Blended Learning: quality framework for a pan-European universities network

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Abstract

Blended Learning (BL) offers advantages for all the stakeholders involved in the educational process (students, teachers, management), and has a positive impact on the quality of students' learning and degree of knowledge acquisition (Akyol, Harrison Azden 2009). It is an institutionalized methodology with respective implementation policy and learning approach implications, although assessing the quality of BL (QBL) remains a complex task (Wallace, Young 2011).

Developed in a partnership of currently 18[1] European universities (EIT Digital Network), the EIT Digital Master School offers education not only in the technical major components of its master programmes in ICT but also in an Innovation and Entrepreneurship (I&E) minor, which counts for 30 ECTS (European Credits Transfer System) in the 120 ECTS master programmes. To harmonize the I&E education across the network of universities, enhance pedagogical cooperation and enable distribution of pedagogical material among partner universities, the best teaching materials, co-designed and co-produced by partners, constitute a data-base of online contents made available through a common repository (Dion et. al 2019). In a BL approach, the shared contents constitute the online component of the I&E courses taught by each partner university and is combined with face-to-face (F2F) pedagogic activities, employing different BL models (flipped class, online pre-packaged content, independent learning, etc.). Online contents are organized in sets of around 5-10 min videos, which teachers can select, combine and package in various ways, in accordance with the needs to structure and deploy their I&E courses. The same online content is available for all universities, but their combination and the blending models applied depend on the courses, allowing for a level of differentiation on top of the harmonized online contents.

This context of networked partners using shared online contents, with the opportunity to employ different BL models, has led EIT Digital to conduct a set of experiments and define a quality framework to assess the learning impact of BL models implemented in I&E education and provide insights on how to select and/or improve these models. To have comparable results and share lessons learned, the EIT Digital partner universities have conducted experiments based on a common frame for setting them up and for reporting the experiments' results. Drawing upon this methodology, the paper describes an approach to define a framework - based on four components *efficiency, effectiveness, impact and scalability* - to assess the courses QBL in a pan-European network of universities. Moreover, the paper explores how to valorize the collected results for improving the quality of BL models and methods used in the courses. Such findings may be relevant in the context of other European Universities networks - sharing similar characteristics - as an approach to leverage the value of such networks for increasing the education quality.

1. Introduction

This paper employs the definition of Heinze & Procter (2006) according to which BL is learning facilitated by the effective combination of online and face to face different modes of delivery, models of teaching and styles of learning and founded on transparent communication amongst all parties involved with a course. Despite various models and deployment approaches, BL (known also as hybrid learning) refers in education literature to the learning process, where the component of online learning is combined with face-to-face teaching (Pisoni 2018).

Empirical evidence from experiments conducted in various Higher Education Institutions (HEIs) argues that BL offers key advantages such as: a) it reduces class-time as the learning process is partially conducted in pre-class online modules; b) it leaves in-class time to develop a constructive debate among students F2F (or online) promoting a more participatory learning approach and discussion of concepts in a critical perspective (Vaughan 2007); c) it leaves additional time to deepen further the discussion on the learning topics or to expand it by introducing new relevant

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aspects; d) it puts students in control of their learning path (Hannafin 1984); e) it allows for a paradigm shift of focus from lesson to students. Scholars consider that thanks to these characteristics, BL helps students to reach better results, which has developed the debate on how to assess the quality of BL and its positive impact (Singh 2013).

To harmonize the I&E education delivered across the EIT Digital Master School partner universities, the I&E teachers' network put a process in place to constantly increase the quality of the I&E courses. In parallel, the network has been following, for various editions, an approach of assessing the quality of the BL models deployed in the I&E courses by exploiting the qualitative feedback received by teachers and students thanks to a process of annual courses' evaluation. This qualitative feedback helped network partners to identify clear strategic actions to further improve the methodologies and deployment features of our BL models.

However, the I&E network of teachers considered to move one step further and complement the qualitative feedback with quantitative data collected from within the BL courses. The network has been facing the question: how to assess the quality of BL? Which are relevant indicators that would enable the identification of critical issues in BL and address them? How to ensure that learnings can be shared to improve quality of BL in a repeatable/replicable approach? Scholars agree that there are various methodologies on assessing the QBL (Bowyer Jessica and Lucy Chambers 2017, Guangzhi Qu and Lunjin Lu 2012, Holley, D., & Dobson, C 2008). The discussion, however, needs to start a step earlier with the definition of the quality of BL, which serves as a starting point for this paper.

However, the final objective of this paper remains the provision of an approach to assess the impact of BL on the quality of courses in a network of universities. To achieve that, this paper draws upon two aspects: a) assessment of longitudinal qualitative data received in several years (2013-2018) through the evaluation of the EIT Digital Master School I&E courses, by teachers and students; b) a set of experiments applied in our network of universities - based on a shared quality framework for BL - aiming at identifying quantitative indicators for assessing the quality impact of BL models and methodologies on the I&E courses. Experiments were different in nature and partners came up with settings, focused on investigating different aspects of the quality framework in the context of their particular courses implementation.

However, as mentioned above, the first step is to provide a shared assessment framework of the QBL. Hence, in the following section, this paper provides a framework for assessing the quality of BL in a network of universities, which share the same online contents and interact through the same online education platform. The third section shares the EIT Digital qualitative assessment of the QBL in the EIT Digital network of universities, while the fourth provides an approach to define the framework and quantitatively assess the QBL in the EIT Digital network. Conclusions and future work perspectives are the object of the final section of this paper.

2. A framework to assess the QBL

In a sociological approach, a way to define a complex concept is to split it into sub-concepts easier to define. This paper offers a multi-dimensional framework of QBL, which is appropriate for both qualitative/structural analysis of the BL benefits and quantitative analysis of the BL models employed to identify their benefits (or criticalities) and individualize the activities for improvement. Moreover, the framework of defining the quality of BL cannot be limited to the definition of the QBL in per se; considering the needs of the EIT Digital I&E education, this paper intends to move a step further with our QBL initiative by aiming at assessing the performance of blending models with regard to four dimensions:

1) Efficiency: ability to use more appropriately teachers' interaction time with students;
2) Effectiveness: how much do students develop target skills and competences, with regard to the intended learning outcomes (ILOs);
3) Impact: on internal stakeholders (i.e. course teachers) and external stakeholders (i.e. students, the ecosystem: EIT Digital companies, start-ups) involved in I&E education;
4) Scalability: economy of resources when growing in the number of students and/or to replicate in multiple universities and courses (repeatability).

Why these four dimensions? There are two principal reasons for that: a) these dimensions encompass the key benefits of BL according to the literature and above all remain key value for evaluating the QBL of the I&E courses in the EIT Digital perspective; b) all four dimensions are versatile and can be employed in assessing both the qualitative feedback

received by students and teachers on the BL courses (qualitative assessment) and offer the opportunity to identify measurable indicators for quantitatively assessing the performance of each of BL models.

Now that it has been provided a framework for conceptualizing the assessment process of the QBL in a network of universities according to the EIT Digital approach, the paper can re-consider the impact of BL on the quality of courses by employing: a) the longitudinal qualitative data approach to claim that BL improves the course quality; and b) the feedback of experiments conducted to define a framework for a quantitative analysis to assess the impact of BL in the I&E education of the EIT Digital Master school program. This dual approach is employed to advance the claim that BL applied in a university network enhances the quality of education.

3. EIT Digital qualitative approach to assess the quality of BL in the EIT Digital network of universities

Since 2015, the focus of the EIT Digital Master School I&E community has been to progressively blend the I&E courses, according to various 'blending models', by increasingly introducing EIT Digital online contents in I&E. The goal has been to achieve a real and structural impact on the way the I&E is taught in partner universities, by encouraging I&E teachers to apply different strategies for using BL, while involving them to jointly design the EIT Digital I&E courses. Thanks to the feedback received by students and teachers during the years of BL deployment in the I&E, the network has collected information to conduct a qualitative/structural analysis of the BL courses benefits within our network of 18 universities. This analysis - drawing upon the reports on the I&E blended courses – has been conducted by employing the four QBL dimensions: efficiency, effectiveness, scalability and impact.

1. **Efficiency:** *ability to use more appropriately teachers' interaction time with students*.
    - BL education offers to our I&E teachers the opportunity to perform in a more efficient manner. Since part of components and concepts are explained in the online content, to which students go through individually, teachers have more available time to discuss in depth about these concepts with students, while the latter improve in the process their critical thinking capacities. If needed, the earned time can be exploited by teachers to offer tailored support to individual students (i.e. on course content) or group of students (i.e. on their team work on a company challenge).
    - Moreover, BL models give more flexibility to the students and learning can happen at different locations: additionally, it leaves space for planning of shared activities between the Universities (Pisoni et.al 2019), improving in this way the complementarity of competences from various I&E teachers in the network. This further improves the quality and consequently the cost-efficiency ratio of the course.
    - Harmonization of courses and shared online content increases efficiency since teachers spend less time in crafting and deploying the I&E course, while addressing in more precise way the ILOs.
2. **Effectiveness:** *how much do students develop target skills and competences, with regard to the intended learning outcomes (ILOs)*.
    - BL education increases the degree at which our teachers fulfil the ILOs and/or expected result from students. BL modules increase (move at an upper level) the standardized value of the courses, since the BL allows the use on each I&E topic of shared content prepared by teachers with the best expertise on that specific topic.
    - This shared content will also help the other teachers to converge at the upper level of quality and introduce/implement and enhance the new concepts and methodologies in their courses.
    - BL is flexible, so it can be integrated in courses strongly based on a project-based pedagogy (key aspect for the I&E education). It provides more effective I&E education by virtually *bringing entrepreneurs* (or any other roles in the innovation ecosystem) *in the classroom*. Various online contents are produced by partner universities, in cooperation with entrepreneurs, aiming at providing different typologies of entrepreneurial cases for students. Thanks to the shared online contents, all network universities can access that content enriching their I&E courses and improving the quality of education.
    - Shared online content enriched by all partners allows teachers to select for their courses the most appropriate entrepreneurial cases or company challenges.
    - Create a 'red thread suite' around the I&E Minor, consisting of a number of blended courses, based on a selection of mandatory online modules, covering most distinctive topics of the EIT Digital I&E education, while the BL model remains to be decided by the teacher. Beyond harmonization and convergence, this approach has ensured an overall increase of the courses' quality in the network, since the online content in the specific I&E topics is produced by the universities with the most appropriate expertise in the area.

3. **Impact on stakeholders** *internal (course teachers) and external stakeholders (students and the ecosystem i.e. EIT Digital companies, start-ups) involved in I&E education*

a. Course Teachers

- Innovativeness: a constant exchange of experiences and best practices leads to innovative approaches in addressing I&E concepts and arguments through BL. This allows teachers to provide tailored blended approaches considering specific needs of their students.
- Community of I&E teachers keeps improving in terms of capacity building and teaching performance.
- By building the complementarity between high quality I&E contents that partners can offer on each I&E topic and flexibility for each partner to implement the most adequate BL models in the proper courses, the BL increases the quality of learning in each partner of the network.
- Online content - co-designed and co-produced by partners of the I&E network, based on the evidenced needs and qualitative feedback received by teachers and students - is shared on the online education platform enabling *the pedagogical cooperation* across partner universities. In a constant exchange of best practices and achieved results of the applied BL models and methodologies, each network partner manages to identify the most appropriate online content and deployment approach of the BL education, which contributes to improve the quality of taught courses in each partner university.
- As explained above, this pedagogical cooperation has a short-term effect on the quality of the I&E BL education as partners exchange the best-practices and the most qualitative online content. However, this approach of the shared BL education in a network of universities, has also a long-lasting impact on the quality of BL as it enhances the process of capacity building among partners. This feedback received by members of the EIT Digital I&E network holds also for *new-member*s as they also embark in the capacity building process, when starting the implementation of the EIT Digital-compliant courses.
- Thanks to this process of capacity building, the I&E network partner universities manage to go *through a reflexive process in their overall offer* where BL or online education is applied. The methodologies and models of BL in the I&E education can be replicated with minor adaptation efforts to other I&E courses offered by partners contributing in this way not only to the development of the EIT Digital I&E Education assets but also to the development of assets from partners' universities at a broader scale.

b. Students

- BL emphasizes teaching methods based on *students' activation*: models such as flipped classroom demand students' activation on the specific I&E course topic either by discussing the concepts in class or preparing brief presentations on the concepts explained in the online content to boost class-discussion. In different implementation approaches of this model, students are called to be pro-active and to lead the discussion or explain key-concepts in the F2F sessions.
- The activation of students at various levels creates the opportunity of reflexive learning, since by interacting with other peers during discussions or team-mates in team-work, they examine and improve their own initial assumptions on concepts and shape their learning attitudes with a clear benefit on the quality of learning.
- BL impact on improving students' performance thanks to more efficient/effective teaching methodologies, since innovative learning approaches attract and stimulate students' attention and participation.
- F2F discussion, which follows the online content or group-work on company challenges can further develop students' capacities to benefit from a project-based education. BL models offer the opportunity for students to learn by doing such as for instance team dynamics, especially when the online-content relates to concrete entrepreneurial cases or company challenges to be addressed by the entire team.
- BL increases the student-centricity since students interact with the online material on the individual basis and so they are encouraged to build up their understanding of discussed concepts and then participate in class debates to evaluate the soundness of these concepts either by interaction with the teachers or thanks to the critical feedback provided by their own peers.
- In various course activities, such as peer-to-peer ('P2P') reviews or team work, students interact with each other through the education platform in de-localized activities. This approach has a direct impact not only on improving the quality of learning (since students develop a more autonomous approach of learning and are in permanent constructive debate with teachers and peers from other universities) but it provides also

a long-lasting effect on improving students' capacities to critical thinking and de-localized collaboration; both skills increasingly demanded in the labor market.

- The red-thread suite approach ensures not only a highly-levelled quality for all students, which remains a must for the EIT signature, but also helps them to create a sense of *knowledge shared community* within the EIT Digital Master School. This shared base, throughout the network, can be further leveraged to achieve qualitative interactions – through shared pedagogical activities – among all EIT Digital Master 400 students regardless the partner university, where they attend the master program.

c. Ecosystem (companies and start-ups)

- Meaningfulness of concepts and arguments in relation to the needs of entire ecosystem's actors, since tailored blended content is produced and shared in the I&E network to address ecosystem needs.
- Added value for the stakeholders (students, companies, other HEIs) to address their specific needs.

4. **Scalability:** *economy of resources when growing in number of students or network partners*.
    a. A blended education approach is instrumental in this process by allowing for the dissemination of shared contents. This approach is also flexible enough to deal with different situations at universities (maturity, legacy, specific local assets) by using different blending models. In this way, the network has ensured the harmonization of learning outcomes (thanks to the shared online contents and common education platform), while preserving the characteristics of each university, by allowing each partner to implement the BL models identified as the most appropriate ones.
    b. Blended education is a natural way to foster dissemination of common online contents and best practices in a universities' network by enabling harmonization while being flexible to adapt to local circumstances.
    c. Increase the cost-efficiency and scalability (in number of students) as BL models allow to have a higher number of students acquainting a superior level of knowledge/competence transmitted in the same amount of F2F time. Improving scalability remains key condition to improve quality specially in courses with a high number of students. Regardless the number, students are equally exposed to online learning concepts and participate in the F2F process of building knowledge for themselves and their peers.
    d. Besides the Red Thread Suite courses, pre-packaged online contents provide blue-prints for the major number of the I&E courses, which improves the scalability for new partners to deploy the I&E courses.
    e. Repeatability - i.e. ability to replicate the use of same BL models - with limited costs - in other courses or partner universities.

4. An approach to define a framework and assess the I&E QBL in the EIT Digital network of universities

When moving from the qualitative assessment to the quantitative assessment of QBL, the key objective remains to assess the performance of blending models with regard to the four dimensions: a) Efficiency i.e. ability to better use teachers' and interaction time with students; b) Effectiveness i.e. how much do students develop their skills and competences, with regard to the ILOs; c) Impact i.e. value to stakeholders, students, teachers, companies; d) Scalability i.e. economy of resources when growing in number of students. To conduct a quantitative assessment of performance for each of BL models and identify measurable indicators, a set of experiments on BL courses has been implemented.

4.1 Setting up the experiment

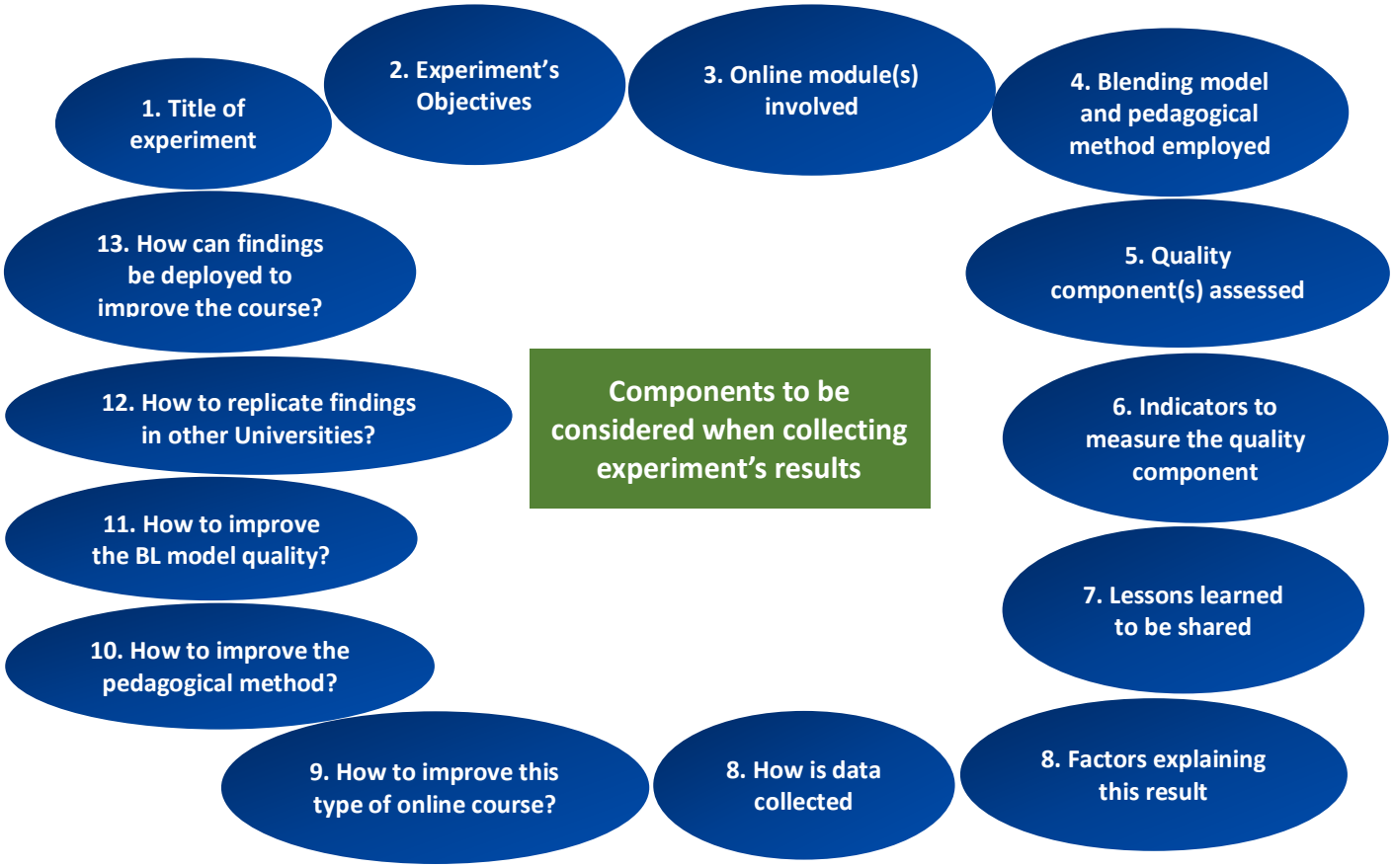
To ensure the experiments' soundness, *a framework* has been setup jointly with partners. Partners had to identify the BL courses, blending models and/or related pedagogical methods on which the quantitative analysis to assess the impact of BL would be conducted. This analysis regarded primarily:

- BL model applied i.e. whether other BL models were more appropriate for that course *(effectiveness)*;
- BL methodology i.e. whether the BL model has been appropriate but the methodology of application can be improved for example by a different combination of online and F2F elements on the course, different workload or tasks for students, application period of each step and harmonization of BL model elements *(efficiency)*;
- Online content, i.e. whether content was adequate or additional elements need to be introduced to increase its impact and compliance with students' expectations, online content capacity to be absorbed effectively by students in terms of sharing content in an interactive and thought-provoking approach *(impact)*;
- how to be *scalable* i.e. share the results with other partners in the network with little adaptation cost.

The need to address these priorities and to easily share the collected findings among partners in a compatible approach led to the definition of a common template for collecting results of experiments (presented in Figure 1). A key aspect

in the experiments' structuring process has been the latter's capacity vis-a-vis repeatability. It is key to assess whether the models or methods are replicable – at reasonable cost – since there is no point in promoting them otherwise. This aspect remains also paramount to the scalability.

Fig. 1 Framework for Conducting and Reporting on the Experiment



4.2 Some initial results of the first wave of experiments on QBL

The key findings regarded the quality component assessed in the experiment, indicators to measure that component and lessons to be shared with other partners.

One of the experiments investigated if teachers managed to save time in classroom by offering to students an online exercise - so to provide an incentive to master the online content - prior to the F2F lecture. To assess this component, it was used as the quantitative indicator the number of videos which needed to be otherwise watched in class. The experiment found that, thanks to the BL, sufficient time was saved to deepen the argument or cover other topics.

Another, experiment analyzed the component of online vs F2F learning in BL to identify the appropriate balance of these components, while seeking for adequate incentives that the teacher needs to provide so students will watch the online-videos at home. The experiment found that an effective way to do that was to ask students to summarize in one page, the videos and/or prepare three open questions for in-class debate. This approach demanded students to be able to extrapolate and digest the concepts from the online content so as to be able to participate in the class-debate.

A different experiment provided helpful feedback in terms of the online content, as it found out that students prefer to have transcripts in parallel with videos in order to accelerate the learning process of the online content. In this way, students can skip the familiar arguments and improve their learning efficiency.

Another experiment, assessing students' expectations from the course as a pre-condition to increase their learning incentive and consequently the achievement of the ILOs, discovered that students prefer to co-design with the teacher the balance between the learning concepts presented online and those discussed in-class. This helps course teacher to apply a BL model, which matches students' characteristics for each course rather than using one jacket fits all approach.

A positive overall outcome from the experiments is the partners' finding that little effort is needed to adapt and re-deploy findings in a network of universities that shares the same online contents and education platform. This aspect

was considered by all experiments as it facilitates the process of up-scaling and replication (repeatability and ability to share improvements that need to be replicable) of successful methodologies, BL models and improvements identified in one partner university can be straightforwardly replicable in other network partners thanks to the low adoption cost.

5. Conclusions and future work

The qualitative feedback from courses annual evaluation and initial results of deployed experiments have indicated that BL methodology has a positive impact on the course quality, when applied in a university network, which shares the access to the same online contents and education platform. The BL can improve course efficiency in terms of timing, effectiveness in terms of quality, but also the impact on external stakeholders i.e. companies and students. In such network of universities that shares same online contents and education platform, the adoption efforts to introduce best-practises or up-scaling activities is reduced (experiments' showed that both tasks demanded limited efforts). From our experiments it appears that BL has specific positive impacts on the I&E courses quality, such as:

- BL is not only compatible but it also enables/eases the implementation of *hands-on experiential* I&E Education thanks to reflexive learning of students and exposure to entrepreneurial and company cases. Different combination of the online sets of videos allows the I&E teachers to experiment in terms of course composition.
- BL enhances *the harmonization* of courses in a network of universities, increasing the efficiency (in terms of course preparation time for teachers), improving effectiveness (as the best quality content is available for students) and improves scalability (in terms of more students exposed to a higher level of knowledge for the same F2F time as well as the reduction of adoption time for new-partners in the network).
- BL increases education quality *by leveraging* richness of expertise in a network of universities, building upon specific complementary capacities of each partner as a key component for improving the quality of I&E courses.
- Common distributed online platform can be leveraged to organize a Distributed Education Environment *with distributed pedagogical activities* across distributed students and classes (as a facilitator for collaboration between teams of students and teachers);
- BL is *a way to improve students'/teachers' interaction with companies*: through webinars, case studies;
- BL is a way to *integrate students' assignments P2P reviews and exercises* (locally or at the network level);
- BL is a way to *leverage our network, making it a differentiator for the EIT Digital*.

As a conclusion, this paper can advance the claim that BL applied in a university network enhances the quality of education. This is a first attempt to define quality of BL and what it means in our specific context. Two additional steps may be considered when implementing this approach in a similar network of universities: a) valorisation of experiments results; b) new experiments, to assess other or the same components of quality by using different indicators.

a) The valorisation of experiments can be divided into two steps:

I. Partners implementing the experiments refine further on how the quality component considered in their experiment can be assessed by measurable indicators they have identified. So, partners provide, at the end of this stage, the indicator to assess the quality and the methodology on how to conduct this assessment process (i.e. how to collect data). This approach offers a clear methodological correlation between the quality component and the measurable indicator to quantify the progress or impact made. In this way, the network will come up with a matrix of quality components and the indicators to assess them in their context of use. This matrix will be available to all partners to assess the QBL in their courses.

II. Partners propose needed changes to improve: the used blending model; the pedagogical method; and how to share the experiences and results with other partners. All those proposed changes will contribute to improve the QBL in the network and can be deployed and implemented in the following university year. Deploying these results timely, will offer the opportunity to assess the progress made, once the employed model/methodology has been improved. In this way, the network can identify the best working blending models and pedagogical methods.

b) In the process of valorization, teachers may have identified other key components of the QBL and so new experiments to assess other or the same (by using different indicators) components of quality can be conducted.

Finally, at an organizational level, future work could be focused on two principal directions:

- Assessing the applicability of our approach to other blended courses and pedagogical activities in other disciplines and courses formats.
- Assessing the applicability of this approach in a larger context of European Universities networks, which share similar patterns, as an operational way to leverage the value of such networks to increase education quality.

Acknowledgments

The authors would like to acknowledge and thank all the teachers and students who take part in the 'going blended' initiative. We would like to thank EIT Digital for supporting such large-scale pedagogical cooperation and thus making this work possible.

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