The Journal of Education Insights Vol 3 Issue 2 2025

Original Research Article

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Blended Education in Practice: Understanding the Gap between Instructional Design Knowledge and Digital Learning Integration

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Abstract: Blended education is increasingly implemented in higher education; yet its sustainable adoption remains a challenge, with persistent gaps between awareness, pedagogical integration, and institutional support. This study examines how lecturers engage with blended education design principles, apply them in instructional design, and utilize online learning environments. By exploring these aspects, this study contributes to our understanding of educational change and the factors influencing its implementation across different experience levels in higher education. Findings reveal that 10-25% of lecturers are unfamiliar with key blended education principles, but a more critical issue is the gap between knowledge and practical application. Approximately two-thirds of lecturers lack familiarity with advanced LMS and Microsoft Teams© functionalities, limiting their pedagogical impact. While Microsoft Teams© is more widely used, its advanced features remain underutilized due to limited awareness and training. Additionally, early-career lecturers show greater familiarity with collaborative and formative strategies compared to their more experienced counterparts, emphasizing the role of generational differences in pedagogical change. These findings highlight the complexity of educational change in an international higher education context, where faculty development, institutional policies, and intergenerational knowledge exchange play crucial roles. The study underscores the need for sustained professional development programs that move beyond technical training to foster pedagogical transformation. Without these efforts, blended education risks remaining an administrative rather than a pedagogical shift, limiting its potential to create student-centered, flexible, and innovative learning environments globally.

Keywords: Blended education; Instructional design principles; LMS; Moodle; Microsoft Teams©; Higher education

Introduction

The introduction of blended education has steadily evolved over the years but received an unprecedented boost due to the COVID-19 pandemic[1]. Formerly considered an emerging trend, distance and/or blended education suddenly became a necessary approach for educational institutions worldwide when physical gatherings were restricted

or prohibited due to health risks. This unexpected shift forced educational institutions to quickly improvise and integrate digital learning resources into their traditional teaching methods. The pandemic acted as a catalyst for the transition to blended education, with universities, lecturers, and students compelled to embrace the capabilities of Learning Management Systems (LMS) and other online learning tools.

Consequently, the phenomenon of blended education was not only more widely accepted but also rapidly implemented in various educational contexts. This acceleration brought both challenges and opportunities[2]. On one hand, educational institutions faced technological hurdles such as a lack of access to digital resources and the need to rapidly train lecturers in the use of new technologies. On the other hand, the circumstances brought about by the pandemic opened the door to innovation and experimentation in educational design, with lecturers forced to find creative solutions to achieve learning objectives in both physical and virtual environments.

Although full distance learning is no longer the current norm, blended education has undoubtedly gained prominence within higher education. However, as educational institutions navigate the complexities of post-pandemic pedagogy, the integration of both physical and virtual learning environments remains an important point of attention for many institutions, with the LMS and other online tools (i.e., online learning environment) being on the key factors in successful implementation of blended education principles. While the rapid transition to blended education was a necessary response to the pandemic, its long-term and sustainable integration into higher education remains a challenge[3]. Research suggests that merely introducing instructional design principles and digital tools does not automatically lead to lasting pedagogical change. Many lecturers initially adopted blended education out of necessity, but questions remain about whether these practices have been effectively institutionalized and embedded into long-term teaching strategies[4]. If blended education is to become a permanent and effective component of higher education, it requires not only technological adoption but also a shift in teaching culture[5].

Understanding where lecturers currently stand in their knowledge, application, and long-term adoption of blended education is essential for supporting meaningful and sustainable change in higher education pedagogy. Therefore, the current study investigated whether lecturers are familiar with previously published design principles for blended education[6] and if they apply them in their instructional designs. As teaching experience plays a crucial role in shaping lecturers' pedagogical approaches and their adoption of educational technology[7], we also examine whether teaching experience influences familiarity with blended education design principles, their application in educational practice, and the use of the online learning environment. By examining these aspects, this study aims to provide insights into lecturers' familiarity with blended education design principles, their practical application, and the extent to which online learning environments are utilized. Understanding these relationships will contribute to a more comprehensive perspective on the institutionalization of blended education, identifying potential gaps between policy, training, and actual lecturer practices. These insights are crucial for ensuring that blended education is not just an emergency response but a sustainable transformation in higher education pedagogy

1. Theoretical Background

1.1 Blended education

Blended education is an instructional approach that deliberately integrates traditional face-to-face teaching with online learning activities and resources[8]. Researchers and practitioners have used different terms to refer to the blended education approach such as hybrid learning, multimodal learning, and flipped learning. This pedagogical model aims to combine the strengths of both in-person and virtual learning environments to create a comprehensive educational experience. Blended education typically involves a mix of in-classroom lectures, discussions, and hands-on activities supplemented with online components such as multimedia materials, discussion forums, and interactive simulations. Underlying effective blended education is the thoughtful pursuit of the ideal mix of online and offline learning activities, aiming to achieve "the best of both worlds"[9]. Blended education emphasizes the importance of ensuring that the chosen blend of online and offline learning opportunities adds genuine value—making the learning process more

effective, efficient, and engaging, aligning with the educational goals for both students and lecturers[10, 11].

Designing blended education experiences is not easy. Several features such as the quality of the learning experiences, learning instruction, learning technologies/tools, and applied pedagogies, should be considered in the design[12, 13]. However, during the COVID-19 pandemic it also became evident that lecturers often lack the competencies to design and implement effective blended education on the one hand, and that, on the other hand, infrastructure is often lacking behind[14].

1.2 Design principles for blended education

An important aspect to consider when designing blended education arrangements, is instructional design. A recent literature review by[15] identifies four categories that are crucial in designing blended education: (1) active and authentic learning, (2) process and content scaffolding, (3) peer-to-peer learning, and (4) formative strategies. For each of these categories,[16] have formulated design principles, for example "Use asynchronous interactions to deliver course information and content. Use synchronous interactions for discussion and deepening of the content" or "Offer different (a)synchronous possibilities for peer-to-peer learning (e.g., chatrooms, discussion forums, e-mail, social media, and blogs)."[17]. A similar literature review by[18] arrived at a comparable set of design principles. The long-term effectiveness of blended education depends not only on the availability of instructional design principles but also on their integration into teaching practices[19]. Studies indicate that while institutions provide frameworks for blended education, successful and sustained implementation requires lecturers to internalize these principles and adapt them to their own contexts[20]. Without continuous professional development and institutional support, there is a risk that blended education remains technologically driven rather than pedagogically transformative.

Design principles for blended education, such as scaffolding, are not necessarily new, as they have their foundation in (traditional) face-to-face education. However, they assume particular significance in blended education environments due to their ability to bridge the gap between face-to-face and online instruction. For example, scaffolding techniques, which were originally developed to support learners in face-to-face contexts[21], are crucial in online and blended settings where immediate feedback and adaptive support are often needed.

Design principles for blended education can serve as guiding frameworks for lecturers to effectively integrate pedagogical strategies into their blended education environments. They offer valuable insights into how to design instructional activities that promote active engagement, provide appropriate support structures, foster collaborative learning experiences, and facilitate ongoing assessment and feedback. By adhering to these principles, lecturers can create rich and meaningful learning experiences that capitalize on the unique affordances of blended education, ultimately enhancing student learning and psychosocial outcomes[17].

1.3 Online learning environment

In blended education, a Learning Management System (LMS) serves a central role in facilitating, supporting, and managing the learning process. The LMS provides a digital platform for hosting and managing educational materials, courses, communication tools, and other learning resources. It plays a crucial role in organizing and delivering content, facilitating interactive learning activities, and fostering communication and collaboration among students and lecturers[22-24]. The LMS enables lecturers to store, organize, and share course materials such as presentations, documents, videos, and interactive media. It supports various forms of learning activities, including assignments, discussion forums, quizzes, and group projects, enhancing student engagement and participation in both physical and virtual learning environments[25]. Moreover, the LMS provides communication channels such as messaging, announcements, and virtual meeting tools, facilitating interaction and collaboration among students and lecturers regardless of their physical location. This promotes effective communication, feedback exchange, and collaborative learning experiences[26]. In addition, the LMS enables lecturers to monitor student progress, manage assignments, track grades, and administer course activities[27]. Furthermore, the flexibility and accessibility offered by the LMS allow students to access learning materials and engage in learning

activities at their own pace and convenience, from any location and at any time[28]. This enhances opportunities for personalized learning and accommodates diverse learning preferences and needs.

Overall, the LMS plays a critical role in blended education by providing an integrated and structured learning environment that supports a combination of face-to-face and online learning activities, facilitates communication and collaboration, and enables effective management of the learning process. However, previous studies indicate that lecturers experience difficulties in fully utilizing the LMS for pedagogically meaningful blended education[29, 30]. While institutions often invest in digital infrastructure, true adoption requires pedagogical innovation and changes in teaching culture[31]. Without ongoing support and training, lecturers may use the LMS primarily as a content repository rather than a tool for active learning and collaboration[32].

In a previous study,[33] administered a questionnaire to a sample of 640 higher education lecturers using Moodle, a widely used open-source LMS. They found that the LMS is mainly used instrumental and functional. "*The LMS is mainly being used as a repository for materials and information, while its pedagogical use remains limited*". They also investigated the level of didactical knowledge and found low didactic knowledge among lecturers for the Moodle platform. Lecturers mainly use it technically. In another study,[34] it was found that 75% of the faculty staff uses "*institutional LMSs mainly for tasks related to uploading the course syllabus, publishing materials, delivering notes and requesting and collecting homework*". In their study, they collected data from more than 35.000 students from 100 institutions across 10 countries and 40 US states and more than 11.000 faculty from 157 institutions in 7 countries and 37 states. They found that lecturers of lack the pedagogical and technical skills to use the LMS more didactical.

Besides the LMS, since COVID, most institutions also introduced Microsoft Teams© as an additional e-learning platform to communicate with students. Microsoft Teams© has increasingly been integrated into higher education as a collaboration and communication tool, often complementing or even replacing traditional learning management systems (LMS). Understanding how lecturers use Teams' functionalities within blended education is crucial, as its potential for fostering active learning, collaboration, and formative assessment is not always fully realized[35]. [36] argued that Microsoft Teams© has the possibility to increase engagement. They found that the platform is easy to use but careful consideration should be given regarding group size and how it is used within the setting. Besides that, Microsoft Teams© is mostly used for real-time communication using video calls and the chat function whereas is also has many more functionalities[37].

Unused potential of the online learning environment has several negative aspects for educational institutions. Not only are high costs paid for a system that does not get the most out of it, but students' learning potential is also only partially stimulated by insufficient use of active learning principles. It is therefore important to do more research about the used and unused potential of online learning environment systems in higher education regarding effective blended education design.

1.4 The role of teaching experience in pedagogical approaches and technology adoption

Teaching experience plays a crucial role in shaping lecturers' pedagogical approaches and technology adoption in higher education[38]. Over time, lecturers develop expertise that influences for example how they integrate design principles for blended education (e.g., formative assessment, peer-to-peer learning) into their teaching. Simultaneously, their familiarity with digital tools, such as learning management systems (LMS) like Moodle and collaboration platforms like Microsoft Teams©, may vary based on experience, training, and institutional support[39].

Previous research suggests that early-career lecturers may be more inclined to adopt modern instructional strategies and digital tools, as they are often trained with contemporary educational methodologies and technology-enhanced learning environments[40]. However, for blended education to become a sustained and institutionally embedded practice, it is crucial that all lecturers, regardless of experience level, receive continued support and opportunities for professional development[41]. More experienced lecturers may rely more on traditional teaching methods and be less familiar with newer instructional design principles or digital learning tools, but targeted faculty training can help bridge this gap and facilitate the long-term

integration of blended education principles across all career stages[42].

As higher education increasingly integrates technology-enhanced learning and digital pedagogy, understanding whether lecturers of different experience levels engage differently with instructional design principles and LMS platforms is critical. This knowledge can help institutions design effective faculty training programs, promoting both pedagogical innovation and technological proficiency across all career stages.

1.5 Research questions

A previous review study[43] identified four design principes for effective blended education. In this study we investigate if lecturers are familiar of these principles and apply them in their instructional design using the full potential of the online learning environment. We therefore examined lecturers' self-reported familiarity with key LMS functionalities and Microsoft Teams©, as well as the frequency of LMS functionalities being applied in course design.

The study aims to explore the extent to which higher education lecturers understand and apply blended education design principles, assess the utilization of the online learning environment in blended education practices, and examine lecturers' familiarity with and usage of LMS and Microsoft Teams© functionalities. By mapping current levels of adoption and usage, this study provides insights into the sustainability of blended education practices Furthermore, this study investigates how teaching experience relates to both pedagogical approaches and digital tool adoption. This leads to the following research questions:

1. To what extent do higher education lecturers know and apply blended education design principles in their instructional designs?

2. To what extent are higher education lecturers familiar with the functionalities of the online learning environment and do they utilize them?

3. To what extent is the full potential of online learning environment utilized in blended education practices?

4. How does teaching experience influence lecturers' familiarity with and application of instructional design principles, Moodle, and Microsoft Teams©?

2. Methods

2.1 Participants

The sample consisted of 99 higher education lecturers from one university of applied sciences in the Netherlands. The sample included lecturers with varying levels of experience, ranging from early-career professionals (0–4 years) to highly experienced lecturers (>25 years), ensuring that insights were gathered across different career stages. The number of years they have worked in education is detailed in **Table 1**.

Table 1. Number of years working in higher education

Number of years	*N*
0-5 years	23
5-10 years	26
10-15 years	11
15-20 years	16
20-25 years	13
> 25 years	10

Participants were recruited through convenience sampling. This study followed the 2018 Association of Universities in the Netherlands' research guidelines for social scientific studies[44]. All participants participated voluntarily and gave their informed consent. The LMS that is used across the university is Moodle. This LMS was implemented in 2016. Microsoft Teams© was implemented during Covid in 2021.

2.2 Data collection

To gain deeper insights into the extent to which higher education lecturers understand and apply blended education design principles in their instructional designs, we developed a questionnaire. This questionnaire presented lecturers with the design principles outlined by[45] organized into four key themes: (1) active and authentic learning,

(2) scaffolding, (3) peer-to-peer learning, and (4) formative strategies. To ensure clarity, these themes were explained, and unfamiliar terms (e.g., knowledge builders) were defined. For each design principle, lecturers were asked whether they were familiar with it and whether they applied it in practice, with both questions offering a binary (yes/no) response. The questionnaire consisted of 22 items and was available in Dutch and English. To ensure the reliability and validity of the questionnaire, several steps were taken. First, content validity was established through an expert review process, in which two experts in blended education and instructional design evaluated the questionnaire for clarity, relevance, and alignment with the study's objectives. Additionally, four lecturers piloted the questionnaire to assess its comprehensibility and practical applicability. Based on their feedback, minor revisions were made to improve wording and clarity. To assess internal consistency, Cronbach's alpha was calculated, yielding a value of .939, which indicates excellent reliability[46]. This suggests that the items within the instrument consistently measure the intended constructs. To facilitate distribution of the questionnaire, all directors and program managers within the institution were asked to share the questionnaire with their teaching staff. Participation was voluntary.

To gain deeper insights into the (under)utilized potential of the online learning environment, we first surveyed lecturers to determine which LMS activities they are familiar with and utilize. This was done using a self-constructed questionnaire that displayed all available activities in Moodle alongside their corresponding icons. The response scale was based on Miller's pyramid model[47], resulting in the following options: *"I don't know the activity," "I know this activity in Moodle," "I know how this activity works in Moodle," "I use this activity in Moodle when it is set up in a course,"* and *"I can add this activity myself and use it in my courses and lessons in Moodle."*

In addition to questioning lecturers, we analyzed the usage of the LMS. We examined all activities available to lecturers within Moodle and identified the frequency of each activity or resource being used in a course between August 2023 and July 2024. This time frame was chosen because this is the academic year in which we surveyed lecturers.

Since the onset of the COVID-19 pandemic, Microsoft Teams© has also been widely used within the university. However, due to the transient nature of data storage in Microsoft Teams©, we were unable to analyze the system directly. Nevertheless, we included questions in the survey to assess which functionalities of Microsoft Teams© lecturers are familiar with and actively use.

Finally, data on teaching experience (0–4, 5–10, 10–15, 15–20, 20–25, >25 years) were collected to examine whether it influenced lecturers' familiarity with and application of instructional design principles, Moodle, and Microsoft Teams©.

2.3 Data-analysis

For the design principles, we calculated the percentages of lecturers who were familiar with and applied each principle. These percentages were then ranked in descending order, from the highest to the lowest level of familiarity with the principles.

Next, for each Moodle activity, we counted the number of responses in each category from the questionnaire, based on Miller's model. This analysis assessed the extent to which lecturers are familiar with Moodle and how they incorporate it into their teaching practices. These responses were ranked according to whether lecturers could add the activity themselves and use it in their courses and lessons in Moodle. For the list detailing the number of times each activity or resource was present in a course in Moodle, we applied the same ranking. This allowed us to examine whether the actual usage aligns with the lecturers' perceptions. Additionally, we determined the number of times each activity or resource was present in a course in Moodle for the academic year between August 2023 and August 2024.

Furthermore, we analyzed the responses related to Microsoft Teams© by determining the number of responses in each category from the questionnaire, following Miller's model. This analysis evaluated the extent to which lecturers are familiar with Microsoft Teams© and how they incorporate it into their teaching practices. These responses were ranked according to whether lecturers could add the activity themselves and use it in their courses and lessons in Microsoft Teams©.

To examine differences in familiarity based on

teaching experience, a one-way analysis of variance (ANOVA) was conducted for each variable. Levene's test for homogeneity of variances was performed to determine whether the assumption of equal variances was met. If Levene's test was not significant ($p > .05$), Tukey's honestly significant difference (HSD) post-hoc test was used for pairwise comparisons. If Levene's test was significant ($p < .05$), indicating unequal variances across groups, the Games-Howell post-hoc test was applied. Effect sizes were calculated using eta squared (η^2), where values of 0.01, 0.06, and 0.14 were interpreted as small, moderate, and large effects, respectively[48]. All statistical analyses were conducted in SPSS (version X.X), with an alpha level of .05 set for significance.

3. Results

3.1 Design principles

To address research question 1, we examined the extent to which higher education lectures are familiar with and apply blended education design principles in their instructional designs. **Table 2** shows the design principles categorized under 'active and authentic learning'. For each design principle, the table indicates the percentage of lecturers who are familiar with the principle and the percentage who are not. It also shows the percentage of lecturers applying the principle in their teaching practice.

Table 2. Active and authentic learning

Design principle	*N*	Knowing the principle % Yes	*N*	Using the principle % Yes
When confronting students with new authentic cases and learning tasks, also address and discuss familiar cases to activate preknowledge and to facilitate transfer.	99	97,0	99	86,9
Provide students with hands-on, activating learning tasks that students can do in their own time (e.g., simple 'home experiments', short field trips).	98	96,9	98	84,7
Make use of active reading and viewing strategies (e.g., provide students with questions to answer from a video).	99	86,9	99	57,6
Activate students by addressing problems or tasks based on higher order thinking skills (e.g., big picture thinking, analysing complex information, and concept mapping).	99	79,8	98	52,0

Table 3 displays the design principles associated with the category of "scaffolding". For each principle, the table provides the percentage of lecturers who are aware of the principle versus those who are not. It also details the percentage of lecturers who incorporate the principle into their teaching practices.

Table 3. Scaffolding

Design principle	*N*	Knowing the principle % Yes	*N*	Using the principle % Yes
Make use of user friendly and accessible (open) resources that meet students' (technological) skills (e.g., YouTube, PhET simulations, Socrative, and free eBooks): usability and technology issues should not frustrate the process.	98	94,9	97	82,5
Use various media (e.g., audio, videos, texts, and images) and visual clues (e.g., colours, arrows, and symbols) when presenting (new) content.	96	94,8	97	86,6
Set up well-organized courses and tasks with clear directions, guidelines, goals, and completion criteria.	98	89,8	98	72,4
Create flexible elements and learning routes based on (a certain amount of) freedom of choice (e.g., differentiation, compulsory and optional components, enrichment materials).	98	85,7	98	48,0
Be aware of redundant information during synchronous interactions. Do not overdo things. Repetition can be done individually by students through asynchronous interactions, like recorded lectures, writings and exercises.	98	82,7	97	61,9
Use asynchronous interactions to deliver course information and content. Use synchronous interactions for discussion and deepening of the content.	98	80,6	97	69,1

Continuation Table:

Design principle	*N*	Knowing the principle % Yes	*N*	Using the principle % Yes
Provide learners with sufficient time between asynchronous and synchronous interactions to process (new) information.	98	76,5	97	60,8
Provide 'knowledge and skill builders', which are short, focused activities by which students, if necessary, can increase their competences before addressing more complex activities.	98	73,5	97	63,9

Table 4 illustrates the design principles categorized under "peer-to-peer learning". For each principle, the table reports the percentage of lecturers who are familiar with the principle and those who are not. Additionally, it outlines the percentage of lecturers who implement the principle in their teaching practice.

Table 4. Peer-to-peer learning

Design principle	*N*	Knowing the principle % Yes	*N*	Using the principle % Yes
Offer different (a)synchronous possibilities for peer-to-peer learning (e.g., chatrooms, discussion forums, e-mail, social media, and blogs).	98	90,8	97	59,8
Lecturers are crucial for students to establish proper knowledge structures (e.g., reasoning, concept mapping, and transfer thinking).	98	81,6	98	79,6
Ask students to actively help each other and even to create learning content for each other (e.g., instruction videos, sharing information and resources, tutoring).	98	80,6	98	62,2
Discussions need to be carefully guided (e.g., guided discussion, based on pending questions).	98	74,7	98	58,2
Use a 'peer grade system' to motivate students to become actively involved in peer-to-peer learning.	98	59,2	98	41,8

Table 5 summarizes the design principles classified under "formative strategies". For each principle, the table presents the percentage of lecturers who are aware of the principle and those who are not. Furthermore, it indicates the percentage of lecturers who apply the principle in their teaching practice.

Table 5. Formative strategie

Design principle	*N*	Knowing the principle % Yes	*N*	Using the principle % Yes
Give timely feedback and provide feedback on content, process, and attitudes.	98	93,9	98	94,9
Monitor students' individual progress, based on ongoing assessment, and provide students with individual assistance or guidance.	98	92,9	97	81,4
Provide fixed moments for self-reflection and offer a reflection method (e.g., STARR, Reflect 'n' Sketch, reflection vlog or blog).	98	85,7	98	73,5
Use multiple moments and strategies, in line with students' activities and work-in-progress, for formative assessment (e.g., short quizzes, checklists, open exercises, response cards, 3-2-1 strategy).	98	79,6	98	53,1

3.2 Higher Education Lecturers' Knowledge and Application of Activities within the LMS

To answer research question 2, we assessed the extent to which higher education lecturers are familiar with the functionalities of the online learning environment and whether they make use of them. **Table 6** shows the extent to which lecturers are familiar with the available activities in Moodle. The responses in the table are organized on a scale ranging from "I don't know the activity" to "I can add this activity myself and use it in

my courses and lessons in Moodle." The table is ranked according to the column "I can add this activity myself and use it in my courses and lessons in Moodle". To address research question 3, we also explored the extent to which the full potential of the LMS is utilized in blended education practices. **Table 6** as well shows the number of times the activity or resource exists in a course in Moodle between August 2023 and July 2024.

Table 6. Lecturers' knowledge and use of Moodle and the number of times the activity or resource exists in a course in Moodle

Activity	*N*	I am not familiar with the activity	I know this activity in Moodle	I know how this activity works in Moodle	I use this activity in Moodle when it is set up in a course	I can add this activity myself and use it in my courses and lessons in Moodle	2023-2024
Resource	72	2	2	0	3	65	27580
URL	72	10	2	3	5	52	1702
Folder	72	14	5	3	2	48	1644
Page	72	10	9	9	4	40	2178
Book	72	10	14	9	5	34	488
Assignment	72	18	12	4	7	31	4076
Label	72	30	7	5	2	28	8881
Forum	72	19	10	7	9	27	395
Choicegroup	72	39	8	4	1	20	80
Quiz	72	27	14	5	7	19	525
Lesson	72	30	13	8	3	18	69
Mediasite	72	40	6	5	6	15	119
Scheduler	72	37	16	3	2	14	505
Groupselect	72	43	11	2	2	14	28
Choice	72	43	14	1	1	13	75
Questionnaire	72	23	28	5	4	12	150
Chat	72	28	25	3	4	12	7
Feedback	72	26	24	6	5	11	105
H5Pactivity	72	36	7	14	4	11	30
Attendance	72	40	16	5	1	10	165
Student quiz	72	41	15	3	4	9	65
Workshop	72	43	11	4	5	9	31
Hot question	72	48	10	4	1	9	78
Journal	72	46	11	5	2	8	13
Media gallery	72	51	8	2	3	8	12
E-voting	72	53	9	1	1	8	11
Hvp (Content)	72	53	9	1	1	8	112
Glossary	72	46	12	5	2	7	12
Realtime quiz	72	48	14	1	2	7	18
Booking	72	56	4	2	3	7	6
Wiki	72	39	14	8	5	6	9
Board	72	43	14	6	3	6	51
Mindmap	72	48	12	2	4	6	9
Publication	72	49	12	3	2	6	505
Data	72	52	11	3	1	5	18
Checklist	72	55	7	3	4	3	105
GeoGebra	72	63	4	1	1	3	3
Diary	72	54	10	5	1	2	4

Continuation Table:

Activity	*N*	I am not familiar with the activity	I know this activity in Moodle	I know how this activity works in Moodle	I use this activity in Moodle when it is set up in a course	I can add this activity myself and use it in my courses and lessons in Moodle	2023-2024
JazzQuiz	72	62	5	2	1	2	5
Script concordance test	72	58	9	1	3	1	0
Lightbox Gallery	72	59	5	5	3	0	15

3.3 Higher education lecturers' knowledge of Microsoft Teams©

Table 7 illustrates the extent to which lecturers are familiar with the various features available in Microsoft Teams©. The responses are categorized on a scale ranging from "I am not familiar with the activity" to " I can add this activity myself and use it in my courses and lessons in Teams." The table is ranked according to the column "I can add this activity myself and use it in my courses and lessons in Teams".

Table 7. Microsoft Teams©

Activity	*N*	I am not familiar with the activity	I know this activity in Teams	I know how this activity works in Teams	I use this activity in Teams when it is set up in a course	I can add this activity myself and use it in my courses and lessons in Teams
Files	99	15	5	11	8	60
Calls	99	21	6	10	4	58
Chat	99	12	8	16	8	55
Callender	99	22	19	13	5	40
Activity	99	40	20	8	7	24
Whiteboard	98	46	17	7	6	22
Assignment	99	53	17	7	7	15
Task by planner and to do	98	70	13	5	1	9
Stream	98	72	11	3	3	9
Edu Class Notebook	98	76	9	4	3	6
Bookings	98	81	7	2	2	6
Insights	98	84	6	3	0	5
Power Virtual Agents	99	87	6	0	1	5
Power Apps	98	85	7	2	2	2
Power Automate	98	87	7	1	1	2
Shifts	99	91	4	2	1	1

3.4 Effects of teaching experience on familiarity with design principles, moodle, and teams

This study examined the influence of teaching experience on lecturers' familiarity with and application of the design principles, Moodle, and Microsoft Teams©. A one-way analysis of variance (ANOVA) was conducted to assess differences in familiarity levels across groups based on years of teaching experience. The results revealed three significant differences.

A one-way ANOVA indicated a significant effect of teaching experience on familiarity with the instructional design principle peer-to-peer learning, $F(5, 97) = 3.138$, $p = .012$, $\eta^2 = 0.06$. Levene's test for homogeneity of variances was significant ($p < .005$), indicating unequal variances among groups. Consequently, the Games-Howell post-hoc test was applied. The results showed that lecturers with 0–4 years of experience were significantly more familiar with this design principle than those with 20–25 years of experience ($p = 0.004$).

A one-way ANOVA also revealed a significant

effect of teaching experience on familiarity with the instructional design principle formative strategies, $F(5, 97) = 2.383$, $p = .044$, $\eta^2 = 0.11$. Again, Levene's test indicated a violation of the homogeneity of variances assumption ($p < .005$), leading to the use of the Games-Howell post-hoc test. The results showed that lecturers with 0–4 years of experience were significantly more familiar with these strategies than those with more than 25 years of experience ($p = 0.016$).

Furthermore, a one-way ANOVA found a significant effect of teaching experience on familiarity with Moodle, $F(5, 71) = 2.508$, $p = .039$, $\eta^2 = 0.16$. However, Levene's test indicated significant heterogeneity of variances ($p < .005$), prompting the use of the Games-Howell post-hoc test. While the ANOVA results suggested a significant overall effect, the post-hoc comparisons did not reveal significant differences between specific groups ($p > .05$). This suggests that although a general trend in familiarity with Moodle based on teaching experience was observed, these differences were not robust enough when adjusted for unequal variances.

4. Discussion and Conclusion

The first research question aimed to explore the extent to which higher education lecturers are familiar with and apply blended education design principles in their instructional designs. A no finding was that a significant portion of lecturers - between 10% and 25% - are unfamiliar with certain blended education principles. Furthermore, a distinction emerged between knowing these principles and actually applying them in practice. This raises the question: why do lecturers, even when aware of these principles, fail to implement them?

Previous research by Cabero and colleagues (2019) identified several factors that may explain this gap. First, many lecturers lack sufficient pedagogical knowledge to fully utilize Learning Management Systems (LMS) like Moodle, limiting their use of these tools to basic administrative tasks rather than as integrated pedagogical resources. Second, teachers' beliefs and attitudes toward technology play a crucial role in how, and to what extent, they apply blended education principles. Resistance or skepticism about the value of technology in education can significantly hinder implementation[49]. Third, insufficient training remains a major barrier to the successful implementation of blended education design. Much of the available training focuses on technical aspects rather than pedagogical integration, leaving lecturers with tools but not the knowledge to apply them effectively. Additionally, institutional and organizational barriers, such as a lack of professional development opportunities and structural support, further hinder implementation.

The second and third research questions examined lecturers' familiarity with online learning environment functionalities and the extent to which the full potential of these systems is utilized in blended education. The findings showed that about two-thirds of lecturers were not familiar with most of the advanced Moodle functionalities, such as mind maps and quizzes, and consequently could not use them effectively. Interestingly, lecturers did report some knowledge and application of basic functionalities such as resources, URL and folders, but these are primarily associated with administrative tasks rather than pedagogical use of LMS, which is in line with previous research emphasizing functional rather than pedagogical use of LMS[50].

Furthermore, a striking gap emerged between lecturers' knowledge of blended education principles and their application the online learning environment. Some unfamiliar activities (e.g., publication and checklist) were reported as frequently, raising questions about whether lecturers fully understand the pedagogical implications of the tools at their disposal.

Another important observation was that lecturers showed greater awareness and use of Microsoft Teams© compared to Moodle. This may due to its integration within institutional systems and intuitive communication tools. However, just like with the LMS, there was a notable lack of awareness and use of advanced educational features. For instance, the Edu Class Notebook, which could improve collaborative learning and organization, remains largely underused. These findings indicate that while digital platforms are being used, they are often not being leveraged to their full pedagogical potential[51].

Research[52] suggests that insufficient pedagogical training, lack of technological skills, and limited institutional support contribute to this gap. The underutilization of online learning environment functionalities, coupled with the high cost and

increasing demand for flexibility, underscores the pressing need to maximize the potential of these systems for enhancing blended education. While lecturers may understand some blended education principles, this is not consistently reflected in their online LMS usage, leaving much of the system's capacity for fostering active learning untapped. As a result, blended education risks remaining an administrative rather than a pedagogical innovation, failing to capitalize on its potential to transform teaching and learning. Additionally, as noted in[53], another challenge may be that lecturers are not fully aware of the meaning and potential applications of many online learning environment tools, further limiting effective adoption and use.

4.1 The role of teaching experience in pedagogical change

Regarding the fourth research question, results show that less experienced lecturers (0–4 years) are significantly more familiar with the instructional design principle "peer-to-peer learning" compared to those with 20–25 years of experience. This suggests that early-career lecturers may be more engaged with collaborative and peer-learning approaches, possibly due to their recent exposure to modern educational paradigms and training programs that emphasize active learning strategies[54]. More experienced lecturers, on the other hand, may rely more on traditional teaching methods and may not integrate collaborative strategies as frequently into their teaching practices[55].

Similarly, a significant effect of teaching experience was found for familiarity with formative strategies, with less experienced lecturers (0–4 years) demonstrating greater familiarity than those with more than 25 years of experience. This may reflect a generational shift in pedagogical training, as recent developments in education emphasize formative assessment as a key component of effective teaching[56]. More experienced lecturers might be less exposed to these evolving strategies or may rely more on summative assessment approaches. These findings highlight the importance of continuous professional development programs to ensure that all lecturers, regardless of experience level, remain updated on contemporary instructional methods.

In contrast, while teaching experience was found to have a significant overall effect on familiarity with Moodle, post-hoc analyses did not reveal significant differences between specific experience groups. This suggests that although a general trend in familiarity exists, these differences are not strong or consistent enough to be statistically robust when adjusted for unequal variances. A possible explanation is that Moodle familiarity is influenced by institutional policies, digital infrastructure, and mandatory training sessions rather than individual teaching experience alone. It is also possible that Moodle adoption varies more based on faculty-specific requirements rather than overall years of teaching experience.

4.2 Implications for sustainable educational change

The findings of this study have significant implications for the sustainable implementation of blended education in higher education.

1) Bridging the gap between knowledge and practice

The distinction between knowing blended education principles and applying them in practice underscores the need for targeted professional development. Institutions should invest in comprehensive training programs that not only cover the technical aspects of using LMS platforms and other online tools but also emphasize their pedagogical applications. Without this integration, blended education risks remaining a surface-level adaptation rather than a meaningful transformation in teaching practice.

2) Leveraging the full potential of digital learning environments

Despite the growing demand for flexible and technology-driven education, underutilization of key functionalities suggests that higher education institutions are not fully addressing modern educational challenges, such as the need for scalable, high-quality learning experiences. Institutions should actively promote the use of advanced digital tools, ensuring that lecturers move beyond basic functionalities toward interactive and student-centered learning environments.

3) Creating a culture of continuous learning

Educational leaders should encourage a culture of innovation, where lecturers are encouraged to experiment with innovative teaching tools and strategies without fear of failure. Offering incentives, such as time for professional development and recognition for innovative teaching practices, can motivate lecturers to invest in more effective use of

online learning environments.

4) Addressing generational differences in pedagogical change

The findings suggest that less experienced lecturers are more inclined to use contemporary pedagogical strategies, while more experienced lecturers may require additional support to integrate these methods into their teaching. Facilitating intergenerational knowledge exchange could help bridge these gaps, enabling experienced lecturers to share their expertise, while early-career lecturers introduce newer, research-informed strategies.

4.3 Limitations and directions for future research

While this study provides valuable insights into the knowledge and application of principles for designing blended education and using online learning environments among lecturers in higher education, it also has its limitations. One notable limitation is the use of convenience sampling, which may bias the results. Since only a small and possibly unrepresentative part of the entire population was surveyed, the findings may not fully reflect the broader population of higher education lecturers. This limits the generalizability of the study's results and suggests that future research should seek more robust sampling methods, such as stratified or random sampling, to ensure a more representative sample.

Furthermore, the study did not take into account possible differences between academic fields or disciplines. The level of familiarity with online learning environment functionalities and blended education design principles may vary depending on the discipline, with some disciplines being more technologically savvy or requiring different pedagogical approaches. Future research could examine whether lecturers from different academic disciplines exhibit different levels of online learning environment use and knowledge of blended education, providing a more nuanced understanding of these dynamics in specific contexts.

Future research could also explore the barriers identified by Cabero and colleagues (2019) in relation to the design principles for blended education[57] to gain insights into how these barriers affect the effective implementation of blended education. Such studies would contribute to a better understanding of the current state of blended education in higher education and could offer pathways for improving its effectiveness.

Moreover, this study focused mainly on lecturers' perspectives without including student feedback. Future studies should investigate the impact of lecturers' use (or non-use) of the online learning environment and blended education principles on student engagement and learning outcomes. A mixed methods approach, combining quantitative surveys with qualitative interviews or focus groups, could provide more insight into the reasons behind the gaps in knowledge and application, and how these affect the effectiveness of teaching and learning.

Longitudinal research would provide valuable insights into how lecturers' awareness and use of online tools evolves over time; especially as professional development initiatives are implemented. This could help determine whether interventions aimed at improving the use of the online learning environment leads to lasting changes in teaching practice.

Future research could explore why more experienced lecturers report lower familiarity with certain design principles for blended education and whether this translates into differences in teaching effectiveness. Furthermore, qualitative studies could provide deeper insights into the perceptions and attitudes of lecturers towards technology adoption and modern instructional strategies. Finally, investigating external factors such as institutional support, access to training, and disciplinary differences in Moodle use may provide a more comprehensive understanding of the patterns observed in this study.

Finaly, while this study provides insights into lecturers' familiarity with design principles for blended education and digital learning tools, future research could further strengthen the validity of the measurement instrument. Specifically, a factor analysis (either Exploratory Factor Analysis (EFA) or Confirmatory Factor Analysis (CFA)) could be conducted to examine the underlying structure of the questionnaire and ensure that the measured constructs align with theoretical expectations. EFA would help identify possible factor groupings within the questionnaire, while CFA could test whether the proposed model fits the data. Additionally, conducting a test-retest reliability analysis could provide insights into the questionnaire's stability over time. Future studies might also expand validation

efforts by collecting data from a more diverse lecturer population, across multiple institutions or disciplines, to examine whether the findings are generalizable beyond the current sample.

4.4 Conclusion: towards a sustainable blended education future

The study reveals that while blended education is increasingly accepted, its full potential remains underutilized. Lecturers continue to use digital learning environments primarily for administrative purposes, and a gap persists between theoretical knowledge and practical application. If blended education is to become a sustained and transformative force in higher education, institutions must go beyond technical training and actively support pedagogical change.

Acknowledgements

We would like to warmly thank Dr. Miriam Goes-Daniëls for her help in compiling the questionnaire and Joost Elshoff MA. for retrieving and analyzing data from Moodle.

Availability of Supporting Data

Access to the database will be provided by the first author on request. Solicitations should contain information about the research aim and the type of analysis.

Conflict of Interest

There is no conflict of interest.

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