Sustainable Learning Design: a case study of eight undergraduate science module interventions

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Abstract

This article presents the results of a case study of eight undergraduate science modules on factors for sustainable Learning Design interventions. Using a mixed-methods approach involving educator interviews, statistical data, screening of learning designs based on a furthered learning design model (STREAM), student surveys, and an efficiency assessment based on the concept of Efficient Learning Design, a total of six factors for sustainable Learning Design in the context of science higher education related to the educator perspective and the actualised learning designs are identified. The article concludes that in addition to the direct factors such as the number of enrolled students and repetition of modules, the educators' consideration for the institutional cost-benefit perspective, their perceived usefulness of technology-enhanced learning and buy-in of its related pedagogy, the students buy-in of technology-enhanced learning, and a consistent structure with online activities, reflection exercises, and feedback are significant underlying factors for efficient and sustainable Learning Design.

Keywords

Learning design, sustainability, Efficient Learning Design, technology-enhanced learning, designs for Networked Learning

Introduction

The ambitions for educational technology and technology-enhanced learning (TEL) in higher education are continuously growing in the light of the need for widening access, maintaining quality, supporting online and distance education in the context of the Covid-19 lockdown, and avoiding dramatically increasing costs (Daniel et al., 2009). As a consequence, Learning Design is currently gaining footing as an educational development methodology to systematically introduce educational technology in higher education in a potentially effective and efficient manner. Learning Design has demonstrated a potential for supporting educators in introducing educational technology in higher education in a pedagogical qualified and potentially effective way supported by pedagogical models or through an orchestrated process (Bennett et al., 2014; Conole, 2013; Dalziel, 2016). However, as most research on TEL is focused on the effectiveness of the technology and applies different methods to measure this across cases, there is a pressing need to investigate the balance between efforts and effects, i.e., the "efficiency" (Godsk, 2022), as well as to look for design and delivery factors that are important for making learning designs efficient and the delivery sustainable across modules. Based on a large-scale Learning Design initiative at a science faculty, this study includes science educators who have participated in Learning Design workshops, designed, and implemented blended and networked learning designs in their modules. To guide the research the following research question was phrased: What are the learning design and delivery factors for sustainable Learning Design interventions in science higher education?

Background

The context of this study is a large-scale science faculty covering all traditional subject areas ranging from Science and Mathematics to Engineering and Computer Science. The faculty is research-intensive with an annual turnover of 341m euro of which 44% originates from external research grants. 7,053 students are enrolled across the programmes and there are 1,731 members of the academic staff (2019). In 2017 the faculty introduced an ambitious strategy for TEL to improve students' preparation out-of-class, feedback, independence, collaborative, and reflective competencies; as well as give educators insight into the students' learning outcome and level of understanding and competence. In addition to the TEL strategy, the educators had additional, module-specific goals with introducing technology.

The Learning Design process was organised as a two-step process. The first step was a three-hour workshop that introduced the ambitions of the Learning Design methodology, the flexible STREAM Learning Design model (Figure 1; Godsk, 2013), the potential of TEL illustrated by 4–5 local cases, and included a hands-on session, where the educators shared experiences with TEL as well as clarified goals and key pedagogical features of their redesign and their intended use of technology. STREAM was used as a flexible but consistent framework to present pedagogical ideas during the process, which made it a useful starting point for analysing the actualised learning designs and associating this with the effects of the module delivery.

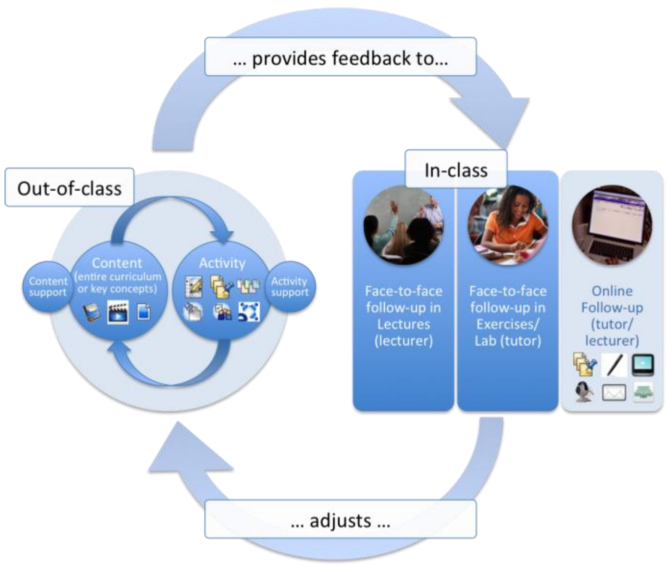

Figure 1. The STREAM Model.

The workshop was followed by an optional second step in which individual in-depth representations of the learning designs were developed and technical implementation and media production support was provided. After the workshop, ad hoc pedagogical, technical, and media support were provided as needed as well as an optional follow-up workshop one year later. Approximately, half of the educators participated in the second step of the workshop and made use of the subsequent ad hoc support.

Methodology

The research is based on a mixed-methods case study of eight module interventions. The modules were sampled by inviting all science modules that have completed the structured Learning Design process starting December 2018 with module delivery during autumn 2019 (N = 18). Eight diverse modules of 5–10 European Credit Transfer System credits (ECTS) accepted the invitation and are included in this study (n = 8): two in mathematics, two in biology, one in molecular biology, one in computer science, and two in geoscience. In total 1,311 students passed the modules, ranging from 15–395 students per module. An overview of the eight cases is available in Table 1.

Data sets were collected for the eight Learning Design interventions examining the efforts and impacts associated with the intervention, the characteristics of the actualised learning designs, the educators' perception of TEL and the intervention, and the delivery of the design, including its impact on the students. In practice, this was carried out by screening the learning designs according to the STREAM model by observing the module pages in the virtual learning environment (VLE), Blackboard Learn. The ideas of the STREAM model were concretised into nine design feature items: (1) a cyclical process shifting between out-of-class, online preparatory content and/or activities followed-up by in-class and/or online activities; (2) out-of-class, online activities designed so they provide data to the educator and/or tutors about the students' learning; (3) that the educator and/or tutors provide online and/or in-class feedback on the out-of-class, online activities based on the generated data; (4) data is used to adjust in-class and/or online (synchronous) activities related to the curriculum of the present loop/week; (5) experiences with the in-class and/or online (synchronous) activities is used to adjust the out-of-class, online content and/or activities of the following loop/week; (6) out-of-class activities are designed as an online, cyclical process with several steps shifting between content and activities that activate the content; (7) out-of-class, online activities where students are asked to reflect on their own learning/understanding of the curriculum; (8) online support provided in forums or similar on both content and activities; and (9) out-of-class activities are designed to be thought-provoking and/or require the student to explore, synthesize, and/or formulate answers for actualising higher levels on the SOLO or Bloom's taxonomies. Thus, from a networked learning perspective item 2 and 3 indicate the connection between the student and the educator, and item 8 indicates the connection between learners (and the educator) (Dirckinck-Holmfeld et al, 2011; Ryberg et al., 2016). Based on the observation, the available data, or the educator interview, the designs were scored on a five-point Likert scale ranging from (1) 'not at all', indicating that the design feature was not implemented, to (2) 'a small extent', to (3) 'a moderate extent' indicating that the design features were implemented in approximate haft of the activities/weeks, to (4) 'a great extent', and to (5) 'a very great extent', indicating that the feature was implemented throughout the module. For item 9, the scale refers to the extent of out-of-class activities that require the student to, e.g., analyse, relate, evaluate, and create, and thus qualify as being on level four ("Relational" or "Analyze") or above on the Bloom's or SOLO taxonomies. For item 8, designs that did not include online support were scored as (1) and designs in which both content and activity support was available in an online forum and capitalised were scored as (5). To ensure inter-rater reliability each score was discussed by the three researchers and the scales were adjusted until they were unequivocal and the scores were identical. The scores for each redesign are provided in Table 1.

In addition to the observations, semi-structured educator interviews were carried out following an interview guide with questions on their perspective on technology-enhanced learning and technology acceptance (inspired by the Technology Acceptance Model, TAM, by Scherer et al., 2019), the learning design and delivery, and the relative scale of the associated efforts and impacts associated with the intervention. That is, did the educators perceive the efforts and impacts associated with the design and delivery of the module as lower or higher than previously and to what extent. To further validate the efforts and impacts of the learning design and delivery, statistical data on students' online module activity in the VLE, pass rates, grades, and module evaluations were used to data triangulate the answers in educator interviews as well as provide insights into students' learning and preferences.

To interpret the balance of efforts and impacts of the interventions and to identify the underlying factors for sustainable learning design, the concept of Efficient Learning Design (ELD) (Author, 2022) was utilised by mapping the eight cases (Figure 2). In brief, ELD analyses the efficiency of Learning Design interventions by mapping the required, aggregated efforts to design and deliver the desired, aggregated impacts compared to before the intervention and by calculating the positive or negative distance to "break-even". This yields four potential outcome scenarios referred to as progressive, underperforming, regressive, and outperforming (Figure 2) as well as a quantifiable magnitude of the Learning Design efficiency (Table 1). For instance, an increased impact at a lower effort yields an outperforming intervention, whereas a decreased impact at a lower effort yields a regressive intervention (ibid.). In progressive and regressive scenarios, the balance between efforts and impacts become important. An outcome where the effort is just barely counterbalanced by the impact is considered "break-even", whereas outcomes where the impact outmatches the effort are considered "efficient". In practice, this means, that outperforming interventions are always sustainable in the sense they have been worth the efforts even though they are discontinued. Other interventions have the potential to be efficient and sustainable should they be located or over time move below the break-even line.

Identification of the underlying factors that affect the efficiency of the learning designs across the eight cases was achieved using a multivariate analysis supplemented with a qualitative analysis of the educator interviews. By correlating the efficiency outcome scenarios in Figure 2 with the STREAM design characteristics, educator perspective on TEL (according to the TAM scales: perceived ease of use (PEOU), perceived usefulness (PU), attitudes toward technology (ATT), behavioural intention to use technology (BI), and actual use (AU)), their efforts, impacts, data on students' online activity and their perceived (learning) outcome obtained from the module evaluations, it was possible to identify significant, potential design and delivery factors for efficient and sustainable Learning Design interventions (Table 2). However, as the sample size is small (n = 8), these correlations were merely used as signs of potential patterns and thus further qualitatively investigated and triangulated with the educator interview and other available data.

The eight cases

Despite being engaged in the same Learning Design process and presented to the STREAM model, the actualised design and delivery of the eight blended modules, as well as the educators' perspectives on TEL, were very different. The observation and screening according to the STREAM model revealed a large difference in the online structure, the activities, and the feedback processes (see Table 1).

Table 1: Overview of the cases

Module alias (code)	Mathematics A (MA)	Mathematics B (MB)	Programming (PR)	Mol. Biology (MOL)	Microbiology (MIB)	Cell Biology (CB)	Mineralogy (MI)	Sedimentology (SE)
Subject area	Mathematics	Mathematics	Comp.Science	Mol.Biology	Bioscience	Bioscience	Geoscience	Geoscience
Educator	Full professor	Full professor	Full professor	Assoc. prof.	Assoc. prof.	Full professor	Assoc. prof.	Assoc. prof.
ECTS credits	10	10	10	10	5	10	10	5
Students (n)	323	395	210	137	96	123	12	15
Scale (total ECTS)	3230	3950	2100	1370	480	1230	120	75
Educator perspective on educational technology (TAM items) (likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither agree or disagree, 4 = Agree, 5 = Strongly Agree)								
TAM PU	4	4	5	5	2	4	4	3
TAM ATT	5	5	5	5	3	5	4	4
TAM PEOU	2	2	3	2	5	4	4	3
TAM BI	1	1	5	5	1	4	5	2
TAM AU	5	5	5	5	4	4	5	4
Learning Design perceived efforts, perceived impacts, and calculated efficiencies (likert scale: -3 = high negative, -2 = medium negative, -1 = low negative, 0 = neutral, +1 = low positive, +2 = medium positive, +3 = high positive)								
LD effort*	-2	-2	+3	+2	-2	-1	0	+1
LD impact*	+1	+1	+2	+2	+1	+1	+2	+1
LD efficiency**	Outperforming (3/√2)	Outperforming (3/√2)	Progressive (-1/√2)	Progressive (0)	Outperforming (3/√2)	Outperforming (√2)	Outperforming (√2)	Progressive (0)
Student efforts and impacts								
VLE avg. activity	54.78 h	57.31 h	78.03 h	52.12 h	22.41 h	65.02 h	17.91 h	12.57 h
Perceived outcome	3.37	3.74	3.90	3.56	3.82	3.83	4.70	4.83
Pass rate	84%	89%	81%	88%	83%	97%	92%	100%
Learning Design characteristics (STREAM compliance), likert scale: 1 = 'not at all', 5 = 'to a very great extent'***								
STREAM item 1	1	1	1	5	1	5	5	1
STREAM item 2	4	4	3	4	2	5	5	2
STREAM item 3	4	4	2	3	2	4	4	2
STREAM item 4	1	1	1	1	1	2	2	1
STREAM item 5	1	1	1	1	1	1	4	1
STREAM item 6	5	5	4	4	1	4	5	1
STREAM item 7	2	2	4	5	2	4	4	1
STREAM item 8	5	5	5	1	1	1	1	1
STREAM item 9	1	1	1	4	2	4	3	1
STREAM total	24	24	22	28	13	30	33	10

*Compared to before the Learning Design intervention. **The Learning Design efficiency is provided as both the scenario and magnitude (the magnitude is calculated as the directional perpendicular distance from break-even (see Author, 2022), ***Details on how the STREAM items are scored are provided in the methodology.

In three of the modules (MOL, CB, MIB), the online activities were designed with a consistent cyclic structure shifting between out-of-class online activities and in-class follow-up (STREAM item 1), whereas no cyclic structure was observed in the other five modules. Considering solely the out-of-class activities, six modules (excluding MIB and SE) were to a great or very great extent designed with an online cyclic alteration between content and activity (STREAM item 6). The out-of-class loop in four modules (PR, MOL, CB, MI) included activities that to a great or very great extent asked the students to reflect on their learning (STREAM item 7). Online content and/or activity support in an online, asynchronous Q&A forum or similar was provided in three modules (MA, MB, PR) to support networked connections between the students (STREAM item 8). In three of the modules (MOL, CB, MI), a large extent of the online out-of-class activities were on a higher learning taxonomic level (STREAM item 9). Except for SE, all modules were designed in a manner so that some or most of the activities provided data on student performance (highest for CB and MI, lowest for MIB) (STREAM item 2). These data were used for supporting networked learning by providing feedback to students (highest extent for MA, MB, CB, MI) (STREAM item 3); however, only two modules (MI, CB) used the data to adjust the in-class activities related to the curriculum of the present week (STREAM item 4). Furthermore, only one module (MI) adjusted the online content or activities of the following week based on experiences from the in-class teaching (STREAM item 5).

Factors for sustainable learning design

The mapping of the educators' perceived efforts and impacts associated with the Learning Design intervention compared to previously revealed that five of the modules qualified as "outperforming", whereas the other three modules were "progressive" (Figure 2). Only one of the eight modules suggested that the efforts were higher than the impacts, which suggests that the intervention may not have been "worth it".

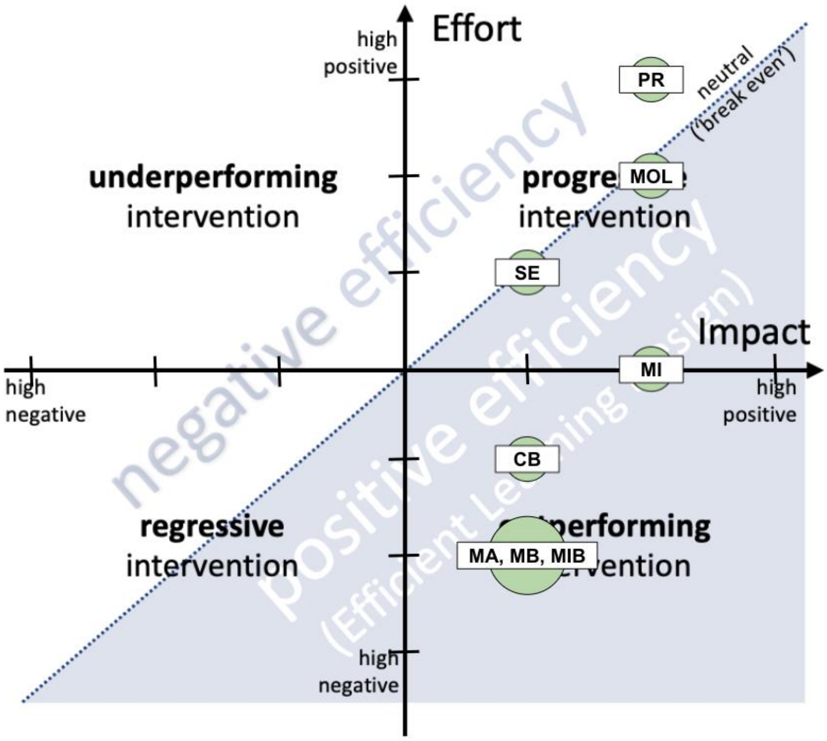

Figure 2: The efficiency of the eight module interventions.

Furthermore, the multivariate analysis identified a total of 15 significant correlations (marked with asterisks, Table 2), which were grouped into the following six factors: three related to the educator perspective, one related to the student perspective, one related to the design and networked learning characteristics, and one related to the scale of the module.

Table 2: Multivariate analysis based on Pearson r correlations.

	TAM PU	TAM ATT	TAM PEOU	TAM BI	TAM AU	VLE activity	Students' perceived outcome	LD impact	LD effort	LD efficiency
TAM PU	1	.858**	-.624	.673	.731*	.703	-.287	.866**	.579	.012
TAM ATT	.858**	1	-.755*	.294	.548	.820*	-.468	.535	.241	.304
TAM PEOU	-.624	-.755*	1	.066	-.643	-.428	.374	-.404	-.186	-.255
TAM BI	.673	.294	.066	1	.286	.244	.208	.839**	.757*	-.382
TAM AU	.731*	.548	-.643	.286	1	.401	-.305	.683	.229	.244
STREAM item 1	.383	.183	.153	.716*	.067	.000	.096	.488	.194	.111
STREAM item 2	.561	.557	-.174	.437	.436	.349	-.177	.468	-.146	.649
STREAM item 3	.309	.477	-.272	.000	.383	.221	-.244	.153	-.506	.917**
STREAM item 4	.078	.000	.480	.480	-.149	-.091	.351	.218	-.118	.348
STREAM item 5	.051	-.267	.314	.419	.293	-.453	.565	.429	.026	.228
STREAM item 6	.738*	.729*	-.499	.308	.799*	.562	-.364	.570	-.059	.621
STREAM item 7	.714*	.401	.000	.891**	.390	.441	-.202	.714*	.516	-.195
STREAM item 8	.383	.548	-.582	-.286	.600	.629	-.473	.098	-.088	.289
STREAM item 9	.226	.070	.269	.601	-.127	.020	-.068	.261	.114	-.008
STREAM total	.668	.545	-.159	.594	.553	.401	-.213	.607	.027	.473

*. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

Educators' consideration for the institutional perspective

Figure 2 illustrates that four to five of the interventions classify as outperforming, whereas the others are progressive. In practice, this means that the progressive modules (PR, MOL, SE) are investing more effort into designing and delivering the module compared to previously. The multivariate analysis suggests that high efforts are linked to the educator's behavioural intention to use technology, $r(6) = .757$, $p < .05$, and potentially also her/his perceived usefulness of the technology $r(6) = .579$ (TAM BI and TAM PU). The progressive educator has a strong intrinsic motivation for educational development but is less concerned about efforts for her/himself, the institution, or the students. In the most progressive cases (PR, MOL) and the three most outperforming cases (MIB, MA, MB), the educator expressed a high level of motivation. For instance, the educators in MOL and PR expressed in the interview that technology was deeply interwoven in all aspects of the teaching and demonstrated a personal interest in using and developing technology. Furthermore, the educator in MOL developed a new digital tool tailored to the specific module, and the educator in PR used advanced digital tools long before any institutional ambitions for educational technology and TEL.

> 'Long before Blackboard, we made our own system for handling of materials and everything so it is a completely natural habit' (PR)

> 'There is practically no part of the module which is not completely interwoven with it [technology] and if we had to do without it, it would be a great setback'.

In both cases, the educational development was driven by a desire to support students' learning with technology-supported feedback. Although the effort was perceived as higher than the other cases, the educators did not express concerns related to the increased effort for themselves, their students, or the institution. Furthermore, the impact was higher compared to cases where a lower effort was invested. However, in the outperforming cases of the large-scale modules MA and MB, the educator expressed a dual motivation of having experienced the value of technology for supporting interaction between educator and students and an institutional perspective to reduce costs without lowering the quality of teaching.

> 'It is a way of establishing communication in a lecture hall … with 250 students… initially, the purpose was that we could rationalise without compromising the quality' (MA, MB).

In the interview, the educator did not distinguish between his own aim and the institutional demands. This indicates that the institutional perspective of having a sustainable balance between effort and impact was more important than the personal perspective.

In the third outperforming case MIB, the educator expressed that the purpose of using technology was solely to ease handling of assignments and communication for both educator and students. No personal aims were expressed, and the institutional perspective was related to student and educator effort. The effort to implement the intervention was considered low and the effort-impact balance therefore favourable.

In total, the cases illustrate an important connection between awareness of the institutional perspective and the introduction of TEL. It appears that educators with a high level of awareness of the institutional needs as well as a critical, balanced approach to the value of TEL focusing on specific aims are more likely to find an efficient balance between efforts and impacts of the intervention as well as sustain or improve this balance.

Educators' perceived usefulness of TEL

Another important aspect of the educator perspective is the educators' perceived usefulness and attitude towards technology in education. A high perceived usefulness and attitude is strongly correlated with STREAM item 6, respectively $r(6) = .738$ and $r(6) = .729$, $p < .05$, the usefulness is correlated with item 7, $r(6) = .714$, $p < .05$, and the usefulness is correlated with a high Learning Design impact, $r(6) = .866$, $p < 0.01$. In other words, educators with a more positive attitude towards and perceived usefulness of TEL are more likely to include online activities and reflection exercises as well as obtain a high impact.

Asked about their perceived relevance of TEL, some educators expressed a sceptical or reluctant attitude, emphasising that TEL is not superior to other tools and techniques used in their teaching. This was most clearly manifested by educators in MIB and SE and reflected in low TAM PU scores. In both cases, the educators stated that the technology had a limited potential:

> 'Handing in reports and correcting them is handled in Blackboard. This works well… [Quizzes and video] has no potential in relation to learning.' (MIB)

> 'I also use [technology] sometimes, but I also prefer to … stick to more traditional tools… [With a] computer but it's really not the same' (SE).

These two cases required less effort compared to previous deliveries and compared to, e.g., MOL and CB, where the educators expressed a more positive attitude towards TEL.

Educators' buy-in of TEL pedagogy

In general, none of the educators saw the technology in itself as a barrier and the data even show a negative correlation between perceived ease of use and positive attitude towards using technology, $r(6) = .755$, $p < .05$. However, the correlation between educators' perceived usefulness of the technology and STREAM items 2, 6, 7, and STREAM total suggests a connection between a large educator buy-in of TEL pedagogy (as represented by the various STREAM items) and impact. The more perceived usefulness of the technology, the larger STREAM compliance, $r(6) = .668$, and impact $r(6) = .866$, $r < .01$. That is to say, educators with a positive attitude towards TEL are likely to use more technology in their teaching and maintain a strong pedagogical focus (STREAM compliance) in their adoption of TEL. However, as the quotes and correlations show, strong technological skills do not ensure a positive attitude and buy-in of educational technology and TEL.

Students' buy-in of TEL

None of the STREAM design characteristics correlated with the students' perceived outcome, but the figures in Table 1 suggest a negative correlation between time on the VLE and the students' perceived outcome. However, this is somewhat in contrast to the actual general impact, which indicates that the higher STREAM compliance, the higher impact, and that in particular, the online reflection activities (item 7) were effective, $r(6) = .714$, $p < 0.05$. This highlights the importance of how the technology is actually used on the module, including the extent and purpose of VLE activities, as well as how the online activities are furthered to the students. The discrepancy between the perceived outcome and the actual impact suggests that the students may not be fully aware of the purpose and benefit of the online activities and that more introduction to the teaching format is needed that could support better use of the online activities as well as prepare students for similar modules.

Online structure with activities, reflection, and feedback

The structure of online activities and in particular online reflection exercises appear to have a potentially large influence on impacts. In general, designs that included online reflection exercises where the students were asked to reflect on their learning and understanding of the curriculum (STREAM item 7) had a strong correlation with a high impact, $r(6) = .714$, $p < .05$. Furthermore, the data suggest that out-of-class activities designed as an online process shifting between content and activities that activate the content (STREAM item 6) have a potential positive influence on impact, $r(6) = .570$. In addition, there is a strong correlation between Learning Design efficiency (magnitude) and the networked learning characteristic of supporting the feedback connection between the educator and the students (STREAM item 3), $r(6) = .917$, $p < .01$, i.e., that the '...educator and/or tutors provide online and/or in-class feedback on the out-of-class, online activities based on the generated data'.

Scale and reuse

Both the scale of the module (total ECTS), the modality (measured as STREAM compliance), and the number of deliveries influence the efficiency and thus also the sustainability. The intervention in MA and MB initially required a high effort from the educator and other staff, but the educator emphasised in the interview that the module delivery is now more efficient and flexible for both educators, students, and the institution compared to before the intervention.

> 'They [the modules MA and MB] are at least as good as the ones offered back then and it is with less staff involved'.

As MA and MB are large-scale modules (323–395 students) with high STREAM compliance and several reuses, the potential impact in terms of the number of students benefitting from the intervention compared to the required effort is extensive. This may also explain the reluctance in SE, and comparing the two small-scale modules (MI, SE) there was no significant difference in students' perceived outcome and pass rates despite large differences in STREAM compliance. Thus, the scale and sustainability may also be a consequence of institutional requirements, such as the number of possible deliveries of the same design as well as the educator's influence. Educators with limited influence on a module and its later deliveries are potentially less encouraged to invest in redesigning the module.

Discussion and conclusions

To maintain high quality higher education without increasing costs dramatically, there is a pressing need for identifying design and delivery factors for efficient and sustainable teaching and learning practices. The article has identified six design and delivery factors for efficient and potentially also sustainable Learning Design interventions involving educational technology in science higher education. The factors are (1) educators' consideration for the institutional perspective; (2) educators perceived usefulness of TEL; (3) educators' buy-in of TEL pedagogy; (4) students' buy-in of TEL; (5) online structure with activities, reflection, and feedback; and (6) scale and reuse. Some of these factors are obvious, and, in particular, the latter of having a favourable balance between the efforts for designing and delivering TEL and its desirable impacts. For instance, the efforts may not be worth the trouble in small-scale and one-off module deliveries. The factors on the online structure and perceived usefulness of TEL seem obvious; however, it may give food for thoughts on how institutions promote and justify the use of educational technology to the educators and how the educators promote the technology to their students. It is less obvious that the cases that supported networked connections between the educator, students' activity, and the content correlated with a high Learning Design efficiency. Moreover, the study reveals that the educators' consideration for the institutional perspective is a strong predictor for an outperforming outcome and thus also an efficient Learning Design practice. How come some educators have this eye and commitment for the institutional perspective while others do not?

All in all, the study suggests that the professional development of educators plays an important role in building a sustainable Learning Design practice. But the study also suggests that TEL teaching competencies are not enough. Educators should embrace the idea of an efficient, reusable teaching practice where efforts are counterbalanced by the impacts over time. In addition, educators must buy-in on the potential, purpose, and pedagogy of TEL and maintain its pedagogical qualities in their teaching practice with activities, reflection, and feedback (e.g., as provided by the STREAM model and the characteristics of networked learning). The latter is interesting from a networked learning perspective, as STREAM item 2 and 3 promote online activities designed to provide data to the educator about the students' learning as well as the educators' feedback on students' online activities, and that they were (strongly) correlated with a high Learning Design efficiency. Thus, the design process must provide support and information to sceptical educators, clarify and justify the purpose of TEL, and can benefit from managerial and local teaching community support.

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