

Research Papers

The 20th EuroFM Research Symposium

16-17 June 2021

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Editor:

Tuuli Jylhä



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■ Preface

I am very proud to present the proceedings of the 20th EuroFM Research Symposium! EuroFM is a network organisation missioned to promote ‘advancement of knowledge in Facility Management in Europe and its application in business, education and research’. This open access publication and online research symposium present and discuss original, advanced FM research in the EuroFM network and beyond.

EuroFM Research Symposium is this year part of the ‘Stay connect’ sessions. The June series of ‘Stay connected’ sessions starts with education (9 June 2021), is followed by research (16-17 June 2021), and ends with business (30 June 2021). The online EuroFM Research Symposium is arranged 16-17 June 2021 in two afternoons. The first day reflects the new office landscape and is targeted at researchers, practitioners, educators and students. The second day of the symposium focuses on research developments in FM and CREM, and in FM education.

This conferences proceedings includes 12 papers. All accepted papers were double-blind peer reviewed. This year it was possible to choose to write either a full (max. 12 pages) or a short paper (max. 6 pages). From the 12 accepted papers, 10 are full papers and 2 are short papers. Approx. 70 % of submitted abstracts were developed and finally accepted in the peer-review process.

I would like to thank all the authors, the members of the scientific committee and the best paper committee, the speakers, the member of the EuroFM board, the EuroFM secretaries and my student assistant Danica Widarta for their contribution, commitment and flexibility in making this open access proceedings. It’s a great, joint effort in the fantastic EuroFM network!

I look forward to our online symposium! May it offer us a possibility to greet old and new FM friends, provide advanced FM knowledge, and generate ideas for future EuroFM research initiations.

Tuuli Jylhä
Chair of the Scientific Committee
Research Chair of EuroFM

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Problem-based learning for the teaching of FM skills: results of a practical use

Alexander Redlein¹, Lisa Thrainer², and Christian Lau³

ABSTRACT

Digitalization and COVID-19 are not game changers, but accelerate several already existing trends. In the area of teaching e-learning and blended learning has always been a topic. Until the beginning of the COVID pandemic, most of the Facility and Real Estate (RE/FM) programs focused on classroom teaching. Only few already used digital learning concepts. Based on a literature review the paper gives an overview of the different possibilities of knowledge transfer and learning. Based on this overview two methods are analyzed in more detail.

- Blended learning
- Problem-based learning

Citation:

Redlein, A., Thrainer, L., Lau, C., Problem-based learning for the teaching of skills: results of a practical use. *The proceedings of the 20th EuroFM Research Symposium 2021*, European Facility Management Network, 16-17 June 2021, online conference.

Both approaches are not only described in theory but also shown in practical usage. The blended learning approach is demonstrated by the setup of an introduction course for FM provided by Springer and the problem-based learning approach by a cooperative lecture of TU Wien and Stanford Mechanical Engineering.

These case studies show that the approach of problem-based teaching combines several advantages. The students can learn when and wherever they like and optimize their own scheduling. They can select the relevant sessions they really need to attend. The lecturers act more as coaches. These two elements optimize the individual knowledge transfer. The practical application of the knowledge proves that the required competences and not only the theoretical knowledge is gained. The feedback of the students also proves the advantages of this method. Therefore, the problem-based teaching method is a very promising approach, which will change the way teaching and knowledge transfer in RE/FM will happen in the future.

KEYWORDS

e-learning, new teaching concepts, problem-based learning, blended learning, learning videos

BACKGROUND AND OBJECTIVES

The imparting of skills in the secondary and tertiary sectors has been influenced by digitization in recent years. Nevertheless, the focus was on face to face events for the transfer of knowledge and competence (Mmb Institut 2019, Scheidig 2020, p. 244, Huber 2016, p. 86, Blömer et al., 2020). The use of digital techniques and media has been researched and tested, but has not been implemented widely. COVID-19 has not really been a “game changer”, but it has made the use of e-learning concepts almost a must. Due to the current situation, most universities have had almost no classroom teaching since March last year. Courses had to be adapted from physical to virtual teaching within a very short time. A lot of universities state they now make most of their offerings available digitally. In most cases, however, only digital tools for video conferencing were used instead of the physical classroom to convey the content. This means that instead of in the classroom or seminar room, the content was conveyed via Zoom or other videoconferencing software. This article deals with more advanced methods such as using the concept of blended learning and problem-based learning.

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LITERATURE REVIEW

According to the literature, there is a variety of teaching methods. The “mmb Institut für Medien- und Kompetenzforschung” (Institute for media and competence research) is a research organisation in the area of learning methods and competence transfer and publishes an overview of the status quo of digital teaching concepts and their use every year. The mmb differentiates between individual and collaborative as well as formal and informal methods.

On the one hand individual methods focus on the transfer of knowledge for a single individual. On the other hand, collaborative methods mainly use social cooperation e.g. team settings. (mmb Institut, 2019)

Informal learning encompasses all learning processes that take place without direct intent to learn. This is done, for example, through participation in forums and social networks, but also through work itself or through exchanges with colleagues. Formal learning, on the other hand, encompasses all ways of learning that provide knowledge in a planned manner. Examples are webinars, blended learning, courses, lectures and seminars. (de Witt, 2012). Figure 1 shows the main current teaching methods depending on these two classifications (mmb Institut, 2019).

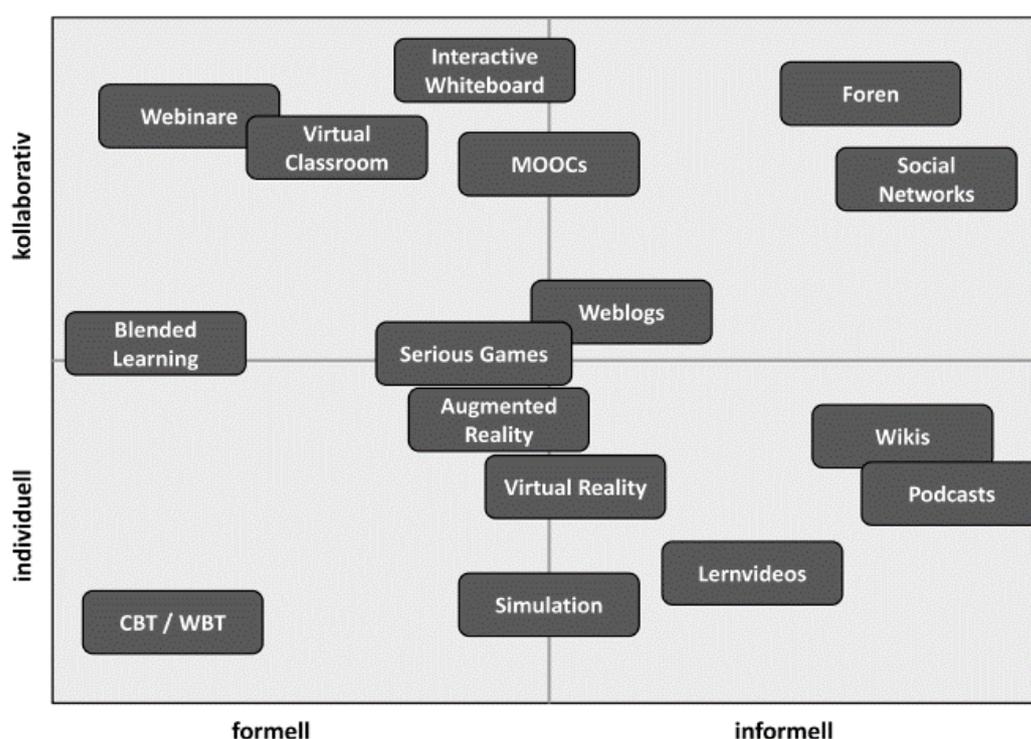


Figure 1: Learning methods according to mmb Institut 2019

Despite this diversity, however, most teachers still prefer formats based on face to face events, i.e. physical presence. These are, for example, lectures with attendance or workshops and seminars (mmb Institut 2019, Siepmann 2018, Poxleitner 2018). This is mainly due to the fact that in this way the interaction and motivation of the learners can be ensured easily. Also, the feedback can be collected by the participants the easiest (Gutbrod 2020, p. 48). Pure passive, digital learning methods such as learning videos have major weaknesses here (Modlinger 2020, p. 166, Kerres 2018, p. 118). But it is precisely the mix of using digital teaching methods with attendance times that activates extensive learning (Kerres 2018, p.105).

A middle way are so-called blended learning formats, in which different methods and media (face to face, readings, learning videos, etc.) are combined (Kerres 2018, p. 23, Erpenbeck et al., 2015, p.29,

Gabler 2021). The aim of this approach is to combine the advantages of face-to-face teaching with online teaching (Kraft 2003, p. 45). For example, classroom teaching is mixed with e-learning formats to ensure interaction, motivation and, above all, to guarantee the acquisition of competence (Kraft 2003, p. 43-44, p. 49). Presence formats and self-learning phases alternate. The presence phases ensure interaction, the possibility to eliminate ambiguities, ask questions and provide feedback (Kraft 2003, p. 49- 51). E-learning enables flexible time design (Erpenbeck et al., 2015, Feldmann & Wolff 2018, p. 200).

The possibility to select the relevant content yourself, if necessary to view content several times, supports individuality and flexibility (Feldmann & Wolff 2018, p. 215-216). The location independence that comes with e-learning and that it can be accessed whenever and wherever, are additional advantages (Stock-Homburg & Groß 2019, Erpenbeck et al., 2015).

The tools in the field of e-learning are diverse. The simplest are digital papers or videos. But also animations, simulations, virtual and augmented reality technologies and gamification are to be mentioned here (Behrend & Gandomi 2019, Feldmann & Wolff 2018, p. 201- 210). In particular, the use of learning videos supports the self-confidence and independence of the learners. This leads to an increase in knowledge, which further contributes to the promotion of critical thinking and better self-reflection. (Mertens et al., 2019)

So far, these advanced methods have only been used in more specific, especially potentially risky scenarios (Arnold et al., 2018). However, the challenges of the past year have also increased the usage in higher education.

METHODOLOGY

In this paper, two approaches are used in practice to analyse the pros and cons of the methods.

1. Blended learning
2. Problem-based learning

Blended learning based on the Springer iversity platform

In every RE/FM program the different definitions of FM and their application in practice are included as a starting point. This content mainly consists of a description of the different definitions, their similarities and differences. In addition, the practical application of the definitions is to be taught. In times of COVID with a reduction of classroom teaching this content is perfectly eligible for the blended learning approach (Blömer, 2020). On the one hand e-learning videos can be used to convey the content. On the other hand feedback sessions can be used to answer questions and reflect the content with a special focus on the similarities and differences (Kerres, 2018). This allows a reflection of the strategic approach of the definitions.

In order to promote international knowledge about FM, an introductory course for FM was designed and implemented jointly by the IFM of the TU Vienna and Springer. For this purpose, the procedure model of Springer iversity was used to ensure interaction and knowledge transfer. The procedure model gives input on designing the learning videos with respect to (Kerres, 2018)

- duration (Modlinger 2020, p. 124, Lingenau & Ahel 2019, p. 27-28),
- content mixture (Lingenau & Ahel 2019, p. 27-28, Modlinger 2020, p. 121, Erpenbeck et al., 2015, p. 7),
- settings (Kerres 2018, p. 473 – 475, Modlinger 2020, p. 99 – 100, Modlinger 2020, p. 122 – 130),
- and cutting and finishing (Kerres 2018, p. 473 – 475, Modlinger 2020, p. 99 – 100, Modlinger 2020, p. 122 – 130).

Problem-based learning

The second lecture that is used as an example is a lecture on process modelling. The goal of the lecture is not only to present the content of the EN15221-5 but also to provide the practical competence to

model and optimise processes within RE/FM in practice. As the practical application of the competences are in the focus of the lecture the problem-based approach was selected for an optimal competence transfer.

As best practice example of setting up a hybrid course using the problem-based learning approach the ME310 of Stanford is used. Stanford University conducts the design thinking training ME310 as a problem-based learning course. This is done in partnership with other universities and industry partners. One of the partner-universities is the IFM of the TU Vienna. The industry partners provide real life use cases every year. The students use the design thinking methodology to “design” products to address the needs and pains of the personas (ME310 Stanford University 2018). In the second use case, the problem-based learning method and the experience of the ME310 course design are used to teach the students of the TU Vienna competences in the field of process management and IT support within RE/FM.

In this use case e-learning videos are used to pass on the content and the methodology of process modelling. The competences gained are applied by modelling the “failure handling” process, which is a very important process in the area of RE/FM.

RESULTS

Blended Learning based on the Springer iversity platform

The experience and specifications of Springer iversity and the results of the literature research regarding blended learning led to a serious redesign of the lecture and the lecture documents that were used before in the classroom teaching setting. The advantage was that a textbook “Modern Facility and Workplace Management” (Redlein et al., 2020) was published by Springer Verlag in spring 2020. This was used as pre-reading, as a consolidation and deep dive into the topic.

Storytelling, the teaching of the content based on practical examples, was also included in the videos. Theoretical content is presented not only through the definition, but also using an example from a company (Kerres, 2018, p. 161).

The imparted knowledge is now provided with the help of the learning videos and can be accessed by the students independently. In addition, learning videos were also used to provide the topic in retrospect and then to repeat it. (Mertens et al., 2019) The creation of the learning videos themselves also turned out to be complex. One can assume that one hour of learning videos in total means two to three days of effort.

That learning videos can be produced successfully the learning objectives and the tasks should be defined in the first step. The learning objectives should be shown to the viewer at the beginning of the learning video. The tasks should be displayed at the appropriate points in the video (Lingenau & Ahel 2019, p. 27-28, Modlinger 2020, p. 121, Erpenbeck et al., 2015, p. 7). The learning content was divided into 5-minute units. This way, the concentration and communication of the content can be optimised. However, this is by no means in line with the classical transfer of knowledge at universities and colleges, which is always structured in 45-minute units. Therefore, the lecture has been revised completely in this regard.

Further tasks are the setting for the video recording (background, lighting, utensils, etc.), the filming, but also the post-processing of the videos above all to mention the partially repeated cutting and editing (Kerres 2018, p. 473 - 475, Modlinger 2020, p. 99 – 100, Modlinger 2020, p. 122 – 130). All these tasks to create high quality learning resources are very time consuming. Only if the material can be used several times the conversion pays off. Figure 2 shows an example of how the content is linked to the videos. They are grouped according to the chapters in playlists, so the students can watch the relevant ones easily until the next feedback session to learn the content and gain the competences.

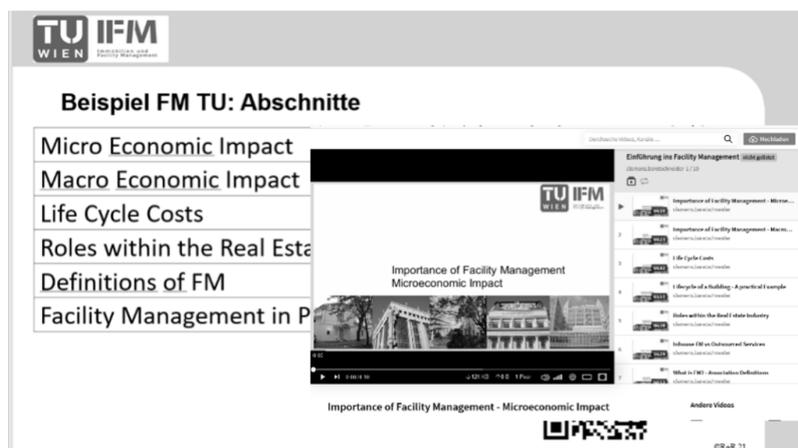


Figure 2: Screenshot of lecture 'Introduction into FM' TU Vienna Playlist Videos

Especially the tutorials of Springer iversity have given good support and a guidance here. They are much more detailed than the usual manuals at universities, but therefore support the work more comprehensively and ensure a higher quality (Springer, 2021). By using quiz formats, learners can also independently control their learning progress (Kerres, 2018). Another method is to design the execution of the tests based on each other. There is the possibility that after successfully completing one test the next one will be activated. (Feldmann & Wolff, 2018).

The cover page of the iversity course is shown in figure 3.

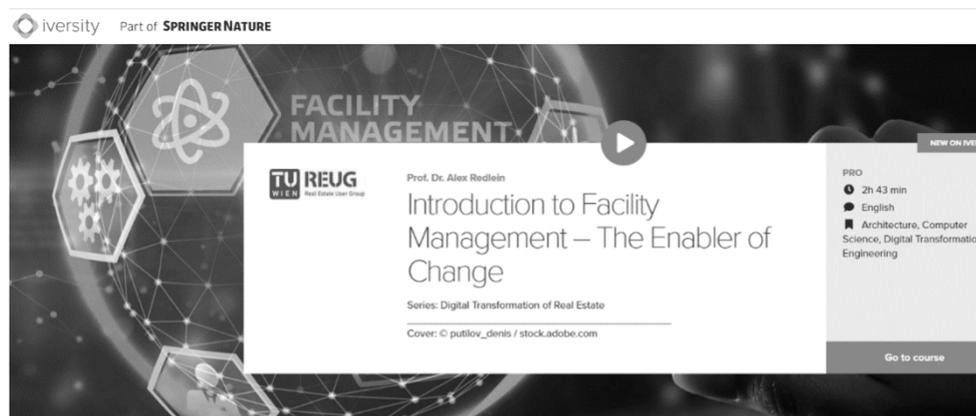


Figure 3: Springer course cover page 'Introduction to FM'

The lecture is now structured in the following way (comp. figure 4):

1. In the kick-off session the competences gained, learning methods used and schedule, tasks/ submission of students and teaching staff, etc. are presented. This kick-off is a face to face session or held via ZOOM.
2. Self-learning unit about micro- and macro-economic impact of FM
3. Feedback session to answer questions, for a critical review of the learning videos and to show relationships between the topics. This session is again a face to face unit or held via ZOOM.
4. Self-learning unit about the different definitions
5. Feedback session to answer questions, for a critical review of the learning videos and to show relationships between the definitions. This session is a face to face unit or held via ZOOM.
6. Self-learning unit about the practical application of the definitions
7. Feedback session to answer questions, for a critical review of the learning videos and to make a deep dive into the possibilities of the application of the EN15221-1. This session is a face to face unit or held via ZOOM. It also sums up the whole content.

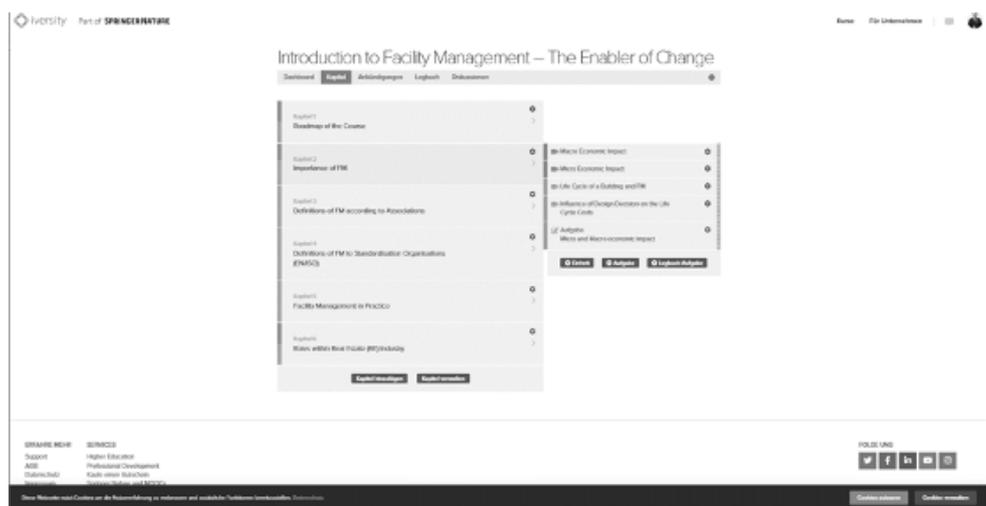


Figure 4: Content of Springer course and details of a chapter

The same concept is also used for the lecture “Introduction into FM” at the TU Vienna. Figure 5 shows the schedule and that the self-learning and the feedback sessions alternate.

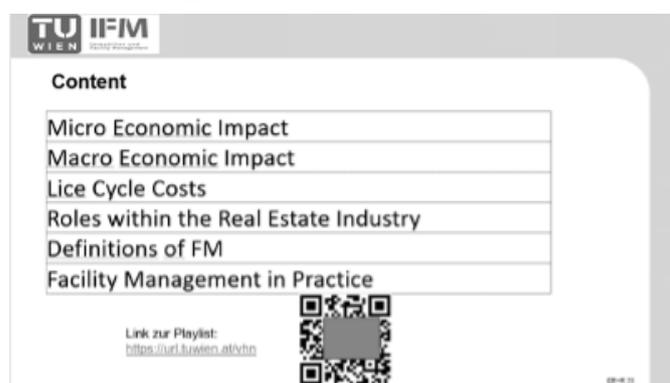


Figure 5: Screenshot of lecture 'Introduction into FM' TU Vienna Content

This method and approach is also used by the IFM’s teaching team when adapting five lectures at three universities. The feedback from the students from all five case studies was very good. Storytelling in particular is perceived as important because it establishes a connection to practice. The possibility of acquiring knowledge flexibly and regardless of location is also considered positive (Erpenbeck et al., 2015). However, the opportunity to receive sufficient personal feedback must remain in order to ensure long-term satisfaction and learning success (Kraft 2003, p. 49 – 51).

Problem-based learning

The second approach is based on the experiences of creating blended learning courses but incorporates the approach of problem-based learning. In this case, the learner should primarily use her/his acquired skills to solve a real problem of practice. This checks whether only knowledge or also the competence to apply the knowledge has been acquired. In a first step the students learn how to model processes based on the example of the “failure handling process”. (Kerres 2018, p. 363 – 370) The first learning videos end with a submission order to the students. The next video starts with an example solution and the common shortcoming. Then the next step is described and another submission is requested. This process consists of six steps. In this way the students learn how to model and optimise processes. At the end of the last learning video, the students get another submission. They have to apply the methodology learned to optimise the preventive maintenance process.

The learning videos can be provided in advance and support the students during their self-study. Despite of the early provision, the videos can be used to call up the knowledge exactly when necessary. This

approach of learning on demand is mentioned by Claudia Bremer in the context of her scientific paper. (Bremer, 2017)

This approach is more likely to be used in small groups, as the learners usually acquire the knowledge in self-study and the teachers act primarily as coaches. Therefore, this method is very laborious for the teachers. Short response times and personal support are very important for the learning success and satisfaction of the learners. At TU Vienna, however, this method was used in an exercise with around 50 students.

Experience shows that European or students of an Austrian university have to familiarize themselves with the method first. The first feedback was from “You dare to do something” to “Super”. The final feedback from the students confirms that they accept the method well and are enthusiastic about the flexibility of the learning method. There was actually no negative feedback. The analysis of the grading of the first two courses shows that the grading was analogous to the last semesters. There was even a slight tendency towards better grades, but this cannot yet be considered statistically relevant.

Again, it should be noted that the teaching team has spent a lot of time on feedback to ensure short response times. In addition to synchronous feedback methods such as Zoom meetings, asynchronous methods such as e-mail or even a ticket system were used. These tools were also extensively used by the students.

CONCLUSION

Overall, based on the case studies conducted, it can be said that blended learning and problem-based learning can be used well in hybrid or even purely virtual teaching. A mix between digital types of content mediation and personal feedback must be used. The cost of this changeover is considerable, but pays off. The results of the case studies show that student satisfaction and learning outcomes in terms of grading are very high.

However, it cannot be assumed that the number of lectures and tutors can be saved, as rapid response times to questions and feedback rounds in sufficient numbers are important for success. The IFM is currently working to test these methods for their suitability also in the field of secondary education, especially in the area of upper secondary education. The initial results show that feedback loops and teacher availability are even more important for success.

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European Facility Management Network (EuroFM) is the platform organization that brings educators, researchers and practitioners in the field of Facility Management together. The aim is to bring forward the FM profession and to come to a better mutual understanding by learning and sharing FM knowledge.