The Design Cycle for Education (DC4E)

A practical model for the design of blended and online education

Maren Scheffel[1], Marcel Schmitz[2], Judith van Hooijdonk[3], Evelien van Limbeek[4], Chris Kockelkoren[5], Didi Joppe[6], Hendrik Drachsler[7]

Abstract: The need for more and better online and blended education has lately become even more apparent. Many educational institutions had to pivot to emergency remote teaching. While online learning in itself is nothing new, the scope, suddenness and speed of this shift certainly was. However, courses and modules created for face-to-face settings, cannot simply be turned into blended or fully online ones easily. Learning design models can provide guidelines and guidance. Often, however, they are not constructed in a comprehensive way and are mainly conceptual. We thus created a procedural design model enriched with templates, tools, information and design examples to specifically support and facilitate the (re)design of blended and online learning and teaching and to thus provide quality education: the Design Cycle for Education (DC4E).

Keywords: design model; learning design; blended learning; online learning.

1   Introduction

In 2018, the European Commission (EC) in their Communication on the Digital Education Action Plan [EU18] supported the claim that digital technology enriches learning and offers important opportunities for information and resource access. It also pointed out, however, that although digital transformation offers many opportunities, there is still a risk of societies being ill-prepared for the future. Two of the priorities mentioned in the Education Action Plan therefore are (1) making better use of digital technology for teaching and learning, and (2) developing relevant digital competences and skills for the digital transformation. The need to address these issues has become even more prominent and important during the Covid-19 pandemic: educational institutions of every level worldwide had to close and move all of their teaching and learning online. While online and distance learning in itself is nothing new, the scope, suddenness and speed of this shift

---

[1] Ruhr-Universität Bochum, Deutschland, maren.scheffel@rub.de, https://orcid.org/0000-0003-4395-4819

[2] Zuyd Hogeschool, Niederlande, marcelschmitz@zuyd.nl, https://orcid.org/0000-0002-1816-6178

[3] Zuyd Hogeschool, Niederlande, judith.vanhooijdonk@zuyd.nl

[4] Zuyd Hogeschool, Niederlande, evelien.vanlimbeek@zuyd.nl

[5] Zuyd Hogeschool, Niederlande, chris.kockelkoren@zuyd.nl

[6] Open Universiteit, Niederlande, didi.joppe@ou.nl

[7] Leibniz-Institut für Bildungsforschung und Bildungsinformation DIPF, Deutschland; Goethe-Universität Frankfurt, Deutschland; Open Universiteit, Niederlande, drachsler@dipf.de, https://orcid.org/0000-0002-1816-6178

certainly was. However, courses and modules created for face-to-face (f2f) settings, cannot simply be turned into blended or fully online ones easily.

There is no direct translation from one to the other as a large number of educators experienced recently. Instead, substantive technological as well as didactic knowledge is needed in addition to educational and content knowledge for a given course or module [MK06]. As Hodges et al. [Ho20] point out, teachers in the Covid-19 online shift might feel like "instructional MacGyvers, having to improvise quick solutions in less-than-ideal circumstances" which makes it even more important to distinguish "between the normal, everyday type of effective online instruction and that which we are doing in a hurry with bare minimum resources and scant time: emergency remote teaching". As research has indicated that prolonged distancing will likely be needed for several years [Ki20] and with governments preparing 1.5-meter distance societies, the demand for thoroughly-developed online and blended education will rise. Educational institutions on all levels should thus use this opportunity and not forget about everything related to emergency remote teaching, online, distance and blended learning [Ho20].

Having a model and tools for educators that support the design of blended learning that is effective, innovative and of high quality has been a longstanding ambition of the learning design (LD) field [Ca09]. Given the current situation, where learners and teachers all over the world will have to rely on blended and online modes for learning and teaching, such models are needed more than ever before. While there were a number of LD models available that support blended or technology-enhanced learning (TEL), they were often not constructed or reported in a comprehensive way and mainly conceptual instead of procedural, which made it challenging for educators to use them in their daily practice [BV18]. Therefore, as "making digital technology benefit students and staff requires an approach that combines teacher training, curricula and educational materials that are fit for digitally-supported teaching models" [EU18], we opted for the creation of our own procedural design model to specifically support and facilitate the (re)design of blended learning for educators and course designers in the field. An important aspect of this design model was to find a balance between autonomy in the development of course content on the one hand, and standardisation of the courses within one institution on the other hand. While a high degree of autonomy is crucial for the individual educator to design education in the way that is most suitable for their educational context, at the same time, this freedom generates an enormous challenge for the comparability of modules. Therefore, some mean of standardisation for a whole program or even a whole university is important.

By creating the Design Cycle for Education (DC4E) [Sc19], we aimed to retaining the strong characteristics of the autonomous design of education, while at the same time exercising a normative function, i.e. a form of standardisation, on the development process. Finally, the development of such a broadly supported design model also provides the framework for a common language which fosters sharing of and communication about (re)designed education. We hope to contribute to the longstanding ambition of the LD field to help educators create, describe and share teaching ideas [Da16] as well as to the

opportunity of rethinking curriculum and teaching-learning-assessment procedures [Un20] by providing educators around the world with a design model, application support tools and example use cases.

2   Background and Related Work

Garrison and Kanuka [GK04] define blended learning as the thoughtful integration of classroom face-to-face learning experiences with online learning experiences. While they take up a substantial part in the educational process, they are not to be seen as separate from one another but ideally reinforce each other. Enhancing learning and teaching with technology aims at making learning effective, efficient and flexible in order to increase learning outcomes and also the satisfaction of involved learners and teachers.

However, the (re)design of educational products to offer more accessible and flexible education using blended learning, requires not only content knowledge, but also pedagogical and technological knowledge [MK06]. Simply delivering the 'old' content through a new (online) medium does not ensure effective learning. Designing online or blended learning requires reconsidering the whole design [GK04]. In the educational field, though, we often encounter a gap between theory and practice. Korthagen et al. [Ko01] showed that educators that have theoretical knowledge about such processes encounter difficulties in translating their insights into effective LDs. Excellent educators are not necessarily the more experienced ones, but those who are able to put their knowledge of pedagogy and content into educational practice [Ha12, Wu14]. For blended learning, we also see the lack of technological-pedagogical and technological skills as a source of problems for educators, i.e. they lack the competence of creating harmony between online and f2f activities [ME16]. In addition, being forced to pivot online in a short period of time without proper guidance and support can lead to feeling overloaded and confused [Un20] and could incorrectly "seal the perception of online learning as a weak option" [Ho20]. A model that helps educators to create blended LDs is therefore needed.

The most common models for LD and instructional design are the Principles of Instructional Design by Gagne and Briggs [GB79], the ARCS Model [Ke83, Ke10], the ADDIE Model [VS86, Pe03, Mo03], the 4C-ID Model [VMK07], the Curricular Spider Web Model [Va03] and the Systems Approach Model [DCC15]. Such models can be categorised in different ways [GB02, Și13, G7] in addition to most existing models being conceptual in nature rather than procedural as Bower and Vlachopoulos [BV18] pointed out. They also stressed that the level of design a model was intended for was often not specified, that context was not considered in many of these models, and that examples of the application of the model were lacking. Due to this, an assessment of which model to adopt was difficult for educators looking for practical design support. This motivated us to develop a procedural model, enriched with templates, tools, information and design examples for educators to create blended LDs adapted to their given circumstances, e.g. when they want to combine LD, learning technology and learning analytics (LA).

Using technology when creating learning activities is not just deciding what tools to use but about using technology to alter the overall user experience. We believe it is about designing a full learning experience and should therefore be an integral part of the design process. The same applies to the integration of LA. The combination of these factors underpinned the decision to choose a design-based approach. Others also seem convinced that this could bridge the gap between theory and practice, for example McKenney & Mor [MM15] and Kali et al. [KMS15]. Our approach is based on the idea that educators should design all learning activities as is advocated by Laurillard [La12] and Kirschner [Ki15].

We thus developed the DC4E that can incorporate different theoretical insights depending on context and target population. In addition, it facilitates educators in making the right decisions in the correct order. It enriches the recognisable steps of process models with practical elements that educators can use, e.g. descriptions of best practices, tools, checklists, templates and summaries. Furthermore, our model evokes careful deliberation and reflection during each step of the design process which is necessary since the (re)design of courses for blended or online settings is often taken lightly in practice.

3   The DC4E

Different stakeholders were involved in developing the DC4E. Researchers involved were also working as educators or educational support staff and thus had experience with course design in practice. Initial drafts were based on existing literature and discussed with researchers of the group TEL group at Zuyd Hogeschool (Zuyd). The model aimed to facilitate educators who had to redesign specific courses for the part-time higher education department. In striving towards flexible courses, a support service consisting of experts on assessment, blended learning was installed to coach educators in the design process. They contributed significantly to the creation of the DC4E by frequent reflection on the different components. The model was then iteratively edited and adapted based on the feedback gathered from researchers, the support experts and assistant professors from Zuyd.

The DC4E was developed to support the transition through (re)design of f2f education to blended learning. Figure 1 shows the visualisation of the DC4E, which was inspired by the work from Mor & Mogilevsky [MM13]. At the centre of the model is the concept of reflection. This is to stress the importance of critically looking at and reflecting on the result of each of the model's steps. The designing educator is reminded of the cyclical, iterative structure and to properly document the choices made at each step. Together with the model, ready-made tools and templates are provided for each of the steps on a companion website[8] thus supporting the designing educators in using technical solutions and gaining evidence-based insights. A detailed description of each step is available on the model's support page.

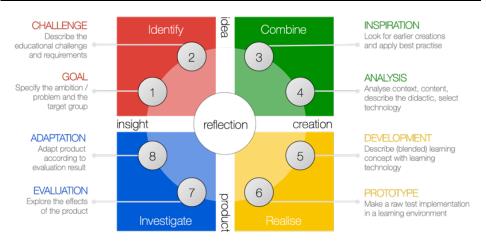[8] https://onderwijsontwikkeling.zuyd.nl/overzicht-ontwerpcyclus/

Figure 1: Visualisation of the eight steps of the DC4E

Identify – from insight to idea. Educational design problems are usually complex and require creativity to be solved [Sl13]. Their solution is found the quickest when conceived by heterogeneous teams of experts. At the beginning of the cycle it is important to define the goal(s) (Step 1) of the blended LD and to identify challenges (Step 2).

Combine – from idea to creation. If the design challenge is set out in a rough form, the next phase is to further explore what the current situation is, which learning activities were selected, what the possible social interactions are that are planned, and, in particular, which contextual factors were taken into account. This is done by finding inspiration (Step 3) from others and to then analyse (Step 4) which of the gathered ideas can be used.

Realise – from creation to product. In this phase, the components of didactic action are filled in and elaborated into a specific design development (Step 5). The prototype (Step 6) is then implemented in the LMS and presented to stakeholders for further development into the final educational product, i.e. the course or module.

Investigate – from product to insight. The first implementation of the module takes place in this phase of the model; the course/module will run for the first time and will then be evaluated (Step 7). Adjustments and adaptations (Step 8) can be made based on the evaluation, i.e. the model's cycle is repeated on the basis of the evaluation data, albeit at a faster pace. In this phase we can still speak of a prototype as it is assumed that various iterations are needed for optimisation.

4   Application of the Model

4.1   Design Metaphors

At many educational institutions learning management systems (LMSs) have –until recently– often been used as a document management system. In those cases, there is hardly any added value in using the LMS from a didactic perspective. The DC4E is aimed at enriching the didactic side of blended learning by offering a structure that makes the design of blended learning activities communicable and mutually comparable and thus inspires educators with examples of blended LDs. It is thus important to create a culture within an institution where the potential of blended learning is known. A first step in this direction is to enhance and advance the design skills of educators for blended learning by using a design-based approach in professionalisation.

To inspire and help educators in making the epistemological design, all learning activities and their inter-dependencies, we suggest the use of three design metaphors for the DC4E: acquisition, participation and knowledge creation (see Fig. 2). Design examples of the acquisition and the participation metaphors are based on the work by Sfard [Sf98]. According to Collis and Moonen [CM08, p.97] "key aspects of an acquisition approach to learning include knowledge, fact, concept, and attainment, the having of knowledge. [...] The participation metaphor [...] places the nature of learning in belonging, participating, communicating, becoming a member of a community [...] in doing". Paavola et al. [PLH04] added a third metaphor, i.e. knowledge creation, that is appropriate for solving complex problems. Complex or wicked problems demand a group to participate in a creative process to assess the problem and formulate a solution (e.g. [Sl13]).

In practice, a blended learning program is not only based on one kind of metaphor but rather a mix of them. The students need to integrate and coordinate knowledge, attitude and skills from the studies. The education offered must thus respond to the context by combining the above-mentioned metaphors so that the student not only acquires knowledge, but also learns to apply it and to use it to analyse, evaluate or create something new. Many, if not all, of the modules are thus built up as a mix of the above metaphors. The aim of learning is to acquire knowledge (acquisition metaphor), to participate in a community or group (participation metaphor), and to develop new knowledge and assimilate existing knowledge (co-creation metaphor) or a combination of these three elements. For example, a module developed according to the co-creation metaphor is preceded by modules developed according to the participation metaphor, possibly preceded by one or more acquisition modules.

A major challenge in designing blended education for a professional program is to connect various learning activities in different contexts, with the necessary flexibility within them, i.e. ensuring that there is a connection between learning activities that take place online, activities at school, and activities from the practice at work. We therefore added a wave motion exchange model to the DC4E (see Fig. 3).

During the Covid-19 pandemic educators had to rapidly redesign their education combining the '(im)possibilities' of the different contexts in a meaningful way. It seems to have created at least some awareness among educators about possibilities of the online and blended learning contexts when designing their learning activities. By critically looking at such designs and optimising them using an evidence-informed design model, educational practices could benefit from the pandemic leading to more effective, efficient and satisfactory education.
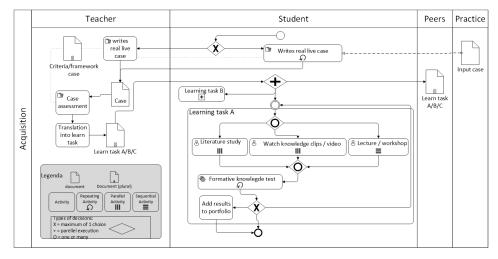

Figure 2: Example of the acquisition design metaphor inspired by Sfard [Sf98] that is one of the templates to be found in the supporting documents of the DC4E
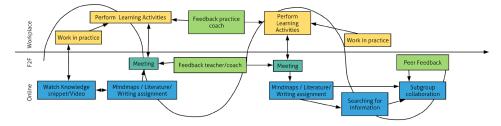

Figure 3: A *wave motion exchange* model between the various contexts for vocational education

4.2   Use Cases

The following use cases describe how the DC4E can be used in practice. While some of these depict the originally intended use, i.e. the design of a whole study program or course, others provide information on how the model can also be used to design individual learning activities or even dashboards.

Designing a Study Program. The DC4E was used at Zuyd's department of Healthcare Studies by the support staff and educators to redesign courses for a part-time higher education programme on Nursery. Educators and support staff co-created courses in hands-on design sessions. The focus was on the fourth and the fifth step of the model, since the aim was redesigning existing courses and decisions on 'goal' and 'challenge' had already been made when the traditional course was designed. Limited pedagogical and technological skills often hinder educators in using the model independently. Therefore, the support staff introduced them to the model by using the tools and the templates from the model provided on the companion website. They created awareness by asking questions linked to every step of the model. This helps educators to reflect on design choices and to discover new possibilities. Moreover, they discussed blended learning and implications for the role of the educator. Often the support staff shows concrete design options, similar to the metaphors, and asks educators to think aloud so they can identify misconceptions. Showing the educators visually how to blend online and face-to-face activities helps them to understand that and how the different activities have to be connected: "Now, I understand that just putting a video in the LMS doesn't work. I have to link it to an assignment or the face-to-face session." Since the model is accessible online and links to a variety of tools, checklists and templates provided, it is possible for the support staff to use the model flexibly, i.e. 'on demand' and 'just-in-time'. In the last year 48 teachers that had to redesign the Zuyd part-time Master in Nursery enrolled in a Moodle course designed for this purpose.

At Zuyd's department of Social Work, a team of educators was tasked to redesign their part-time study program. In January 2020 the institution's TEL advisory staff was tasked with training seven Social Work educators in blended educational design. Using the DC4E and the supplemental material, the TEL advisory staff created a bootcamp workshop. The first four steps of the design model were tackled in the workshop in January, followed by an extra session about learning goal definition in February as expertise in that area as well as in the use of the learning management system was identified as lacking. Due to this and the TEL advisory staff's involvement in pivoting all running program's at Zuyd online due to the Covid-19 pandemic, the progress on this specific redesign had to be put on hold. This emphasises the need to develop and train relevant digital skills and competences for digital transformation as advocated by the European Commission [EU18].

Designing a Learning Activity. In addition to the DC4E being used for the design of whole programs or courses, it also posed as the basis for a serious game with which educators can design specific learning activities. The Fellowship of the Learning Activity and Analytics (FOLA²) [SS20] captures and systematises the LD of learning activities along the DC4E's eight steps and makes the players aware of the multidisciplinary approach of LD and the connection of LA to LD. The game was used at the Engineering department of Zuyd with the goal to redesign learning activities about computational fluid dynamics. The challenge was that they had to be done fully online whereas before the wind tunnel at the university had been used. Inspiration was thought from existing teachings about wind tunnels as well as information about online lessons that involve technical tutorials.

Analysing the given context and content, pedagogy and learning activity type were chosen as 'case study'. During the development the design team collaboratively selected several interactions between learners, teachers, material and the environment, added specific intentions and content to each interaction and decided where to add what type of learning-enhancing technology (e.g. tools for wind tunnel simulation and communication). Several aspects were then selected to be paid special attention to during the run of the prototype, i.e. use of resources, social interaction and LA data from the wind tunnel simulation software. Evaluation and adaptation will take place after the run.

Designing a Dashboard. Even though the DC4E has primarily been created for TEL-supported blended LD, it can be applied to design LA dashboards. Following the model's steps, educators at Hogeschool Windesheim, Netherlands, were involved in co-creating a teacher-facing dashboard to support them in their teaching processes [tD21]. They looked at the dashboard's goal, any challenges, the context, content and didactic purpose, visualisations that need to be developed, the test implementation's fit into the learning environment, intended effect, and possible adaptations for the next round. Similarly, FOLA4^2 method was used to design a learning dashboard at Zuyd for the ICT department in four sessions: The first consisted of four teachers, the second of six teachers, the third of four first-year students, and the last of five first-year students. The teachers chose a list of metacognitive competences for relevant items for a project management course and the learning activity type case study. The teachers used steps 5 and 6 to design a learning activity, including LA elements. The teachers identified several aspects of what they would like to know about their students' behaviour in the given scenario. The student sessions used the same course, the same learning activity type, and the chosen metacognitive competences. With those in play, the students also used steps 5 and 6 to design their learning activity and they also noted down which indicators and metrics could provide learning data for a learning dashboard. Based on this, the research team designed a student and a teacher (class) dashboard that illustrates per learning activity, the measurements and scores for the metacognitive competences. It gives the individual student an overview of scores during multiple courses per metacognitive competence and shows teachers a class overview of scores per student on every metacognitive competence.

5   Conclusion

Within this article we presented a practical learning design process model for educators that need to (re)design traditional face-to-face courses to blended learning scenarios. In contrast to other more abstract models, the DC4E provides step-by-step instructions for practitioners and points to useful templates, tools, and examples for the design process. The DC4E therefore bridges a gap from educational theory to practise while also balancing the autonomy of educational designers, and at the same time introducing standardisation of courses within an institution. The experiences so far show that the DC4E enables communication of course design from different disciplines very well. This is a major achievement as the design of the courses often is not operationalised, and a fixed

terminology to discuss design choices can thus be established. The DC4E therefore contributes towards an institutional culture of (blended) course design. This leads to higher awareness of good and less good design decisions as well as a common knowledge on good blended learning design. By being more aware and by reflecting design decision, course designers can come into an inquisitive attitude to investigate pros and cons of their own course designs.

We also learned, that redesigning face-to-face to blended learning is not something educators can do on their own, as the didactic and technical opportunities are too rich. Therefore, expert guidance in establishing a university cooperate design for blended learning is required to turn traditional course content into attractive blended learning courses. It is important to use technology that works for people and improving education and skills for this is key when it comes to digital transformation [EU20]. The emergency transition to online learning revealed that educators could have been more well-prepared and supported if institutions had invested more in blended learning-skills. But institutions can benefit from the good practices in online learning and teaching that emerged during the Covid-19 pandemic. Furthermore, the crisis constitutes a major opportunity for reconsidering what is good learning [Un20] and these practices could lead to more effective, efficient and satisfactory learning when we will return to 'normal' society. Finally, a model alone is not enough to drive this change: for the final realisation of successful blended learning, templates and examples as well as a community of practitioners within an educational institution are needed to sustainably implement new learning offers and provide quality education.

References

[BV18]   Bower, M.; Vlachopoulos, P.: A critical analysis of technology-enhanced learning design frameworks. British Journal of Educational Technology, 49(6):981–997, 2018.

[Ca09]   Cameron, L.: How learning design can illuminate teaching practice. In: The Future of Learning Design Conference. 2009.

[CM08]   Collis, B.; Moonen, J.: Web 2.0 tools and processes in higher education: quality perspectives. Educational Media International, 45(2):93–106, 2008.

[Da16]   Dalziel, J.; Conole, G.; Wills, S.; Walker, S.; Bennett, S.; Dobozy, E.; Cameron, L.: The Larnaca Declaration on Learning Design. Journal of Interactive Media in Education, 1(7):1–24, 2016.

[DCC15]   Dick, W.; Carey, L.; Carey, J.: The systematic design of instruction, Eighth Edition. Pearson, 2015.

[EU18]   EU: European Commission: Communic. from the Commission to the Eur. Parliament, the Council, the Eur. Economic and Social Committee and the Committee of Regions on the Digital Education Action Plan, 2018. COM(2018) 22 final.

[EU20]   EU: European Commission: Communic. from the Commission to the Eur. Parliament, the Council, the Eur. Economic and Social Committee and the Committee of Regions: Shaping Europe's digital future, 2020. COM(2020) 67 final.

[G7]   Göksu, I.; Özcan, K.; Çakir, R.; Göktas, Y.: Content analysis of research trends in instructional design models: 1999-2014. J. of Learning Design, 10(2):85–109, 2017.

[GB79]   Gagne, R.; Briggs, L.: Principles of instructional design. Holt, Rinehart & Winston, 1979.

[GB02]   Gustafson, K.; Branch, R.: Survey of Instructional Development Models. Fourth Edition. ERIC Clearinghouse on Information and Technology, Syracuse, NY, US, 2002.

[GK04]   Garrison, D.; Kanuka, H.: Blended learning: Uncovering its transformative potential in higher education. Internet and Higher Education, 7(2):95–105, 2004.

[Ha12]   Hattie, J.: Visible learning for teachers: Maximizing impact on learning. Routleddge/Taylor & Francis, NY, NY, US, 2012.

[Ho20]   Hodges, C.; Moore, S.; Lockee, B.; Trust, T.; Bond, A.: The Difference Between Emergency Remote Teaching and Online Learning. EDUCAUSEreview, 2020.

[Ke83]   Keller, J.M.: Motivational design of instruction. In (Reigeluth, C.M., ed.): Instructional design theories and models: An overview of their current status. Erlbaum, Hillsdale, NJ, 1983.

[Ke10]   Keller, J.M.: Motivational design for learning and performance: The ARCS model approach. Springer, New York, 2010.

[Ki15]   Kirschner, P.A.: Do we need teachers as designers of technology enhanced learning? Instructional Science, 43(2):309–322, 2015.

[Ki20]   Kissler, S.M.; Tedijanto, C.; Goldstein, E.; Grad, Y.H.; Lipsitch, M.: Projecting the transmission dynamics of SARS-CoV-2 through the postpandemic period. Science, 2020.

[KMS15]   Kali, Y.; McKenney, S.; Sagy, O.: Teachers as designers of technology enhanced learning. Instructional Science, 43(2):173–179, 2015.

[Ko01]   Korthagen, F.; Kessels, J.; Koster, B.; Lagerwerf, B.; Wubbels, T.: Linking practice and theory: The pedagogy of realistic teacher education. Lawrence Elbaum Associates, 2001.

[La12]   Laurillard, D.: Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology. Routleddge, New York, NY, US, 2012.

[ME16]   Ma'arop, A.H.; Embi, M.A.: Blended Learning in Higher Learning Institutions: A Review of the Literature. International Education Studies, 9(3), 2016.

[MK06]   Mishra, P.; Koehler, M. J.: Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6):1017–1054, 2006.

[MM13]   Mor, Y.; Mogilevsky, O.: The learning design studio: collaborative design inquiry as teachers' professional development. Research in Learning Technology, 21, 2013.

[MM15]   McKenney, S.E.; Mor, Y.: Supporting teachers in data-informed educational design. British Journal of Educational Technology, 46(2):265–279, 2015.

[Mo03]   Molenda, M.: In Search of the Elusive ADDIE Model. Performance Improvement, 42(5):34–37, 2003.

[Pe03]   Peterson, C.: Bringing ADDIE to life: instructional design at its best. Journal of Educational Multimedia and Hypermedia, 12(3):227–241, 2003.

[PLH04]   Paavola, S.; Lipponen, L.; Hakkarainen, K.: Models of Innovative Knowledge Communities and Three Metaphors of Learning. Review of Educational Research, 74(4):557–576, 2004.

[Sc19]   Scheffel, M.; van Limbeek, E.; Joppe, D.; van Hooijdonk, J.; Kockelkoren, C.; Schmitz, M.; Ebus, P.; Sloep, P.; Drachsler, H.: The means to a blend: A practical model for the redesign of face-to-face education to blended learning. In: EC-TEL'19. LNCS 11722. Springer, pp. 701–704, 2019.

[Sf98]   Sfard, A.: On Two Metaphors for Learning and the Dangers of Choosing Just One. Educational Researcher, 27(2):4–13, 1998.

[Şi13]   Şimşek, A.: Instructional design and models. In (Çagiltay, K., ed.): The principles of instructional technology: Theory, research, trends. Pegem Academy, Ankara, Turkey, 2013.

[Sl13]   Sloep, P.: Networked professional learning. In (Littlejohn, A.; Margaryan, A., eds): Technology-enhanced Professional Learning: Processes, Practices and Tools, pp. 97–108. Routledge, London, 2013.

[SS20]   Schmitz, M.; Scheffel, M.: The Fellowship of the Learning Activity: playing, cooperating, creating awareness and designing learning activities. In: LAK20 Companion Proceedings. SoLAR, p. 192, 2020.

[tD21]   ten Den, L.: Making Use of Students' Usage and Perception Information to Improve Online Learning Activities: A Dashboard Design Founded on Teachers' Needs. Master Thesis, Open Universiteit, 2021.

[Un20]   United Nations Educational, Scientific and Cultural Organization: COVID-19 crisis and curriculum: sustaining quality outcomes in the context of remote learning, 2020. Issue note no 4.2.

[Va03]   Van den Akker, J.: Curriculum Perspectives: An Introduction. In (van den Akker, J.; Kuiper, W.; Hameyer, U., eds): Curriculum Landscapes and Trends, pp. 1–10. Springer Netherlands, Dordrecht, 2003.

[VMK07]   Van Merriënboer, J.; Kirschner, P.: Ten steps to complex learning: A systematic approach to four-component instructional design. Routledge, New York, 2007.

[VS86]   Van Strien, P.: Praktijk als wetenschap. Methodologie van het sociaal wetenschappelijk handelen. Van Gorcum, Assen, 1986.

[Wu14]   Wubbels, T.: Verbeter het onderwijs: Begin niet alleen bij de docent. afscheidsrede, Utrecht University, 2014.