loaded sorts in two different factors) (Du and Lundberg, 2021). Appendix shows the participants' loading in factors in detail. Based on the Q factor analysis, a holistic factor interpretation was conducted by the research team to provide an overview of the participants' perspectives based on the factor arrays. The factor interpretation process in Q methodology is highly qualitative, abductive and iterative, and starts with a within-factor interpretation supported by the participants' demographic information and post-sorting qualitative data (Du and Lundberg, 2021). To clarify the differences between the five factors, a cross-factor interpretation is presented. Details of the findings of the Q factor analysis and factor interpretation are reported below.

#### 4. Results

To interpret the results and identify the collective opinions held by groups of participants, each factor is described in the form of a holistic narrative that includes quantitative attributes and factor interpretations. Each statement number is specified in brackets, together with its given value in the particular factor array. Each statement is referred to by its item number and rated on a scale from  $-4$  to  $+4$  (e.g. “#5/3” refers to statement 5, which has a value of 3). For distinguishing statements, “D” ( $p < 0.05$ ) is used after the value to emphasise statements in which the viewpoints across factors significantly differed, and D\* is used to indicate “significantly distinguishing statements” ( $p < 0.01$ ). Table 2 provides an overview of the results, including demographic information, and displays factor Q-sort values for statements sorted according to the level of consensus.

In Q studies, common variance in the region of 35–40% or above would be considered a promising solution (Watts and Stenner, 2012), while other researchers also argue that common variance is relatively meaningless in Q methodology (Brown, 1980,  $p$  0.233). Thus, the explained variance of 45% in this study is acceptable.

##### 4.1 Factor 1: seeing problem-based learning for education for sustainable development as an opportunity for institutional change

Factor 1 was chosen by eight participants. They highlighted the need for large-scale change in their institutes and societies, and see their learning experiences in the SEA project as an opportunity to develop their use of PBL to enhance ESD. Factor 1 participants considered urgency for change to be the most important consideration, particularly in terms of prevailing teaching methods in the institution (#22/4) and a societal need to enhance ESD (#31/1). These participants also pointed to a lack of leadership understanding and institutional support in several lower-ranked statements. These included leaders' understanding of what it means to enhance ESD using PBL (#11/–4D\*); leaders' interests in PBL implementation for ESD (#15/–3D\*); institutional requests for further implementation of ESD via PBL after the SEA project (#9/–2); support for this (#18/–2); institutional resources and capacity to enhance ESD using PBL (#24/–2); and a policy of rewards for implementing new teaching practices (#14/–4). In their post-sorting responses, they confirmed and elaborated on their viewpoints. For example:

**Table 2.**  
Overview of the results and factors (F) Q-sort values for statements sorted by level of consensus

Overview of the results	F1	F2	F3	F4	F5
<i>N</i>	8	5	3	3	2
<i>% Explained variance</i>	14	8	11	7	5
<i>Gender n</i> (M: male; F: Female)	M: 5; F: 3	M: 2; F: 3	M: 2; F: 1	M: 1; F: 2	M: 1; F: 1
<i>Average age</i> (years)	41	37	55	41	49
<i>Average teaching experience</i> (years)	13	10	29	17	20
<i>Highest-ranked items</i> (agency dimension)	22 (IP)	22 (IP)	26 (IP)	28 (A)	13 (IP)
	13 (IP)	28 (A)	4 (IP)	2D (A)	23 (IP)
	11D* (A)	1D (A)	28D* (A)	5 (A)	19 (IP)
	14 (A)	5 (A)	14 (A)	8 (A)	8 (A)
<i>Lowest-ranked items</i> (agency dimension)					
<i>Statement</i> (agency dimension; <i>Z-score variance</i> )	3C	3C	3C	2	2
10. PBL is appropriate for solving the current students' learning problems that I have experienced (IP; 0.109)	-1	-2	-2	-2	0
29. My colleagues provide constructive feedback on my initial PBL practice for ESD (A; 0.139)	-2	-4D	-1	0	-2
1. My colleagues understand why I seek to implement PBL for ESD (A; 0.22)					
3. My colleagues show interest in joining me in my future practice of using PBL for ESD (A; 0.257)	-1	-3	-1	-2	1D
12. There is a societal trend towards adopting new pedagogical methods that suit the young generation (E; 0.306)	0	2D	1	1	-2
9. My institution requests that I further implement ESD using PBL after my participation in the SEA project (A; 0.311)	-2	-1	0	-1	2
25. Engaging in ESD using PBL is beneficial for my future job opportunities (IP; 0.356)	1	0	-2	0	-2
16. Using PBL for ESD provides opportunities for students to be connected to society (E; 0.371)	0	1	2	3	-1
5. My institution has the culture to encourage innovative teaching in general (A; 0.385)	-3	-4	-3	-4	0D
17. I enjoyed my initial practice of using PBL for ESD (IP; 0.39)	2	-2	2	0	2
24. My institution is capable of enhancing ESD using PBL with the needed resources (IP; 0.396)	-2	2D	0	-2	0
15. My leaders are interested in extending PBL implementation for ESD (IP)	-3D*	2D	0	1	0
31. There is a societal need to enhance ESD (E; 0.464)	1	1	-1	-1	-3
30. I appreciate new ways of thinking about education (IP; 0.501)	3D	0	1	-3D*	1

(continued)

Overview of the results	F 1	F 2	F 3	F 4	F 5
26. I am capable of conducting PBL for ESD (IP; 0.502)	0	0D	4	2	3
21. There is an emphasis on ESD at my institution (E; 0.51)	-1	1	1	-3	-3
19. Engaging in the PBL implementation for ESD enhances my qualifications for academic promotion (IP; 0.529)	1	-2	-2	1	-4
14. There are rewards for implementing new teaching practice (i.e. PBL) at my institution (A; 0.561)	-4	-1	-4	-1	-1
23. Implementing PBL for ESD improves my teaching competence (IP; 0.563)	3	2	1	0D	4
18. I anticipate receiving needed support from my institution to enhance ESD using PBL (IP; 0.626)	-2	3	2	0	0
8. My leaders have a common understanding that PBL is appropriate for our institution (A; 0.643)	-3	-1	0	-4	-4
27. My students understand that PBL is beneficial to their future (A; 0.716)	-1	-1	-2	3D*	-1
11. My leaders understand what it means to enhance ESD using PBL (A; 0.815)	-4D*	3D*	-1	-1	-1
13. The SEA project activities inspire me to proceed further with using PBL to enhance ESD (IP; 0.821)	4	1	3	-2D*	4
6. My students' learning performance is improved with an initial PBL piloting experience for ESD (A; 0.861)	1	0	-3D*	3D	1
4. I value my learning gains from this SEA project (IP; 0.914)	2	-2D*	4	2	1
20. PBL is appropriate for ESD in general (IP; 0.982)	2	-3	3	1	-2
2. My students react positively to an initial PBL piloting experience for ESD (A; 1.041)	0	0	-3D*	4D	2
22. There is a need to change the prevailing teaching methods in my institution (IP; 1.082)	4	4	0	-3D	3
7. There is a common understanding in my institution of its educational goals for sustainable development (A; 1.134)	0	-3	2	2	-3
28. My students' engagement in learning is improved with an initial PBL piloting experience for ESD (A; 1.719)	2	4	-4D*	4	3

**Notes:** IP = intrapersonal dimension of agency; A = action dimension of agency; E = environmental dimension of agency; C = significant consensus;  $p < 0.05$ ; D = significantly differed;  $p < 0.05$ ; D\* = significantly distinguishing statements,  $p < 0.01$

**Source:** Authors' own creation/work

Table 2.

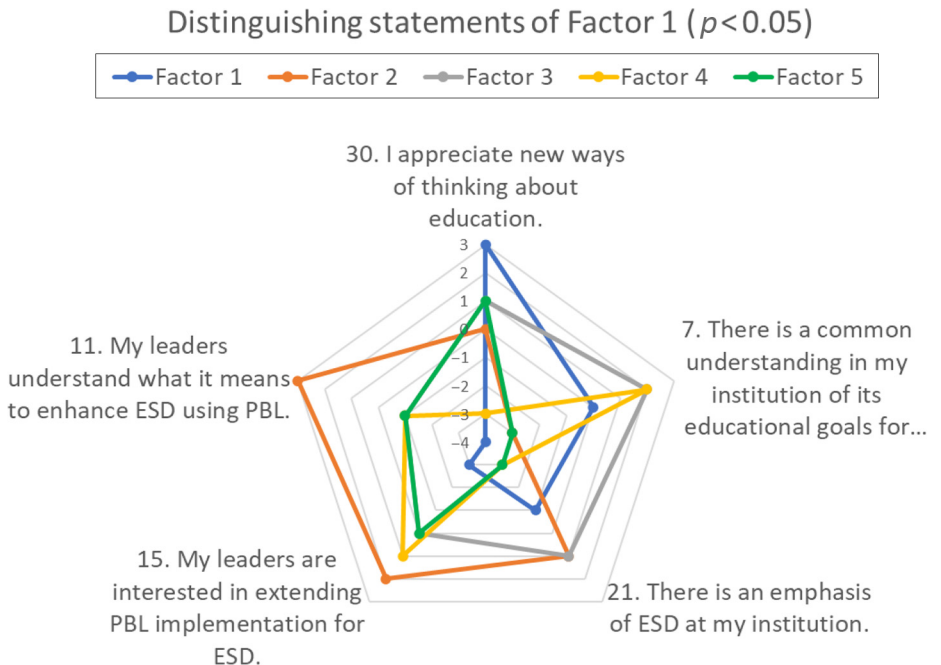
There is a need to change current teaching and learning strategies in my country [...] there is very limited or no proper understanding amongst university leaders regarding the importance of PBL approaches [...] teachers are not adequately supported and promoted to develop new teaching methods (F1-1).

In addition, this group of participants also emphasised their positive experience of the SEA project, including appreciation of new ways of thinking about education (#30/3D); enjoyment of the use of PBL to enhance ESD (#17/2); and inspiration to proceed further (#13/4). These opinions were further endorsed in their post-sorting responses. One participant stated: “The current system is insufficient for proper learning [...] PBL would enhance ESD and young people will show more interest in the new pedagogical method” (F1-4). Others further explained:

As PBL is a new method to me, I enjoy it very much. I believe that PBL will improve my teaching competence as it benefits my students [...] my institution has no policy and support regarding rewards for any new practice. My institution is not capable of implementing PBL, as the student-teacher ratio is high (more than 50). Huge change is needed (F1-7).

Having joined the SEA project, I have gained knowledge and a deep of SEA and PBL. PBL helps me improve the quality of research and teaching. I also applied [them] even though my university leaders do not understand (F1-6).

Figure 3 illustrates how ways the ranking of distinguishing statements of Factor 1 varies in Factors 2, 3, 4 and 5. For example, statement 30 is statistically distinguished in Factor 1 (#30/3D), while in others factors it is not (e.g. Factor 2: #30/0; Factor 3 and 5: #30/1, Factor 4: #30/-3).



**Figure 3.** Distinguishing statements of Factor 1 and their sorting in comparison with Factors 2, 3, 4 and 5

Source: Authors' own creation/work

#### 4.2 Factor 2: receiving institutional and leadership support for making changes in teaching practice

Five participants leaned significantly towards Factor 2. The group included three professors, one associate professor and three lecturers. Generally, they recognised the importance of understanding and interest from leaders in their departments, and support from their institutions. While leadership support was highlighted, support from colleagues was not mentioned. All agreed that there is a need to change the prevailing teaching methods (#22/4), which is related to the societal trend towards adopting new pedagogical methods to suit the younger generation (#12/2D) and a societal need to enhance ESD (#31/1). As F2-2 explained: "Societal need should always lead to an implementation of new teaching methods".

The Factor 2 participants underlined the important role their institutions play in change; in particular, they highlighted leaders' understanding of what it means to enhance ESD using PBL (#11/3D\*) and their interest in its implementation (#15/2D). Alongside leadership support, the participants noted the importance of support from their institutions (#18/3). As one participant explained:

I think the educational system in my university is traditional such that it is in urgent need of change, and PBL can be introduced as a solution. It is good that the current leaders understand this because they can support any change that takes place (F2-1).

Factor 2 participants also valued the improvement they observed in students' learning engagement during an initial PBL piloting experience (#22/4). As one participant wrote: "I think the young generation is quick to adopt new methods and students should have a piloting experience for ESD to get used to the methods" (F2-5).

Participants in this group also noted the importance of societal needs, leadership support and students' improvement, but gave a low ranking to the significance of institutional culture; for example, regarding engagement in innovative teaching (#5/-4) and common understandings of educational goals for SD (#7/-3). In contrast with the other factor groups, these participants regarded colleagues' support as the least important, giving low rankings to, for example, an understanding of why the participants in question sought to implement PBL for ESD (#1/-4D), colleagues' interest in becoming engaged themselves (#3/-3) and providing constructive feedback on the participants' initial PBL practice (#29/-2). In their post-sorting responses, one participant wrote that "there is lack of common understanding among my colleagues, but whether they understand [this] or not, I seek to implement PBL for ESD for students, not for my colleagues' sake" (F2-5).

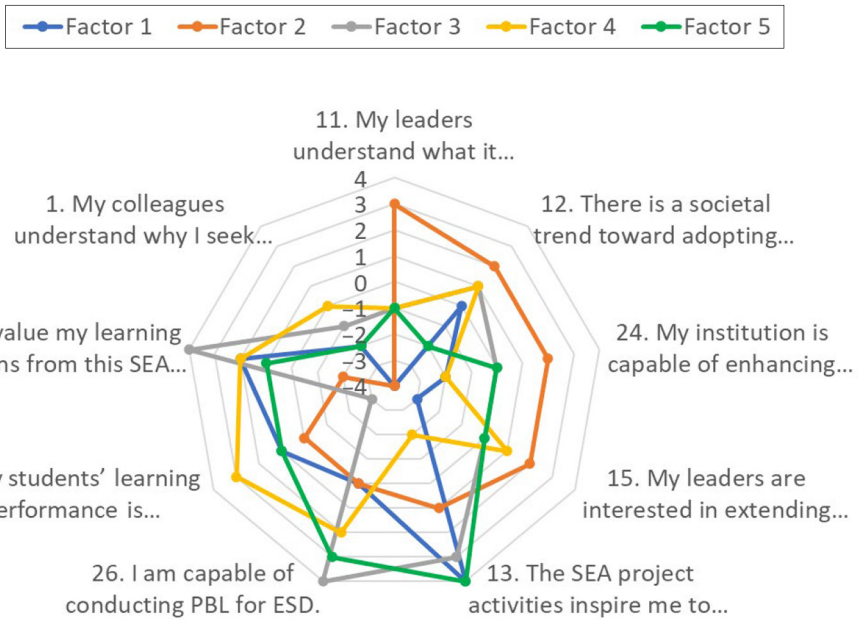
Furthermore, learning gains from the project (#4/-2D\*) and PBL appropriateness for ESD in general were deemed to be less important (#20/-3) than other Q items. The participants explained this by saying that the appropriateness of PBL for ESD did not need to be further highlighted. As F2-3 argued: "Institutional and other changes are more important than personal learning in a system."

Figure 4 illustrates how the ranking of the distinguishing statements of Factor 2 vary from those of Factors 1, 3, 4 and 5. For example, statement no. 11 is significantly distinguished in Factor 2 (#11/3D\*), while in other factors it is not (e.g. Factor 1: #11/-4; Factor 3, 4 and 5: #11/-1).

#### 4.3 Factor 3: appreciating personal learning gains and beliefs

Factor 3 comprised three participants. In contrast to the other factors, the participants in this group reflected little on institutional aspects, which may have been because they had not yet

Distinguishing statements of Factor 2 ( $p < 0.05$ )



**Figure 4.** Distinguishing statements of Factor 2 in comparison with Factors 1, 3, 4 and 5

**Source:** Authors' own creation/work

piloted PBL for ESD. Each valued their learning gains from the project (#4/4), which gave them confidence in their ability to conduct PBL for ESD (#26/4). They believed that PBL is appropriate for addressing students' learning challenges (#10/3) and that it is appropriate for ESD in general (#20/3). As one participant explained: "After this project, I understand PBL and how it supports ESD much more clearly, so I am confident that I can apply it on my course" (F3-1).

While highlighting their positive personal experiences, the participants gave the lowest rank to institutional rewards for implementing PBL (#14/-4). This was "because there is no reward for me or other colleagues if we implement a new teaching practice" (F3-1). Nor did they believe that engaging in ESD using PBL was beneficial for future opportunities (#25/-2), since they did not believe that improving teaching was related to career advancement. For instance, (F3-2) pointed out that "we are encouraged to implement new teaching practices, but it does not lead to future promotions."

In contrast with the other factors, these participants gave low scores to student-related aspects. For example, they did not consider improving students' learning engagement (#28/-4D\*); improvement of students' learning performance (#6/-3D\*); students' positive reaction to an initial PBL piloting experience (#2/-3D\*); or students understanding that PBL would be beneficial to their future (#27/-2) as important. This was possibly because the participants had not yet piloted PBL for ESD. As F3-3 wrote: "I believe PBL is appropriate for our institution, but I have not put it into practice."

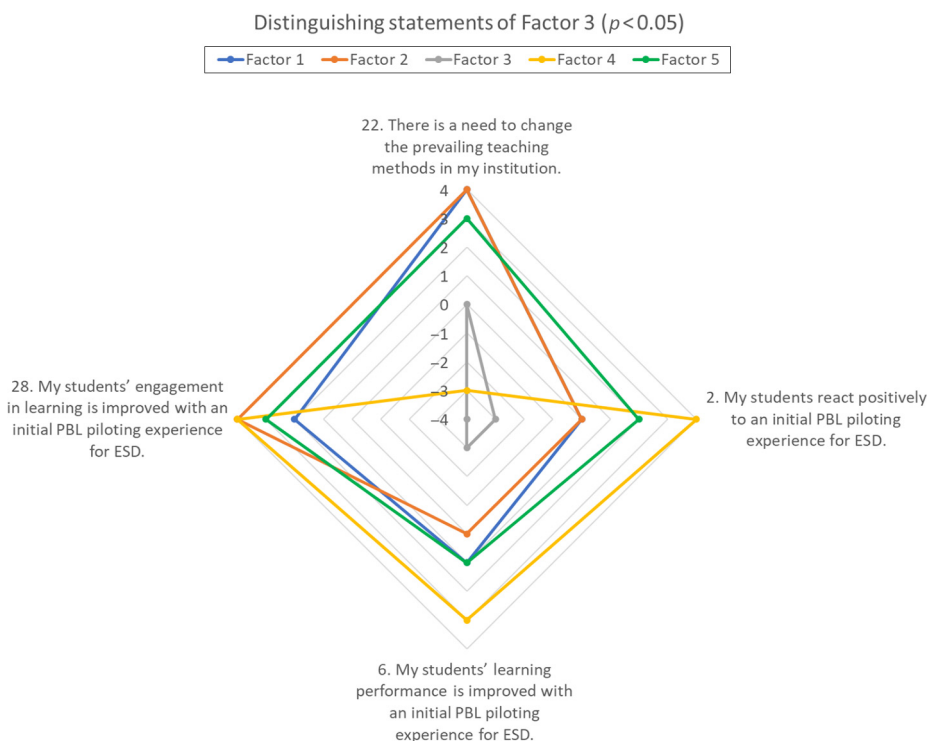
Figure 5 illustrates how the ranking of the distinguishing statements of Factor 3 vary in Factors 1, 2, 4 and 5. For example, statement no. 22 is significantly distinguished in Factor 3

(#22/0), while in other factors it is not (e.g. Factor 1 and 2: #22/4; Factor 4: #22/−3, Factor 5: #22/3).

4.4 Factor 4: observing student improvement in learning engagement and performance

Factor 4 again comprised three participants. The participants underlined the role of students in their choices; for example, their feedback on the use of PBL for ESD and improvements in their learning engagement and performance. The participants emphasised the significance of improvement in students' learning engagement (#28/4) and performance (#6/3D), and positive reactions from students to the piloting of PBL (#2/4D). They emphasised how important it was for their students to understand that PBL was beneficial to their future (#27/3D\*); for example, because it provided opportunities for them to be connected with society (#16/3). In their written responses, participants elaborated in the prioritisation of students; for F4-3, students "are key in my choices. They are positive and have improved their learning engagement".

The participants in this group ranked some institutional aspects positively and others negatively. The existence of a common understanding of ESD at their institutions (#7/2) was ranked high, but other statements were ranked low. The latter included leaders' understanding of PBL appropriateness (#8/−4); institutions' encouragement of innovative teaching in general (#5/−4) and the need to change prevailing teaching methods (#22/−3D); and the emphasis placed on ESD, along with the need to provide the necessary resources to



**Figure 5.** Distinguishing statements of Factor 3 in comparison with Factors 1, 2, 4 and 5

Source: Authors' own creation/work

enhance ESD using PBL (#29/-2). These participants had already experienced changes, so they did not think there was a need to highlight the importance of further change in the future. For F4-2, “it was already agreed that PBL is appropriate to my institution”. In addition, compared with all other factors, the participants in this group gave a noticeably low rank to appreciation of new ways of thinking about education (#5/-3D\*); “they already exist in my institution and my life and are part of my habits and routine thoughts” (F4-2).

Figure 6 illustrates how the ranking of the distinguishing statements of Factor 4 varies from those in Factors 1, 2, 3 and 5. For example, statement no. 2 is distinguished in Factor 4 (#2/4), while in other factors it is not (e.g. Factor 1 and 2: #2/0; Factor 3: #2/-3, Factor 5: #2/2).

#### 4.5 Factor 5: taking agentic actions to improve teaching competence and create change

Two participants significantly loaded on Factor 5. One was an associate professor and the other a lecturer. Both highlighted the importance of increasing their teaching competence through practising PBL for ESD. Their appreciation of what they had learned through their involvement in the SEA project and their initial success increased their sense of agency in terms of engaging in further ESD, with the ultimate goal of generating further institutional change.

Inspired by their learning from the project (#13/4), the participants enjoyed their initial practice of using PBL (#17/2) and observed improvements in their teaching competence (#23/4). They did not consider whether their efforts would improve their prospects for

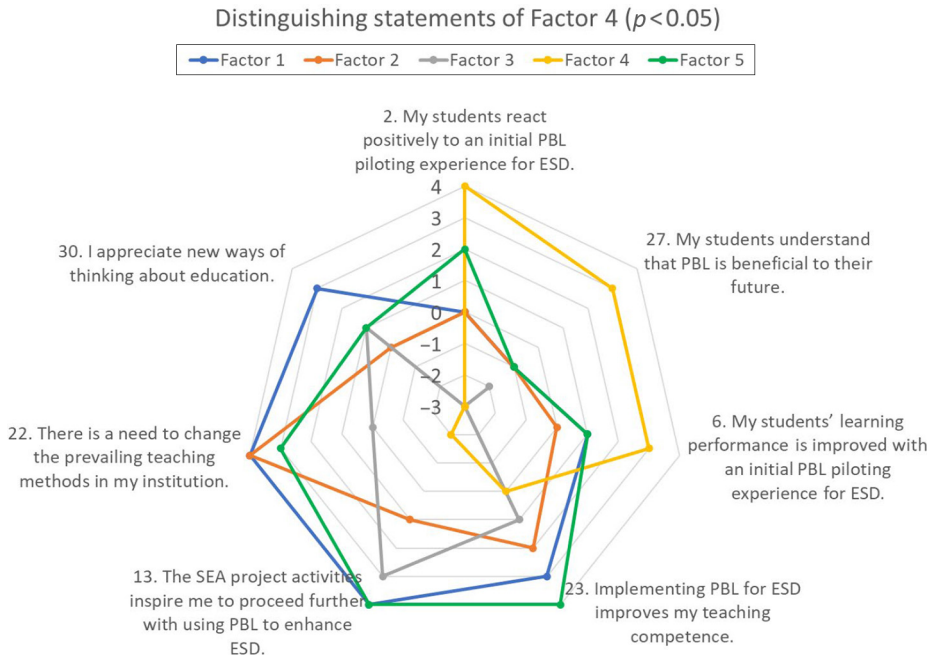


Figure 6. Distinguishing statements of Factor 4 in comparison with Factors 1, 2, 3 and 5

Source: Authors' own creation/work



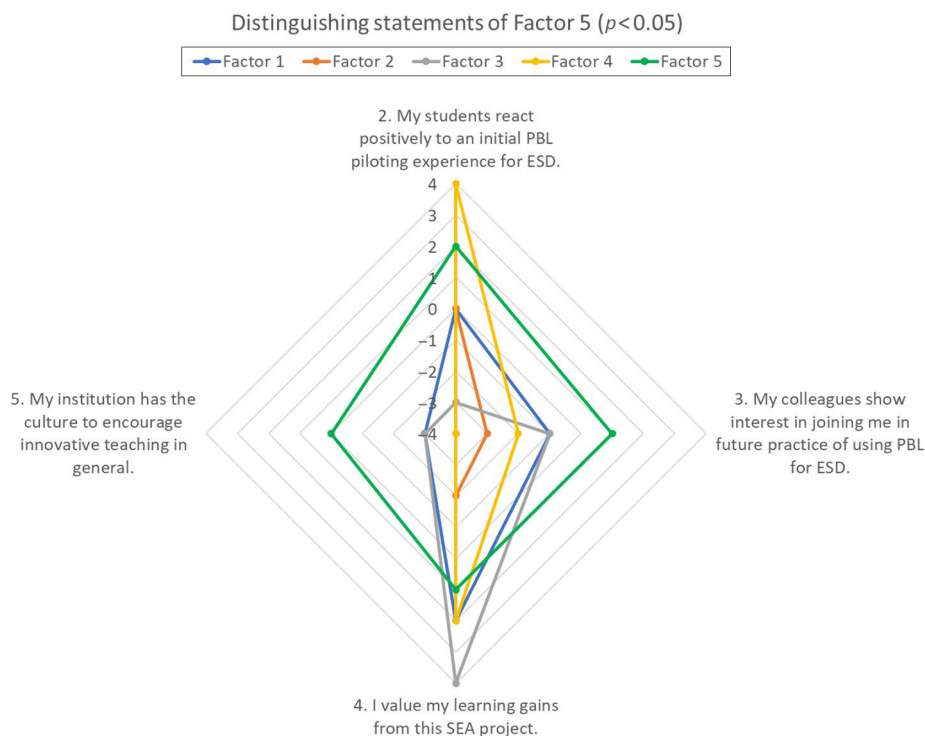
promotion (#19/-4) or job opportunities (#25/-2) to be important. For them, implementing PBL for ESD was their own decision and they were simply doing what they believed in:

From my learning in the SEA project, I found that PBL is a good way to enhance ESD, and my students' engagement in learning improved through my methods. The teaching methods in my institution need to be changed, but first of all, it is important I can make choices regarding the appropriate method (PBL) so I can improve my teaching (F5-1).

Both participants appreciated the importance of their respective institutions' request that they implement PBL for ESD (#9/2) and their colleagues' interest in collaborating with them (#3/1D). They scored their leaders' understanding of PBL (#8/-4); their institutions' emphasis on ESD (#21/-3); a common understanding of the institution's ESD goals (#7/-3); and a societal need to enhance ESD (#31/-3). As F5-2 explained:

The SEA project activities inspired me to think about the teaching methods I have attempted to apply and test. Although I knew PBL before, I know it much better now. It has a different meaning compared with before. It takes time for the leaders to understand PBL, and changing their ideas is hard work [...] so it is important that we keep trying until they can change. The ultimate goal is to generate more change.

Figure 7 illustrates how the ranking of the distinguishing statements of Factor 5 varies from those in Factors 1, 2, 3 and 4. For example, statement no. 3 is distinguished in Factor 5 (#3/2D), while in others factors it is not (e.g. Factor 1 and 3: #3/-1; Factor 2: #3/-3, Factor 4: #3/-2).



**Figure 7.** Distinguishing statements of Factor 4 in comparison with Factors 1, 2, 3 and 5

Source: Authors' own creation/work

#### 4.6 Consensus

Despite widely differing opinions, one statement was statistically identified as one that participants from all five factors agreed upon; namely, that PBL was appropriate for addressing the learning needs of today's students (#10/F1: 3, F2: 3, F3: 3, F4: 2, F5:2). This indicates that the participants maintain a positive attitude towards PBL and share the same belief regarding PBL as potential solution to address their educational challenges. This view aligns with literature, which highlights the need for problem-oriented, collaborative, student-centred learning environments to give students the skills to address professional and social trends they will encounter in the future (e.g. [Hadgraft and Kolmos, 2020](#)).

### 5. Discussion and recommendations

The current study has examined the supporting factors that university teachers considered to be the most important in the implementation of PBL. The results were discussed in relation to the literature and a theoretical framework, along with their implications for the participants' agentic behaviour. The participants' views were examined using three dimensions of professional agency (i.e. intrapersonal, action and environmental). Some participants (e.g. F3-1 and F3-3) believed that change was needed and felt capable of fostering it, showing intentionality and forethought by setting up goals and planning, implementing and evaluating their actions ([Bandura, 2006](#); [Eteläpelto et al., 2013](#)). In addition, they re-imagined their teaching practice through PBL and for ESD, pointing to PBL potential to enable deep and transformative learning ([Sterling, 2004](#); [Hermes and Rimanoczy, 2018](#)).

In this context, experiences with PBL as a learning approach played an important role in participants' learning and integration of ESD in their courses. From an action and relational perspective, the participants referred to the impact of their PBL-ESD teaching practice on students' learning, and the support they needed from leaders and colleagues ([Du and Lundberg, 2022](#)). From an environmental perspective, the participants referred to two primary levels of contextual influence: students' learning and the societal relevance of ESD as drivers for change (which implied a strong bottom-up approach), and a lack of institutional policy and rewards systems to support such change. PBL for ESD is a complex and transformational endeavour that requires both bottom-up and top-down commitment and agency ([Sylvestre et al., 2014](#); [Hernández-Díaz et al., 2021](#); [UNESCO, 2021](#)).

Although the professional learning programme fulfilled its purpose by fostering participants' learning and agency, the results revealed a strong emphasis on intrapersonal resources and a lesser one on the action and environmental dimensions. For example, the participants had limited PBL practice, experience and influence, and this heightened the risk of disconnection, loneliness and demotivation, which present obstacles to the change that is so much needed in higher education to prepare future professionals to act and build a more sustainable future ([UNESCO, 2021](#)). That said, the research contributes to a comprehensive understanding of the strengths and risks involved in successfully integrating ESD in in the context of engineering education in southeast Asia, and which directions professional learning should take to strengthen university teachers' agentic behaviour for PBL-ESD.

We make several recommendations to strengthen professional agency and address the remaining gaps in the literature. Firstly, the action aspects of professional agency can be bolstered in several ways. Universities should develop cross-institutional cooperation and take inspiration from the actions and initiatives of partner institutions, for example, by co-organising seminars and events to exchange knowledge of best practices, which could be hosted by a different partner each year; by developing comparative studies on impacts of change in students learning; or by establishing international professional learning communities, etc. Institutions

should also consolidate links with stakeholders who can provide support and local communities by, e.g. disseminating research results with external partners; or by consulting and involving alumni and industry partners in the process of change.

Secondly, tailor-made strategies could be pursued. The participants' ideas on how their professional agency might be enhanced varied, as evidenced by the emergence of five distinct factors. It is worth noting that the participants were from a wide range of disciplines, institutions, regions and southeast Asian countries, and were, therefore, culturally and educationally diverse. As a result, their learning needs might have differed. Tailor-made strategies for further professional learning and development would allow for the integration of contextual knowledge from different sources and stakeholders, fostering deep, meaningful and transformational learning processes for change.

## 6. Conclusion

The current study contributes to ESD research in two key ways. The first is methodological: Q methodology is not only rarely used in ESD research contexts (e.g. [Sylvestre et al., 2014](#); [D'Amato et al., 2019](#)) but also combines quantitative and qualitative approaches to capture participants' subjective opinions on a complex topic. Its second contribution is its empirical exploration of teachers' professional agency for ESD and PBL. Educating for SD requires agency, but while this has previously been studied in the context of student learning ([Guerra et al., 2022](#)), it has rarely been explored in the context of teacher training ([Martínez Valdivia et al., 2023](#)).

At the same time, the current study has some limitations. From a methodological perspective, it was not possible to run a Q study on professional agency before the programme had taken place. A pre-Q study would have made it possible to assess whether the participants' perspective on professional agency changed after their involvement in the learning programme. In addition, the study could have been strengthened through the use of multiple sources of data, thus, helping to create a broader understanding of the participants' professional agency in greater depth. In particular, this work could have addressed the extent to which participants' responses were influenced/determined by their contextual and institutional, personal and professional experiences, as well as their motivation. The results as they stand revealed certain patterns regarding professional agency, but did not afford a deeper understanding of how cultural, personal, institutional and regional diversity were drivers for change and how these varied amongst the participants. Future researchers might explore participants' professional agency in particular contexts and across time by using a range of sources, including life stories and interviews. In addition, enquiries could be made into how social learning across and collaboration between institutions and countries, as well as partnerships with external stakeholders, strengthen teachers' professional agency and foster the institutional transition to ESD.

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Part. no.	Factor group	1	2	Factor 3	4	5
6	F1-1	0.8229				
2	F1-2	0.6952				
16	F1-3	0.6649				
13	F1-4	0.6547				
1	F1-5	0.6401				
8	F1-6	0.5293				
17	F1-7	0.4794				
7	F1-8	0.4627				
9	F2-1		0.6693			
3	F2-2		0.6187			
28	F2-3		0.5867			
12	F2-4		0.5415			
11	F2-5		0.4632			
23	F3-1			0.8462		
24	F3-2			0.8462		
26	F3-3			0.4556		
18	F4-1				0.7271	
10	F4-2				0.5689	
27	F4-3				0.4974	
5	F5-1					0.5756
15	F5-2					0.5412
<i>Unloaded participants</i>						
19	F1-9	0.3508	0.2408	0.0399	0.1458	0.0777
14	F3-4	0.0663	0.1509	0.4086	-0.1228	-0.0588
20	F3-5	0.1241	0.079	0.3953	0.2222	0.1915
22	F4-4	0.0641	0.1554	0.0854	0.3662	0.1852
25	F4-5	-0.092	-0.0583	-0.0168	0.2709	-0.035
21	F5-3	0.0606	-0.0909	0.0824	-0.0121	-0.3178
4	F5-4	0.0621	-0.1283	-0.0636	-0.108	0.1728

**Table A1.**  
Participants' factor  
loading

Source: Authors' own creation/work

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