



FABLE PROJECT - IO2 – DI2.1 FRAMEWORK FOR BLENDED LEARNING AND PEDAGOGICAL INFRASTRUCTURE FOR UNIVERSITY EDUCATION

Authors

Adj. Prof. Jussi Kasurinen (D.Sc.) – LUT University (Software Engineering)

Mahyar Mohammadi - LUT University (Software Engineering)

As a reminder, the specific objectives of IO2 are:

The overall goal of IO2 is to design a generic methodology for transforming in-person courses into blended learning courses that takes into account both the topic taught and the level of the students. The IO2 defines the pedagogical engineering methodology to be taken into account by determining the most relevant pedagogical tools and modalities of blended learning, and based on these actions defines a recommendation for the coaching and tutoring process to be set up to help students succeed while decreasing the number of students dropping out of school.



Co-funded by the
Erasmus+ Programme
of the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



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Introduction

This report introduces the results from the study conducted by LUT University to establish a framework and understanding on how online education, hybrid education and blended education are arranged, what is the state-of-the-art of the practices, and how these practices could be extended to new organizations.

These results combined with the report *Di2.2 Survey on blended learning methods in university education* provide the knowledge and information for enabling organizations to assess their skills and the existing infrastructure against observations made from the pre-existing research literature, and mapping the current trends of the blended and hybrid learning.

The results of this report are also a part of a larger research project, from which a Master's Thesis work titled *"Current trends of blended and hybrid learning, Case study: FABLE Project"* available via LUTpub document database was written.

Framework study

The framework study was conducted as a systematic mapping study, with the intent of discovering the current trends on online education. The timespan of the study focused on post and during-COVID19 pandemic, years 2020-2021, because it became apparent that it has had a large effect on the purposes and objectives on why higher education applies online approach to its pedagogical methods.

BLENDED LEARNING AS A CONCEPT

Blended learning is more than just combining face-to-face and online teaching. The most challenging problem is determining the right combination of appropriate learning venues and instructional strategies to meet the learning objectives. Many teachers are unfamiliar with the phrase "blended learning" as a twenty-first-century concept. Despite its importance, many commercial and public organizations viewed the rise of technological applications with suspicion. (Fiel, 2020.)

Researchers commonly use the phrase blended learning. Nevertheless, what precisely do we imply when we say "blended learning"? Truitt and Ku (2018) mention that the word "blended learning" generally refers to using technology to allow students to learn multiple times, places, and speeds. Various models that define how blended learning appears in the classroom are included in this term. In today's schools, there are a variety of blended learning methods.

Kumar et al. (2021) described blended learning as an online learning experience that assists students in engaging in meaningful learning through flexible online information and communication technology, less overcrowding in the classroom, and a structured teaching and learning approach. Abusalim et al. (2020) pointed out that blended learning, often known as hybrid or mixed learning, can take various forms depending on the definition used. There is not just one definition of blended learning in the literature.

According to Driscoll (2002) and Harvey (2003), Blended learning can be termed blended learning even if it takes place entirely in the classroom because a component of class work is completed by students utilizing online resources in classrooms. According to Graham (2006, 2013), Blended learning combines traditional and online learning. Finn (2004) and Boelens et al. (2015) clarify that combining traditional and online learning collects the benefits of each, ignoring the disadvantages of each. According to Boelens et al. (2015), blended learning is reduced face-to-face class time.

RESEARCH METHOD

Budgen et al. (2008) state that A systematic mapping study is an objective technique for evaluating the kind and scope of the available research to address a specific research question. These types of studies can assist in determining research gaps and suggesting topics for additional analysis. As a result, they offer a structure and framework for future research efforts to be appropriately designed.

Systematic mapping research is an excellent way to study blended learning trends. A mapping study is a type of literature review that tries to examine a primary issue by identifying, evaluating, and organizing the goals, methods, and contents of prior research that is done. As a result, current research, research gaps, and matured sub-areas may be recognized and explained (Budgen et al., 2008). Petersen et al. (2008) state that a systematic mapping study's primary objective is to offer an overview of a research field and determine the quantity and type of accessible research and findings within it. Plotting the frequency of publication through time is a systematic way to detect patterns. An additional goal may be to discover where research on the topic has been published.

Included databases

The below top scientific literature digital libraries are selected based on prior positive experiences:

- Google Scholar
- Springer Link
- LUT Primo
- IEEE Xplore

The number of hybrid / blended learning subjects published has continuously increased. According to Google Scholar, 1450 scholarly publications were published in 2020 and 501 already in Q2/2021 when this mapping study was conducted.

Inclusion and exclusion criteria

The papers, including blended learning, online education, and best practices, were identified as meaningful regarding the research questions. The following criteria were used to choose the articles:

- The title or abstract of the article discusses blended learning explicitly.
- The title or abstract of the article mentions hybrid learning explicitly.
- The abstract discusses the blended/hybrid learning topic at the higher education level.

Regarding the research questions, the papers were skipped if they were not about

blended learning or were about blended learning outside of the software engineering area. The following were the article's exclusion criteria:

- The paper was about blended learning but not related to software engineering.
- The paper was not accessible as a whole.
- The paper was written in a language other than English.

With these limitations a list of 36 primary documents were identified. The initial primary document set was built with a pilot search, from which some results are listed in the Table 1. The primary documents identified are also listed in the references of this report.

Table 1. Pilot search results, examples

Source	Search string	Results
Google Scholar	“Blended learning & online education & best practices.”	2020 → 1460 papers 2021 → 501 papers
	“Blended learning models & online education & best practices”	2020 → 2620 papers 2021 → 885 papers
	“Blended learning & e-learning & online education & distance learning”	2020 → 2750 papers 2021 → 1110 papers

Mapping study results

In this section we present the most important observations. More details on the results and the background research process can be accessed via this link :

<https://urn.fi/URN:NBN:fi-fe2021120759335>

Which is a permanent link to the LUTpub database and links to the thesis manuscript of 2th author of this report.

Reading the approved papers and analyzing how they presented issues linked to the study questions helped categorize the articles. The title, publication year, and the most critical topic of interest were all taken down from each paper. After reading carefully the reports, based on the criteria, the total number of the accepted articles is reduced to 36 unique papers. Figure 1 shows the main categories considered from the studies.

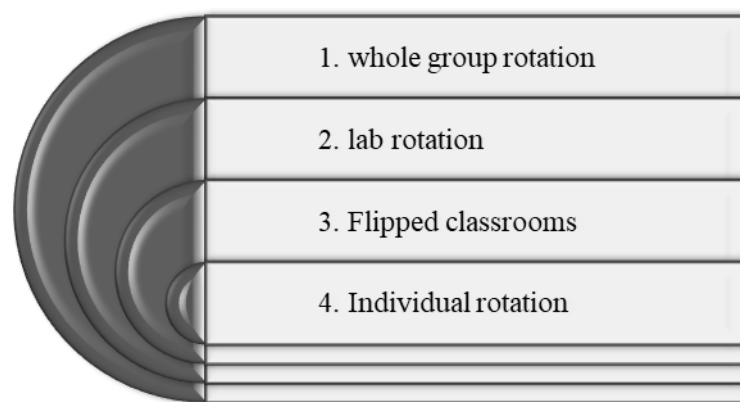


Figure 1. The main categories of articles regarding blended learning

The most popular blended learning method is Whole Group Rotation, with 27 papers. The following popular approach is Individual Rotation, with 23 articles. Next, Flipped Classroom is discussed in 11 reports. The least popular blended learning method is Lab Rotation, with only four articles. Figure 2 demonstrates the distribution of the articles in each category.

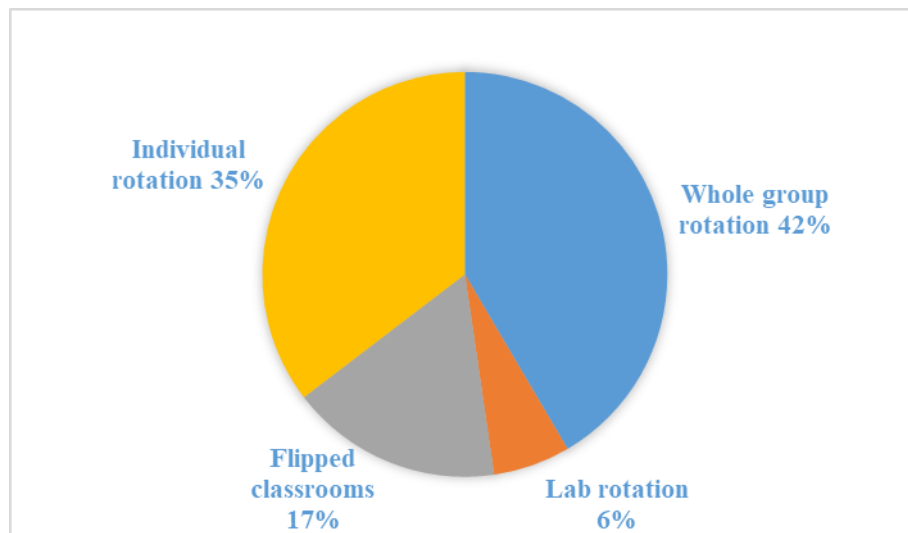


Figure 2. Number of papers in each category

For studying the current trends in blended learning, the papers which are published since 2020 are considered. Due to starting the thesis research in July 2021, most articles are from the beginning of 2020 to the second quarter of 2021, and only two papers are found for the third quarter of 2021. Figure 3 shows the distribution of articles by publication date in each category.

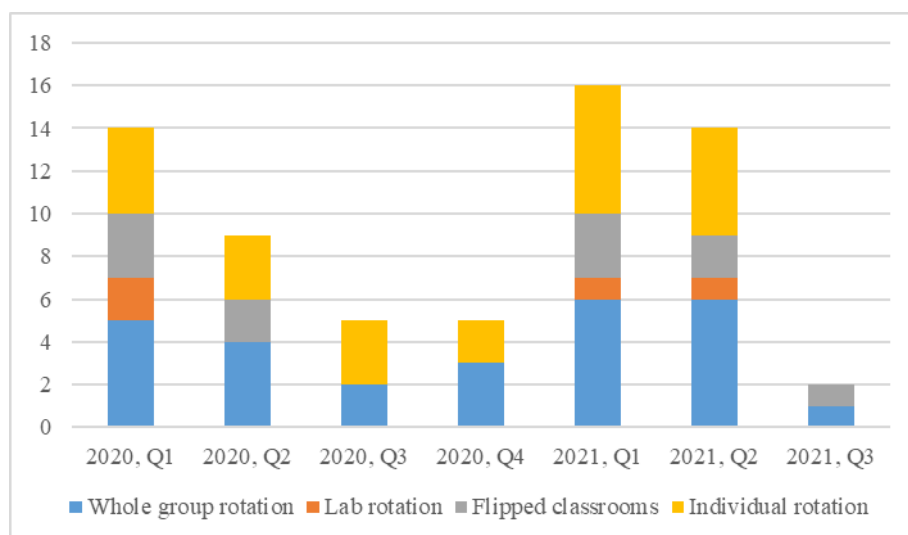


Figure 3. Papers in each category, ordered by date of publication

The papers are mainly found in the five digital databases including IEEE Xplore, Springer Link, Elsevier, Sage Pub, Emerald Insight. The distributions of papers that use the specific digital databases in a total of 36 blended learning trends are shown in Figure 4. With 18 articles, SpringerLink had far more articles.

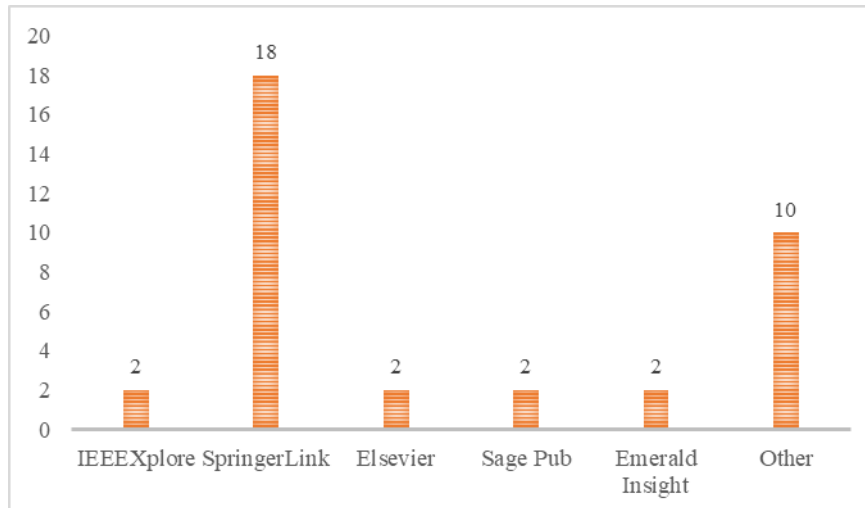


Figure 4. Blended learning trends results by specific digital databases (n=36)

The systematic map of blended learning trends is displayed in Table 3. The table shows the categories and articles for each type. The following section summarizes the key results from the papers.

Table 2. The systematic map

Group rotation	Lab rotation	Flipped classrooms	Individual rotation
(Moorhouse & Wong, 2021)	(Campos et al., 2020)	(Moorhouse and Wong, 2021)	(Antwi-Boampong & Bokolo, 2021)
(Astudillo & Martin-Garcia, 2020)	(Bartuseviciene et al., 2021)	(Lapitan et al., 2021)	(Astudillo and Martin-Garcia, 2020)
(Stavtseva & Kolegova, 2020)	(Jackson et al., 2020)	(Zhao et al., 2021)	(Stavtseva and Kolegova, 2020)
(Hien Vo et al., 2020)	(Dong et al., 2021)	(Williams and Corwith, 2021)	(Lockee, 2021)
(Ustun et al., 2021)		(Abusalim et al., 2020)	(Hien Vo et al., 2020)
(Geraldine et al., 2021)		(Richardson et al., 2020)	(Ustun et al., 2021)
(Armellini et al., 2021)		(Alqahtani and Rajkhan, 2020)	(Geraldine et al., 2021)
(Zhao et al., 2021)		(Mavengere et al., 2021)	(Armellini et al., 2021)
(Hamann et al., 2021)		(Dong et al., 2021)	(Zhao et al., 2021)
(Kingsbury, 2021)		(Rosenbusch, 2020)	(Hamann et al., 2021)
(Campos et al., 2020)		(Julia et al. 2020)	(Sisttermans, 2020)
(Zhu et al., 2020)			(Martin et al., 2020)
(Sisttermans, 2020)			(Dolenc et al., 2021)
(Dolenc et al., 2021)			(Salta et al., 2021)
(Salta et al., 2021)			(Bartuseviciene et al., 2021)
(Bartuseviciene et al., 2021)			(Jackson et al., 2020)
(Williams and Corwith, 2021)			(Chaeruman et al., 2020)
(Jackson et al., 2020)			(Richardson et al., 2020)
(Chaeruman et al., 2020)			(Roslinda Fiel, 2020)
(Abusalim et al., 2020)			(Mavengere et al., 2021)
(Hamdan et al., 2021)			(Dong et al., 2021)
(Richardson et al., 2020)			(Rosenbusch, 2020)
(Roslinda Fiel, 2020)			(Julia et al. 2020)
(Mavengere et al., 2021)			
(Dong et al., 2021)			
(Rosenbusch, 2020)			
(Sunita, 2020)			

Conclusions

In this report we summarize our findings from a systematic mapping study conducted by LUT University on the topic of understanding the trends of hybrid and online education. Based on 36 primary documents also listed in the references, we were able to identify 4 main pedagogical approaches to the online learning.

Combining these results and the primary documents with the observations data reported in the *Di2.2 Survey on blended learning methods in university education*, we aim to provide the framework from which all institutions of higher education build their online learning modules. In these reports, we have identified primary sources for information, observations on what works and what does not, and in all, provide resources and ideas which different institutions can use as the base level for assessing their online education needs.

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contact@fable-project.com www.fable-project.com

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