Towards teaching strategies addressing online learning in blended learning courses for adult-learners

Nanda van der Stap [a],[*], Theo van den Bogaart [a], Stan van Ginkel [a], Ebrahim Rahimi [b], Johan Versendaal [b]

[a] *Digital Ethics, HU University of Applied Sciences, Utrecht, Netherlands*
[b] *Faculty of Beta Sciences, Open University, Netherlands*

A B S T R A C T

Blended learning offers a learner-centred approach that employs both in-class learning and digital technology to facilitate online learning. Such an approach is especially advantageous to adult-learners in higher education as it meets their educational needs. However, adult-learners' participation in blended learning programmes remains challenging due to a general lack of online interaction, and no clear teaching strategies that address this concern. Literature relating to adult-learners' educational needs and online interaction was consulted in order to design teaching strategies that foster adult-learners' online interaction. The aim of this study is to further validate these teaching strategies, hence a multiple case study was carried out using a mixed method approach. As such, eight teachers and sixteen students from four courses across three universities in Belgium and the Netherlands were interviewed. Additionally, a questionnaire testing a pre-defined set of variables was distributed to 84 students. The results lead to a set of validated teaching strategies that help teachers to further develop their professional skills and expertise. The teaching strategies can be grouped into three categories, namely 1) the teacher's online presence, 2) collaborative learning activities and preparatory learning activities, and 3) the distribution of learning content and learning activities across online and in-class learning. An elaborate set of validated teaching strategies is included. This study aids towards teacher professional development and adds evidence-based knowledge to teaching strategies and instructional frameworks for adult-learners in higher education.

Teaching/learning strategies, adult-learning, cooperative/collaborative learning, teacher professional development, online learning.

1. Introduction

Literature on educational technology generally considers blended learning as a 'blending' of in-class or face-to-face (f2f) and online instructional activities, aiming to stimulate and support learning (Boelens et al., 2015). Moreover, blended learning facilitates a transformative, pedagogical approach aimed at increasing the levels of interaction among students through cooperative or collaborative activities, evoking higher-order thinking and deep learning (Biggs & Tang, 2007; Kjærgaard, 2017; McKenna et al., 2019). This approach is highly welcomed by adult-learners in higher education as it affords them flexibility in terms of time and place (Decelle, 2017; Diep et al., 2017; Jones & Blankenship, 2017). Despite this affordance, preliminary studies that took place in a higher education context reveal that a lack of interaction with online learning content results in an increasing number of adult-learners leaving the blended learning programme prematurely (Choi & Kim, 2018; Johnson et al., 2018; Kuo & Belland, 2016), having lower learning outcomes (e.g. Cuesta Medina, 2018; McKenna et al., 2019; Serrano et al., 2019), or having poorly perceived learning experiences (Armellini & De Stefani, 2015; Kim et al., 2016; Morueta et al., 2016).

When designing education aimed at higher education adult-learners, it is important to consider their educational needs and

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learning characteristics, or affective states as it relates to education (Millheim, 2011; Youde, 2018), as any educational design should cater for the target group (Biggs, 2003). Whilst higher education adult-learners are self-motivated (Chametzky, 2014), and, as said, the construction of blended learning appeals to them, the implementation of an online mode to the learning environment is challenging as most higher education adult-learners are likely to be more familiar with traditional, in-class education and need to see the meaning of the 'added' online mode (Owston & York, 2018). In particular, higher education adult-learners need to have opportunities that facilitate deep-learning (Cuesta Medina, 2018; Kjærgaard, 2017), they need to see the relevance and meaning of what they need to learn and how they need to interact with learning content (McKenna et al., 2019), and they need opportunities for self-directed learning (Zhang & Zheng, 2013, pp. 151–152). To foster interaction with online content, it is therefore imperative that said educational needs, or affective states, are considered. As online interaction is both the pillar of blended learning, and the culprit of adult-learners' de-motivation, said affective states need to be aligned with the design of the dichotomy of the blended learning environment.

Previous studies have revealed two salient challenges concerning the lack of online interaction in blended learning. The first of these is related to social presence, which is "the ability of participants in a community of inquiry to project themselves socially and emotionally as 'real' people (i.e., their full personality), through the medium of communication being used" (Garrison et al. p. 94). This involves students' awareness of other beings in the online environment (Andel et al., 2020; Hodges et al., 2020). The second salient challenge is related to convergence, where online learning and f2f learning are structured along the best-suited delivery mode (King & Arnold, 2012; Owston & York, 2018). When students do not experience social presence, they feel isolated and refrain from online interaction (Martin & Bolliger, 2018; Oyarzun et al., 2018). Likewise, when students do not see the relevance of the relation of the activities in the online and f2f modes, they often ignore the online environment and choose to participate in the f2f mode only, being the mode they are most familiar with (Owston & York, 2018; Östlund, 2008).

Lack of social presence and convergence between online and f2f modes are two challenges that can be met through blended learning teaching strategies,[1] in particular as they relate to the affective states of adult-learners in higher education (Chametzky, 2014; Milheim, 2011; Snyder, 2009; Vanslambrouck et al., 2019). Affective states are those states that, as said, relate to adult-learners' educational needs and learning characteristics, and which largely influence the way adult-learners approach learning (Pappas & Jerman, 2015; Youde, 2018), and remain motivated (Gómez & Duart, 2011; Martin & Bolliger, 2018). Higher education adult-learners are to be distinguished from 'hands-on' adult-learners (Boelens, Voet, & De Wever, 2018), where students generally learn by doing. This distinction is captured by the experiential adult-learning theory which explains that hands-on adult learners learn from experience (see e.g. Cercone, 2008; Milheim 2012). Typically, these students have craft knowledge, but need sufficient teacher direction or student support (Boelens et al., 2018). In contrast, higher education adult-learners have, inter alia, a high sense of self-directedness, preferring a large amount of autonomy, one in which they direct and strategise their own learning (e.g. Chan, 2010; Zhang & Zheng, 2013, pp. 151–152). These differences, among others, between teacher-directedness and self-directedness have their bearing on both social presence and convergence as course design capturing these essences should meet the needs of students (Biggs, 2003). Against this background, teaching strategies in blended learning programmes specifically geared towards higher education adult-learners are essential for their engagement in learning processes (Hodges et al., 2020; Vanslambrouck et al., 2019; Youde, 2018). In the absence of such teaching strategies, teachers may fall back on traditional methods and pedagogical approaches that are generally more suited for students who have recently left secondary education, entering tertiary education for the first time (Serdyukov, 2017).

When considering teaching strategies in the design of blended learning programmes, designers need to contemplate both the target group or student factors (here: adult-learners in higher education) and the teaching context, understood as the design, facilitation, and monitoring of the learning environment (here as related to: social presence and convergence). The student factors and the learning environment are two aspects that Biggs (2003) refers to as 'presage' in his 3 P model. Biggs (2003) in his 3 P model explains that when designing education, several aspects have to be taken into account, namely the factors of 'presage', 'process, and 'product'. The presage factor is two-fold and includes the learner characteristics and educational needs on the one hand, and the teaching context or learning environment on the other. The process factor is where the learning processes are the result of the design of a learning environment aligned with the educational needs of a specific group of students. The product factor is where the learning outcomes are the result of said learning processes. In short, the learning environment is where activities and learning content are in line with students' educational needs, and designed in order to effect learning processes that bring about targeted learning outcomes. This overall approach is understood as 'constructive alignment' (Biggs, 2003). Biggs's (2003) model is particularly useful as it connects design principles to student factors, and, as such, has been successfully applied in previous research on design principles (Phelps, 2009; Noroozi, 2012; Van der Stap, van den Bogaart, van Ginkel, Ruiz-Thijssen, & Versendaal, 2023).

Thoughtful contemplation of design of a blended learning educational programme is necessary in order to understand what leverages students into interaction, how students should interact with the content, with whom, and according to which mode (Hodges et al., 2020; King & Arnold, 2012; Kjærgaard, 2017). Teaching strategies should therefore consider the full implications of presage to evoke the intended learning processes that in turn deliver the desired learning outcomes. Indeed, when a learning environment is not tailored to students' educational needs, learning processes may be impaired (Hodges et al., 2020; Kuo & Belland, 2016).

As a first step in creating an instructional framework encompassing blended learning teaching strategies, literature was consulted, both on higher education adult-learners' educational needs or affective states (e.g. Cercone, 2008; Chametzky, 2014; Zhang & Zheng, 2013, pp. 151–152), and on social presence and convergence (e.g. Garrison, 2000; Garrison & Kanuka, 2004). The findings resulted in

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[1] The teaching strategies referred to in this study are a set of validated blended learning design principles in line with Laurillard's (2013) approach to Design Based Research, as further elaborated through evidence-based practices.

a comprehensive set of teaching strategies. However, said set of teaching strategies are based on theory only, and have not yet been empirically validated. Against this background, this multiple case-study sets out to explore social presence and convergence in blended learning environments tailored specifically to higher education adult-learners, and how social presence and convergence are perceived by them. This study will further refine the previously designed teaching strategies by learning from concrete evidence-based practices[2] at varying universities in Belgium and The Netherlands.

More specifically, this study aims to empirically examine the teaching strategies needed to foster online interaction amongst higher education adult-learners in blended learning programmes. To this extent the following question is asked:

> How can online interaction be leveraged amongst higher education adult-learners in blended
>
> learning programmes?

The results of this study will culminate in validated blended learning teaching strategies for higher education adult-learners as the study adds prescriptive knowledge that will help fill the gap in the current literature on the pedagogical uses of digital technology in education specifically in catering for higher education adult-learners, teaching strategies aimed at leveraging higher education adult-learners into online interaction in blended learning programmes, and blended learning in general as it addresses social presence and convergence aimed at fostering interaction with online content. Additionally, the findings are synergised into blended learning teaching strategies that can foster online interaction which teachers can use when designing blended learning courses.

In the following sections we conceptualise the case study, followed by research questions, and the method and analysis applied. Lastly we discuss how the findings in this study fill the gap in online interaction in the current blended learning practice as it relates to adult-learners in higher education, together with blended learning teaching strategies geared towards said students.

2. Conceptualising the case study

In following Biggs' constructive alignment as outlined above, it becomes clear that both aspects of presage (student factors and learning environment) need to be aligned before learning processes may be expected. This means that learning activities and learning content: what to do, how to do it, and according to what mode (Kjærgaard, 2017; McKenna et al., 2019) need to relate to the educational needs (affective states) of adult-learners (Biggs, 2003; Milheim, 2011; Snyder, 2009). The challenge, as explained, is leveraging adult-learners into online interactions. Therefore their affective states in relation to blended learning in general, and online interaction in particular, need to be aligned. Fig. 1 shows the conceptual framework of adult-learners' salient affective states as it relates to leveraging online interaction, and the resulting learning processes and learning outcomes.

2.1. Adult-learners in higher education

Adult-learners in higher education, who are presumed[3] working professionals, should be met with a different approach to learning (Chametzky, 2014; Pappas & Jerman, 2015; Youde, 2018). To understand what such a different approach should entail, a full comprehension of the educational needs of adult-learners in higher education is required. A previous systematic literature review (Van der Stap et al., 2023) revealed the commonalities between the salient adult-learning theories as being, inter alia, 1) the need for deep learning, for example as afforded through design, i.e., where basic concepts are elaborated on into higher-order thinking activities (e.g. Biggs & Tang, 2007; Kjærgaard, 2017; McKenna et al., 2019), 2) the need for content and activities to have meaning and relevance (e.g. Martin & Bolliger, 2018; Snyder, 2009), and 3) the need for self-directed learning and autonomy (e.g. Chan, 2010; Milheim 2012; 2014; Zhang & Zheng, 2013, pp. 151–152). Some of these affective states are strongly related to each other, e.g. deep learning and meaning, but also self-directed learning and relevance. Said aspects will be interwoven in the present case study.

2.2. Designing the blended learning environment

The learning environment is where the course design comes to fruition through students interacting with content and with each other by carrying out the learning activities that effect learning processes (Biggs, 2003; Gómez & Duart, 2011). More specifically, a learning environment can be seen in its entirety as one that has physical, technological, psychological, social, and cultural resources (Loi & Dillon, 2006). As Piccoli et al. (2001) explain, this would include six aspects that can be used as a basis of a systematic design of any learning environment, namely: technology, pedagogical foundation, content, learning model, interaction model, and learner control.

Whilst adult-learners are self-motivated learners (Chametzky, 2014), it is important to understand what they value in order to avoid demotivation. In blended learning, adult-learners, being more familiar with traditional f2f pedagogy, need to see the *relevance* of the 'added' online mode (Owston & York, 2018). This requires a careful reconsideration of the design of the blended learning environment

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[2] Evidence-based practices are those that correspond with recommendations in literature.

[3] Traditionally Knowles' (1984) definition of andragogy rests on six assumptions that more likely would be applicable to those learners who have the life experience needed to self-direct and self-manage (Chametzky, 2014). While the adult age is normally set at age 25, from the definition it becomes likely that this can include younger learners and exclude older learners. In this proposal it is assumed that those students who study part-time, do so because of work, family, or both, and therefore presumably have the life-experience needed to be defined as adult-learners.
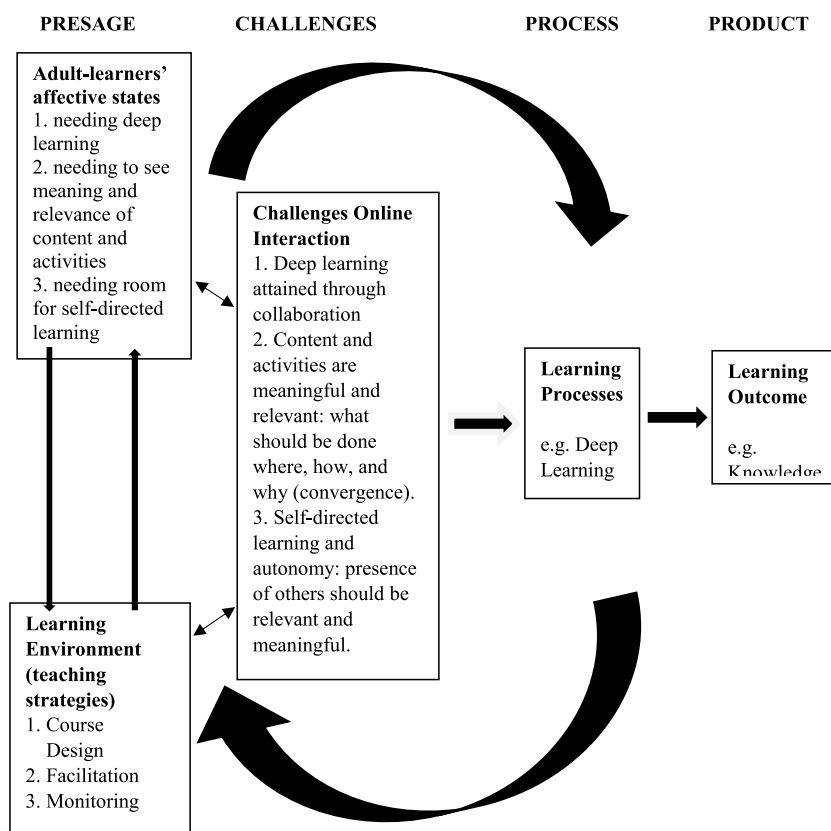
Fig. 1. Conceptual Framework *Nb*: adapted from Biggs' 3 P model (2003).

and begs the question: what to do online, and what to do f2f (Cuesta Medina, 2018; Kjærgaard, 2017; McKenna et al., 2019). The challenge of designing a blended learning course is to arrive at an integration of both modes in such a way that one mode adds value to the other (Gómez & Duart, 2011). A previous systematic literature review (Van der Stap et al., 2024) revealed that the synergy of both modes is achieved by placing basic concepts in the online mode, leaving room for higher-order thinking concepts in the f2f mode (Kjærgaard, 2017). This approach is facilitated through collaborative activities (Garrison et al., 2000), which is of particular interest to adult-learners in higher education as they facilitate deep learning (Cuesta Medina, 2018; Kjærgaard, 2017; Owston & York, 2018).

Additionally, adult-learners need to experience the *meaningful presence* (one of adult-learners' identified educational needs) of other beings in the online mode and experience being seen (King & Arnold, 2012; Owston & York, 2018), in order to remain motivated to interact online. The design of the learning environment then needs to foster interaction amongst adult-learners with others in the online mode so as to prevent them from feeling isolated (Martin & Bolliger, 2018). This requires careful consideration of the design of blended learning programmes.

To provide an understanding of interaction with learning content through collaborative activities, Garrison et al. (2000) explain the concept of three presences: 1) social presence, 2) cognitive presence, 3) teacher presence. In addition to social presence, which has been explained above, cognitive presence is explained as "the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry" (Garrison et al., 2001, p. 89). A third presence is 'teacher presence', which is defined as the design of the course, the facilitation of academic discourse, and direction of cognitive and social processes with the aim of realising personally meaningful and academic learning outcomes (Garrison et al., 2000). The three presences are captured by the Community of Inquiry (COI) framework which focuses learning from a collaborative point of view (Garrison et al., 2000), as shown in Fig. 2.

Within the Community of Inquiry (COI) framework, social presence plays a central role in cognitive presence. As explained by Garrison et al. (2000), "The primary importance of this element is its function as a support for cognitive presence, indirectly facilitating the process of critical thinking carried on by the community of learners" (p.89). Indeed, when social presence is established, cognitive presence is activated and more easily sustained (Gutiérrez-Santiuste et al., 2015; Kozan & Richardson, 2014; Shea, 2006). Nevertheless, whilst social presence plays a central role in cognitive presence, both those presences are the result of teacher presence through design, facilitation, and direction. In other words, the learning environment, and with it the learning processes, are the result of carefully implemented teaching strategies that fully implement social presence in order to evoke and sustain cognitive presence, and through which the online and f2f modes are the results of 'thoughtful integration' (Garrison & Kanuka, 2004), which are furthermore aligned with the student factors (here: adult-learners).
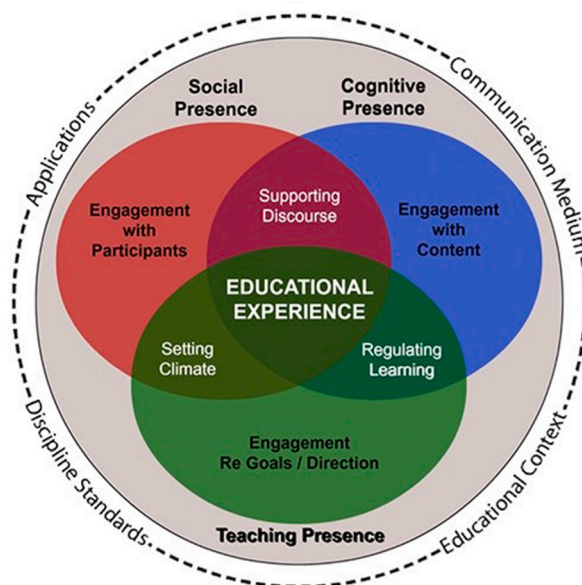
Fig. 2. The Community of Inquiry framework. *Nb*: Image used with permission from the Community of Inquiry website and licensed under the CC-BY-SA International 4.0 license (https://creativecommons.org/licenses/by-sa/4.0/). The original image is located at https://www.thecommunityofinquiry.org/framework.
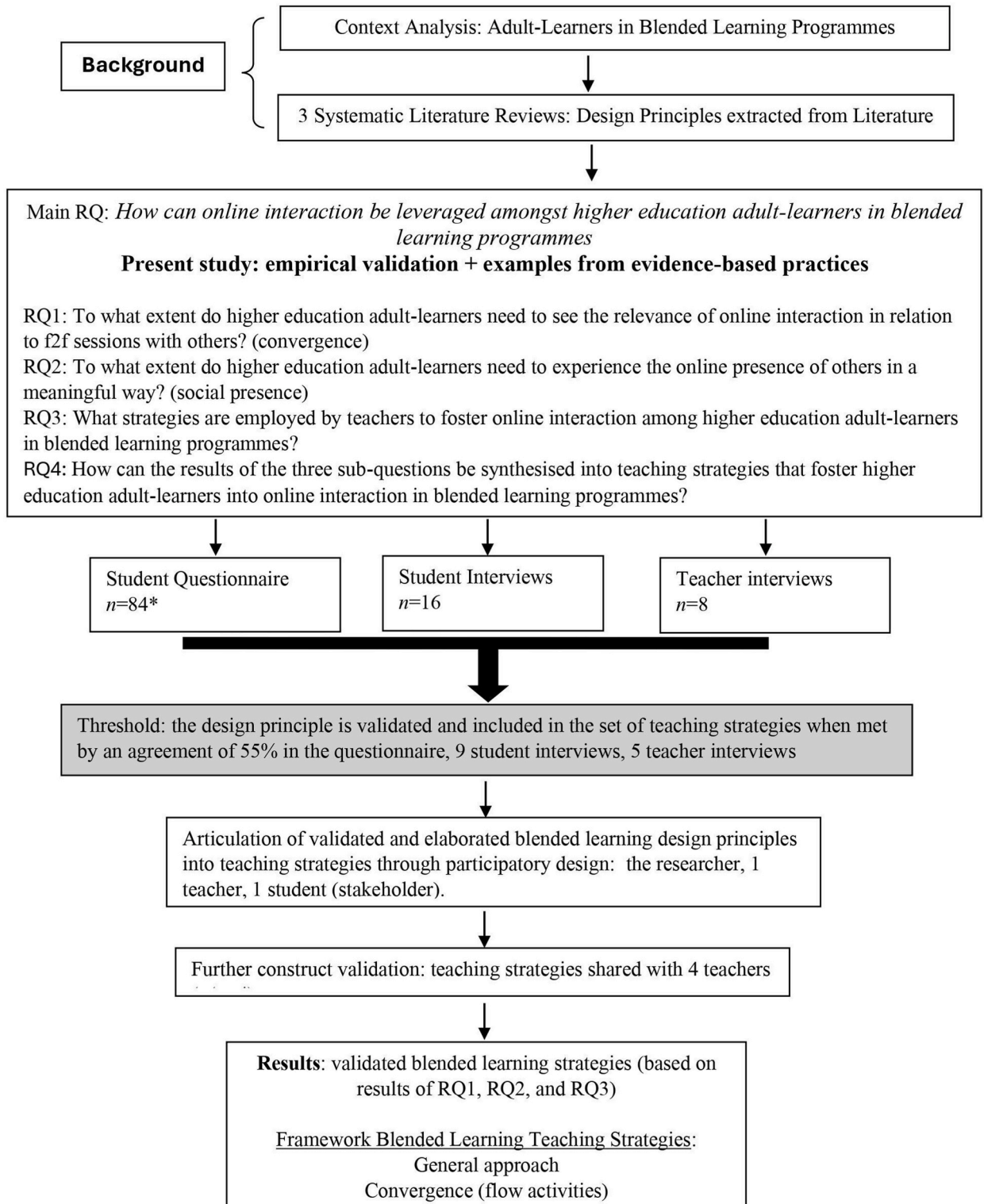
2.3. The present study

To arrive at teaching strategies tailored for higher education adult-learners, it is essential to validate claims made in literature as illuminated in the previous systematic literature reviews (Van der Stap et al., 2023; Van der Stap et al., 2024). To filter out students' affective states in online interaction from students' obedience or diligence, the research questions are specifically directed towards adult-learners' affective states as these relate to their perceived value of online interaction, of which an understanding is sought after in this present study.

The first affective state has been summarised as 'needing to see the relevance of online interaction in relation to f2f sessions' (convergence). The second affective state has been summarised as 'needing to experience the presence of others (peers and teacher) in a meaningful way' (social presence). Since the result of the present study is to arrive at teaching strategies geared towards fostering online interaction amongst higher education adult-learners, it is essential to understand how adult-learners' affective states and learning experience relate to course design. In The Netherlands and Flanders (Belgium), where this present study was conducted, it is frequently the teacher who designs the course. It is important therefore to understand how teachers establish teaching presence, through design, facilitation, and direction, and the effect this has on the adult-learners participating in their courses. The salient affective states of adult-learners in higher education, as mentioned, are interwoven in the questions that are investigated. Henceforth, the following are examined.

1 To what extent do higher education adult-learners need to see the relevance of online interaction in relation to f2f sessions with others? (convergence)
2 To what extent do higher education adult-learners need to experience the online presence of others in a meaningful way? (social presence)
3 What strategies are employed by teachers to foster online interaction among higher education adult-learners in blended learning programmes?
4 How can the results of the three sub-questions be synthesised into teaching strategies that foster higher education adult-learners into online interaction in blended learning programmes?

3. Methodology

This study uses a naturalistic case study style (Stake, 1995) to document adult-learners' affective states pertaining to (the lack of) online interaction, and the teacher's design choices, through a mixed-method approach. Data was collected during a regular semester through a questionnaire and interviews with students and teachers respectively, the latter who are also the course designers in Flanders (Belgium) and The Netherlands. The questionnaire and student interviews relate to the first two research questions. The teacher interviews relate to the third research question. A description of the validation process and articulation of teaching strategies, a participatory design undertaking, is described in the discussion section in answer to sub-question 4. See Fig. 3 for an extensive outline

Background	Context Analysis: Adult-Learners in Blended Learning Programmes
	↓
	3 Systematic Literature Reviews: Design Principles extracted from Literature

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Main RQ: *How can online interaction be leveraged amongst higher education adult-learners in blended learning programmes*
Present study: empirical validation + examples from evidence-based practices

RQ1: To what extent do higher education adult-learners need to see the relevance of online interaction in relation to f2f sessions with others? (convergence)
RQ2: To what extent do higher education adult-learners need to experience the online presence of others in a meaningful way? (social presence)
RQ3: What strategies are employed by teachers to foster online interaction among higher education adult-learners in blended learning programmes?
RQ4: How can the results of the three sub-questions be synthesised into teaching strategies that foster higher education adult-learners into online interaction in blended learning programmes?

Student Questionnaire $n=84$*	Student Interviews $n=16$	Teacher interviews $n=8$

Threshold: the design principle is validated and included in the set of teaching strategies when met by an agreement of 55% in the questionnaire, 9 student interviews, 5 teacher interviews

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Articulation of validated and elaborated blended learning design principles into teaching strategies through participatory design: the researcher, 1 teacher, 1 student (stakeholder).

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Further construct validation: teaching strategies shared with 4 teachers

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Results: validated blended learning strategies (based on results of RQ1, RQ2, and RQ3)

Framework Blended Learning Teaching Strategies:
General approach
Convergence (flow activities)

* 84 questionnaires were distributed yielding a 34.5% response rate which is deemed acceptable (Nulty, 2008)

Fig. 3. Flowchart methodology.

of the methodology applied, including the participatory design process and the results.

3.1. Research setting

The present study uses a convergent design (Creswell & Plano Clark, 2011), comparing both qualitative and quantitative data sources simultaneously. For both types of data, parallel constructs were used whilst data were analysed separately. The mixed-method approach enabled the assessment of personal experiences and teaching presence through both quantitative and qualitative data (Creswell & Plano Clark, 2011). The potential strengths of both qualitative and quantitative methods are therefore drawn upon. The method.

3.2. Participants and data collection

3.2.1. Teachers

The participating teachers in this multiple-case study were eight teachers, seven female and one male. The teachers were selected based on their experience in blended learning from the researcher's own network, either directly or through third-party reference. Basing our selection on teachers experienced in blended learning would provide for rich insights, as opposed to randomised samples. To this extent, the teachers received information letters and informed consent forms. All the teachers had an average of 8 years' experience in blended learning course design and blended learning teaching. There were two teachers in Flanders (Belgium), and six teachers in the Netherlands. Each teacher uses a Learner Management System (LMS) called Canvas, through which the students interact with online content and assignments. As different teachers approach blended learning in different ways, this aspect is further expanded during the teacher interviews.

Seven of the eight teachers were teachers at teacher-training colleges, catering for a variety of programmes such as languages, maths, pedagogy, biology, geography, history, and chemistry. One teacher was a teacher of an MBA programme. Within these programmes different blended learning courses were catered for by the selected teachers. Two courses lasted for one whole semester, the other courses were all half a semester. All the programmes in which the teachers taught were graduate programmes at universities of applied sciences.

3.2.2. Students

There were 84 students invited to participate in a questionnaire. From the 84 students 40 students were randomly invited for semi-structured interviews. A random selection is preferable to avoid bias and increase generalisability (Yin, 2014). A total of 16 students agreed to participate in the interview. All the students in this study were graduate students participating in four blended learning graduate teaching-training programmes from three universities in The Netherlands and Flanders. All students had at least one year experience with blended learning in different courses. This ensured answers based on a broad experience with blended learning courses, as opposed to the findings of one particular teacher. All the students participated in part-time teacher training programmes which included a mandatory internship or suitable employment. The students had an average age of 39, the minimum age was 27. In view of their age and existing employment, the students were assumed adult-learners, fitting within the criteria as defined by adult-learning theories.

There were sixteen students from four different courses. The students were unknown to the researcher prior to the interviews. Approved information and consent forms with the researcher's email address were forwarded to the teachers of participating institutes for distribution to their students who could then contact the researcher themselves.

3.2.3. Questionnaire

To participate in the questionnaire, the aforementioned teachers were given a code generated by the survey programme called 'Crowdtech', which they then distributed to their students ($n = 84$). By entering the questionnaire through a code, anonymity is guaranteed. Said code to the questionnaire was distributed to the aforementioned 84 students across four blended learning programme courses at three universities. Of the 84 students, 29 students, or 34.5%, completed the questionnaire. Researchers have determined that in social science research using online questionnaires this is an acceptable response rate (see Nulty, 2008; Sheehan, 2001).

A closed-ended questionnaire (see Appendix A) was developed since close-ended questions enable quick comparisons of answers between students (Cohen, Manion, & Morrison, 2013). The questionnaire was designed by the first researcher and subsequently reviewed by four members of the research team, not including the first researcher. Next a focus group consisting of two students, four teachers, and one expert ($n = 7$) was invited through information letters, whereupon several discussions followed. Additionally, the questionnaire was piloted to a group of five students which resulted in a further finetuning of the questions. This process was repeated three times until no further alterations were deemed necessary. The questionnaire included a total of sixteen questions, investigating eight variables. Each question in the questionnaire was asked twice, but phrased differently in order to increase construct validity (Cohen et al., 2013) as this construction double-checks the answer with the earlier question to which it is paired. The questions tally with a set of variables (see Appendix B), which are related to the two aforementioned themes derived from literature, namely social presence and convergence as it relates to adult-learners' affective states, i.e. their educational needs and learning characteristics.

The questionnaire was aimed at obtaining an overview of students' considerations for online interaction, or refraining from such. To this extent, a four-point Likert-like scale was designed in favour of the traditional five-point scale since a 'forced option' was sought after (Chyung et al., 2017). In this manner a diversion of results due to respondents avoiding an opinion by answering 'neutral' to a question could be avoided.

3.2.4. Interviews

The students ($n = 16$) participating in this study were invited for voluntary participation in semi-structured interviews (Edwards & Holland, 2013). The interviews were semi-structured to increase reliability since the structure and types of questions were the same for all candidates, whilst at the same time leaving scope for further questioning when deemed necessary (Keith, 1988). The interview protocol (see Appendix C) was designed around a set of inductively acquired, predetermined open-ended questions, which allowed the interviewer to ask for more in-depth clarification (Cohen et al., 2013). The interview questions were drawn up with a co-researcher, then discussed in the research team consisting of three members, followed by a discussion with one focus group composed of two teachers. Following this procedure, the questions were analysed in relation to the aforementioned variables to ensure content validity. Next, the interview was piloted twice to further validate the construct. The interviews took an average of 20 min.

Additionally, deep interviews with the participating teachers ($n = 8$) focussed on their blended learning design choices, and followed a similar protocol. All the teachers were interviewed by the first researcher of this study. The interviews varied in time, 39 and 112 min, with an average of 69 min. After analysing the interviews it became clear that theoretical saturation appeared to have been reached (Glaser & Strauss, 2017), since after removing one or two random samples from the set of eight teachers, no insights had been lost. To avoid social desirability bias (Cohen et al., 2013), all interviewees were informed that there were no right or wrong answers, that anonymity would be guaranteed, and that data would be reported with full confidentiality prior to each interview. The interviewees were given the transcripts of the interviews afterwards to ensure that they had said what they had intended to say. They were free to alter, delete, or add text. Two teachers made use of this opportunity.

All the interviews of the interviewees were audio-recorded with permission granted prior to each interview.

3.3. Data analysis

3.3.1. Questionnaires

A total number of 30 students fully completed the questionnaire. Whilst we appreciate that this is a rather limited size of respondents, the present study seeks to validate findings from previous systematic literature reviews and to learn from evidence-based practices, the results of which therefore are not intended to be generalisable to a wider population (Cohen et al., 2013).

An initial step in the analysis was to clean the data (Gillham, 2000). Data cleaning in this case involved correcting contradicting data. From the 30 students, one student was inconsistent with answers, 'agreeing' on one item and 'disagreeing' on the second item to which the question was paired. It was decided with a co-researcher to remove the inconsistency this student produced. Hence, to maintain reliability, the participant's responses were eliminated from the dataset. No other contradictions were found as all the other students' responses were seen to be consistent with their answers, the only variations being between the degree upon which students either agreed or disagreed. Hence 29 participants were included in the final data set.

In the next phase of analysis, the parallel questions were added to the questions they were paired with, after which the results were totalled. This gave an overall score of 58 responses per item. Next, the total score was halved to account for the actual included number of participants (29), after which the percentages in relation to the variables were then calculated. The results were subsequently double-checked by a co-researcher.

3.3.2. Interviews

To avoid harmful effects of subjectivity, content analysis was applied to all the interviews with two researchers, the researchers having read all the scripts to familiarise themselves with the content. Next, the conceptual framework that results from preliminary literature reviews (Van der Stap et al., 2024) was used in order to arrive at an initial coding scheme, despite familiarity with concepts. Starting with open coding allowed for new, unknown themes to emerge (Corbin and Strauss, 1994). This process was followed by selective coding, and lastly concluded with axial coding. The first and second researchers openly discussed the coding strategy, upon which the second coder independently analysed all sixteen scripts as they pertained to the students, and four scripts as they pertained to the teachers. After the coding was completed, the various disparities were discussed by the two independent coders until full agreement was reached.

To further guide the analysis process, the final codes that had emerged were categorised through deductive reasoning and the use of sensitising concepts (Corbin and Strauss, 1994). This process was repeated until broader categories were formed, describing the content in such a way that comparisons with other responses were made possible. Each category was summarised in a discussion with the independent second researcher. Next, the summaries were drawn together and emerging patterns were analysed after which three salient themes were identified that allowed for mapping onto the previously examined challenges. These salient themes were 1) leveraging online interaction through convergence, 2) leveraging online interaction through social presence, 3) teaching presence through design, 4) teaching presence through facilitation, and 5) teaching presence through direction. Mapping the themes on the challenges allowed for comparison to the number of students that shared a given opinion or affective state. All conclusions were drawn together with the co-researcher in several discussions until full agreement was reached. The final version of the coding scheme with operational definitions (see Appendix D) shows the main categories that emerged from the themes: four categories pertaining to the first two themes, eleven categories pertaining to the last three themes.

4. Results

We first briefly present the findings of the questionnaire and the student interviews in Table 1 and Table 2 respectively, together with a side by side comparison of both in Table 3. Following this, we present the findings of the teacher interviews. In the discussion

that follows in the next section we address the research questions.

4.1. Questionnaire results

In the questionnaire, the online environment (LMS) is referred to as Canvas. Students from the participating institutes in Flanders and The Netherlands are familiar with this term as it refers to their LMS, and might be confused if the term 'online mode' were used. The paired questions are placed together in Table 1, showing the results in comparison to their variables, where the ratings in which students can agree or disagree have been merged in overall agree or overall disagree. Overall, only half of the students do not value working with peers online, preferring to work on their own. Students further value online activities and content to be aligned with f2f content and activities, either through elaboration or teacher feedback on their online activities during f2f lessons or in the online environment itself. Nearly half of the students agree that if no attention is given to the assignments either promptly online or during f2f sessions, they will no longer be carried out. To this extent, nearly all students agree that studying online content and carrying out online activities should be necessitated in preparation for the f2f sessions. Nearly half of the students feel that if online content is repeated during f2f sessions, they would only consider one of them: either study online, or attend the f2f session. In terms of meaning and relevance, more than half of the students would not carry out assignments if there is no direct relation to their professional practice or assessment.

4.2. Student interview results

The result of the interviews in relation to students' preferences with regard to social presence and convergence (online presence of others and online/f2f synergy) are analysed according to the subsequent categories that emerged from the interviews. See Table 2.

When examining the results, it becomes evident that the majority of students value activities with others if they are meaningful. Likewise, the teacher's online feedback is highly valued. As one student said: "*I have little time, if I'm to spend my time on an assignment that the teachers consider valuable, then I would at least like to have some form of response to my effort.*" Students value weekly online contact and particularly prefer working in small groups, as one student explained:

> "*I like small groups over large groups, in particular you can get to know each other and ask them practical questions relating to activities, such as when and how. That works much quicker than waiting for the teacher to answer or having to look it up.*"

In terms of collaboration, a strategy employed by the COI framework, as well as one that facilitates convergence, students ($n = 12$) appreciate learning from different perspectives, feel that peer-feedback is valuable, and appreciate how collaborating helps clarify concepts. One student explained:

> "*online we met up as a group in relation to a case study with collaborative assignments. In class this was followed-up by exercises and further collaborative assignments that added onto the online content. It was highly structured which was great. Also, there was scaffolding. Top*".

Only a small number of students ($n = 4$) feel that collaboration is meaningless. Nevertheless, a large number of students ($n = 10$) feel that collaboration is difficult to carry out and time consuming. As one students stated:

> "*it's okay if you want us to work collaboratively, but these type of assignments take up a lot of time. It is only worth the time if they are of any meaning to the content I need to learn.*"

Another student explained:

Table 1
Student answers in relation to variables.

Variable	Paired questions	% agree rounded off $N = 29$	% disagree rounded off $N = 29$
1. Assignments in the online platform are not carried out because there is no peer-feedback	Q 1 & 9	48	52
2. Assignments in the online platform are needed in preparation for the f2f meetings	Q 2 & 6	91	9
3. Assignments in the online platform are not carried out when there is no relation to professional practice or tests	Q 3 & 12	60	40
4. Assignments in the online platform are ignored when there is no teacher response	Q 4 & 8	72	28
5. Studying learning content in the online platform is necessary to understand the content of the f2f meetings	Q 5 & 13	98	2
6. Learning content in the online platform is repeated during f2f meetings so only one is attended to	Q 7 & 15	68	32
7. Assignments in the online platform are not carried out because no attention is given to them during f2f meetings	Q 11 & 14	63	37
8. Assignments in the online platform are not carried out because no valuable teacher feedback is experienced	Q 10 & 16	54	46

Notes See Appendix B for the relationship between the variables and questionnaire.

Table 2
Student preferences in relation to affective states.

Main Category	Sub-Category	Number of Students
in relation to online presence of others		
regarding meaningful online contact	weekly online contact is valuable	9
	small groups are valuable	13
	meaningful activities with others are valued	12
relating to being seen by the teacher online	the teacher's response to comments is valuable	6
	the teacher's feedback online is valuable	13
	the teacher's online postings is valuable	2
	the teacher's forum participation is valuable	8
in relation to online/f2f synergy		
regarding collaboration	different views give a broader picture	12
	helps to understand or verify concepts	12
	peer-feedback is valuable	12
	time consuming	10
	difficult online	10
	self-study is valuable	7
	collaboration is meaningless	4
regarding online concepts/ F2f scaffolding	provides deeper learning	13
	clarifies content	14
	scaffolding of both environments is valuable	16
	an initial f2f meeting to know peers is valuable	16
	additional resources online is valuable	16
	meaningless when f2f repeats what's online	15
	time consuming to do both	11

Notes The number of students shown are the number of students that agree with the statement.

Table 3
Relation of variables and categories.

Relation of variables questionnaire and categories student interviews

VN	Variables Questionnaire	Emerging categories student Interviews	Meta themes
1	Assignments in the online platform are not carried out because there is no peer-feedback	Affective states regarding meaningful online contact	Social presence
2	Assignments in the online platform are ignored when there is no teacher response	Affective states regarding being seen by the teacher	
3	Assignments in the online platform are not carried out because no valuable teacher feedback is experienced	Affective states regarding collaboration	
4	Assignments in the online platform are not carried out because no attention is given to them during f2f meetings	Affective states f2f/online scaffolding	Convergence
5	Assignments in the online platform are needed in preparation for the f2f meetings	Affective states regarding collaboration	
6	Studying learning content in the online platform is necessary in preparation for the content of the f2f meetings		
7	Learning content in the online platform is repeated during f2f meetings so only one is attended to		
8	Assignments in the online platform are not carried out when there is no relation to professional practice or tests		

Notes VN = Variable Number.

"there are some assignments that need to be carried out, but due to lack of time I decide if they are meaningful enough for me to spend my time on."

With regard to convergence, all the students feel that scaffolding of both environments is valuable, that an initial f2f meeting is valuable, and that the teacher's online resources are valuable. Nearly all the students ($n = 15$) feel that it is meaningless when the f2f sessions repeat what is available online. Some comments students made were:

"when the online environment offers learning content with assignments at a certain level, it gives you the chance to come to the f2f session prepared whereby the learning content is elaborated on which directly takes your knowledge to a higher level".

Another student stressed:

"Of all the blended learning courses, one stood out, a so-called flipped classroom course. I thought it was fantastic to prepare in the online environment and then go into the f2f session which expands and elaborates on your knowledge. It really added extra value."

This corresponds with the 'learner control' dimension of the learning environment design framework by Piccoli et al. (2001). Most

students ($n = 14$) feel that convergence helps clarify concepts, and provides deeper learning ($n = 13$).

Next, the variables of the questionnaire and the categories that emerged after coding in relation to the student interviews are displayed in Table 3. In answering the first two research questions (section 5), this relation will be drawn upon. Interestingly, only three variables relate to students' affective states regarding social presence, whereas five variables relate to students' affective states regarding convergence, indicating that convergence is highly appreciated in comparison to social presence.

4.3. Teacher interview results

Table 4 shows the various components of teaching presence strategies as set out by the COI framework, together with the number of teachers ($n = 8$) that have exploited the various strategies. The teaching presence strategies relate to the design of the course, facilitation, and direction of cognitive processes. Most teachers ($n = 6$) provide basic concepts and theory online without repetition, however, as one teacher explained: "*I do often repeat what's online, not all of it, but I don't want to leave students behind. It's not that students don't want to interact online, it's lack of time*". Half of the teachers provide quizzes and exercises online in order to practise understanding of basic concepts, and half approach the dichotomous environment as circular, rather than linear, for example: after the first online/f2f sequence, further elaboration occurs online. Only half of the teachers have students collaborate online in preparation for f2f sessions. Those who do not feel that it is too time consuming for students, as explained by one teacher: "*perhaps in the past students worked more collaboratively, but since students have to learn so much in such a short time, and with such little time, I tend to just focus on what is essential.*" The majority of teachers ($n = 6$) monitors students' collaboration online and answer questions students post on the forum. Likewise, the same number of teachers ($n = 6$) regularly post online and provide prompt feedback. Only two teachers respond to students' online postings, i.e. when students post a general comment (see Table 4 for different types of online contact). All the teachers have clear assignment guidelines and evaluation criteria, confirm understanding, provide prompt feedback, correct misconceptions, and provide additional resources. Notably, teaching strategies that may be expected in a traditional, in-class settings, such as directing cognitive processes scored high. Teachers have considerably low results in relation to online facilitation, and in online/f2f sequencing.

5. Discussion

We first address RQ1 and RQ2 in relation to the beliefs with regard to the relevance of interaction, and the beliefs pertaining to meaningful presence of others. To this extent, we draw comparisons between the results of the questionnaire and the student interviews, and go into more detail in order to relate the findings to the research questions. Next we address the third research question (RQ3). To further substantiate and illustrate the findings, each sub-section draws on quotes given by students and teachers (translated from Dutch to English). Following this, we address the fourth research questions (RQ4)), and in answering the main research question we provide a table with teaching strategies.

5.1. RQ1: beliefs about the relevance of online interaction in relation to f2f

Students' beliefs about the relevance of online interaction show that the relation between both modes should be meaningful, which corresponds with claims made in literature (see McKenna et al., 2019; Owston & York, 2018). The results from the questionnaire and

Table 4

An Overview of the Strategies for Levering Online Interaction, together with an Illustration and Instructors' Use.

Teacher's application of teaching presence (TP) strategies		
Strategies	Illustration	Used by N instructors
1. Design	–	
Sequencing online/f2f	Online: theory and basic concepts are online through web lectures, reading materials, and video clips. F2F: scaffolding	6
	Online: practising theory through quizzes and exercises, F2F: scaffolding	4
	After first sequence (online/f2f) further online elaboration	4
Assignment guidelines	"Assignments are structured. It is clear what students have to do, how, and when it should be completed"	8
Evaluation criteria	There are clear criteria so students can evaluate peers, as well as themselves	8
Collaborative activities	Students work together on assignments, before returning to f2f for deeper learning	4
2. Online Facilitation	–	
Monitoring online activities	The teacher monitors how students collaborate online in forums	6
Responding on students' postings	The teacher responds to students' postings online by posting further questions for students to think about	2
	The teacher answers questions students post on the forum with or without a strategic pause	6
Regular postings online	Teachers regularly post announcements online which can be conversational, instructional or organisational	6
3. Directing cognitive process	–	
Confirm understanding	The teacher confirms if a student has understood a concept in an elaborative context	8
Prompt feedback	The teacher provides prompt feedback, both online and f2f	6
	The teacher provides prompt feedback f2f	8
Correct misconceptions	The teacher corrects misconceptions in an elaborative context	8
Additional Resources	The teacher provides additional resources for students to further self-study	8

interviews reveal that students highly valued when basic concepts and preparatory activities were placed online and were further elaborated upon during the f2f session: 91% and 98% in the questionnaire, 15–16 students from the total of 16 students in the interviews. This corresponds with emphasis on scaffolding in literature, see, e.g., Gómez & Duart, 2011; Hoey, 2017; Kjærgaard, 2017.

There were some differences pertaining to peer-feedback: for nearly half of the students in the questionnaire (item 1), lack of peer feedback was not a reason for them to ignore assignments, however, twelve students in the interviews stated this to be of value. The difference could lie in the fact that the question posed in the questionnaire was stronger, as in 'not carrying out the assignment' than the proposition in the interview 'being of value'. The students in the questionnaire may still find it valuable to receive peer-feedback even though they carry out the assignments in spite of it. The same could be said for item 7 from the questionnaire where the wording in the questionnaire might be too strong resulting in different opinions: 63% of the students would not carry out the assignments if no attention during the f2f meeting was paid to them, whilst 37% would still carry out the assignments in the absence of such, in stark contrast with all sixteen students in the interview stating the value of said scaffolding.

A similar point can be made with regard to collaborative activities: whilst slightly more than half of the interviewed students consider the collaborative activities to be time consuming ($n = 10$), they nevertheless consider them to be meaningful ($n = 12$). This corresponds with the general notion that higher education adult-learners in particular need to see the meaning of activities, likewise, they need to see the meaning of collaboration (see e.g., Chan, 2010; Frey, 2003).

Seemingly, for higher education adult-learners, not only the content (what to learn), but also the way they are expected to learn (how to learn) should be meaningful from a learning perspective as well as personal perspectives, given the time restrictedness of adult-learners (Henschke, 2011; Chametzky, 2014).

5.2. RQ2: beliefs about needing to experience the presence of others in a meaningful way

Students appreciated collaborative activities (as they afford both scaffolding and social presence, and can facilitate convergence) provided they were structured and meaningful (see Cercone, 2008).

Some students explained that they valued small groups, not necessarily for collaboration, but more for practical reasons as answers received from group members were quicker than when having to look this up (see e.g. Gómez & Duart, 2011; Hajibayova, 2017; Owston & York, 2018).

One aspect that showed high similarities in responses between the questionnaire and the interviews are the affective states relating to the lack of teacher presence online, particularly as it relates to 'being seen', such as responding to assignments: for 72% of the students in the questionnaire this was a reason to not carry out the online assignment, i.e., not interact with the online environment. This corresponds with the thirteen out of sixteen students considering this to be valuable, another seven students would also appreciate a response to a posting (see e.g. Hoey, 2017; Lowenthal & Dunlap, 2018; Oyarzun et al., 2018). Whilst it mattered to the students that a response was given to their online assignments in terms of teacher feedback, this feedback did not necessarily have to be valuable (54% of students felt that it should be valuable, for 46% of students this was not an issue, item 8). Placing these two results together suggests that students simply want to be seen by the teacher in the online mode, as opposed to being ignored: the value of the feedback weighed less than simply receiving it. This could also be due to the fact that students may presume their teacher's feedback to be valuable in any event, especially in a teacher-training programme where, most likely, teachers have a considerable amount of knowledge and skills in feedback-giving.

5.3. RQ3: Strategies employed by teachers to foster online interaction among higher education adult-learners in blended learning programmes

As may perhaps be expected, most teachers at a teacher training college apply the strategies that are available. The few strategies that are not met by all the teachers will henceforth be addressed.

On the aspect of sequencing online/f2f, not all the teachers felt that this would allow the students to learn what needs to be learned. This echoes previous literature explaining that when teachers realise that students do not interact online, they feel compelled to repeat online content to ensure that students would not miss out on important learning aspects (see e.g. Cuesta Medina, 2018; Östlund, 2008), hence a reversion to traditional teaching results (Serdyukov, 2017). This then turns into a vicious circle when compared to the student affective states above: a large number of students (68% of the questionnaire and 15 out of 16 interviewed students) would ignore the online part of the learning environment when it tends to be repeated during f2f meetings. This phenomenon is also acknowledged in literature where it is emphasised that both modes of the learning environment should not overlap (Cuesta Medina, 2018).

Another disparity of applied strategies lies in the collaborative aspects. Not all teachers had their students work collaboratively as they felt it would impede too much on students' time. Whilst the dilemma is understandable, it should be noted that affording deep learning through, inter alia, collaboration is highly valued by adult-learners in particular, as shown above in both the questionnaire and student interviews, and as emphasised in literature (see e.g., Baragash & Al-Samarraie, 2018; McKenna et al., 2019. Therefore, in considering student factors, the time aspect and the deep learning aspect need to be weighed against one another.

The last strategy not fully embraced is that of online facilitation. When comparing this strategy to students' perceived value, its absence or presence did not matter much to the students either way, the only exception being the aspect of online feedback as it seems that even in a blended learning programme, where presumably students meet f2f with peers and their teacher on a regular basis, they still want to 'be seen' online, preferably in the form of receiving prompt feedback to online assignments (see e.g., Hoey, 2017).

5.4. RQ4: How can the results of the three sub-questions be synthesised into teaching strategies that foster higher education adult-learners into online interaction in blended learning programmes?

In order to arrive at blended learning teaching strategies aimed at fostering higher education adult-learners into online interaction, a co-design approach was adopted through participatory design. The participatory design in the context of this study included a teacher, the researcher and a stakeholder (here: an adult-learner). Combining all three parties ensures a solid design (Könings et al., 2005, 2014; Könings & McKenney, 2017). Moreover, involving students' perspectives in the design optimises the construct (e.g., Kirschner, 2015; Könings et al., 2005), as all three collaborate in order to evaluate the construct (Roschelle & Penuel, 2006). The purpose of the participatory design in this study is to arrive at a set of well-formulated teaching strategies as informed by findings from the literature on the one hand, (Van der Stap et al., 2023; Van der Stap et al., 2024), and empirically validated by the teachers' experiences and the student findings in the present study on the other. To avoid bias, all participants in the co-design were instructed to focus the articulation of the blended learning teaching strategies solely on the results of the questionnaire and interviews in the present study. As such the validated principles (blended learning teaching strategies) from the questionnaire and interviews in which they appeared (see Table 5), were articulated based on the inclusion threshold: the principle is considered in the questionnaire with at least 55% agreement, at least nine student interviews, and at least five teacher interviews.

It was decided between the participants of this co-design that the principles validated through the present study would then be further fine-tuned into well-formulated blended learning teaching strategies, i.e. when a design principle is empirically validated, along the lines of van den Akker (1999). To this extent, the results from the present study were summarised and synthesised with the design principles from previous literature reviews on adult-learners (Van der Stap et al., 2023) and social presence and convergence (Van der Stap et al., 2024) into formulated teaching strategies along the lines of van den Akker (1999). van den Akker (1999) explains that interventions designed for a specific purpose or goal should be characterised or identified through specific procedures for reasons given. As such, the teaching strategies that are derived from this present study are defined following this structure: characteristic of intervention, procedure, reasons to include goal or purpose. Application of van den Akker's (1999) formulation of teaching strategies has been successfully implemented in previous studies in the domain of higher education (Noroozi et al., 2012; Spelt et al., 2009; Van Ginkel et al., 2015).

Deriving design principles from design requirements is in line with Design Based Research where the previously derived design requirements first extracted from the environment (Van der Stap et al., 2019), further informed through theory from which the design principles are extracted, upon which further empirical validation solidifies the design principles into design features or teaching strategies (Laurillard, 2013). By conceptualising teaching and instruction as design science, Laurillard (2013) introduces a trifecta of design requirements, design principles, and design features or teaching strategies, aiming to develop instructional patterns and models. To further validate the construct, the teaching strategies were shared with four other experienced teachers for feedback leading to

Table 5
A framework of teaching strategies facilitating online interaction in blended learning.

TEACHING STRATEGIES: GENERAL APPROACH TO BLENDED LEARNING	
TS 1	Have an initial f2f meeting to set the climate. This enables social presence and can facilitate community building
TS 2	Create well thought-out collaborative activities. This facilitates convergence and social presence
TS 3	Plan feedback moments online/f2f, this facilitates deep learning and social presence
TS 4	Continue a discussion from one mode into the other. This facilitates scaffolding (see also FAs below)
TS 5	Allow for some self-paced learning. This enables reflection and meets adult-learners' needs
TS 6	Post comments online and be accessible. This facilitates social presence and motivation
TS 7	Plan peer-evaluations. This facilitates deep learning, reflection, and social presence, and meets adult-learners' needs
TS 8	Create real-world, meaningful activities. This motivates and meets adult-learners' needs
TS 9	Plan higher-order activities f2f. This facilitates deep learning and meets adult-learners' needs

TEACHING STRATEGIES: FLOW ACTIVITIES FACILITATING CONVERGENCE	
FA1 f2f 1	Feedback on online assignments (if not yet provided online), checking concepts through ARS (Automatic Response Systems such as Kahoot!), clarifying further, picking up comments from forum discussions
FA2 f2f 2	expanding discussions, further collaboration on assignments, peer-feedback or group-projects started online, further group discussions.
FA3 f2f 3	checking on some group activities, e.g. discussions, and elaborating to whole class. Further quizzes or ARS, further questioning and clarifying
FA4 f2f 4	starting a discussion that could be continued online, or allowing students to finish activities online, or presenting further material for students to further elaborate through self-study online (f2f4 and online 4 are optional)
FA1 online 1	input through web lectures, videos, online recordings, power points, screencasts, infographic, blend space, etc
FA2 online 2	self-study: exercises, quizzes, in-video questions. Collaborative: peer-feedback, discussion questions, group-projects
FA3 online 3	personal or group feedback, forum Q & A, guiding forum discussions, content or instructional announcements
FA4 online 4	further discussions, self-study

Notes TS: Teaching Strategy. F2f – face-to-face (in-class).
Notes FA: Flow Activity (f2f/online). Not every FA has to be carried out, simply ensure a clear division between online and f2f activities. For easy application, after the first initial f2f meeting, FA1 online 1 can be followed up by FA1 f2f1, and so on.

additional insights, upon which final solutions were developed. This process was repeated until full agreement was reached, resulting in teaching strategies that provide a general approach to blended learning, and teaching strategies that specifically address convergence (flow activities) in line with higher education adult-learners' affective states.

5.5. Main aim of this study: How can online interaction be leveraged amongst higher education adult-learning in blended learning programmes

From the results it is clear that adult-learners want a clear sequencing from one environment to the other in a way that affords deep learning and higher-order thinking in a meaningful way. At the same time, there should be some room for self-directed learning and autonomy (Cercone, 2008; Zhang & Zheng, 2013, pp. 151–152), as well as allowance for limited time availability (Chamtezky, 2014). Lastly, it should be noted that the activities themselves need to be meaningful to the adult-learner. In answering the fourth research question, the results of the first three research questions (RQ1, RQ2, and RQ3) were synthesised whereby a threshold was introduced to guide the validation process of the design principles. Furthermore, the articulation of the design principles were formulated along Van den Akker's (1999) approach into well-formulated teaching strategies. During this process it became clear that the empirically validated blended learning design principles (here: teaching strategies) can be divided into a general approach to blended learning, and strategies that are specifically aimed at convergence which would include suggestions concerning what activities can be done online and what can be done f2f as content and activities flow from one mode onto another (flow activities). Accordingly, a framework of teaching strategies outlining both the general approach to blended learning and the flow activities facilitating convergence is provided. See Table 5 for a full overview of the teaching strategies, which may be combined into a tentative instructional framework aimed at adult-learners in blended education.

The strategies provided are in line with the COI framework as teaching presence (through design, facilitation, and direction), evokes social presence and cognitive presence. Teaching presence should include a clear planning that does justice to social presence in order to sustain cognitive presence. This framework can therefore be seen as practical means to corroborate these presences. This framework is also in line with Biggs' (2003) 3 P model where the design of the learning environment (teaching presence), should be aligned with the student factors (here: adult-learners' affective states) in a way to evoke learning processes. This framework therefore provides details on how those learning processes may be evoked as it incorporates both social presence and convergence in a way that fosters online interaction in blended learning programmes.

5.6. Limitations

The students in the present study are graduate students in teacher-training programmes. This makes them knowledgeable on most aspects of teaching. Such a knowledgeable position may also make them extra critical. Whilst a critical perspective is highly appreciated as it gives clear insights and lifts desirability bias, at the same time it may be that their lens was too narrow, expecting more than what could reasonably be provided as teachers are restrained by the facilitations their institutes provide. Part of the challenges teachers face is not only designing their own programme, but 'fitting' their programme within the institute's facilities and restrictions. This aspect may be overlooked by students.

A second limitation stems from the type of students participating in this study. For pragmatic reasons, due to a limited availability of blended learning courses, all students were part of the educational domain. It could well be that a broader selection of students from various domains may result in differing experiences with blended learning.

5.7. Implications and suggestions for future research

When incorporating blended learning into a standard programme, the roles of both the teachers and students change. Learning shifts from a teacher-centred learning approach to a learner-directed and teacher-facilitator approach. When properly applied, students become more motivated and take active responsibility for their own learning process as the student is afforded more autonomy, which meets one of the needs of adult-learners. Teachers' roles, in turn, are ensuring that learning activities are structured and designed according to the higher education adult-learners' learning preferences. At the same time, the teacher should facilitate collaboration and peer-evaluation. With the shift from basic concepts and theory to the online environment, e.g. through powerpoints, reading material, or audio-visual material, the f2f sessions are freed-up to spend time on further collaboration, discussions, consultation, clarification, feedback, or even activities that cannot be done online. As time spent lecturing makes place for facilitation, and the teacher's role shifts from a sage on the stage to a guide on the side, it begs the question: are teachers ready for their changing role? What competences do they need to have? What do they consider valuable in learning? Future research should aim to seek answers to these questions.

Additionally, some aspects at the institutional level need to be considered. The first one is the physical learning space. Whereas an auditorium may have been useful for lecturing to a larger audience, with the shift from traditional classroom teaching to online lectures/f2f learning, some spaces may not be suitable when implementing collaborative or group-based activities. Likewise, for blended learning to be properly facilitated, teachers need to rethink the amount of f2f time they need. This needs to be in line with colleagues teaching the same students so that students who are not expected to attend course A, are not required to travel to campus for needing to attend course B. Facilitation then needs to be at institutional level, or at least at programme level, to meet students in their time management. Future research should investigate what is needed to fully facilitate blended learning at institutional level.

6. Conclusion

This study responds to a need of teaching strategies fostering online interaction amongst adult-learners in blended learning programmes (e.g. Hodges et al., 2020; Milheim, 2011; Serdyukov, 2017; Snyder, 2009; Van der Stap, van den Bogaart, & Versendaal, 2019; Youde, 2018). Following three systematic literature reviews relating to 1) adult-learners 2) social presence, and 3) convergence (the latter two of which are synergised), design principles were extracted from previous literature (Van der Stap et al., 2024), upon which they have been empirically validated in the present study. In addition to the validated design principles (teaching strategies), examples from evidence-based practices reveal the importance of 1) meaningful collaborative learning activities, 2) addressing online comments or questions, and 3) the sequencing of both modes of the learning environment to be relevant and meaningful. Teachers that implemented these strategies were highly considerate of the limited time adult-learners have and the choices they are therefore confronted with.

When the results from students' interviews and questionnaire are studied, it becomes clear that the relevance of f2f/online sequencing should be self-evident, i.e., one mode necessitates the other. When delving further into students' comments, the sequencing of both modes are considered relevant when online activities and content are not repeated during f2f sessions, and when activities in the online mode are followed-up during f2f, or answered through online feedback. Moreover, the sequencing becomes meaningful when online concepts are further exploited through prompting and discussions during f2f sessions as this facilitated deep learning. This echoes the examples from 'evidence-based practices', but is in stark contrast with only half of the teachers interviewed implementing such a 'thoughtful integration' (Garrison & Kanuka, 2004) of the online and f2f mode whereby content and activities are delivered according to the best-suited mode (Kjærgaard, 2017).

Additionally, the teacher's presence online in the form of feedback or direction, was highly appreciated, a teaching strategy not embraced by all the teachers, save those from evidence-based practices. Furthermore, only half of the teachers provided their students with collaborative assignments, yet the students highly value the deep learning that can be had from sharing perspectives and delving deeper into learning content through discussions. Whilst it is true that adult-learners' time is an important aspect to be considered, students are happy to put in the time provided the assignments had added value, i.e., were meaningful.

Based on the results, the teaching strategies (see Table 5) may help course designers in designing blended learning programmes for adult-learners in higher education. Said teaching strategies may help fill the current gap in literature as they add evidence-based knowledge on pedagogical uses of digital technology in education catering for adult-learners, teaching strategies aimed at fostering adult-learners into interaction with online content, and blended learning in general as it solidifies a role for social presence in the online learning environment, one that is usually discussed in solely online learning or distant learning programmes, but is absent or minimised in discussions on blended learning.

CRediT authorship contribution statement

Nanda van der Stap: Writing – original draft, Validation, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Theo van den Bogaart:** Writing – review & editing, Validation, Methodology, Investigation, Formal analysis, Data curation. **Stan van Ginkel:** Writing – review & editing, Validation, Formal analysis. **Ebrahim Rahimi:** Writing – review & editing, Validation, Supervision, Investigation, Formal analysis. **Johan Versendaal:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Funding acquisition.

Declaration of competing interest

The authors are not aware of any potential conflicts of interest.

Data availability

The data that has been used is confidential.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.compedu.2024.105103.

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Nanda van der Stap is an English teacher educator at the University of Applied Sciences Utrecht, where blended learning is central to her teaching practice. She is now conducting doctoral research in conjunction with Open University on optimising the design of blended learning environments through leveraging online interaction.

Theo van den Bogaart currently holds a position as senior lecturer within the maths department of the HU University of Applied Sciences Utrecht. His research interests includes blended learning, educational design, and problem solving skills. Theo.vandenbogaart@hu.nl

Stan van Ginkel Dr. Stan van Ginkel is an associate professor of educational technology at the University of Applied Sciences Utrecht (HU) in The Netherlands. Ongoing research includes the impact of virtual learning environments on the development of students' academic and communication competencies. Stan.vanginkel@hu.nl

Ebrahim Rahimi Ebrahim is an Assistant Professor at the computer science department of the Faculty of Beta Sciences at the Open University of the Netherlands. His research interests include computer science and programming education, computational thinking, technology-enhanced learning environments, design-based education, MOOCs, teachers' pedagogical content and knowledge (PCK), and gamification. Ebrahim.rahimi@ou.nl

Johan Versendaal is a Professor at the Faculty of Beta Sciences at the Open University of the Netherlands. His research interests are in the area of IT auditing, internal auditing and managerial decision making on IT risks in general and IT projects in particular. Johan.versendaal@hu.nl