HOW TO EFFECTIVELY DESIGN BLENDED HIGHER EDUCATION?

Recommendations for teaching practice

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TABLE OF CONTENTS

Introduction

The sudden and ad-hoc transition from face-to-face to online and blended education during the Covid-19 pandemic made clear that education not only has an impact on knowledge and skill acquisition, but also on students' psychosocial development. The sudden shift compelled many lecturers to resort to creative, yet not always effective, temporary solutions in their teaching practice. As online and blended teaching approaches increasingly assume a significant and enduring role in professional higher education, it is important to **investigate effective ways to implement blended education**.

This guide aims to inform and inspire lecturers in professional higher education. To achieve this, we provide a series of **recommendations** on how lecturers can effectively design blended education, to enhance both students' learning outcomes and psychosocial development (referred to as students' **broad development** from here on). Our research team has thoroughly developed these recommendations, which are **evidence-informed**, meaning they result from a meticulous literature review on robust scientific studies about blended education, combined with scientific insights and practical expertise on how students learn effectively and efficiently.

In this guide, you will find **recommendations** with a view to **enhancing students' learning outcomes**, focusing on knowledge and skill acquisition. Additionally, there are specific recommendations to support students' **psychosocial development** in a blended learning environment, including motivation, collaboration, and self-efficacy. However, many recommendations **positively impact both** aspects, allowing you to work efficiently towards the broad development of students.

Prior to the concrete recommendations, in the section titled "*Blended Education and Broad Development: What's in a Name?*", we first define "blended education" in this guide. We also briefly outline the concepts of "learning outcomes" and "psychosocial outcomes," which combined make up the broad development of students.

We hope that this guide **inspires** lecturers in professional higher education who aim to provide their students with effective and efficient **blended education**, in which learning outcomes are optimally achieved while the psychosocial development of students is also adequately supported.

The Authors

Explanation of Icons Used in this Guide

• Recommendations related to **"enhancing learning outcomes"** are identified by the icon	
• Recommendations related to "**enhancing psychosocial outcomes**" are identified by the icon	
• Sections with **definitions** of key concepts are marked with the icon	
• Sections providing **deeper insights** are marked with the icon	
• Sections that provide further explanations of a **teaching method** are marked with the icon	

Blended Education and Broad Development: What's in a Name?

Blended Education

In this guide, we employ a commonly used general definition of **blended education, i.e.** "a **deliberate and integrated combination of online and face-to-face education**[54]". Within this definition, we want to focus on the terms "**deliberate**" and "**integrated**". Blended education is more than simply combining online and face-to-face education on campus. Yet it is also more than adding a few online components to a traditional face-to-face teaching approach. It is essential to thoughtfully combine these elements to achieve effective and efficient education.

> With the above definition, blended education can be distinguished from (a) *emergency remote teaching*[41] (ERT), which refers to the sudden transition to fully remote education in an emergency situation such as a pandemic, (b) intentionally fully online or remote teaching, and (c) completely *face-to-face* teaching.

With the aid of the MIX taxonomy[43] (see Figure 1), various teaching approaches can be situated along the continuum from face-to-face to fully online education. The vertical axis represents the degree of technology usage, while the horizontal axis represents the degree of content transmission and/or application, creating a total of nine fields.
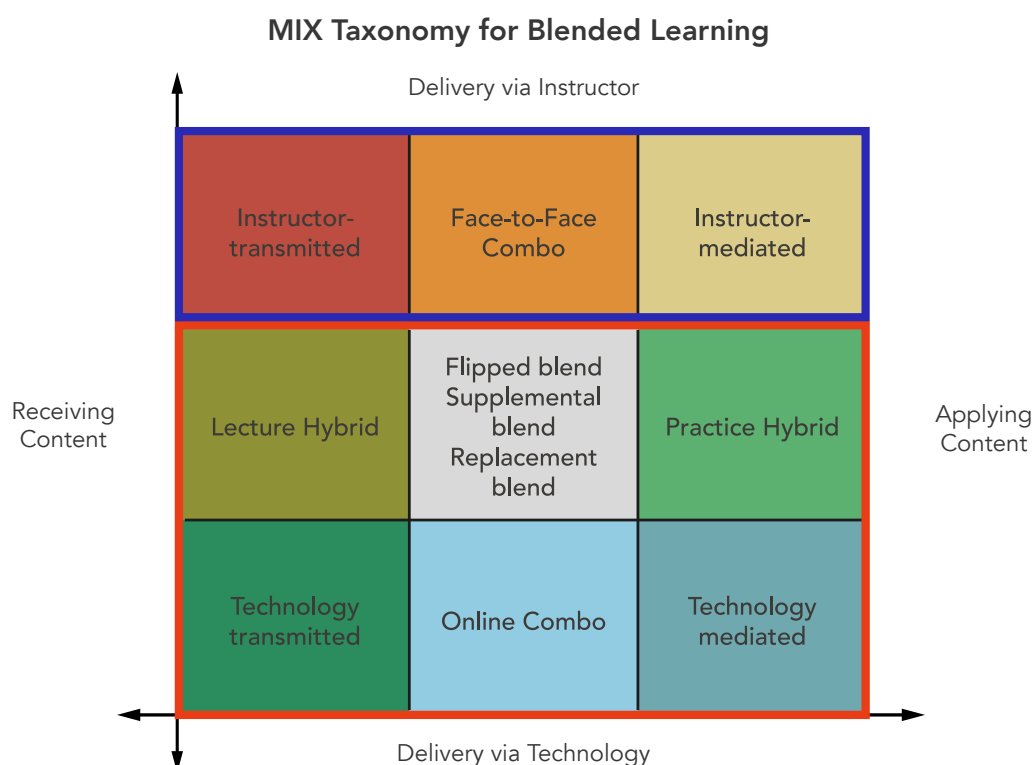
MIX Taxonomy for Blended Learning

Figure 1. Based on Mix taxonomy[43]

The recommendations in this guide apply to the **lower six fields** of Figure 1, specifically **the teaching approaches that employ technology to some degree during the teaching and learning process**. We particularly focus on the various types of blended education in the centre of the figure. The **upper three fields** (face-to-face teaching) served as a **comparative basis** in our literature review on their potentially distinct impact on student outcomes.

💡 In the section *"How was this guide created?"*, you will find more details on the methodology of the underlying literature review and the precise delineation of different teaching approaches on the MIX taxonomy.

Students' broad development

In this guide, we refer to the "broad development" of students as the enhancement of both **learning** and **psychosocial outcomes**. Both types of outcomes are considered highly important for student development. The significance and focus on both types of outcomes is underlined in Fink's Taxonomy[40] (see Figures 2a and 2b), which distinguishes six types of significant learning.

Enhancing Learning Outcomes

Three types of **significant learning** in Fink's taxonomy focus on cognitive outcomes: **acquiring foundational knowledge, applying knowledge (skills), and integrating knowledge** (see Figure 2a). This aligns with what we refer to as learning outcomes, and explores the impact of blended education on learning outcomes by examining both **knowledge** and **skills**.

In professional higher education, it is essential for students to acquire strong foundational **knowledge**, learn how to apply it, and be able to transfer it to new situations. The acquired knowledge is crucial for students to develop specific skills in authentic professional scenarios. Besides knowledge acquisition, **skill development** is also an important learning objective. It is important for students to learn how to proficiently perform certain tasks, such as conducting laboratory experiments, removing stitches, providing physiotherapeutic treatments, or applying communication skills.
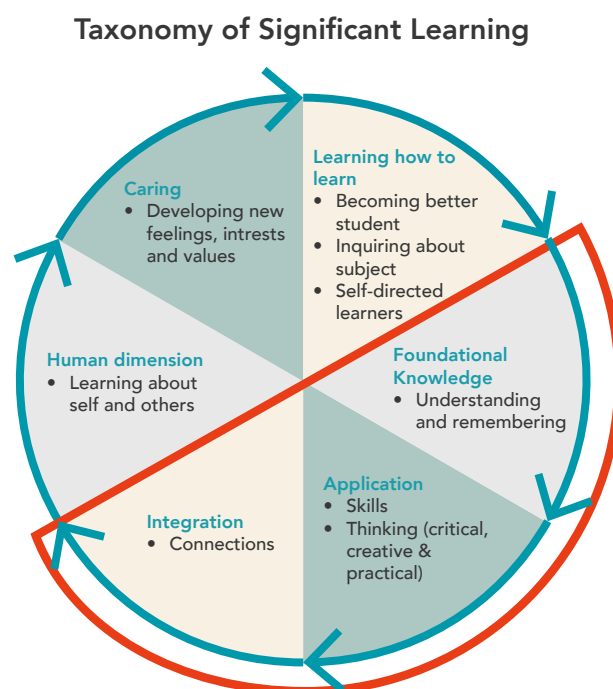
Taxonomy of Significant Learning

Figure 2a. Focus on learning outcomes within Fink's taxonomy[40].

💡 Skill development typically requires (repeated) practice which combines the application of knowledge with practical experience. A concrete example is the removal of stitches. To be able to remove stitches (skill), you first need knowledge of various wound types and stitching techniques, various medical instruments, and how to handle them correctly. Therefore, you initially need theoretical domain knowledge to perform the task correctly[53]. Through (gradually reduced) lecturer support, repeated practice, and automation, you subsequently learn to remove stitches smoothly and accurately. In this sense, many skills are essentially flawlessly applied knowledge.

A strict distinction between knowledge and skills is not always possible or desirable. Profound (domain) knowledge forms the solid foundation for skill development and application. Many of our recommendations aim to enhance both knowledge and skills, in other words, learning outcomes in the broad sense.

Enhancing Psychosocial Outcomes

In addition to learning outcomes, Fink also **emphasizes the intra- and interpersonal perspectives, caring** (emotions, interests, and values), and **learning how to learn** (metacognition) (see Figure 2b), proposing a **holistic approach to education**. This aligns with the psychosocial outcomes in this guide. In our literature review, we not only examine the impact of blended education on learning outcomes, yet also focus on its effects on various psychosocial outcomes among students. The latter encompass **affective** outcomes such as motivation, confidence, independence, attitudes, and satisfaction, as well as **interpersonal and intrapersonal** outcomes such as collaboration, interaction, and engagement[16].

Taxonomy of Significant Learning

Caring
• Developing new feelings, intrests and values

Learning how to learn
• Becoming better student
• Inquiring about subject
• Self-directed learners

Human dimension
• Learning about self and others

Foundational Knowledge
• Understanding and remembering

Integration
• Connections

Application
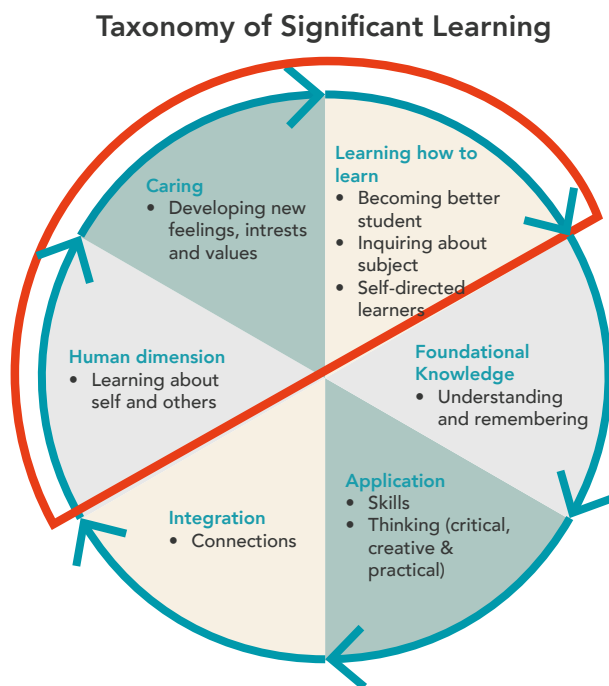• Skills
• Thinking (critical, creative & practical)

Figure 2b. Focus on psychosocial outcomes within Fink's taxonomy[40].

Results

Below, we briefly discuss the results of the literature review on the effects of blended higher education on learning outcomes and psychosocial outcomes. Based on these results, we then formulate concrete, practical recommendations to enhance students' broad development in blended education.

Learning Outcomes

Most studies indicate that blended education, compared to face-to-face education, **enhances** students' learning outcomes[2,3,5,6,11,12,15,20,27,29,31,32,33]. However, blended education does not *automatically* lead to higher learning outcomes[14,25]. The **didactic approach** used within blended education is the key factor in explaining differences in learning outcomes among students[5,13,16,24,29]. Therefore, if you adopt a blended instructional approach, it is important to consider several key pedagogical principles that we further discuss in the recommendations.

Psychosocial Outcomes

In terms of affective outcomes, **satisfaction** is the most addressed aspect. Most results are positive[2,6,7,9,17,19,35], indicating that students report higher satisfaction levels (regarding the course) after a blended course, compared to face-to-face education. Furthermore, several studies report improvements in other aspects such as **motivation**[2,16,35], **(self)efficacy**[2,9,16], and **attitudes**[2,16].

The context of intra- and interpersonal development also yielded positive results. The level of **interaction** [16,19,21], both among students, and between students and lecturers, was often higher in blended teaching. Students reported **greater engagement**[2,16] and **increased participation**[2,16,19].

However, in some review studies a reverse pattern was observed, for example, due to a higher perceived workload[7,35]. Thus, blended education does not *automatically* result in positive psychosocial outcomes; the effect depends significantly on its implementation. It is therefore important to consider the recommendations for teaching practice provided below.

Recommendations

The recommendations in this guide are primarily based on studies of the **flipped classroom**, one of the most effective and extensively researched types of blended education. However, these recommendations are also valuable for other blended education types and, moreover, even for fully face-to-face education[47,51]. They represent robust (didactic) guidelines that contribute to effective teaching in general. Many recommendations below may not be entirely new, but they are equally important in a blended context.

The **flipped classroom** is a teaching approach in which students independently review content before class (**pre-class activities**), such as reading a case study or watching instructional videos. This allows for sufficient time during class to actively engage with the content (**in-class activities**), such as solving content-related problems, engaging in discussions, completing assignments, working in groups, or participating in quizzes. During the active processing and practicing of the learning content in class, students can rely on instruction, support, and feedback from the lecturer, and there is time and space for interaction among students, as well as between students and lecturers.

The Flipped Classroom
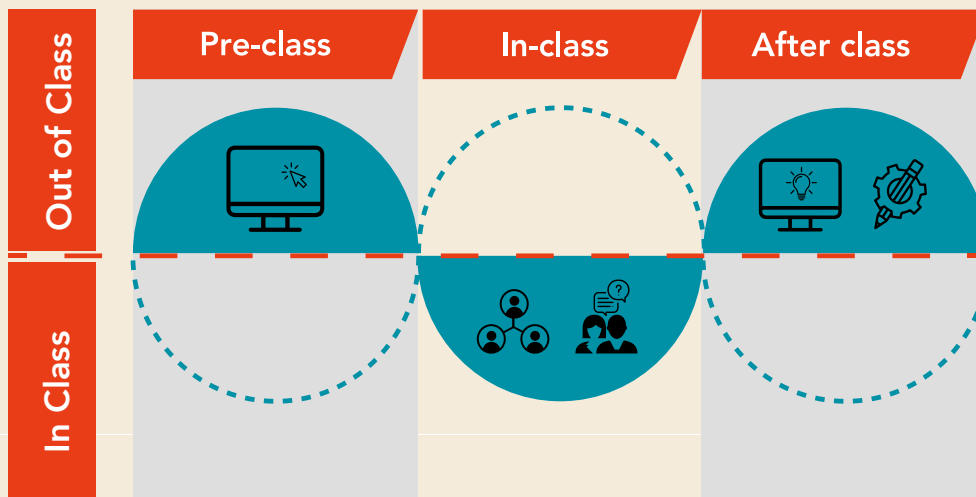
Organizational prerequisites

This guide provides six instructional principles that you can use when designing effective blended higher education. However, before embarking on this journey, it is important to understand that the success of your efforts in developing a blended course depends on several organizational prerequisites:

Make blended learning materials accessible

Good preparation is the key to success[17]. First, verify whether every student has access to the **necessary software and hardware tools** (e.g., laptop, reliable internet connection...) and has the required **technical skills** (e.g., using learning platforms, software...) to actively engage with the course materials both online and offline. If not, refer students to available facilities within the program, on campus or centrally within the institution, and provide them with the necessary resources to deepen their knowledge[17].

Monitor the study load

Make sure that the overall study load of the course does not increase[7,19]. Redesigning a course implies a risk of adding content, additional exercises, and evaluation on top of existing lessons, which can increase the study load. Therefore, set up a **clear schedule** for yourself and the students. How much time do different activities require? Replace some face-to-face contact moments thoughtfully with independent study time. For instance, you can reduce twelve contact sessions to nine or six, ensuring students have enough time to actively and independently engage with the course materials before returning to the classroom (face-to-face).

MAKE BLENDED LEARNING MATERIALS ACCESSIBLE

- Verify whether all students have the required tools and a stable Internet connection.

- Verify whether all students are sufficiently technically proficient to use the tools. Provide support as needed.

- Refer students to existing facilities provided within the program, or centrally on campus.

MONITOR THE STUDY LOAD

- Watch over the total anticipated study load of course units. Do not exceed it.

- When transferring to blended formats, avoid simply adding more learning materials, exercises, and test formats to existing lessons. Replace thoughtfully and purposefully.

- Set a clear schedule for yourself and the students. How much time is required for the different learning activities?

CHOOSE BASED ON YOUR LEARNING OBJECTIVES

- Formulate clear learning objectives for your course unit before you start your blended design.

- Match your didactic approach, and then the type of blend and learning activities to the learning objectives.

- Provide sufficient time and space to practice the newly acquired knowledge and skills with students. A flipped classroom, for example, explicitly provides room for practice sessions.

PROVIDE CLEAR INSTRUCTION AND STRUCTURE

- Provide students with a clear and defined overview of the contents, structure, and learning objectives of your course unit.

- Make explicit connections between the new subject matter and students' relevant prior knowledge. Brush up on that knowledge as needed.

- Discuss the blended approach with your students, and frame its goals, benefits and expectations. Describe clearly what is expected of students during both online, and face-to-face sessions.

1

2

SUPPORT THE ORGANIZATION OF THE LEARNING PROCESS

- Be conscious of the self-regulatory skills expected of students in blended learning formats. They require explicit support to develop these skills.

- Explicitly inform students on effective learning strategies, and model their use.

- Support students in the organization of their learning activities, and steadily decrease that support as they become more competent.

3

FACILITATE INTERACTION

- Use work formats that encourage interaction, collaborative learning, and peer feedback, such as think-pair-share and group work.

- Ensure that the interaction formats encourage students to actively cognitively engage with the learning content.

- During online sessions you can use forums or breakout rooms, for example. It is important to follow up on these as teachers.

4

PROVIDE SUFFICIENT, FOCUSED FEEDBACK

- Make sure your learning objectives and success criteria are clear to students. Also verify whether students interpret them as intended.

- Visualize students' study progress. Regular, process-oriented feedback with concrete support provides guidance for learning, and clarifies what is expected.

- Make sure your feedback gets students thinking, and then working.

5

START REGULARLY WITH A LOW-THRESHOLD QUIZ

- Regularly start your class with a lowthreshold quiz to activate students' prior knowledge, and gain insight into possible gaps or misunderstandings.

- In addition, they will remember lesson content better due to the active retrieval of information from longterm memory.

- Alternate with other forms of retrieval practice, such as oneminute papers, braindumps, or think-pair- share.

6

CHOOSE BASED ON YOUR LEARNING OBJECTIVES

1

The flipped classroom turns out to be **very effective in enhancing students' skills**[1,9,26,32,34]. In the face-to-face component of the flipped classroom, specific time slots are allocated during class for students to process, apply, and integrate knowledge, and practice skills,[21] guided by the lecturer. During these instances, there is less emphasis on lecturing and acquiring the necessary foundational knowledge, as students are expected to study independently before class, for instance with the help of instructional videos.

These positive effects of the flipped classroom are less pronounced when the objective is to strengthen students' foundational knowledge and to focus on their understanding and retention of learning content (such as basic vocabulary). Nevertheless, the flipped classroom still has a slightly positive effect compared to face-to-face education in these cases. However, in order to achieve and enhance these positive effects, one should **consider several other recommendations for instruction** discussed in this guide.

It is important to first determine the specific learning objectives, and only then identify the suitable teaching approach. Blended education should not be a goal as such, but rather a means to achieve those learning objectives. For example, when aiming to strengthen students' skills, the flipped classroom can be a highly effective instructional approach. In language education, for instance, it can be particularly effective to practise listening, speaking, reading, and writing skills[32].

PROVIDE CLEAR INSTRUCTION AND STRUCTURE

2

Clear communication about the content and format of your lessons is essential in blended education, as various instructional activities are combined. Lecturers should provide students with a **clear and well-defined overview** of the **lesson format**, **course structure**, and the **objectives** they aim to achieve.

You can use, for example, an **advance organizer** that outlines the content and structure of the lesson(s) and explicitly connects new content to relevant prior knowledge. Clearly connecting the different lessons and activities helps students to better understand the overall picture, promotes deeper learning, and boosts their satisfaction[17].

⚙ An advance organizer is a tool used to activate prior knowledge in a structured manner. It provides students in advance with mental frameworks that help them to **integrate new content** with the knowledge they had already acquired. You can use stories or graphical outlines like diagrams, timelines, mind maps, concept maps, etc. which assist students in answering questions like 'Where did we start? 'Where are we heading to? How are this lesson and previous ones connected?'[51]
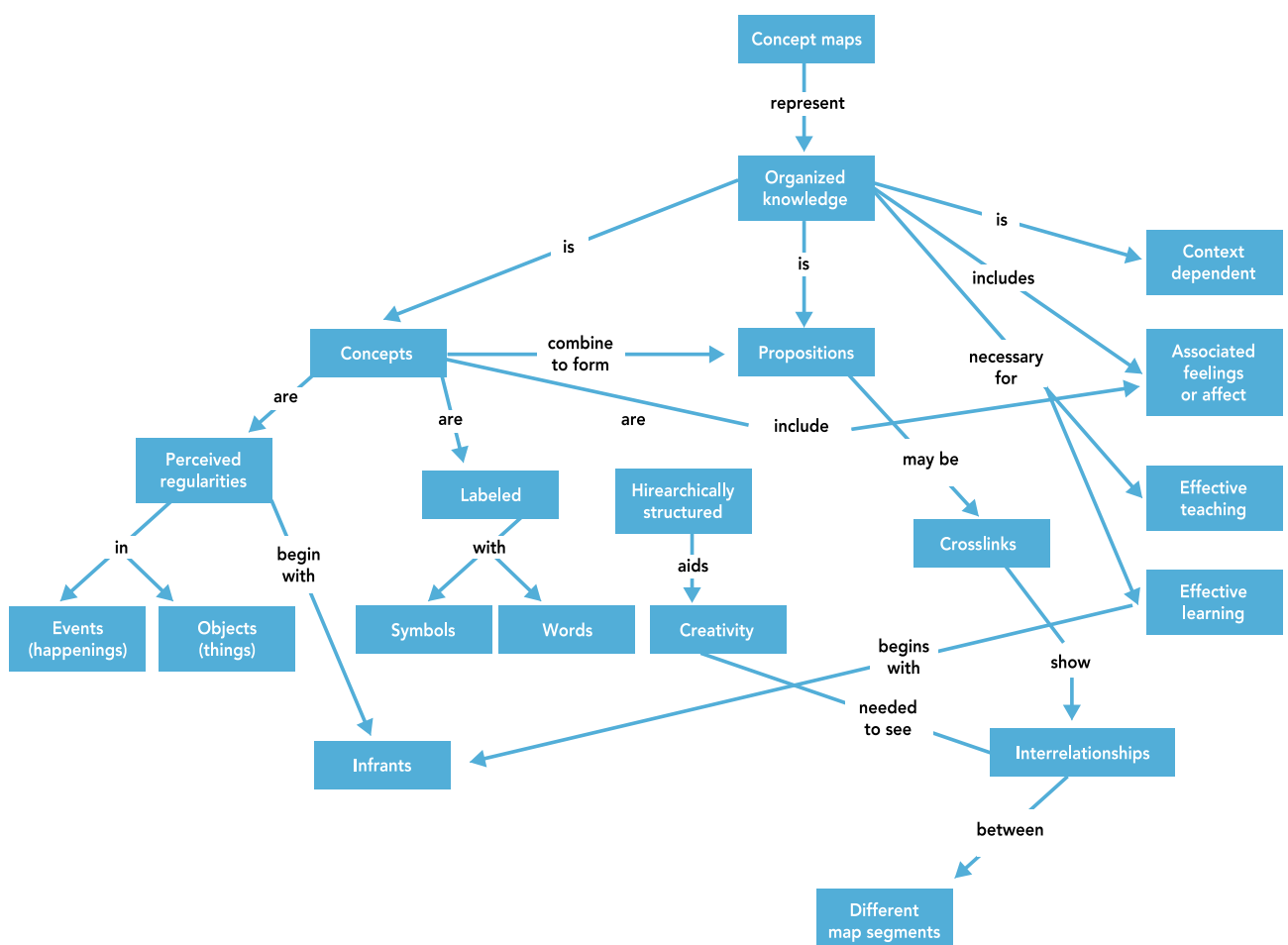
It is also very useful to provide students with a concrete schedule for both the out-of-class and in-class components, and explicitly outline which tasks you expect students to complete during different components[17,21]. A **fixed contact or study slot** can be helpful in this regard.

Finally, it is crucial to thoroughly inform your students about the **specific objectives of the blended approach**. One of the challenges is that students are often not yet sufficiently familiar with this teaching approach[21]. Therefore, clearly explaining its objectives, benefits, and challenges to your students in advance helps to raise their awareness and appreciation of its added value[17].

SUPPORT THE ORGANIZATION OF THE LEARNING PROCESS

3

A high degree of **self-regulation** has a positive effect on both the psychosocial and the learning outcomes of students[9,55]. This implies they need to be able to consciously and independently use **metacognitive strategies**[42]. In other words, students should be able to reflect on the learning objectives they need to achieve, determine the most effective approach to complete a learning task, and evaluate their learning process, including the necessary adjustments if required.

🔍 **Self-regulation** is how students **guide their behaviour in alignment with their learning goals** and **reflect on** their increasing **effectiveness**[55]. This enhances their self-efficacy and motivation to continue improving their learning strategies. Due to their increased motivation and adaptive learning strategies, self-regulating students are more likely to achieve academic success and develop an optimistic outlook on their future.

In blended teaching approaches like the flipped classroom, higher levels of self-regulation are required[5], especially in the pre-class component with independent work without direct lecturer support. The flipped classroom's effectiveness largely depends on how effectively students use the available time for pre-class activities to enhance their learning[16]. By providing adequate guidance and support to students in successfully carrying out the learning activities outside of class, students will be **better prepared** and experience **higher satisfaction**

during the lessons[17]. However, many students are not yet sufficiently trained to fully self-regulate[36]. Therefore, students require a certain amount of support in the organisation of their learning process.

How can you provide the necessary support?

For students, it is not easy to accurately estimate how much time they need in order to process certain study materials, which learning strategies they should best apply, and how to verify whether they have sufficiently mastered the content. These strategies must first be **explicitly taught and supported**.

Metacognitive **scaffolding** is an effective way to go about it (see Figure 3). You initially provide ample support in organising the learning process, tailored to the students' mastery level. For example, by discussing and modelling effective learning strategies, giving feedback, providing instruction, and so on. As students' mastery grows, you gradually reduce the lecturer support so that they ultimately employ self-regulating metacognitive strategies.

🔍 **Scaffolding** is an instructional strategy where you **initially offer** students ample s**upport**, which is then **gradually** reduced as their mastery level increases. In this manner, students are gradually challenged to **assume** the **responsibility** for their own learning process.
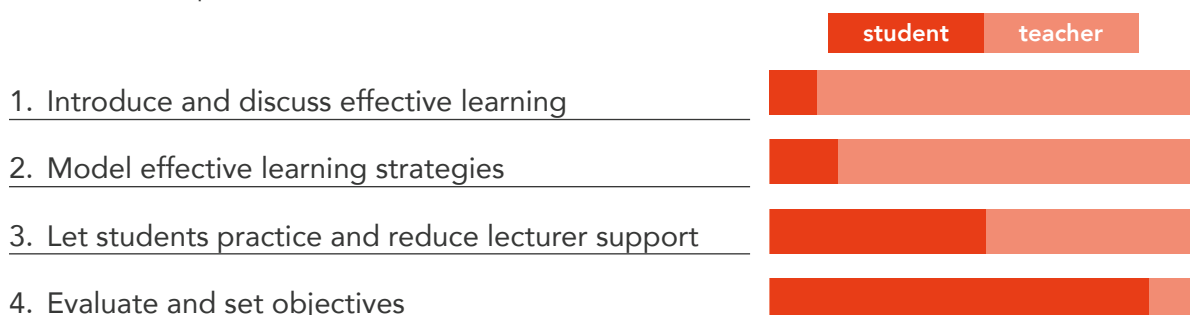

Figure 3. Teaching metacognitive strategies through scaffolding. Source: Leer studenten studeren met succes[42]

FACILITATE INTERACTION

4

An **interactive** and **collaborative** component within blended education has a **positive impact on learning outcomes**[26,27,28]. By incorporating various forms of collaboration and interaction (among students, between student and lecturer, and between student and learning materials) into a blended design, students' knowledge and skills can be further enhanced[5,22]. The interactive components should **motivate** students **to cognitively engage** with the learning materials, leading to better retention and understanding[44]. This means that students should not merely appear occupied with various working methods, but should also be genuinely challenged, encouraged to think deeply about the content, and consequently gain lasting learning experiences[44,46].

Moreover, an interactive and collaborative component within blended education can **enhance students' motivation and strengthen their self-regulating skills**[5,22]. One of the major advantages of the flipped classroom is that the time freed up during the in-class component allows for increased face-to-face interaction between the lecturer and students, and amongst the students themselves[16,21]. You can use this time frame to focus on activities where students collaboratively engage in critical thinking about learning materials, and offer the necessary support during the learning process (see also recommendation 3).

Concrete activities to optimise interaction and collaboration include quizzes (see also recommendation 6), *think-pair-share*, and group work[51].

> ⚙️ **Think-pair-share** is a class activity that comprises three steps in which students first think independently about a question or problem ('Think'), then discuss their ideas in pairs ('Pair'), and finally exchange ideas with the whole group ('Share'). This has the advantage that all students must make a cognitive effort to participate.

Collaboration and interaction can be applied in both face-to-face and online settings. For instance, during online sessions, students can be temporarily divided into pairs or smaller **working groups** through *breakout rooms* where they can collaborate to solve problems. Additionally, you can facilitate online **discussion forums.** It is, however, also important to monitor them regularly[21]. An essential consideration is to provide time and space for personal feedback from the lecturer[21].

PROVIDE SUFFICIENT FOCUSED FEEDBACK

5

In a blended learning environment, there is an increased expectation for students to engage in self-study. It is essential that they regularly receive insight into their learning progress. Therefore, especially during online activities, it is important to offer students sufficient **timely and process-oriented feedback** that **stimulates their thinking**[2,49] and provides concrete tools for improvement (knowledge-developing feedback).

It is important to clarify what you expect of students through clear quality criteria (feed up), communication on where they stand in the learning process (feedback), and a clear indication of what steps they need to take to achieve the goals (feed forward)[49,51]. By offering such focused feedback early on in the learning process, you provide students with a grip on their learning and the opportunity to adjust their learning process. Timely feedback is therefore essential for students' **self-regulation** (see also recommendation 3) and to increase their **cognitive engagement**[19].

Effective feedback follows three guiding principles[39]:

1. A solid foundation: offer high-quality lessons and regularly employ formative assessment. This helps to identify the gaps and focus your feedback effectively.

2. Well-timed feedback to enhance learning: make an informed judgment about the most appropriate moment in the learning process. Good feedback focuses on the task, subject, and/or students' learning strategies. Avoid focusing on personal traits and be specific.

3. The student's response: encourage students not only to be receptive to feedback, but also provide concrete tools that stimulate their thinking, ensuring that they effectively put them to use. The latter is crucial for their learning process.

One of the advantages of the flipped classroom is that you can use the time freed up during in-class moments to provide feedback on students' performance, and to identify and resolve misunderstandings [19]. This can be done, for example, through **model answers**, references to **background materials**, standard feedback **on common errors** or misconceptions, or individual **feedback sessions**.

START REGULARLY WITH A LOW-THRESHOLD QUIZ
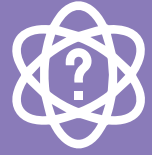
6

The effect of the flipped classroom is enhanced when students are encouraged to briefly and actively **repeat or refresh** the **learning material** at the start of the in-class component [20].

You could, for instance, start the lesson by regularly organising **a short and low-threshold quiz** to refresh and test the learning materials that students had to study independently beforehand. This approach **activates** relevant **prior knowledge** that students need to have activated in their minds in order to connect it efficiently and effectively to the rest of the lesson. This method also helps to ascertain if students have understood and retained the **learning material**, allowing you to immediately address any gaps or misconceptions as needed [21], differentiate if necessary, and thus strengthen students' learning outcomes. Moreover, organising a quiz is also a way to encourage **interaction** (see recommendation 4). For example, you could ask students who provided the correct answer to rephrase it in their own words and explain it to their peers.

Regularly using quizzes and similar activities at the start of the lesson positively influences students' learning outcomes and is considered an effective learning strategy [9,12]. When students **practice actively retrieving learning material from their memory** (retrieval practice), they strengthen their memory more compared to so-called passive learning strategies, such as re-reading the material [42]. In other words, it helps students to retain information better, and for a longer period of time.

It is therefore worthwhile to regularly organise quizzes that ask questions about previously covered material, prompting students to retrieve this information from their memory [51]. It is a good idea, however, **to alternate with different types of retrieval practice**. Starting every lesson of each course with a quiz, for example, is not very motivating.

Alternatives include think-pair-share (see also recommendation 4), a *brain dump*, or a *one-minute paper*. The main goal is to have students practice independently retrieving information from their memory.

An important consideration is that the quiz (or other retrieval technique) should be **low-threshold**. Students are allowed to make mistakes and you should inform them that the purpose of the quiz is to facilitate learning rather than to evaluate them. Furthermore, in the context of the flipped classroom, the quiz should be taken at the **beginning of the in-class activity** rather than in preparation of the lesson (i.e. as a pre-class activity) or as an assessment that is part of the course evaluation [9].

A **one-minute paper** is a brief assignment in which students are asked to formulate an answer to a question within one minute. Typical questions include: 'What is the main idea/insight you will take home from today's lesson?' and 'What question has not yet been answered?' [50]. Traditionally, lecturers give one-minute papers at the end of a lesson or course as exit tickets, but in the flipped classroom it is particularly beneficial to start the in-class activity with a one-minute paper to recap the pre-class activity. In this way, students are encouraged to independently reflect on the learning material they previously studied.

How was this guide created?

Approach

This guide is based on the results of a literature review, more specifically a rapid evidence assessment. We analysed existing systematic reviews and meta-analyses that studied the effectiveness of blended learning on the broad development of students in (professional) higher education. This literature review was conducted as part of the research project "Effective Blended Higher Education" at Thomas More University of Applied Sciences. More information about this research project can be found on the project page (in Dutch): www.thomasmore.be/onderzoek-blended-leren.

The literature review was based on the following research question:

What is the impact of different types of blended learning on learning outcomes and psychosocial outcomes among students in professional higher education?

The rapid evidence assessment was conducted in accordance with the PRISMA guidelines. The initial search (time frame 2011-2021) was carried out in the ERIC and Web of Science databases, and the inclusion criteria were established based on the PICOS framework. Throughout this process, the screening, quality assessment of the studies, and data extraction and processing were conducted independently by at least two researchers. Any points of disagreement were then discussed within the research team. The robust foundation for the recommendations in this guide is formed by the in-depth analysis of 35 systematic review studies and meta-analyses that were included.

Positioning Studies within the Taxonomy of Blended Learning

Figure 4 provides an overview of the various teaching approaches that are addressed, and positions the 35 systematic reviews and meta-analyses from the literature review within the framework of the MIX taxonomy.

Instructor-transmitted	Face-to-Face Combo	Instructor-mediated
Lecture Hybrid	2; 3; 5; 7; 9; 11; Flipped blend 12; 15; 16; 17; Supplemental blend 19; 20; 21; 25; Replacement blend 27; 29; 31; 32; 33; 35	Practice Hybrid
26; 34 Technology transmitted	8; 10; 14; 23; 24 Online Combo 1; 4; 6; 13; 18; 22; 28	Technology mediated

Figure 4. Positioning studies on MIX Taxonomy [43]

We distinguish two types at the extremities of Figure 4, namely combination courses (at the top and bottom), hybrid courses (on the left and right), and three subtypes of blended learning in the centre of the figure, which are the flipped blend, supplemental blend, and replacement blend.

In **combination courses,** lecturers provide support during both the delivery and application of learning content through instruction. How this instruction is delivered (whether digitally or not) determines whether it is a face-to-face or an online combination course.

In **hybrid courses**, face-to-face instruction and technology mediated instruction occur simultaneously. The type of instruction determines whether it is a hybrid lecture or a hybrid practical session.

In the **three blended teaching approaches** at the centre of the figure, lecturers combine face-to-face instruction with online instruction, and provide support during both the delivery and application of learning content through instruction. We distinguish between:

- **Flipped blend** courses, where the presentation of learning content takes place online, and feedback on its application is face-to-face;
- **Supplemental blend** courses, where the presentation of learning content occurs face-to-face, and feedback on its application is online;
- **Replacement blend** courses, where the presentation of learning content and feedback on its application take place face-to-face and online.

Although we used a broad definition of (and search for) blended learning in our literature review, it turned out that most of the selected scientific articles focus on the flipped blend (see Figure 4). This is not entirely surprising, as it is the most common type of blended learning in both scientific research and teaching practice. Therefore, the recommendations in this guide are primarily, but not exclusively, focused on enhancing the flipped classroom.

Methodological Note: Measuring Outcomes

An important methodological note to bear in mind while reading this guide is that not every type of outcome among students in the selected studies was measured using the same type of instrument.

Student **learning outcomes**, namely the knowledge and skills acquired in a course component, were typically mapped through quantitative data. Such measurements were carried out using relatively objective benchmarks such as final exams and tests, project scores, midterm exams, weekly quizzes, etc., with the highest standard being objectively comparable scores.

Psychosocial outcomes of students were typically mapped through questionnaires (with or without self-reporting). When the guide mentions terms like better, higher, more frequently, or more intensely, this reflects significant or meaningful differences from the scientific articles. An important note in this context is that the effects found for psychosocial outcomes were often relatively small. On the other hand, the literature frequently cited several points of consideration. These points of consideration therefore provided us with tools from which recommendations were derived, intending to optimise the effects of blended teaching approaches on various psychosocial outcomes among students.

References

Literature review

1. Ahmadi, S-F., Baradaran, H. R., & Ahmadi, E. (2015). Effectiveness of teaching evidence-based medicine to undergraduate medical students: A BEME systematic review. *Medical Lecturer, 37*(1), 21-30. doi: 10.3109/0142159X.2014.971724

2. Al-Samarraie, H., Shamsuddin, A., & Alzahrani, A. I. (2020). A flipped classroom model in higher education: A review of the evidence across disciplines. *Educational Technology Research and Development, 68*(3), 1017-1051. doi.org/10.1007/s11423-019-09718-8

3. Balakrishnan, A., Puthean, S., Satheesh, G., Unnikrishnan, M. K., Rashid M., Nair S., & Thunga, G. (2021). Effectiveness of blended learning in pharmacy education: A systematic review and meta-analysis. *PLoS ONE 16*(6), 1-17. doi:10.1371/journal.pone.0252461

4. Batdi, V., Dogan, Y., & Talan, T. (2021). Effectiveness of online learning: A multi-complementary approach research with responses from the COVID-19 pandemic period. *Interactive Learning Environments.* doi:10.1080/10494820.2021.1954035.

5. Bernard, R. M., Borokhovski, E., Schmid, R. F., Tamim, R. M., & Abrami, P. C. (2014). A meta-analysis of blended learning and technology use in higher education: From the general to the applied. *Journal of Computing in Higher Education, 26*(1), 87-122. doi:10.1007/s12528-013-9077-3

6. Berry, M. C. D., Neto, J. M. D., de Souza, M. I. D., Figueredo, C. M. D., Reher, V., & Evans, J. L. (2020). Effectiveness of technology-enhanced learning to improve periodontics educational outcomes: A systematic review. *Journal of Dental Education, 84*(7), 830-839. doi: 10.1002/jdd.12179

7. Betihavas, V., Bridgman, H., Kornhaber, R., & Cross, M. (2016). The evidence for 'flipping out': A systematic review of the flipped classroom in nursing education. *Nurse Education Today, 38*, 15-21. doi: 10.1016/j.nedt.2015.12.010

8. Botelho, M. G., Agrawal, K. R., & Bornstein, M. M. (2019). A systematic review of e-learning outcomes in undergraduate dental radiology curricula-levels of learning and implications for researchers and curriculum planners. *Dentomaxillofacial Radiology, 48*(1). doi: 10.1259/dmfr.20180027

9. Bredow, C. A., Roehling, P. V., Knorp, A. J., & Sweet, A. M. (2021). To flip or not to flip? A meta-analysis of the efficacy of flipped learning in higher education. *Review of Educational Research, 91*(6), 878-918. doi: 10.3102/00346543211019122

10. Campbell, K., Taylor, V., & Douglas, S. (2019). Effectiveness of online cancer education for nurses and allied health professionals: A systematic review using Kirkpatrick evaluation framework. *Journal of Cancer Education, 34*(2), 339-356. doi: 10.1007/s13187-017-1308-2

11. Chen, K-S., Monrouxe, L., Lu, Y-H., Jenq, C-C., Chang, Y-J., Chang, Y-C., & Chai, P.Y-C. (2018). Academic outcomes of flipped classroom learning: A meta-analysis. *Medical Education, 52*(9), 910-924. doi: 10.1111/medu.13616

12. Farmus, L., Cribbie, R. A., & Rotondi, M. A. (2020). The flipped classroom in introductory statistics: Early evidence from a systematic review and meta-analysis. *Journal of Statistics Education, 28*(3), 316-325. doi: 10.1080/10691898.2020.1834475

13. Gegenfurtner, A., & Ebner, C. (2019). Webinars in higher education and professional training: A meta-analysis and systematic review of randomized controlled trials. *Educational Research Review, 28*, 100293. doi: 10.1016/j.edurev.2019.100293

14. Gill, M., Anderson, E., & Hilsmann, N. (2019). Best practices for teaching pharmacology to undergraduate nursing students: A systematic review of the literature. *Nurse Education Today, 74*, 15-24. doi: 10.1016/j.nedt.2018.11.017

15. Hew, K. F., Bai, S., Huang, W., Dawson, P., Du, J., Huang, G., Jia, C. & Thankrit, K. (2021). On the use of flipped classroom across various disciplines: Insights from a second-order meta-analysis. *Australasian Journal of Educational Technology, 37*(2), 132-151. doi: 10.14742/ajet.6475

16. Jang, H. Y., & Kim H. J. (2020). A meta-analysis of cognitive, affective, and interpersonal outcomes of flipped classroom in higher education. *Education Sciences, 10*, 115. doi: 10.3390/educsci10040115

17. Li, S., Liao, S., Burdick, W., & Tong, K. (2020). The effectiveness of flipped classroom in health professions education in China: A systematic review. *Journal of Medical Education and Curricular Development, 7*, 1-7. doi: 10.1177/2382120520962838

18. Liossi, C., Failo, A., Schoth, D. E., Williams, G., Howard, R. (2018). The effectiveness of online pain resources for health professionals: A systematic review with subset meta-analysis of educational intervention studies. *Online Pain Education, 159*(4), 631-643. doi: 10.1097/j.pain.0000000000001146

19. Lo, C. K. & Hew, K. F. (2021). Student engagement in mathematics flipped classrooms: Implications of journal publications from 2011 to 2020. *Frontiers in Psychology, 12*, 1-17. doi: 10.3389/fpsyg.2021.672610

20. Lo, C. K. & Hew, K. F. (2019). The impact of flipped classrooms on student achievement in engineering education: A meta-analysis of 10 years of research. *Journal of Engineering Education, 108*(4), 523-546. doi: 10.1002/jee.20293

21. Lo, C. K., Hew, K. F., & Chen, G. (2017). Toward a set of design principles for mathematics flipped classrooms: A synthesis of research in mathematics education. *Educational Research Review, 22*(1), 50-73. doi: 10.1016/j.edurev.2017.08.002

22. Mannisto, M., Mikkonen, K., Kuivila, H-M., Virtanen, M., Kyngäs, H., Kääriäinen, M. (2020). Digital collaborative learning in nursing education: A systematic review. *Scandinavian Journal of Caring Sciences, 34*(2), 280-292. doi: 10.1111/scs.12743

23. Mccutcheon, K., Lohan, M., Traynor, M., & Martin, D. (2015). A systematic review evaluating the impact of online or blended learning vs. face-to-ace learning of clinical skills in undergraduate nurse education. *Journal of Advanced Nursing, 71*(2), 255-270. doi: 10.1111/jan.12509

24. Means, B., Toyama, Y., Murphy, R., & Baki, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. *Lecturers College Record, 115*(3),1-47. http://www.sri.com/sites/default/files/publications/effectiveness_of_online_and_blended_learning.pdf

25. Muller, C., & Mildenberger, T. (2021). Facilitating flexible learning by replacing classroom time with an online learning environment: A systematic review of blended learning in higher education. *Educational Research Review, 34*, 1-16. doi: 10.1016/j.edurev.2021.100394

26. Noetel, M., Griffith, S., Delaney, O., Sanders, T., Parker, P., del Pozo Cruz, B., & Lonsdale, C. (2021). Video improves learning in higher education: A systematic review. *Review of Educational Research, 91*(2), 204-236. doi: 10.3102/0034654321990713

27. Odegaard, N. B., Myrhaug, H., T., Dahl-Michelsen, T., & Røe, Y. (2021). Digital learning designs in physiotherapy education: A systematic review and meta-analysis. *BMC Medical Education, 21*(48). doi: 10.1186/s12909-020-02483-w

28. Pei, L., & Wu, H. (2019). Does online learning work better than offline learning in undergraduate medical education? A systematic review and meta-analysis. *Medical Education Online, 24*(1), 1666538. doi: 10.1080/10872981.2019.1666538

29. Shi, Y., Ma, Y., MacLeod, J., & Yang, H. H. (2020). College students' cognitive learning outcomes in flipped classroom instruction: A meta-analysis of the empirical literature. *Journal of Computers in Education, 7*(1), 79-103. doi: 10.1007/s40692-019-00142-8

30. Sinacori, B., & Williams-Gregory, M. (2021). The effect of distance learning on knowledge acquisition in undergraduate second-degree nursing students: A systematic review. *Nursing Education Perspectives, 42*(3), 136-141. doi: 10.1097/01.NEP.0000000000000756

31. Turan, Z. (2021). Evaluating whether flipped classrooms improve student learning in science education: A systematic review and meta-analysis. *Scandinavian Journal of Education Research.* doi: 10.1080/00313831.2021.1983868

32. Vitta, J. P., & Al-Hoorie, A. H. (2020). The flipped classroom in second language learning: A meta-analysis. *Language Teaching Research,* 1-25. doi: 10.1177/1362168820981403

33. Vo, H. M., Zhu, C., & Diep, N. A. (2017). The effect of blended learning on student performance at course-level in higher education: A meta-analysis. *Studies in Educational Evaluation, 53*, 17-28. doi: 10.1016/j.stueduc.2017.01.002

34. Warren, J. N., Luctkar-Flude, M., Godfrey, C., & Lukewich, J. (2016). A systematic review of the effectiveness of simulation-based education on satisfaction and learning outcomes in nurse practitioner programs. *Nurse Education Today, 46*, 99-108. doi: 10.1016/j.nedt.2016.08.023

35. Youhasan, P., Chen, Y., Lyndon, M., & Henning, M. A. (2021). Exploring the pedagogical design features of the flipped classroom in undergraduate nursing education: a systematic review. *BMC Nursing, 20*(1). doi: 10.1186/s12912-021-00555-w

Additional literature

36. Anthonysamy, L., Koo, A. C., & Hew, S. H. (2020). Self-regulated learning strategies and non-academic outcomes in higher education blended learning environments: A one decade review. *Education and Information Technologies, 25*(10), 1-28. doi: 10.1007/s10639-020-10134-2

37. Buelens, W., Surma, T., & Kirschner, P. A. (2021, September 21). To flip or not to flip. https://excel.thomasmore.be/2021/09/to-flip-or-not-to-flip

38. Doo, M. Y., Bonk, C., & Heo, H. (2020). A meta-analysis of scaffolding effects in online learning in higher education. *International Review of Research in Open and Distributed Learning*, *21*(3), 60-80. doi: 10.19173/irrodl.v21i3.4638

39. Education Endowment Foundation. (2021). https://educationendowmentfoundation.org.uk/education-evidence/guidance-reports/feedback.

40. Fink, L. D. (2013). *Creating significant learning experiences. An integrated approach to designing college courses, revised and updated.* Jossey-Bass.

41. Hodges, C. B., Moore, S., Lockee, B. B., Trust, T., & Bond, M. A. (2020). The difference between emergency remote teaching and online learning. https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning.

42. Hoof, T., Surma, T., & Kirschner, P. A. (2021). *Leer studenten studeren met succes.* Antwerpen: Thomas More-hogeschool.

43. Margulieux, L. E., McCracjen, W. M., & Catrambone, R. (2016). A taxonomy to define courses that mix face-to-face and online learning. *Educational Research Review, 19*, 114-118. doi: 10.1016/j.edurev.2016.07.001

44. Mayer, R. E. (2021). *Multimedia Learning* (3rd ed.). Cambridge University Press.

45. Muijs, D. (2022, 15 juni). Dit moet je weten over metacognitie en zelfregulerend leren. Geraadpleegd op 30 augustus 2022, van https://www.academica-group.com/kennis/dit-moet-je-weten-over-metacognitie-en-zelfregulerend-leren

46. Nuthall, G. (2007). *The hidden lives of learners.* NZCER Press.

47. Rosenshine, B. (2012). Principles of instruction: Research-based strategies that all lecturers should know. *American Educator, 36*(1), 12-39.

48. Sasidhar, S. (2019). Weekly live revision sessions to scaffold student learning in a blended learning course. In 2019 IEEE Frontiers in Education Conference (FIE) (pp. 1-5). IEEE. doi: 10.1109/FIE43999.2019.9028715

49. Sluijsmans, D., Buelens, W., & Vanhoyweghen, K. (2021, 2 maart). Kan technologie het feedbackproces versterken? https://excel.thomasmore.be/2021/03/kan-technologie-het-feedback-proces-versterken/

50. Stead, D. R. (2005). A review of the one-minute paper. *Active Learning in Higher Education, 6*(2), 118-131. doi: 10.1177/1469787405054237

51. Surma, T., Vanhoyweghen, K., Sluijsmans, D., Camp, G., Muijs, D., Kirschner, P. A. (2019). *Wijze lessen: Twaalf bouwstenen voor effectieve didactiek* (1e ed.). Meppel, Nederland: Ten Brink Uitgevers.

52. Theelen, H., & Van Breukelen, D. H. J. (2022). The didactic and pedagogical design of e-learning in higher education. A systematic literature review. *Journal of Computer Assisted Learning*, 1-18. doi: 10.1111/jcal.12705

53. Van Merriënboer, J. J. G. & Kirschner, P. A. (2018). *Ten Steps to Complex Learning: A Systematic Approach to Four-Component Instructional Design* (3e ed.). Routledge.

54. Van Valkenburg, W. F., Dijkstra, W. P., De los Arcos, B., Goeman, K., Van Rompaey, V., & Poelmans, S. (2020). European Maturity Model for Blended Education (EMBED).

55. Zimmerman, B.J. (2002). Becoming a Self-Regulated Learner: An Overview. *Theory Into Practice, 41*(2), 64-70. doi: 10.1207/s15430421tip4102_2