Sociomaterial Perspective of Learning Design Practice and Its Implications on Learning Design Software Development

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Declaration

I declare that this thesis has been composed solely by myself and that the work contained herein is my own except where explicitly states otherwise by reference or acknowledgement.

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Abstract

Research in Learning Design (LD), a subfield of Technology-Enhanced Learning (TEL), aims to enable teachers to design and share pedagogically informed teaching ideas that make effective use of technology to enhance learning. LD is a widely researched field with numerous LD tools and LD approaches. However, despite its richness, there are several challenges to be addressed, including the low adoption of a plethora of LD tools that do not meet adequately the requirements of HE lecturers and practitioners.

The thesis presents a sociomaterial design framework and design principles for LD tools to fill the gap between the Learning Design Practice (LD-P) of HE lecturers and existing LD tools and LD approaches. Design-Based Research (DBR) was employed as the primary paradigm and method in this thesis. A sociomaterial design framework was developed and the design principles for LD tools were derived through iterative design phases of DBR: analysis, development, two cycles of testing and reflection.

The study was structured as follows. An extensive analysis of the LD field, existing LD approaches and LD tools, their weaknesses, strengths, and challenges are presented in Chapter 2. Chapter 3 presents the methodological design details of the thesis. The open issues and challenges are further explored from experts' perspective using interview protocol, and from HE lecturers' perspective via a survey in Chapter 4 and Chapter 5, respectively. The findings from Chapter 2, Chapter 4, and Chapter 5 helped to triangulate data that constituted the foundation-stones for a sociomaterial design framework and verified the need for introducing a new conceptual framework. In Chapter 6, an analysis of the LD-P of the experts from the sociomaterial perspective is presented, whilst an analysis of HE lecturers' LD-P from a sociomaterial perspective is presented in Chapter 7. Chapter 8 presents the novel sociomaterial design

framework and uses it to examine available LD tools and LD approaches. Chapter 9 presents points of overlap and misalignments and design principles derived from the analysis of Chapter 8 and also it presents the sample implementation of the design principles. Finally, Chapter 10 gives a summary and findings of this thesis, thesis contributions and directions for future works.

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Chapter 1

Introduction

Technology-enhanced Learning (TEL) explores how digital technologies can be integrated into the learning process in innovative and transformative ways (Goodyear & Retalis, 2010). Learning Design (LD), a sub-field of TEL, is an area that explores how tools can enable teachers to describe or represent practical teaching-learning approaches so that their ideas and designs can be shared with and adjusted by other teachers (Dalziel et al., 2016). The last few years, the LD field has taken considerable advantage of technological innovations maximising their benefits for the learning design practice (LD-P), which is defined as an act of design for learning by teachers. In this context, Dalziel et al. (2016) defined learning design (with lowercase letters) as a plan for a sequence of teaching-learning activities that take place in a learning unit (Dalziel et al., 2016).

In 2015, research by the UK's Quality Assurance Agency (QAA) for Higher Education (HE), an independent institution entrusted with tracing and advising on, quality and standards in HE of UK, reported that LD, which includes the quality of teaching materials, strategies of assessments and workload, makes the most significant contribution to the overall student satisfaction (Rienties, Li, Marsh, & Rienties, 2015). The study included interviews with academic staff along with 60,000 Open University (OU) students and found that students who were more convinced of the quality of educational materials, assessment approaches, and workload were significantly more satisfied with the overall learning practice. This study reinforced the importance of LD and its impact on student satisfaction.

On the other side of the Atlantic, in the US, extensive research has also shown that LD plays a critical role in learning and teaching. Kizilcec et al. (2013), at Stanford University, analysed learners' engagement patterns on three Massive Open Online Courses (MOOCs) using different pedagogies run on the Coursera - a platform that offers MOOCs - and they revealed four distinct patterns of engagement (Anderson et al., 2014).

Also, Ferguson & Clow (2015) analysed the patterns that the Stanford team revealed on four Future Learn (a UK-led MOOCs platform) courses at the OU. The OU team found that only two of these patterns applied in that case. However, they revealed seven new distinct engagement patterns and suggested that "patterns of engagement in these massive learning environments are influenced by decisions about pedagogy" (Ferguson & Clow, 2015, p. 1). Overall, these studies demonstrate the importance of LD by pointing out that learners' engagement depends on the pedagogical strategies chosen for these courses.

The state-of-the-art in the LD field is characterised by a co-existence of a plenitude of tools for creating learning designs and LD conceptual frameworks/models (called LD approaches in this thesis), which focus on the pedagogical perspective of the designs. Dalziel et al. (2016) describe an LD approach as "a descriptive language/notational format/visualisation for describing teaching and learning activities based on many different pedagogical approaches that can be used in the LD process" (p. 23). These include, for example, 4SPPIces, the Conversational Framework, 4Ts, 3P, the e-Design Template, Six Elements, Constructive alignment, Design Principles Database, Design Narrative, 7Cs, ISiS, Quality Matters, 3E, CADMOS approach, IMS LD approach, and Learning Ecosystem (Celik & Magoulas, 2016b). Moreover, several representations of LD have arisen (Agostinho, 2011). These representations include the Educational Modelling Language (EML), the IMS LD, Learning Activity Management Systems (LAMS), digital representations or LD tools, and patterns. LD tools became the most popular among other representations. There have been several research projects that attempt to develop LD tools, such as the METIS[1], the GLUE!PS[2], and the LDSE[3]. From the literature search, various LD tools have been identified. These tools are the Integrated Learning Design Environment (ILDE), ILDE2/edCrumble, the Learning Designer, CADMOS, Reload, LD Tool, HKU Learning Design Studio, LAMS, GLUE!PS, LdShake, ScenEdit, CeLS, DialogPLUS, WebCollage, MOT+, exeLearning, coppercore, GLO Maker, Pedagogic Pattern Collector, ReCourse, CompendiumLD, Pedagogical Plan Manager, PHOEBE, OpenGLM, LAMS Activity Planner, OpenScenario, HEART, Cloudworks, and Map My Programme, London Pedagogy Planner, and PeerLAND (Celik & Magoulas, 2016b).

Despite ongoing recognition of the value of LD and the existence of various LD approaches and tools, which admittedly are offering new opportunities to lecturers and tutors, the adoption of LD theory-informed lessons and the embedding of LD tools in daily LD-P remain restricted to certain institutions or even small groups of designers. Therefore, the representation of LD stays as a central challenge of the field (Dalziel et al., 2015). This is attributed to several factors, such as the difficulty of capturing and representing LD-P's complexity, how this is reflected in LD tools (Persico & Pozzi, 2015), inadequate empirical study that examines HE lecturers' LD-P regarding how they design for learning, what influences their decisions, and what supports they use, and development of LD tools that are based on assumptions about LD-P rather than empirical evidence (Bennett, Agostinho, & Lockyer, 2014; Persico & Pozzi, 2015; Nguyen & Bower, 2018). It is also attributed to the limited representation of LD-P in meaningful ways within the LD tools for lecturers to comprehend, debate, and share

[1] https://www.metis2020.com

[2] http://www.gsic.uva.es/glueps

[3] www.ldse.org.uk/

efficient teaching-learning ideas (Mor & Craft, 2012). Therefore, misrepresentation of LD-P and misalignment of HE lecturers' LD-P with the LD tools have restricted lecturers from using and benefiting from them in their daily LD-P, and consequently, the adoption of these tools has stayed very limited in the HE lecturers' community.

This thesis contributes to available research by exploring how we can further un-pack complex learning design practices in HE to develop a more holistic view of the learning design process in HE and inform the development of software for learning design. To this end, it analyses LD experts' LD-P and HE lecturers' LD-P from sociomaterial perspective and proposes a sociomaterial design framework. It further examines LD tools and LD approaches using the framework developed, identifying the points of overlap and misalignment between experts' LD-P, HE lecturers' LD-P, LD approaches, and LD tools. Lastly, it suggests design guideline to inform the developments of future LD tools.

The rest of this chapter is structured as follows. The next section presents the research questions and objectives of this thesis. Section 1.2 presents the structure and the contribution of this thesis.

1.1 Research Questions and Objectives

The main aim of this PhD thesis is to explore the modern context of LD-P in HE and re-conceptualise the process we design software for Learning Design. To achieve this aim, the following research questions (RQs) have to be addressed.

1. What is the state-of-the-art in the LD field in terms of LD tools and LD approaches and what are the open challenges according to the literature and the perceptions of the practitioners?
2. Can we enhance our understanding of the Learning Design practice through a sociomaterial approach, and what are the factors that influence LD-P and the implications for Learning Design software development?

To answer the research questions, the following objectives should be met:

1. Analyse existing literature on LD tools, LD approaches and LD practice.
2. Research the challenges of LD field and LD tools from LD experts (senior researchers in LD field, who have also directed projects on LD tools, and are also senior teaching staff in HE institutions) and from HE lecturers' perspectives.
3. Research, analyse and model LD-P of LD experts and HE lecturers from a sociomaterial perspective and explore the role of LD technology in this context.
4. Create a sociomaterial design framework and explore the alignment between LD-P, LD tools, and LD approaches from sociomaterial perspective.
5. Derive design principles for LD tools that align with the sociomaterial view of LD-P.

1.2 Thesis Structure and Contribution

This thesis is organised as follows:

Chapter 2 presents the state-of-the-art in LD. It presents LD approaches, LD tools developed based on these LD approaches and studies conducted on teachers' perspectives and needs about LD tools. Furthermore, open challenges and issues in LD, which were mentioned in Chapter 1, are explored in detail in this chapter. This offers insights into the scope and limitations of previous research efforts in the area and LD practice and forms the first step in the triangulation of LD's problems.

In **Chapter 3**, the methodological considerations of this thesis including the philosophical underpinnings of this study, design-based research (DBR), and justifications about the methods used in this thesis are presented. In particular, the thesis combines sociomaterial theory with the DBR and uses sociomaterial theory as an analytical lens in understanding actual LD-P of HE lecturers- this choice is explained and justified in this chapter. The flexibility of DBR allowed us to employ various methods for data collection and analysis, such as literature review (Chapter 2), semi-structured interviews (Chapter 4 and Chapter 6), survey (Chapter 5 and Chapter 7). The qualitative data analysis method is used to analyse the semi-structured interview and survey data. Moreover, the sociomaterial analysis is used as a critical lens to further explore the data (results of this analysis are presented in Chapter 6 and Chapter 7).

Chapter 4 presents the results of interviews that were conducted with experts to understand the open issues and challenges of the LD field from the experts' perspective. Chapter 4 is the second step in the triangulation of the LD field's problems.

Chapter 5 describes the findings of a survey that was conducted with HE lecturers to better understand the open issues and challenges in the LD field from the HE lecturers' perspectives. To this end, an online questionnaire was designed and distributed to HE institutions. The collected data are analysed following a qualitative data analysis procedure. This chapter is the final step in the triangulation of the LD field's problems.

Chapter 6 investigates the LD-P of the experts from the sociomaterial perspective. Using sociomaterial theory as a lens for our analysis has helped us to discover human and non-human actors involved in LD-P and their entangled relations from the expert's perspectives. Based on the findings of this chapter, a sociomaterial design framework (model 1) for LD tools is developed and presented in this chapter.

Chapter 7 investigates the LD-P of the HE lecturers from sociomaterial perspective. It analyses the human and non-human actors and their entangled relations in the LD-P of HE lecturers. The findings lead to the development of a second sociomaterial design framework (model 2) that focuses on LD software tools from the HE lecturers' perspective.

Chapter 8 discusses the similarities and differences between the LD-P of HE lecturers (the findings of Chapter 7) and experts' perspectives on LD-P (the findings of Chapter 6), which led to the derivation of models 1 and 2, presented previously, and introduces a unified design framework that seamlessly integrates the two models The combined sociomaterial design framework is used as an instrument to examine six well-known LD approaches and ten LD tools. A misalignment between the LD tools, LD approaches and LD-P is revealed.

In **Chapter 9**, points of overlap and misalignments between LD tools, LD approaches, and HE lecturers' LD-P are scrutinised. A set of design principles for LD tools are derived based on the examination of LD tools and LD approaches and the points of overlap and misalignments. Also, a sample implementation of design principles is presented.

Finally, **Chapter 10** concludes the thesis with a summary of the research and findings and presents the contribution of this research. It also determines directions for future work and the ways that they could be addressed.

Chapter 2

Learning Design Field

The literature review in this chapter offers a broader context for our aims and objectives and motivates the research questions of the research of this thesis.

Learning Design (with capital letters) is a sub-research area of the Technology-Enhanced Learning field that has been aiming to develop descriptive LD approaches and LD tools to describe activities of learning and teaching based on a wide range of pedagogical methodologies and to research how these approaches and tools can help lecturers to share and adapt teaching plans (Dalziel et al., 2016). In the literature, there have been several attempts to position the LD area in the wider educational technology field and define its main concepts. According to Persico & Pozzi (2015), LD aims to provide lecturers robust digital LD tools that will help them to share, adapt, and reflect LD ideas so that LD-P becomes well-organised, more pedagogy informed, and finally, effective in promoting the development of communities of LD-P. According to Dalziel et al. (2016), learning design (with lower case letters) is the teaching-learning practice that occurs in a learning unit in the LD field. In this context, some researchers also used the term of *design for learning* to define LD (Laurillard, 2012). Furthermore, in the LD tradition, LD-P is described as the practice of application of LD concepts to develop and apply teaching-learning activities (Dalziel et al., 2016).

Dalziel et al. (2016) provided a new theoretical foundation for the LD field in their study. They presented a comprehensive overview of educational technology and how it relates to the key components of LD and named it as the Learning Design Conceptual Map (LD-CM). Dalziel et al. (2016) defined the key components of LD in the LD-

CM, as following (also see Figure 2.1); (i) guidance, (ii) representation, and (iii) sharing.

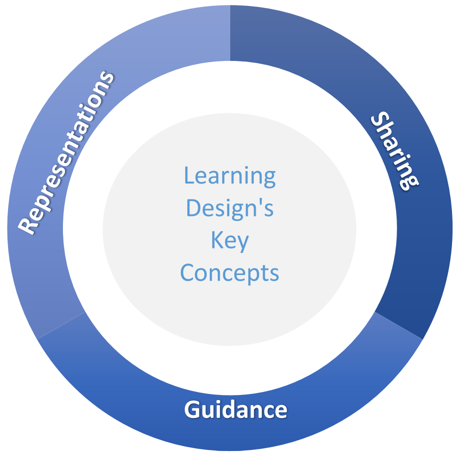

Figure 2. 1: LD's Key Concepts

A descriptive framework to represent activities of teaching-learning is the most essential of the LD's key concepts presented in Figure 2.1. Guidance and sharing complement this notion. The "guidance" element includes the various methods that can guide lecturers' thinking about their practice of teaching-learning, assisting them in understanding and adopting the latest teaching-learning approaches. The "Sharing" element focuses on the proliferation of teaching-learning ideas among the lecturers' community. By considering the three core elements of the LD-CM, the ultimate goals of the LD field can be summarised as follows:

a) getting benefit from others' LDs,
b) re-using and sharing LDs,
c) adapting LDs to various disciplines,
d) building a community of learning designers,
e) creating pedagogy informed and technology integrated LDs,
f) differentiating learning activities,
g) localising LDs based on the needs of learners,

h) highlighting how learners learn and how teachers teach efficiently,
i) developing software to create, share, re-use, and implement LDs (Dalziel et al., 2016).

State-of-the-art in LD is designated by the concurrence of various LD tools and LD approaches (Gráinne Conole, 2013). LD approaches provide expressive languages for defining teaching and learning activities based on various pedagogical methods (Dalziel et al., 2016). LD tools are the digital artefacts which are developed based on the LD approaches to support teachers in designing various sort of educational events building upon pedagogically informed criteria for the learning objectives identification, proper teaching-learning approaches, criteria for assessment, media and technological tools (Persico et al., 2013). LD approaches have an intermediary role between the actual LD-P of lecturers and LD tools, as illustrated in Figure 2.2.

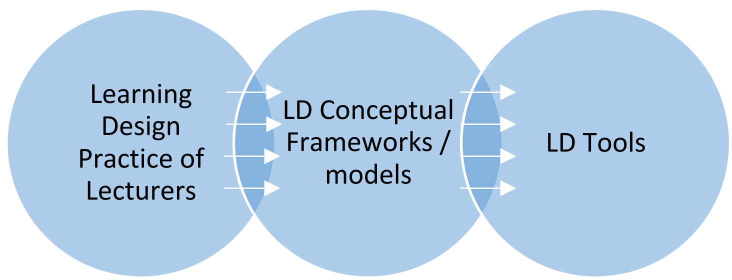

Figure 2. 2: LD approaches play an intermediary role

The rest of this chapter is organised as follows. The next section presents a revision of available LD approaches, explaining their backgrounds and providing their current status, i.e. active or inactive. Section 2.2 review existing LD tools, their scopes, and determines their theoretical underpinnings and relations with the LD approaches. Section 2.3 gives an overview of empirical studies conducted on teachers' perspectives on LD and LD tools. The open challenges in the LD field and related works to the research of this study are presented in Section 2.4. Finally, the chapter ends with a summary in Section 2.5.

2.1 Learning Design Approaches and Learning Theories

Several LD approaches have been developed to support lecturers in decision making in LD-P (Persico & Pozzi, 2015). They can be expressed in the form of guidelines to inform LD-P and promote reflection on design choices (Persico et al., 2013). By doing a systematic literature review (Celik & Magoulas, 2016), we identified eighteen LD approaches as presented with their reference and key elements in Table 2.1.

Table 2. 1. LD Approaches

Approaches	Reference	Elements Emphasised
4Ts	(Pozzi et al., 2016)	Task, Team(s), Time, and Technology
E-Design Template	(Walmsley, 2015)	Active Induction, Guided Exploration, Facilitated Investigation, Self-Organised Learner
7Cs	(Gráinne Conole, 2014)	Conceptualise, Capture, Communicate, Collaborate, Consider, Combine, Consolidate
Learning Ecosystem	(Hung, 2014)	Learning Content, Learning Context, Learning Subjects, Learning Technology
TPACK	(Koehler, Mishra, & Cain, 2013)	Technological Knowledge, Pedagogical Knowledge, Content Knowledge
Design-Inquiry Approach	(Mor & Mogilevsky, 2013a)	Imagining a Challenge, Investigate, Inspiration from Past, Ideating a Solution, Prototyping, Evaluating
Conversational Framework	(Diana Laurillard, 1999, 2002, 2012)	Teacher's Concepts, Teacher's Constructed Learning Environment, Student's Concepts, And Student's Specific Actions
4SPPIces	(Pérez-Sanagustín, Santos et al., 2012a)	The Space, The Pedagogical Method, The Participants, The History
Design Narrative	(Mor, 2011)	Context, Challenge, Theoretical Framework, Events, Actions, Results, Reflections
3P	(Chatti et al., 2010)	Personalisation, Participation. Knowledge-Pull
Design Principles Database	(Kali et al., 2009)	Specific Principles, Pragmatic Principles, Meta-Principles
ISiS	(Emin, 2008)	Elicitation of Context, Elicitation of Dimensions, Provide Flexible Design Processes, Reuse
3E	(Smyth, 2007)	Enhance, Extend and Empower
Quality Matters	(Sener, 2006)	Course Overview, Introduction, Learning Objectives, Assessment and Measurement, Instructional Materials, Learner Interaction and Engagement, Course Technology, Teacher Support, Accessibility

Six Elements	(Gagnon & Collay, 2001)	Situation, Groupings, Bridge, Questions, Exhibit, Reflections
CADMOS Approach	(Katsamani & Retalis, 2011)	Conceptual Model, Flow Model
IMS LD	(Jeffery & Currier, 2003)	Scenario {Roles, Activities, Environments, Learning Resources, Method}
Constructive Alignment	(Biggs J & Biggs, 1996)	Curriculum, Intended Outcomes, Teaching Methods, Assessment Tasks

The various elements of each LD approach, reflecting activities or other aspects of learning-teaching practice considered in each model, are presented in the last column of Table 2.1. To explain these elements, for example, according to the 4Ts model, an online collaborative activity always can be viewed as a task to be performed by at least one group of students within a specific period in a given technological condition. In another example, according to the e-Design template framework, learning activities can be grouped according to the critical elements of the framework. The components of the 7Cs of conceptual frameworks represent the key stages in the LD-P. The Learning Ecosystem model provides a holistic view of teaching practice with its essential elements. The Design Inquiry approach endeavours to shape teaching practice in the scientific investigation model and the key aspects of the approach are the stages of the learning-teaching design cycle. According to TPACK, effective teaching with educational technologies can be achieved through interaction between teachers' technological knowledge, teachers' pedagogical knowledge, and teachers' content knowledge. The core elements of the Conversational Framework correspond to the principal components of the learning-teaching process. 4SPPIces's main components highlight the four factors that need to be considered in the design of Computer-Supported Collaborative Blended Learning (CSCBL). The Design Narrative model focus on design for learning in the sense of problem-solving and its main components involved in the design process. The 3P model emphasises the three key elements involved in learning. The features highlighted by the Design Principles Database are the layers of design for learning. According to the ISiS conceptual framework, the design and share of LDs should be promoted based on its core elements. The elements of the 3E framework represent the levels involved in the learning-teaching practice. The Quality Matters is a rubric, and an LD should be examined regarding the factors emphasised by this rubric. Regarding the Six Elements, learning should be designed according to its essential elements. CADMOS approach tells that learning happens in layers and there are two models for this: a conceptual model and flow model. According to IMS LD, LD is a pedagogical scenario comprised of roles performed by students and teachers, activities, teaching-learning environment, and resources for learning. The Constructive Alignment stresses the alignment between its core elements (see Table 2.1) in the teaching system.

Following the classification of Persico et al. (2013) and Persico and Pozzi (2015), who attempted to organise LD approaches according to their supported functions in two categories, the LD approaches presented in Table 2.1 can be arranged as follows. The first category includes LD approaches that focus on a specific pedagogical theory to better support an activity design, which is then aligned with that pedagogy. The second category covers "general purpose" LD approaches, which can be suitable for various learning contexts and could serve several pedagogies.

In the first category, we can include the 4Ts model that focuses on online CSCBL. Another approach of this category is the e-Design Template that has been developed for teachers to plan e-Learning. Similarly, the 4SPPIces conceptual model is another approach developed to provide practitioners with a design language for CSCL.

The second category includes the 7Cs Framework, Learning Ecosystem, and the Design-inquiry Approach. The Conversational Framework and the Design Narrative are approaches that accommodate or merge several pedagogies. Similarly, 3P, Design Principles Database, ISiS conceptual framework, 3E, Six Elements, Quality Matters, CADMOS approach, IMS LD, TPACK and Constructive Alignment are approaches considered under this category.

To further determine the theoretical underpinnings of LD approaches, analysis of several LD approaches is conducted below with respect to the adopted learning theory, such as behaviourism, constructivism, cognitivism, connectivism and so on.

Behaviourist theory focuses on measurable behaviours of individuals. The learned behaviours are repeated by individuals until they became automatic. Specific principles of behaviourism are directly pertinent to LD. These principles are as follows: a highlight on creating measurable and observable learning outcomes among students, an analysis of students to determine where learning should begin, emphasising on advancing early learnt behaviours before moving on to complicated levels and promoting to improve student performance. There is no relevant LD framework for this theory in LD literature.

The constructivist theory argues that learners and environment interact with each other and this interaction results in knowledge. There are specific principles of the constructivist theory that is directly relevant to LD as following: a highlight on the context in which the behaviours will be learnt, an emphasis on the use of learnt skills in other situations, presenting context in different ways, an emphasis on supporting learners to go beyond the information given using problem-solving skills, and assessments that help the transfer of information and skills. The main LD approaches inspired from constructivist principles are the 4SPPIces model, constructive alignment, the 4Ts approach, the e-design template, and the design principles database, constructivist LD approach, design narrative approach, conversational framework, and 7Cs of LD framework.

The following are specific principles from the cognitivist theory that are directly relevant to the LD: emphasis on the learners` engagement in the learning process actively, identifying prerequisite relationships using hierarchical analysis, stresses out on shaping, organising, and ordering information, highlight on the learning environment in terms of allowing learners to make connections with prerequisite skills.

Among the LD approaches presented in Table 2.1, there is no LD approach whose principals were based on the cognitive theory.

Connectivism is a learning theory developed for digital age learners recently by extending traditional learning theories (cognitivism, behaviourism, and constructivism) (Hung, 2014). The connectivism theory's specific principles that are directly relevant to the LD are as follows: knowledge produced by a diversity of opinions, the connection is essential for continual learning, technological appliances affect learning, up-to-date knowledge is essential in connectivist theory, and decision making is also in the learning process. The Learning Ecosystem Model has been developed according to the principles of the connectivist theory.

All these LD approaches offer a quite rich basis for creating theory-informed LDs, but their richness introduces several challenges to teachers/designers, who find it increasingly difficult to choose the most suitable form for a particular context of use, and, thus, it limits their adoption or the full exploitation of their potential in practice. As Persico et al. (2013) point out, most designers would prefer frameworks perceived as more familiar with their current practice, and only a small number of them have enough time to try several frameworks or explore completely new ones. In the following sub-sections, we describe in more detail six well-known LD approaches that have influenced the development of LD software tools- relevant tools will be presented later in Section 2.2.

2.1.1 7Cs of LD Framework

Conole (2014) developed the 7Cs framework based on the studies conducted at the Open University (OU) as part of the LD initiative. Colone's (2014) work is associated with design workshops of Carpe Diem design at the University of Leicester. The 7Cs framework is created as a mediating artefact following the socio-cultural theory and was verified and improved by workshops' series. It considers the core stages included in LD-P, starting from conceptualisation of a teaching-learning through trialling and examining it in a practical real teaching-learning setting. The 7Cs framework comprises of the following levels: Conceptualise, Capture, Create, Communicate, Collaboration, Consider and Consolidate. Each level considers specific questions about the LD process as presented in Table 2.2.

Table 2. 2. The questions addressed in each stage of the 7Cs (Conole, 2014, p. 504)

No	7Cs's stages	The questions asked in each stage
1.	Conceptualise	What is the vision for the learning intervention, who is it designed for, what is the essence of the intervention, what pedagogical approaches are used?
2.	Capture	What Open Educational Resources are being used and what other resources need to be developed?
3.	Create	What is the nature of the learning intervention the learners will engage? What kinds of learning activities will the learners engage?
4.	Communicate	What types of communication will the learners be using?
5.	Collaboration	What types of collaboration will be learners be doing?
6.	Consider	What forms of reflection and demonstration of learning are included? Are the learning outcomes mapped to the activities and assessment elements of the learning intervention?
7.	Consolidate	How effective is the design? Do the different elements of the design work together?

7Cs of LD framework is developed in close connection with HE lecturers on a long-term basis, and it was verified and improved by a set of workshops. It was trialled in a variety of contexts over the last couple of years. The JISC-funded SPEED project allowed the researchers of the 7Cs to operate a series of face-to-face workshops, along with a series of simultaneous sessions to four UK universities. Besides, researchers of the 7Cs conducted various sets of workshops at international conferences. The evaluation of the 7Cs framework comprised of observations of the participants at the workshops and the collection of data from those participants. Overall, the reaction of the participants to the 7Cs of LD framework was positive and they found the workshops engaging, helpful, and inspirational.

2.1.2 Conversational Framework

Laurillard's (1999, 2002) conversational framework is a contemporary LD approach for teachers that focus on the creation and sharing of learning designs using online LD support tools to make learning and teaching more pedagogy informed. The framework defines the important form of the teaching-learning process in HE (Laurillard, 1999).

At the individual level, according to Laurillard (1999), learning in HE is happening through iterative conversation between the lecturer and the learner that operates in two levels: "the discursive, theoretical, conceptual level and the active, practical, experiential level" (Laurillard, 1999, p. 29). These stages are connected by each stakeholder engaging in the practice of theory and reflection about the theory in the light of practice.

Laurillard (1999) applied the conversational model at the level above the individuals and analysed universities- how their system might be designed based on the conversational framework. According to the conversational framework, learning technology strategy of the institution should be based on conversations between institutional strategies for learning technology, institutions' teaching-learning theory, unit planning, and course running with learning technology.

Furthermore, Laurillard (1999) took the analogy of conversational framework and applied it to the HE system. In this case, the conversation between the national strategy for learning technology, HE sectors' teaching-learning approach, HE planning of learning technology, universities running teaching-learning with learning technologies is sought.

Laurillard (1999) even went to a higher-level description, description of society and how the institution would operate within it. It is found that there is a quid pro quo operation between the curricula, courses theories, projects, and programme planning in the universities and policies, values, government strategies, agencies of governments in society.

2.1.3 ISiS

ISiS model (Intentions, Strategies, interactional Situations) aims to allow lecturers to structure the design of LD scenarios to promote sharing and adjusting these scenarios among lecturers' community (Emin, 2008). According to the ISiS model, there are four levels in designing and exchanging LD scenarios:

1. "elicitation of context, primarily by identifying the knowledge context from the situational context of a learning unit;
2. elicitation of intentional, strategic, tactical and operational dimensions;
3. capability to provide flexible design processes allowing different combinations of design steps and to continue the design during the runtime phase;
4. reuse of existing scenarios, elements or design patterns which will enable the teacher/designer to design scenarios more efficiently" (Emin, 2008, p.4)

According to ISiS model, there is a high-level scenario, named structuring scenario, where the design of a learning unit happens in cases or phases. The knowledge context describes the focused knowledge elements such as capabilities, competencies, and notions, the characteristics of the learners, or the duration of a learning unit. The situational context is defined by a group of variables: resources used to support activities, locations where teaching-learning activities are played, planning where the activities are planned or several students are considered, and roles shared among the stakeholders.

The intentional, strategic, tactical and operational levels can be described as follows. The "intention level" is about defining the intentions of the learning designers. Therefore, it is connected to the knowledge context defined in the above paragraph. The "strategy level" focuses on strategic characteristics. In "strategy level", the strategies are proposed to accomplish the aims set in "intention level". The "tactical level" considers the refinement of the strategies chosen by connecting them with their solutions. The "operational level" defines the solution with details clearly.

2.1.4 The 4SPPIces model

4SPPIces is a conceptual model that gives learning designers and professionals a common representation language to produce Computer-Supported Collaborative Blended Learning (CSCBL) scripts and the technological environment for promoting their performance (Pérez-Sanagustín et al., 2012). 4SPPIces is a novel model because it combines four factors in one common language. It describes the space as a factor that needs to be taken into account in the design and indicates the history factor to distinctly shape the connections among various other factors which influence the performance of the script (Pérez-Sanagustín et al., 2012).

According to 4SPPIces model, four factors need consideration in designing and planning CSCBL scripts: space, the pedagogical method, the participants and the history (Pérez-Sanagustín et al., 2012). The Space factor (S) is the place where teaching-learning activities take place with its elements and there are two types of S, called physical and virtual. The physical space is about physical manipulation of the components of the teaching-learning environment. In virtual space, the learners manipulate the components of virtual space virtually.

Another factor of 4SPPIces model is the Pedagogical Method factor (PM) that is about structuring the activities, differentiating the lecturers and the students' tasks with activities, defining the features of the groups, and describing the input and outputs that will be created from one stage to another.

The 4SPPIces model's Participants factor (P) is about considering the features of the learners who participate in the activity. There are four aspects of P factor: considering the number of the participants, the students' profile that might influence the design of the activities, profile-dependent group formation is about grouping students based on their profiles, and the physical location aspect is about where the activities will take place.

The History factor (H) explains the results regarding the aspects of the first three factors whose various variations might influence the enactment of the activities.

2.1.5 CADMOS Approach

CADMOS (CoursewAre Development Methodology for Open instructional Systems) approach advocates the "separation of concerns" for the LD process (Katsamani & Retalis, 2011). According to the CADMOS approach, the design of learning scenarios is performed in layers by learning designers and there are two models for this: the conceptual model and the flow model. The Conceptual Model is associated with the teaching-learning activities that students and teachers will be involved in during the educational process of a specific subject. The flow model includes the navigational design patterns of the teaching-learning activities. In the next sub-sections, we revise these models with details.

2.1.5.1 Conceptual Model

According to the CADMOS approach, creating an LD starts at the conceptual level where a lecturer must specify the activities of LD (Katsamani & Retalis, 2011). For each composite activity, some features need to be determined:

- Title: a title of the composite activity
- Description: a definition of the composite activity
- Role: the actor that will be engaged in this activity (student or lecturer)

For each simple activity, the features that need to be set are:

- Title: a title for the simple activity
- Description: a description of the simple activity
- Role: the actor that will be engaged in this activity (student or teacher)
- Type: the type of simple activity such as informative, theory, example, assessment, feedback, scaffold, simulation-modelling, and communicative

- Learning goal: the learning goal that corresponds to this activity
- Prerequisite: the prerequisite that a student must fulfil to complete this activity

Then the lecturer should connect each simple activity with a resource. The teacher can relate various specific resources to a learning activity. For each resource the features that must be determined are:

- Title: a title for the resource
- Description: definition of the resource
- Type: the resource's type, e.g. hypertext, audio, video, assessment, forum, and quiz
- Editor: the editor of the resource
- Copyright: free/proprietary
- Learning Object: the file or website that corresponds to this resource

2.1.5.2 Flow Model

After having performed the conceptual level, learning designer proceeds to the next layer which is the flow level. In this layer, the learning designer deals with the arrangement and navigation of the learning activities.

2.1.6 IMS LD

IMS LD is a technical specification that gives the components that describe the design of any teaching-learning practice following a formal way in the form of the containment framework (Jeffery & Currier, 2003). IMS LD was built upon the EML. EML is a meta-language that allows codifying the pedagogical essence of teaching-learning elements in a unit, connecting each part of the content with the knowledge that defines its instructional approach. The Open University of the Netherlands (OUNL) designed EML as a notational language in the 1990s. EML aimed to represent a broad variety of instructional approaches. The various cognitive, constructivist and behaviourist approaches constituted the basement of the EML.

IMS LD is described as a pedagogical scenario whose components are roles acted by students and lecturers, the activities developed for students, environments where the teaching-learning event takes place, and method that is the scenario itself. Figure 2.3 retrieved from (Berlanga & García, 2005) presents the hierarchical rank of the components of IMS LD. An asterisk (*) next to a concept in Figure 2.3 designates a component that may happen more than once. Jeffery & Currier (2003) describes the core components of IMS LD as follows:

- "The play is presented in a series of acts, in which roles are played by those taking part, for example, learner, tutor, and mentor.
- People playing the roles undertake a series of activities within an act. For a learner, these might include discussing with classmates the relative merit of a piece of the source material. A tutor's activity may be to comment on their conclusions.
- Each role is presented with its learning objects and services (e.g. communication tools) within an activity.
- An act is completed after all the activities of a specified role, or roles, are finished. Alternatively, a time limit may be set, after which an act is completed.
- When one act completes, the next act is started. The play finishes when all the acts are completed; the LD finishes when all the plays are completed" (p. 2).

```
learning-design
  title
  learning-objectives
  prerequisites
  components
    roles
      learner*
      staff*
    activities
      learning-activity*
        environment-ref*
        activity-description
      support-activity*
        environment-ref*
        activity-description
      activity-structures*
        environment-ref*
    environments
      environment*
        title
        learning objects*
        services*
        environment-ref*
        metadata
method
    play*
      act*
        role-parts*
          role-ref
          activity-ref
metadata
```

Figure 2. 3. The main components of IMS LD (IMS Global Learning Consortium, 2003)

2.2 Learning Design Software

Several LD tools have been developed to enable teachers and lecturers define or portray practical teaching ideas so that they can be shared with, and adopted by, their peers. Celik & Magoulas (2016a)'s systematic literature review study identified various digital LD tools and their connection with specific LD approaches. An overview of these tools is presented in Table 2.3. To a large extent, like with LD approaches, the theoretical underpinnings of the LD tools also rest on constructivism or connectivism.

Table 2. 3. LD tools and relevant frameworks

No	LD Tool	Reference	Underlying LD Approach
1.	ILDE2/edCrumble	(Albó & Hernández-Leo, 2018a)	7Cs Framework
2.	Map My Programme	(Dalziel et al., 2016)	A set of free Google apps
3.	PeerLAND	(Papanikolaou et al., 2016)	TPACK Framework
4.	OpenGLM	(Derntl, 2015)	IMS-LD - Design Representations
5.	ILDE	(Hernández-leo et al., 2013)	7Cs Framework
6.	HKU LD Studio	(Mor & Mogilevsky, 2013b)	Design-inquiry Approach
7.	The Learning Designer	(Laurillard et al., 2013)	Conversational Framework
8.	WebCollage	(Villasclaras-Fernández et al., 2013)	Adaptation patterns
9.	Pedagogic Pattern Collector (PPC)	(Prieto et al., 2012)	Conversational Framework
10.	CADMOS	(Katsamani & Retalis, 2011)	CADMOS Approach
11.	GLOMaker	(Khademi et al., 2011)	Generative Learning Objects – Design Patterns
12.	GLUE!PS	(Prieto et al., 2011)	*GLUE*!-*PS* Data Model
13.	LD Tool	(Agostinho, 2011)	The Learning Design Visual Sequence
14.	LdShake	(Hernandez-Leo et al., 2011)	4SPPIces
15.	Pedagogical Plan Manager (PPM)	(Olimpo et al., 2010)	XML - Design Representation
16.	ScenEdit	(Emin, Pernin, & Aguirre, 2010)	ISiS
17.	Cloudworks	(Gráinne Conole & Culver, 2009)	A socio-cultural perspective
18.	exeLearning	(Navarro & Climent, 2009) (http://exelearning.net/en/)	XHTML or HTML5 format
19.	HEART	(Donald & Blake, 2009)	HEART LD support strategy
20.	LAMS Activity Planner	(Cameron, 2009)	LAMS - Design Representation
21.	OpenScenario	(Jullien et al., 2009)	Four pillars of the pedagogy
22.	ReCourse	(Griffiths, Beauvoir, Liber, & Barrett-Baxendale, 2009)	IMS-LD - Design Representation
23.	Reload	(Griffiths et al., 2009)	IMS-LD - Design Representation
24.	CompendiumLD	(Brasher et al., 2008)	IMS-LD - Design

			Representation
25.	London Pedagogy Planner (LPP)	(San Diego et al., 2008)	Conversational Framework
26.	MOT+	(Paquette et al., 2008)	MISA instructional design method
27.	PHOEBE	(Masterman, 2008)	Wiki technology
28.	CeLS	(Ronen et al., 2006)	IMS-LD - Design Representation
29.	LAMS and LAMS v2	(Dalziel, 2006)	LAMS - Design Representations
30.	DialogPLUS	(Gráinne Conole & Fill, 2005)	DialogPlus taxonomy
31.	coppercore	(Britain, 2004)	IMS-LD - Design Representation

In terms of organising tools in different categories, Britain (Britain, 2007) categorised tools as authoring environments, run-time environments, and integrated environments. Conole (2008) distinguished LD tools into visualisation tools, pedagogical planners, generic tools, and LD resources. With respect to the LD representation used in the tools, within the same study, Grainne Conole (2008) organised the tools in two groups: textual representation and visual representation.

More recently, Persico & Pozzi (2015) categorised the LD tools based on their functions into authoring and sharing tools, assessment planners & learning analytics (LA), reflection tools & pedagogical planners, delivery tools, and repositories. Following this scheme, ILDE, HKU Learning Design Studio, Learning Designer, GLO Maker, CeLS, WebCollege, DialogPLUS, MOT+, LAMS, exeLearning, CopperCore, CADMOS, Recourse, OpenGLM, CompendiumLD, and Reload can be considered as authoring and sharing tools. Map My Programme, ILDE2/edCrumble, and PeerLAND are considered in the category of assessment planners & learning analytics. PPC, PHOEBE, LdShake, OpenScenario, LAMS, LPP, and PPM form the category of Reflection Tools & Pedagogical Planners. The delivery tools category covers GLUE!PS. In the repository's category, Cloudworks, HEART and LDTool can be included. The categorisation of the LD tools and their timeline is illustrated in Figure 2.4. The year each LD tool was introduced is shown in this figure.

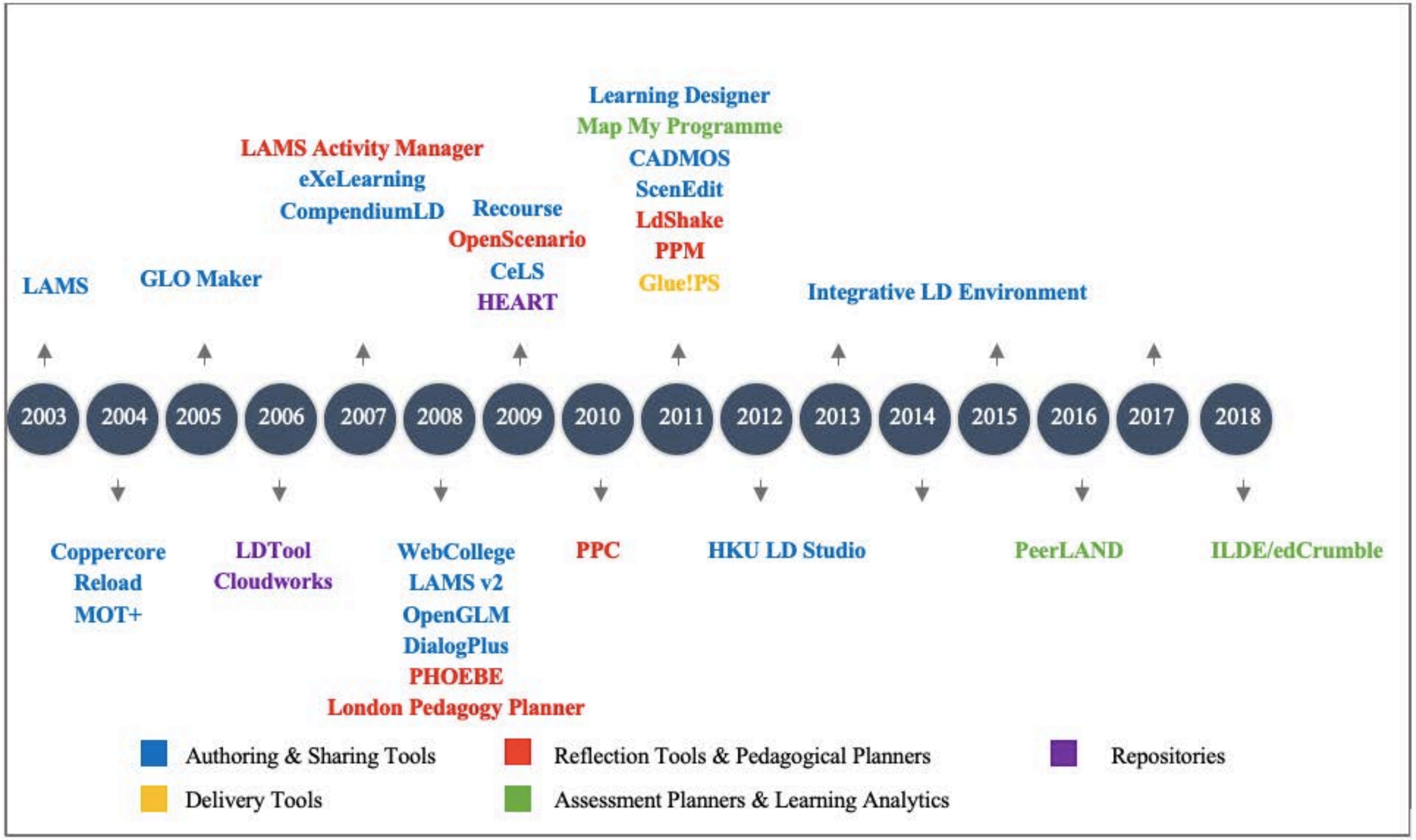

Figure 2. 4. The timeline and categorisation of the LD tool

To further analyse and distinguish LD tools, reconceptualising the framework proposed by (Britain, 2007), a new framework is presented in Table 2.4. One of the distinct differences of our framework from Britain's is that our framework evaluates LD tools in terms of their facilities that consider LA. Another dimension introduced compared to Britain's approach is that the new framework considers the tools with regards to their ability to deploy LDs into VLEs, export and import LDs into different file formats. Like Britain's framework, our framework also consists of three main sections: general properties, LD properties, and technical properties. The main sections and their subsections associated with their corresponding meanings are presented in Table 2.4. The general properties section comprises of five subsections, the LD properties section has four subsections, and there are three subsections in technical properties section. Using the framework presented in Table 2.4, in the following sub-sections, we analyse LD tools.

Table 2. **4.** Evaluation framework used in the study

GENERAL PROPERTIES	**Scope**	What is the main function of the tool?
	Release date	What is the release date of the tool? Does the tool still exist?
	Target users	Who is the system for?
	Export & Import	Can the tool import and export of LDs into other file formats?
	VLEs	Can the tool deploy LDs into Virtual Learning Environments?
LEARNING DESIGN	**Design language**	What notation language does the tool use?
	Activity model	How the tool illustrates activities?
	Workflow model	What is the model used in the representation of the LD flow?
	Learning analytics	Does the tool have any functionality regarding LA?
TECHNICAL	**Form of software**	What is the form of the software of the tool?
	User interface	What does the tool present in terms of the user interface?
	Technical needs	Does the tool have any technical requirement or additional software to run the application?

2.2.1 Authoring and Sharing Tools

According to Persico & Pozzi (2015), the group of authoring and sharing tools includes tools which "allow the representation of activities and are rooted in specific pedagogical models". As presented in the timeline, sixteen authoring and sharing tools are placed in this category. We present their characteristics in line with the dimensions of the evaluation framework in Table 2.5 and Table 2.6.

Table 2. 5. An analysis of authoring and sharing tools

		ILDE	HKU LD Studio	Learning Designer	GLO Maker	CeLS	Web Collage	Dialog PLUS	MOT+
GENERAL PROPERTIES	Scope	Authoring, sharing, editing, exploring	Authorin g (For self-directed activities)	Authorin g (create, share, edit and reuse)	Authorin g	Create and reuse activity	Authoring tool (pattern-based)	Authori ng tool	Authori ng tool
	Release date	2012– still running	2013 – still running	2011 – still running	2006 – Not available	2009 – still running	2006 – still running	2006 – Not availabl e	2008 – Not availabl e
	Target users	Teachers	Teachers	Teachers ,	Teacher-designer s	Teachers and researchers	K-12 teachers	Teacher s	Teacher s
	Export & Import	N/A	JSON file.	MSWord , Share as an URL	N/A	XML-based model	IMS LD (A level)	IMS LD	IMS LD
	Deploy into VLEs	Moodle, SCORM, metisVLE, MediaWiki	N/A	N/A	N/A	N/A	LAMS, Moodle	N/A	LAMS, Moodle
LEARNING DESIGN	Design language	Integration of LD tools	Text-based (Similar to IMS-LD)	Formal learning concepts	Text-based	N/A	Graphical and pattern-based	Nugget taxonom y languag e	Graphic s-based, formal
	Activity model	OpenGLM, WebColleg e, exeLearnin g, CADMOS	It follows the sequence of learning.	In sequence , similar to the lesson plan	Sequenti al	Presentatio n, input, interaction, dialogue	Collaborati ve activity patterns	Nugget Model	IMS LD
	Workflo w model	OpenGLM, WebColleg e, exeLEarnin g, CADMOS	It follows the sequence of learning.	Main propertie s of an LD	Sequenti al	XML-based model	Collaborati ve learning flow patterns	Nugget Model	IMS LD
	Learning analytics	Peer-review evaluation of LDs	N/A	Graphica l show of activities	N/A	N/A	Provides assessment patterns.	N/A	N/A
TECHNICAL	Form of software	Web-based	Web-based	Web and desktop-based, Mobile App	Web-based	Web-based	Desktop-based, web-based	Web-based	Web-based
	User interface	Easy-to-use	Compris ed of two steps.	Interacti ve	N/A	Interrelated stages	Flexible	N/A	N/A
	Technica	Java	N/A	Window	N/A	Internet	N/A	N/A	N/A

	l needs	Run-Time		s, Mac, Linux		Explorer 5			

Table 2. 6**.** An analysis of authoring and sharing tools

		LAMS	eXeLearning	Copper Core	CADMOS	Recourse	Open GLM	Compendium LD	Reload
GENERAL PROPERTIES	Scope	Authoring, Community, and Run-time Environment	Authoring tool	Authoring tool	Authoring tool	Authoring tool (IMS LD compliant)	Authoring tool (create, share and reuse)	Authoring for designing learning activities	Authoring and runtime environment
	Release date	2003 – still running	2007 – still running	2004 – still running	2011 – still running	2009 – still running	2006 – still running	2005/06 – still running	2004/2005 – still running
	Target users	Teachers	Teachers, academics	Teachers	Novice teachers	Teachers (IMS LD)	Non-professional IMS LD user	Lecturers, teachers	Teachers (familiar to IMS LD)
	Export & Import	LAMS, IMS LD	IMS LD, HTML5, ePub3	IMS LD (A, B, C Levels)	IMS LD (A, B), MS Word	IMS LD	IMS LD (A, B), ILDE	IMS LD	IMS LD (A, B, C), XML format
	Deploy into VLEs	Moodle, Blackboard, Sakai, LRN, WebCT, SharePoint, OLAT, Desire2Learn	SCORM, Moodle	N/A	Moodle.	LAMS, Moodle	Moodle	LAMS, Moodle	N/A
LEARNING DESIGN	Design language	Visual-based descriptive language	IMS LD, SCORM	IMS LD	Visual-based in layers	Graphical and pattern-based	Graphical and pattern-based	Visual-based	Contains all entities of IMS LD
	Activity model	LAMS educational workflow system	IMS LD, SCORM	IMS LD	Conceptual/flow model	IMS LD	Visual modelling metaphor	Mind mapping, or concept mapping	IMS LD
	Workflow model	LAMS educational workflow system	IMS LD, SCORM	IMS LD	Conceptual/flow model	IMS LD	Visual modelling metaphor	Mind mapping, or concept mapping	IMS LD
	Learning analytics	Monitors progress of a student	N/A	N/A	N/A	N/A	N/A	Allows users to think on assessments	N/A
TECHNICAL	Form of software	Desktop-based	Desktop-based	Desktop-based	Desktop-based	Desktop-based	Web-based	Web-based	Desktop-based
	User interface	Drag and drop user interface	N/A	N/A	User-friendly	Visual-based	Comprised of panes	Flexible, simple	Tabs and editing fields
	Technical needs	Written in Java and operated in	N/A	N/A	N/A	Java Run-Time	Java Run-Time	N/A	Java Run-Time

		cross platforms							

2.2.2 Assessment Planners and Learning Analytics

Tools that mainly focus on informing learning in terms of LA are listed in this category, as shown in Table 2.7. ILDE2/edCrumble, Map My Program, and PeerLAND are analysed according to our framework in Table 2.7

Table 2. 7**.** An analysis of assessment planners and learning analytics

		Map My Programme	ILDE2/edCrumble	PeerLAND
GENERAL PROPERTIES	Scope	Mapping and planning assessments	Authoring, sharing, editing, exploring	Peer evaluation tool for LD
	Release date	2011 – still running	2018– still running	2016- still running
	Target users	Teachers	Teachers	Students/Teachers
	Export & Import	N/A		N/A
	Deploy into VLEs	N/A	Moodle, SCORM, metisVLE, MediaWiki	N/A
LEARNING DESIGN	Design language	Visual-based	Integration of LD tools	Text-based
	Activity model	N/A	OpenGLM, WebCollege, exeLEarning, CADMOS	N/A
	Workflow model	N/A	OpenGLM, WebCollege, exeLEarning, CADMOS	N/A
	Learning analytics	The tool provides a summative and formative evaluation of the assessments.	Advanced integration of LA into LD tool	Peer evaluation
TECHNICAL	Form of software	Web-based	Web-based	
	User interface	N/A	Easy-to-use	
	Technical needs	Google Account	Java Run-Time	

2.2.3 Reflection Tools & Pedagogical Planners

Tools in this category are intended to "help the teacher/designer reflect on the pedagogical choices to take, thus supporting the process of decision-making" (Persico & Pozzi, 2015). These are shown in Table 2.8 and Table 2.9.

Table 2. 8. An analysis of reflection tools and pedagogical planners

		PPC	PHOEBE	LdShake	OpenScenario
GENERAL PROPERTIES	Scope	Pedagogical Pattern Collector	Pedagogic planner	Social network-oriented tool	Scenario-based tool
	Release date	2011 – still running	2006 – Not available	2011 – still running	2009 – Not available
	Target users	Teachers	Teachers	Teachers	Teachers
	Export & Import	N/A	N/A	N/A	N/A
	Deploy into VLEs	N/A	N/A	N/A	N/A
LEARNING DESIGN	Design language	Pattern-based	Wiki-based, and set of resource	Various pedagogical approaches	Scenario-based design
	Activity model	Cognitive model	Sequence structures	4SPPIces Model	Scenario-based model
	Workflow model	Cognitive model	Sequence structures	4SPPIces Model	Organization, learning, observation, evaluation
	Learning analytics	N/A	Assessment and activities	N/A	N/A
TECHNICAL	Form of software	Web-based	Web-based	Web and desktop-based	Web-based
	User interface	Browser, designer, abstractor	N/A	N/A	Flexible
	Technical needs	N/A	N/A	N/A	N/A

Table 2. 9. An analysis of reflection tools and pedagogical planners

		LAMS	PPM	LLP
GENERA L PROPERT	Scope	Create learning activities	Pedagogic planning of LDs	Pedagogic planning for LDs
	Release date	2007 – still running	2010 – still running	2008

	Target users	Teachers	Teachers	Teachers
	Export & Import	N/A	N/A	N/A
	Deploy into VLEs	Moodle	N/A	N/A
LEARNING DESIGN	Design language	Sequential	Hierarchical entities	Formal teaching-learning concepts
	Activity model	Sequential	Pedagogical Hierarchy	In sequence
	Workflow model	Sequential	Pedagogical Hierarchy	Main properties of LD
	Learning analytics	N/A	N/A	N/A
TECHNICAL	Form of software	Web-based	Web-based	Web-based
	User interface	N/A	Hierarchy Manager, Field Sector, Data Area	Interactive
	Technical needs	Flash Player	N/A	N/A

2.2.4. Delivery Tools

Delivery tools are specifically designed to support the delivery of the activities and LD into the learning environment. A tool of this category is evaluated in Table 2.10.

Table 2. 10**.** An analysis of delivery tools

		GLUE!PS
	Scope	It allows integration of existing external tools including Google Docs, Google Spreadsheets, Google Presentations, Dabbleboard, Noteflight, Doodle, Wookie Widgets.
GENERAL PROPERTIES	Release date	2011 – still running
	Target users	Teachers, practitioners, researchers
	Export & Import	Supports IMS LD specification (Level A equivalent)
	Deploy into VLEs	Moodle, MediaWiki, LAMS
LEARNING DESIGN	Design language	N/A
	Activity model	N/A
	Workflow model	N/A
	Learning analytics	N/A
TECHNICAL	Form of software	Middleware architecture, Desktop-based
	User interface	N/A
	Technical needs	N/A

2.2.5 Repositories

This category defines the tools that provide teachers with LD ideas, a sample of practices, and experiences' reports. The tools analysed across the dimensions identified in the framework are presented in Table 2.11.

Table 2. 11**.** An analysis of repositories

		Cloudworks	HEART	LDTool
GENERAL PROPERTIES	Scope	Social networking environment	LD support strategy	Authoring, sharing, and browsing among existing LDs
	Release date	2008 – still running	2009 – Not available anymore	2008 – still running
	Target users	Teachers	Teachers	Teachers (Primary, secondary, and higher education teachers
	Export & Import	N/A	N/A	N/A
	Deploy into VLEs	N/A	N/A	N/A
LEARNING DESIGN	Design language	N/A	Visual and text-based	Text-based
	Activity model	N/A	Pedagogical dimension	The sequence of learning tasks
	Workflow model	N/A	Pedagogical dimension	Description, intended learning outcomes, resources, tasks, supports
	Learning analytics	Peer feedback	N/A	N/A
TECHNICAL	Form of software	Web-based	Web-based	Web-based
	User interface	N/A	Graphical and text-based presentation of the contents	Description, intended learning outcomes, resources, tasks, and supports sections are presented to be filled by a user
	Technical needs	N/A	N/A	N/A

2.2.6 An Overview of Some Well-known LD Tools

In this section, we discuss ten well-known LD tools in the field of LD along with their characteristics, underlying LD approach, and theoretical basements with details. These well-known LD tools are chosen according to the number of their mentions in the LD literature and these are ILDE, the Learning Designer, ScenEdit, LdShake, CADMOS, eXeLearning, LAMS, CompendiumLD, OpenGLM, and WebCollage.

2.2.6.1 Integrated Learning Design Environment (ILDE)

ILDE (available at http://ilde.upf.edu/) has been developed under the project METIS (Meeting teachers' co-design needs by integrated learning environments) as an authoring, sharing, editing, and exploring the environment (Hernández-Leo et al., 2014). ILDE is the most recently developed LD tool within the LD field (Maina et al., 2015). ILDE's LD approach is based on the 7Cs conceptual framework whose theoretical foundation is the constructivist theory. 7Cs framework was a conceptual underpinning for the ILDE's architecture. It provided a structured and logical representation of the relationship between the various components of ILDE.

The ILDE tool enables teachers to choose among various LD authoring tools, co-create, share, explore LDs, and implement these LDs into virtual learning environments (VLEs). It is built by integrating other LD tools like LdShake, eXeLearning, OpenGLM, WebCollege, CADMOS, CompendiumLD, and GLUE!PS (Hernández-Leo et al., 2014). The architectural components of the ILDE are presented in Figure 2.5 retrieved from (Hernández-Leo et al., 2014). ILDE adopts LdShake to support co-design, OpenGLM, WebCollege, exeLearning, and CADMOS for authoring, GLUE!PS for implementation, and CompendiumLD for conceptualisation.

<table>
<tr><td>Community</td><td colspan="2">Conceptualise, Authoring and Implementation Tools</td><td>Learning Environments</td></tr>
<tr><td rowspan="5">LdShake</td><td>Web Authoring</td><td>WebCollege
eXeLearning</td><td rowspan="5">Moodle, MediaWiki</td></tr>
<tr><td>Desktop Authoring</td><td>OpenGLM
CADMOS</td></tr>
<tr><td>Document-based Authoring</td><td>OULDI tool</td></tr>
<tr><td>Conceptualise</td><td>CompendiumLD</td></tr>
<tr><td>Implementation</td><td>GLUE!PS</td></tr>
</table>

Figure 2. 5. The architecture of ILDE (Hernández-Leo et al., 2014)

ILDE's development started in 2012 and was introduced to the users around 2014. Its target users are teachers. The tools integrated into ILDE can communicate with each other such as OpenGLM, WebCollege, exeLearning, and CADMOS. Also, LDs can be deployed into Moodle, SCORM, metisVLE, and MediaWiki. The tool allows users to use multiple design languages as it comprised of the integration of various LD tools. Moreover, the tool uses the activity workflow models of the tools that it implements. Regarding LA, the ILDE allows peer-review evaluation of LD solutions.

ILDE is a web-based tool whose main screen is presented in Figure 2.6. However, some of the LD tools included in it are desktop-based. Easy to use interface of the ILDE makes the LD-P easy for the users. Java runtime environment is required for some of the desktop-based tools integrated into the ILDE.

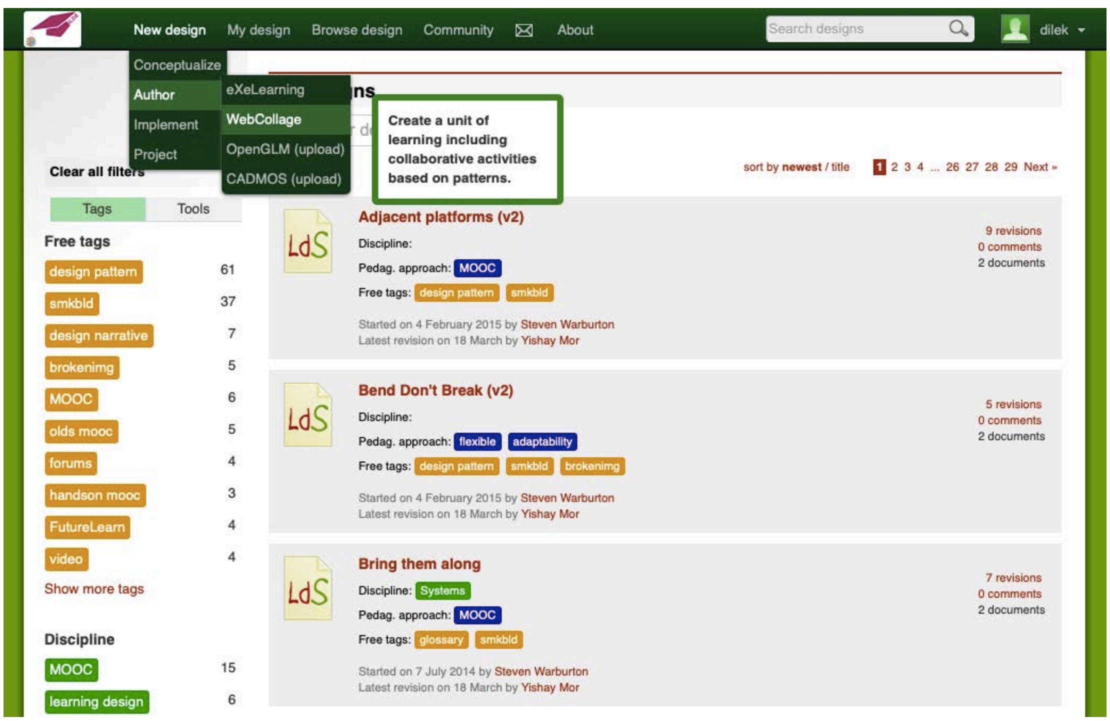

Figure 2. 6. A screenshot of ILDE

ILDE2/edCrumble is a web-based platform allowing teachers to author LDs by taking advantages of LA (Albó & Hernández-Leo, 2018a). The main screen from the authoring page of edCrumble is presented in Figure 2.7.

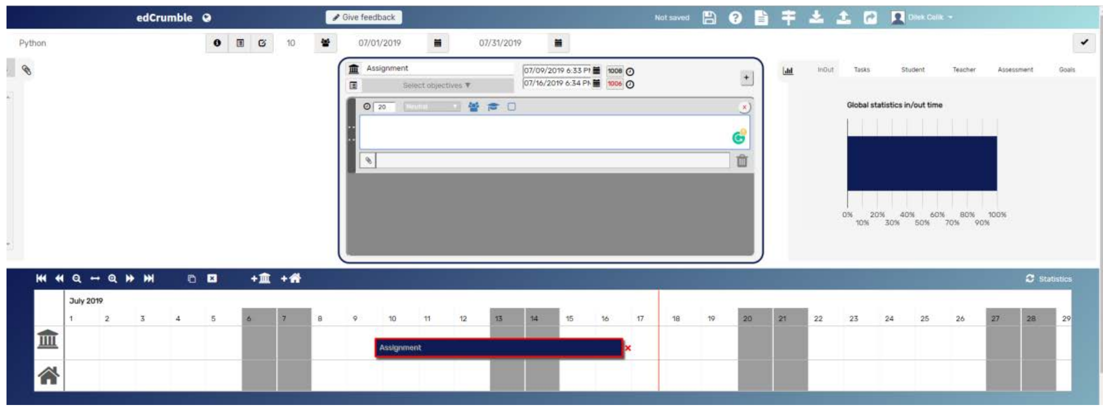

Figure 2. 7. A screenshot from edCrumble

2.2.6.2 The Learning Designer

The Learning Designer (available at https://www.ucl.ac.uk/learning-designer/) is a collaborating, sharing, editing, and exploring tool built upon the Phoebe Project, underpinned by semantic technologies (http://learningdesigner.org/) (Laurillard et al., 2013), and adopts the Conversational Framework. This tool aims to express pedagogical ideas and collaboration in designing TEL among teachers and practitioners with its interactive user interface. By providing sample patterns that can be searched and edited, the tool allows teachers to create LDs from scratch and share them with others. The learning designer was created in 2011, and the tool is still available to the users.

The interface of the Learning Designer is presented in Figure 2.8. The LDs created in the tool can be exported as an MS Word file, or shortened as URLs to be shared with others. The Learning Designer does not support any VLEs. In the Learning Designer, design language follows the formal learning concepts. The activity model is sequential, and the workflow model is similar to a lesson plan, an LD presented with activities and key facilities of teachers` design including a topic, several learners, aim, result, and learning`s duration visible and changeable. Web-based and desktop-based forms of the tool are still available. Additionally, the Learning Designer is the only LD tool that is available as a mobile app.

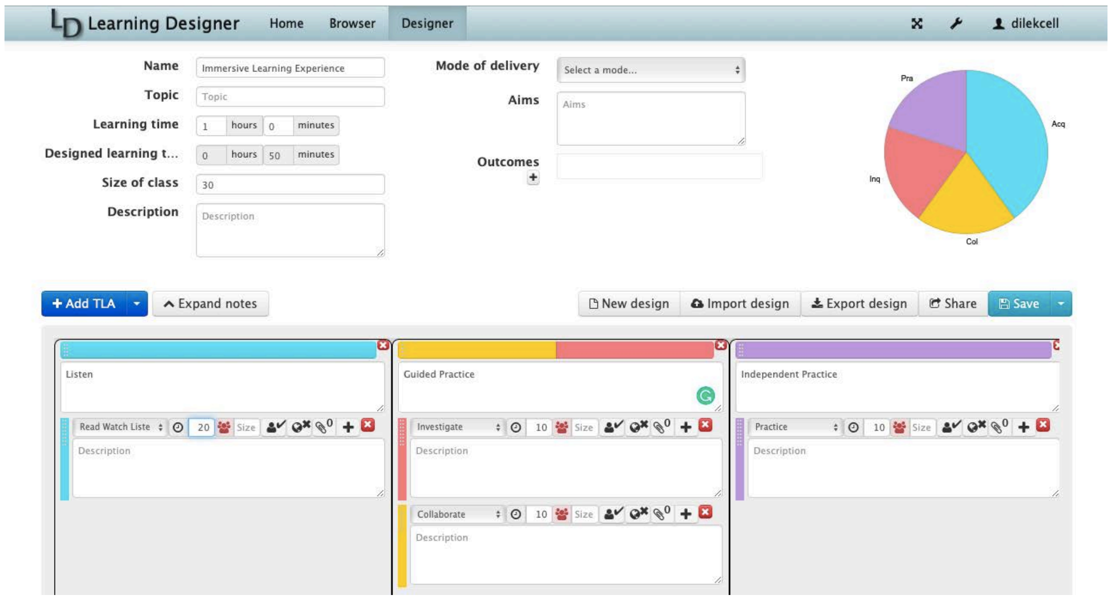

Figure 2. 8. A screenshot of the Learning Designer

2.2.6.3 ScenEdit

ScenEdit (http://scenedit.imag.fr) is a graphical and web-based authoring tool built upon the conceptual framework of ISIS for the design of learning. The tool was introduced in 2010 to favour share and reuse of LDs by providing patterns (Emin, Pernin, & Aguirre, 2010). The tool allows users to export LDs to XML, and pdf files so that they can be shared with others.

ScenEdit's demo version is not available on its webpage (http://scenedit.imag.fr). Therefore, to analyse the tool better, we retrieved the screenshot of ScenEdit along with its main features from the paper that first described it (Emin, Pernin, & Aguirre, 2010). Figure 2.9 presents the main screen of ScenEdit. From Figure 2.9, we see that there is a section for intentions, strategies, scenario edit, and interactional scenarios.

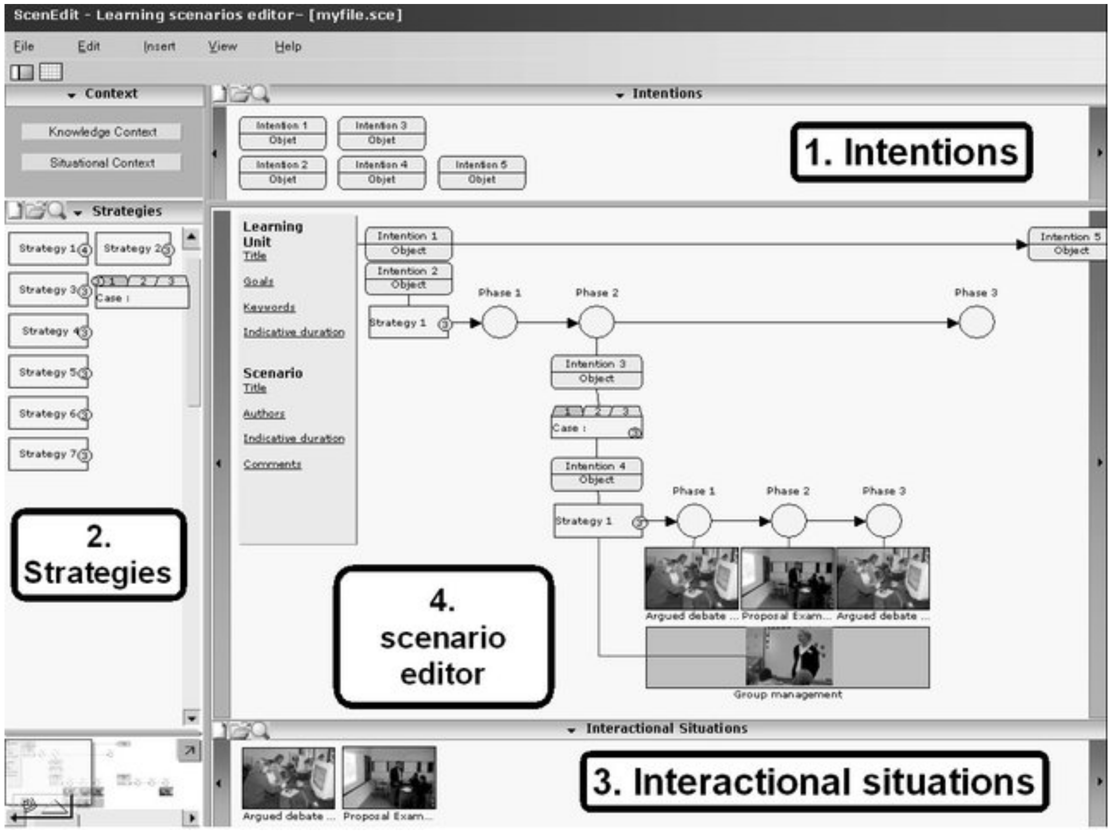

Figure 2. 9. The main screen of ScenEdit (retrieved from (Emin, Pernin, & Aguirre, 2010))

2.2.6.4 LdShake

LdShake is another LD tool in the LD field (available at http://ldshake.upf.edu/demo/). It is a social network-oriented authoring tool which allows teachers to share and co-edit LD solutions. It is developed at Universitat Pompeu Fabra in Spain by the GTI group (Hernandez-Leo et al., 2011). One of the characteristics that distinguish it from other LD tools is being "support-oriented toward teamwork within institutions or transversal thematic teamwork across institutions, and not oriented toward fully open collaboration" (Hernandez-Leo et al., 2011). Another distinctive property of LdShake is being structured as a system of the social network developed for the co-creation and sharing LDs by teachers. The format of LDs designed in LdShake is generic, but it can be adapted/tailored to the subject being taught or to the lesson, or the needs of the tutor.

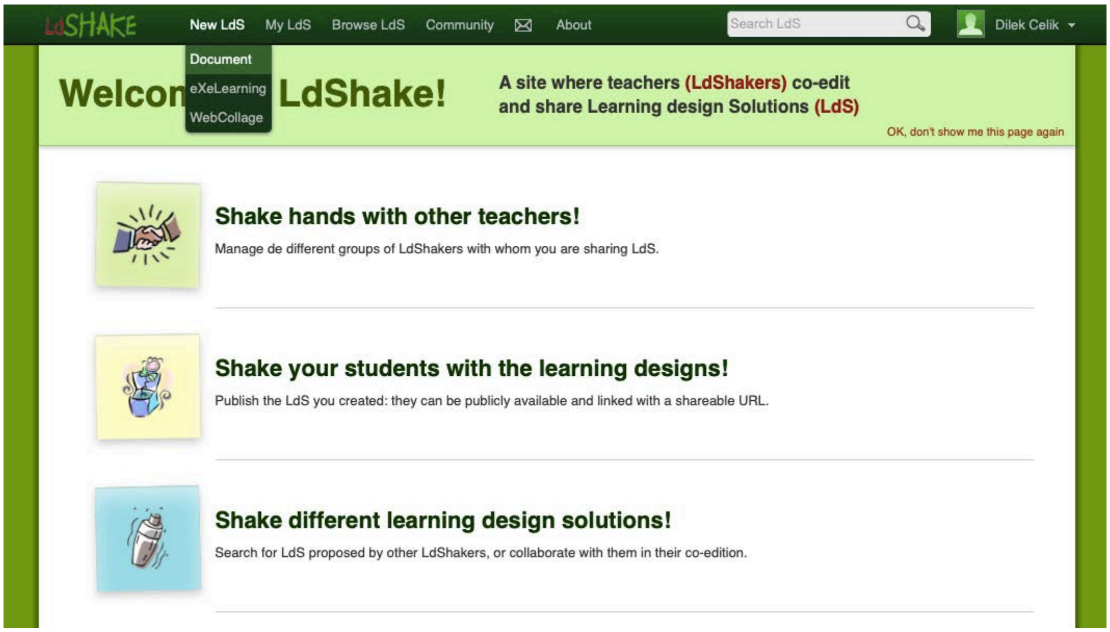

Figure 2. 10. The main screen of LdShake

The main screen of LdShake is presented in Figure 2.10. From Figure 2.10, we see that LdShake embeds eXeLearning and WebCollege as an authoring tool. The tool allows users to design LDs and share LDs with others and also to adapt and adjust the LDs developed by others.

2.2.6.5 CADMOS

CADMOS is a visual-based authoring tool with a user-friendly interface developed especially for novice teachers who have basic LD skills and computer skills (Katsamani & Retalis, 2011). CADMOS can be downloaded from its webpage and settled on the desktop to be used as it does not have a web version. However, the CADMOS download link (http://cadmosld.com) provided by the CADMOS project (https://cosylab.gr/index.php/tools/115-cadmos) does not work. Therefore, we retrieved the features of the CADMOS tool and the main screen of it from the main paper that introduced the tool (Katsamani & Retalis, 2011).

The screenshot of the main page of CADMOS is presented in Figure 2.11. The main facilities of the CADMOS are to be used by novice teachers, use of visual language, to guide the teachers, present LD objects including resources, rules and activities, describe the activities in LD by conceptual model and flow model, change LD created with CADMOS to IMS LD, and import IMS LD and change it to CADMOS's system for LD. Therefore, CADMOS allows teachers to reuse existing IMS LDs.

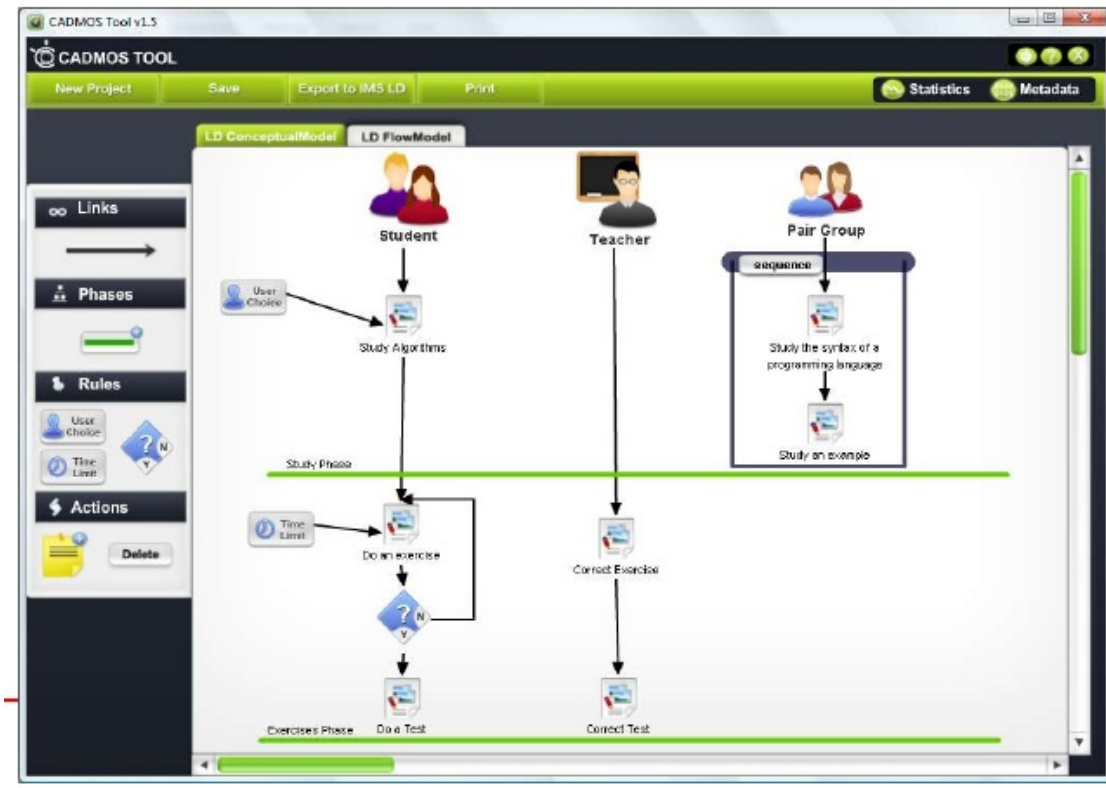

Figure 2. 11. The CADMOS tool as retrieved from (Katsamani & Retalis, 2011).

2.2.6.6 eXeLearning

eXeLearning is a web-based open source rich text editor developed to design XHTML or HTML5 based interactive web contents of LDs. The main paper that eXeLearning is introduced was not written in English (Navarro & Climent, 2009) therefore we retrieve the information about the tool through its webpage (http://exelearning.net/en/). The tool allows users to:

- design reachable contents in XHTML or HTML5,
- develop an entire webpage,
- contain interactive elements in each page,
- export the webpage's contents into various formats such as IMS
- categorise the content regarding various metadata approaches.

The main screen of the eXeLearning is presented in Figure 2.12.

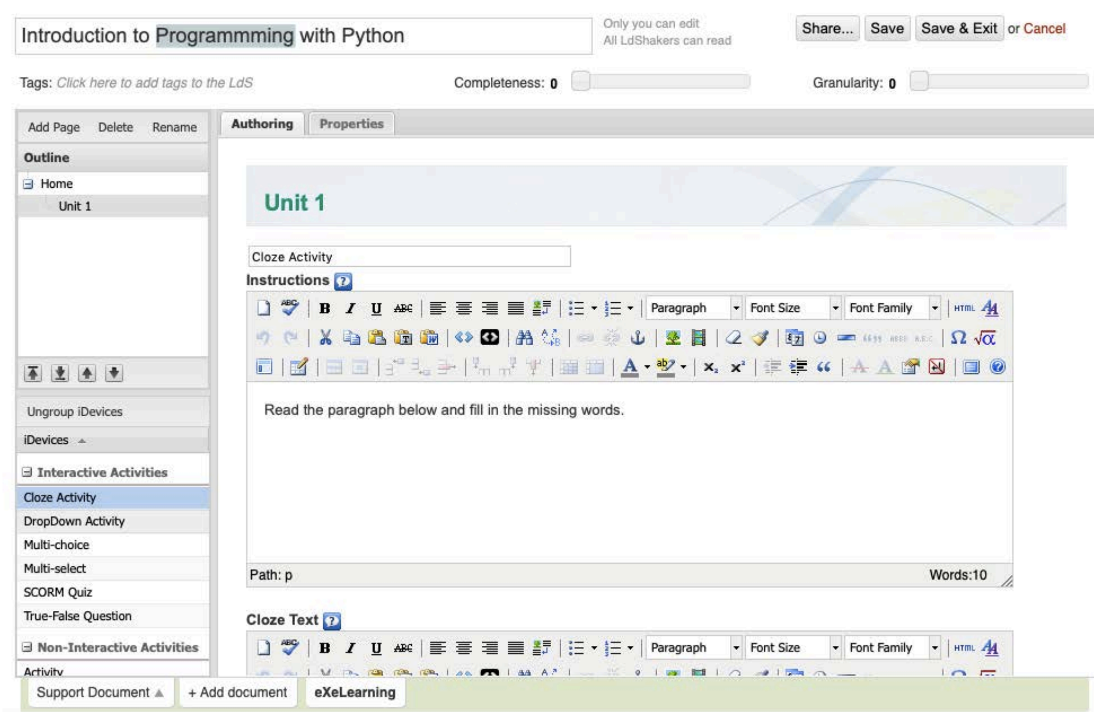

Figure 2. 12. The main screen of eXeLearning

There is no underlying LD approach behind the exeLearning design whilst its novelty lies in that the LDs and activities written in the tool can be published as a webpage obtaining a public URL. Therefore, the LDs developed within the tools can be accessed online.

2.2.6.7 IMS LD Based Tools

2.2.6.7.1 LAMS (Learning Activity Management System)

LAMS (available at https://demo.lamsfoundation.org/lams/) is an LD tool that has been developed to help teachers to author, monitor and run learning activities online. It is an integrated system inspired by IMS LD and EML. Its deployment started in 2003 and it was made available as a software at the beginning of 2005. LAMS has been developed by Dalziel (2006) and the tool is still alive with its latest version as presented in Figure 2.13. The main functionality of this tool is to allow teachers to create learning activities' sequence including tasks, group activities, and class activities by providing visual authoring environment. Additionally, LAMS can be used for "running" the LDs within the tool as well as deploying the LDs into VLEs such as Moodle and Blackboard.

LAMS v2, released in 2006, is an extended version of LAMS tool with the facilities of tool wrappers and a new interface. The tool wrapper facility allows users to connect external tools including Google Maps and Moodle. One year later, new features were added to the tool including Live Edit.

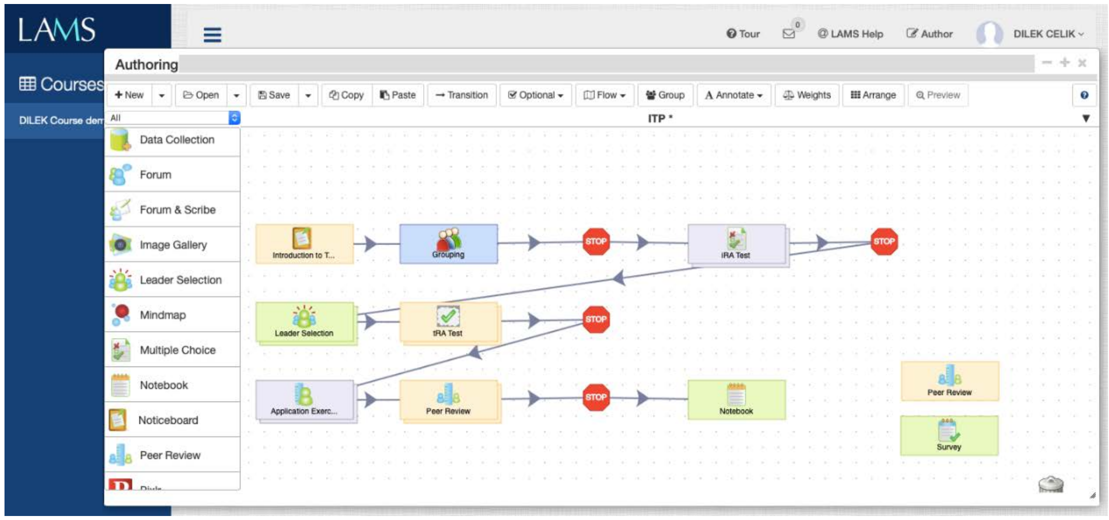

Figure 2. 13. The screen from the LAMS authoring environment

Figure 2.13 presents that LAMS has activity tools on the left, the sequencing in the centre, and sequence management and repository tools across the top.

2.2.6.7.2 CompendiumLD

CompendiumLD (available through http://compendiumld.open.ac.uk/download.cfm) is an LD authoring desktop-based software with its flexible interface as presented in Figure 2.14. It is being developed to support teachers in articulating their ideas and mapping out the learning sequences. The tool is being developed by Brasher et al. (2008) and it is still available on its webpage. The CompendiumLD allows users to design learning activities, think on the assessment, create resources` repository by attaching text documents, and media, adding notes on an existing LDs on the tool, deploy and export LDs in variety of ways, and plan out LDs.

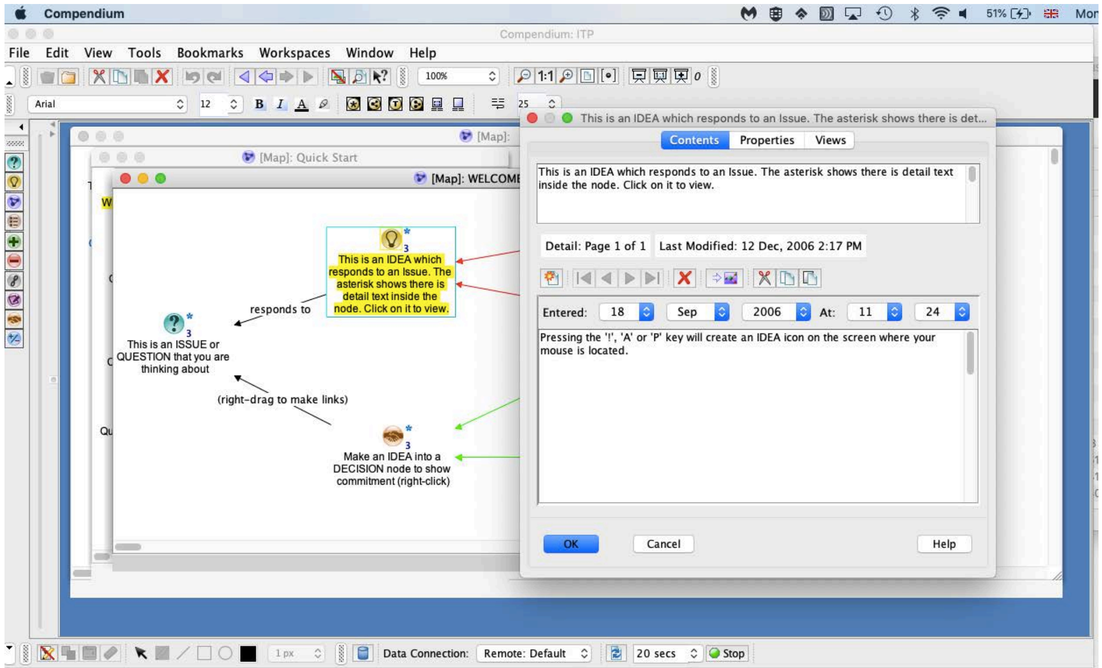

Figure 2. 14. The main screen from CompendiumLD

As can be seen in Figure 2.14, the tool includes generic and specific icons that represent the learning activities' components. Dragging and dropping these icons may be done in the CompendiumLD tool. Figure 2.15 illustrates the example of an activity designed using nodes – a metaphor adopted by CompendiumLD - that can be linked and labelled.

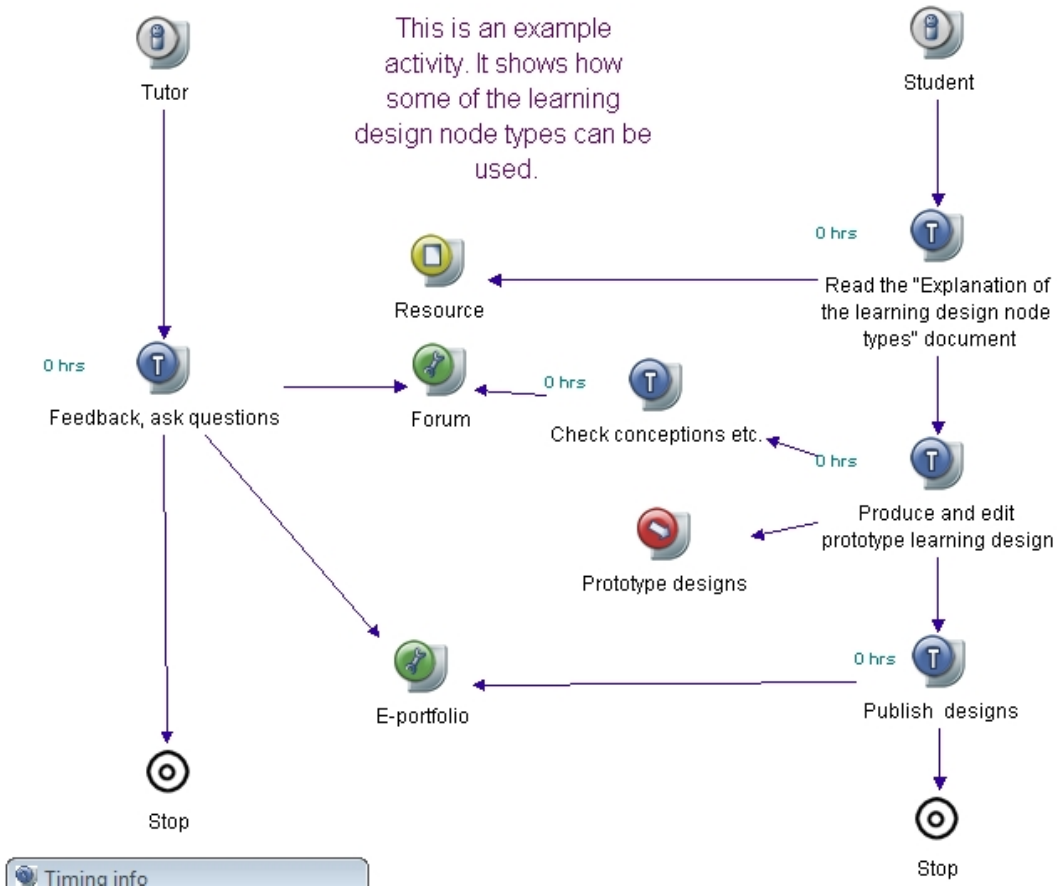

Figure 2. 15. An example activity designed in CompendiumLD

2.2.6.7.3 OpenGLM

Open Graphical Modeller (OpenGLM) is a desktop-based authoring tool for LDs (available at http://sourceforge.net/projects/openglm) (Derntl, 2015). It is an open-source tool supporting IMS LD. The tool is specifically designed for non-IMS LD users to create, reuse, and share LDs. Two novel features distinguish OpenGLM from other IMS LD based authoring tools: adopting visual metaphor and providing built-in search.

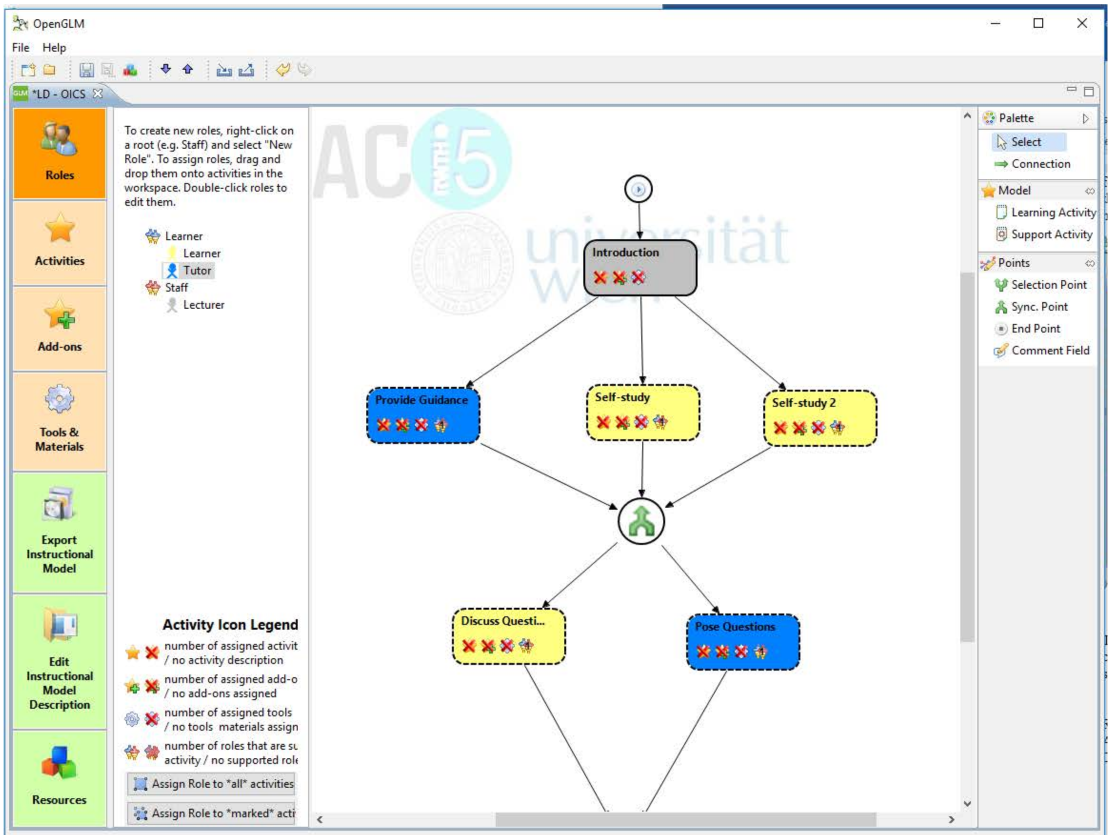

Figure 2. 16. The main screen from OpenGLM

As shown in Figure 2.16, the visual modelling metaphor of OpenGLM allows to cancellation of complicated and unintuitive components and structuring the IMS LD using a graphical user interface. The built-in search function allows access to open repository for an import and export.

2.2.6.7.4 WebCollage

WebCollage is a graphics and pattern-based LD authoring tool that supports the collaboration of teachers online. The tool allows teachers to create LDs to be compliant to IMS LD, represent them, and deploy them in VLEs and LD tools such as LAMS and Moodle. It has been developed in the context of the RELOAD project which is the provider of the plug-in framework. The tool developed by GSIC group at the University of Valladolid in Spain (Hernández-Leo et al., 2015).

Figure 2.17 exhibits a screenshot of the interface of the WebCollage tool that allows users to create a new phase by choosing among the available built-in phases including Brainstorming, Pyramid, Think Pair Share, Jigsaw, and Think Aloud Pair Problem Solving. After choosing one of those phases, a user can define the attitudinal objective, procedural objective, problems, and complexity.

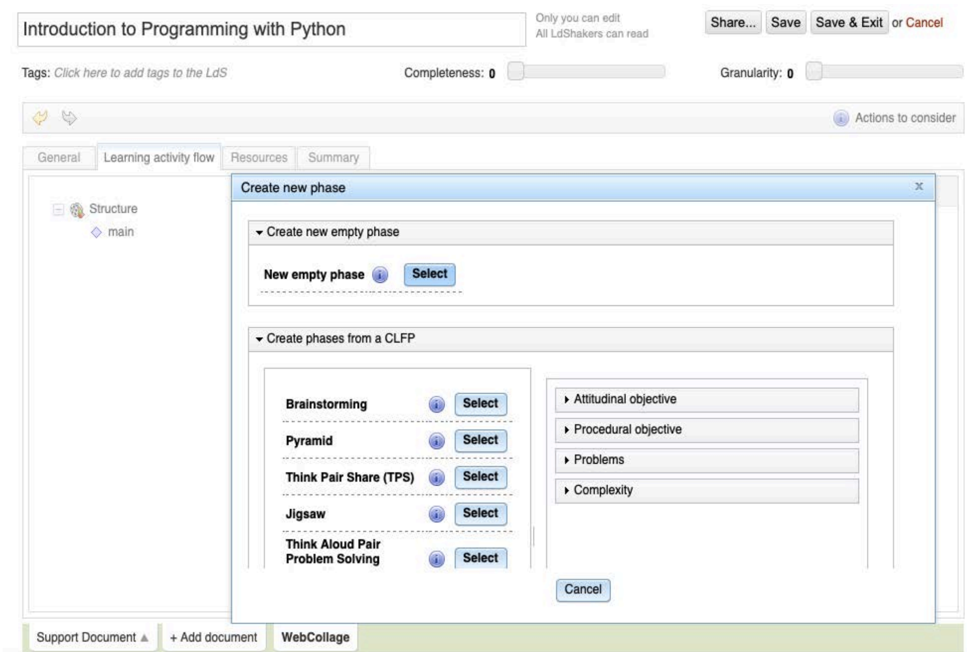

Figure 2. 17. A screenshot from WebCollage

For example, Figure 2.18 presents the Jigsaw assessment flows chosen among others in the WebCollege tool. After choosing specific flows, the details and features can be adjusted to the topic that the user intends to design.

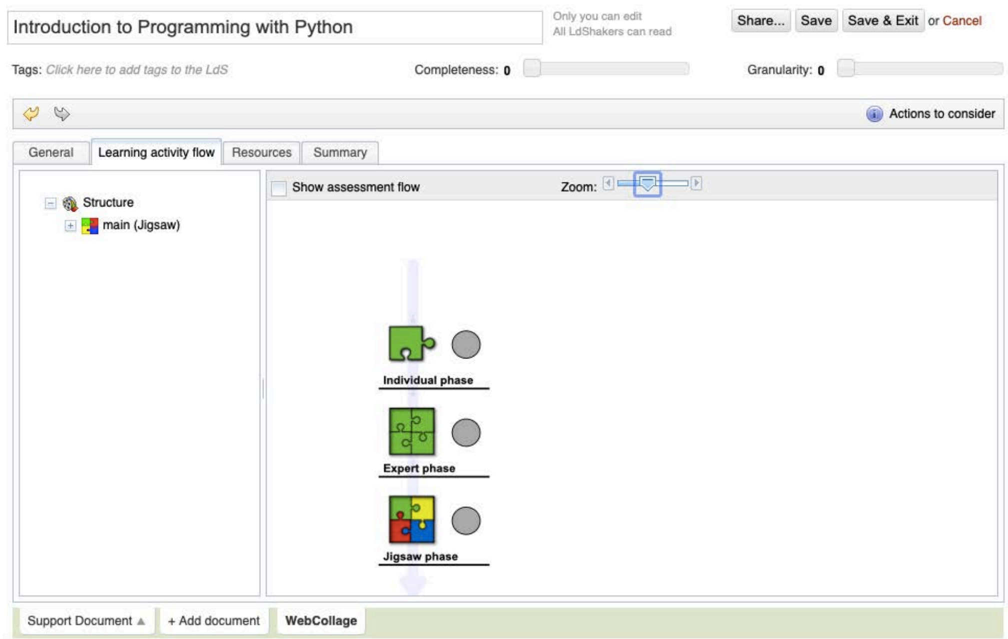

Figure 2. 18. Web Collage's Jigsaw assessment flows

2.3 Empirical Studies in the LD Field

In this section, we present the results of our systematic literature review (Celik & Magoulas, 2016b) about the empirical studies that investigated LD-P of HE lecturers. Specifically, we present the results under three themes in the following sub-sections: empirical studies on HE lecturers' LD-P, HE lecturers' perspectives on LD tools, and need analysis of HE lecturers.

2.3.1 Empirical Studies on HE Lecturers' LD-P

Several LD studies have pointed out how important it is to understand how HE lecturers' design for learning first and then design LD tools (Bennett, Agostinho, & Lockyer, 2014; Persico & Pozzi, 2015; Nguyen & Bower, 2018). Nevertheless, in the LD literature, very few studies have focused on exploring LD-P of HE lecturers (Peter Goodyear, 2015). There have been limited studies into the HE lecturers' LD-P regarding how they design for learning, what influences their decisions, and what supports they use (Bennett et al., 2015; Nguyen & Bower, 2018). We retrieved all the empirical works on HE lecturers' LD-P from the LD literature and present them in Table 2.12, including information about the sample size used.

Table 2. 12. Empirical studies about HE lectures' LD-P

Number	Reference with Year	Sample Size
1.	(Nguyen & Bower, 2018)	9 primary school-level pre-service teachers
2.	(Agostinho, Lockyer, & Bennett, 2018)	30 teachers from 16 Australian universities
3.	(Bennett, Agostinho, & Lockyer, 2017)	30 teachers from 16 Australian universities
4.	(Bennett et al., 2015)	16 Australian teachers
5.	(Arpetti, Baranauskas, & Leo, 2014)	90 teachers of Italian as a second language
6.	(Laurillard et al, 2013)	10 participants
7.	(Arpetti, Baranauskas, & Leo, 2013)	30 university teachers
8.	(Bennett et al., 2011)	30 academics from 16 Australian universities
9.	(Agostinho et al., 2009)	32 LDs are analysed
10.	(Masterman, Jameson, & Walker, 2009)	13 university teachers – case studies
11.	(Goodyear & Markauskaite, 2009)	8 interviews with 1 teacher
12.	(Ellis, Hughes, Weyers, & Riding, 2009)	19 university teachers
13.	(Postareff & Lindblom-Ylänne, 2008)	71 university teachers
14.	(Bennett, Agostinho, and Lockyer 2008)	32 university teachers
15.	(Norton et al., 2005)	696 respondent
16.	(Stark, 2000)	89 faculty members

The study described in (Stark, 2000) was the first step in understanding LD-P of HE lecturers. Stark (2000) focused on North American college teachers' LD-P and concluded, however, that further in-depth research is needed about the actual decisions teachers make about the form of instruction.

Other studies point out the importance of contextual factors in LD-P such as discipline, class size, year level, or teaching space (Norton et al., 2005; Bennett et al., 2008).

Postareff & Lindblom-Ylänne (2008)'s study included interviews with seventy-one university lecturers to understand variation in defining LDs. They identified ten aspects of teaching that were categorised into four groups: pedagogical development, teaching process, the conception of learning, and learning environment.

Ellis, Hughes, Weyers, & Riding (2009) investigated university teachers' approaches to design LDs and how they think about learning technologies by conducting interviews with nineteen university teachers. Their iterative analysis showed that the ways of thinking about approaches to design LDs and learning technologies comprised of qualitatively various categories.

Goodyear & Markauskaite (2009)'s study included a series of eight interviews with one university teacher in one semester to understand the design decisions the teacher made. The study concluded that the teacher's design aspects for teaching depend on the capability to study with various sources of information and ways of knowing (Goodyear & Markauskaite, 2009).

Masterman, Jameson, & Walker (2009) focused on the under-researched aspect of the design of LDs, that is the novice teachers' perceptions of LDs. The study included thirteen case studies with thirteen university teachers. The study found that the biggest value to novice teachers is to provide learners with a structured sequence of teaching-learning activities.

Agostinho et al. (2009) made an analytical study that examines thirty-two LDs to enhance understanding of what constitutes an efficient LD description and concluded that this should be characterised by pedagogical neutrality, quality rating and suggestion on possible reuse.

Arpetti et al. (2013) conducted interviews with thirty HE teachers to investigate their LD-P and relation with LD to develop an epistemology of LD-P that could be used to increase awareness of LD among HE lecturers' community.

Laurillard et al. (2013)'s paper introduced the Learning Design Support Environment project and its goals. They also mentioned that they begin the project with interviews with ten practitioners to elicit their requirements on LD-P. According to Laurillard et al. (2013), teachers need a theory-driven way that will present characteristics of pedagogy and help to discover how to utilize learning technologies. Laurillard et al.

(2013) summarized the design requirements for LD tools as following: offer well-targeted, LD recommendations system, and allow users to edit LDs, support a design process step by step, and provide flexibility.

Later, Bennett et al. (2011) and Bennett et al. (2015) focused on the factors that shape HE teachers' design decisions, with the work described in (Bennett et al., 2011) focusing on the specific context of Australian HE teachers. According to Bennett et al. (2015), teachers perceive their learning design as planning based on their belief on learning influence, while other participants consider their learning design is underpinned by theoretical approaches. It is pointed out that there are student-related, teacher-related and context-related key influences on teachers’ design decisions (Bennett et al., 2015).

Students-Related. Students’ characteristics are one of the important elements in LD decisions. The university teachers built up a profile of their students and they are refining their designs based on students’ experiences over time (Bennett et al., 2015).

Teachers-Related. Teachers’ belief about learning and teaching, prior LD experiences, others’ ideas from collegial discussion and literature, knowledge of learning theories affect their design for learning.

Context-Related. The collegial context in which university teachers work is a strong influence on their LD decisions. Institutional policy and culture, attributes of the unit that includes class size, timetable, and resources like staff, workload, time, and infrastructure have influences on LD decision of teachers.

Arpetti, Baranauskas, & Leo (2013)’s a study aimed to elicit teachers’ requirements regarding LD-P by conducting semi-participatory practices with ninety teachers. The study found various practical and useful indications to inform the development of tools for LD.

Bennett, Agostinho, & Lockyer (2017) investigated LD-P of thirty teachers from sixteen Australian universities conducting the qualitative study. The result of the study showed that Australian university teachers' LD-P is a top-down iterative process and Bennett, Agostinho, & Lockyer (2017) presented a descriptive model of LD-P in their study.

Recently, Agostinho, Lockyer, & Bennett (2018) explored LD-P of thirty teachers from sixteen Australian universities in terms of what kind of support they access. The data is collected through semi-structured interviews. It is found that the kind of supports the participants access in their LD-P were "colleagues, literature, workshops and seminars, conferences, institutional support services, and enrolment in the postgraduate study" (Agostinho, Lockyer, & Bennett, 2018, p. 1)

The most recent study by (Nguyen & Bower, 2018) focused on how novice teachers go about technology-enhanced learning design processes. Nguyen & Bower (2018)'s study included an in-depth analysis of LD-P that completed in five weeks by three groups that comprised of three pre-service teachers. The main finding of this study was that the participators rarely considered the pedagogy through collaborative LD activities. The support for the teacher, collaboration with the group, abilities of technologies were defined as strong influencers of LD-P of TEL.

2.3.2 HE Lecturers' Perspectives on LD Tools

In this sub-section, we review the studies that explore HE lecturers' perceptions of LD tools. In the LD field, the main argument regarding these studies is that they are restricted to the evaluation of certain LD tool or tools rather than exploring empirical and objective evidence about actual LD-P of HE lecturers (Prieto et al., 2014).

In Table 2.13, we summarize information about the studies, including the number of participants and the LD tools evaluated in each case.

Table 2. 13. Summary of the studies on HE lecturers' perspectives on LD tools

No	Study author and date	Sample Size or Methodology	Tools Analysed
1	(Laurillard et al., 2018)	300	The Learning Designer
2	(Hernández-Leo et al., 2018)	41	ILDE
3	(Boloudakis, Retalis, & Psaromiligkos, 2018)	26	CADMOS
4	(Zalavra, Eleni; Papanikolaou, 2018)	35	The Learning Designer
5	(Papanikolaou et al., 2016)	13 students as designers	PeerLAND
6	(Prieto et al, 2014)	24	Web College, EDIT2
7	(Conole, 2014)	44 case studies	Compendium
8	(Levy, 2014)	12	LAMS
9	(Hernández-leo et al., 2013)	Questionnaire, Interviews, Face-to-Face group	ILDE
10	(Masterman et al, 2013)	Review of three tools	Phoebe, the LAMS Activity Planner and the Learning Designer
11	(Katsamani and Retalis, 2013)	36	CADMOS
12	(Prieto et al., 2013)	21	GLUE!-PS
13	(Verbert et al., 2012)	20 – case study	LAMS
14	(Masterman and Manton, 2011)	Summative Evaluation	Phoebe
15	(San Diego et al., 2008)	51	London Pedagogy Planner
16	(Masterman & Vogel, 2007)	Synthesize the findings of three projects	LAMS, LD tools project, VLE project

Laurillard et al. (2018)'s study aims to evaluate the Learning Designer's potential in the building and supporting the community of knowledge building teachers. The study found that the teaching professionals were ready to use the LD tool and appreciated the way the tool-assisted them to reflect on the pedagogies chosen by them.

Hernández-Leo et al. (2018) implemented the ILDE software and trialled it in training workshops with one hundred forty-eight participants from HE education institutions to illustrate its feasibility and capabilities. The workshops included the deployment of the LDs designed in the ILDE to the VLEs and enactment with learners in actual learning situations. The study concluded that providing an LD community system that flexibly helps the whole LD life cycle for teachers is possible.

Boloudakis, Retalis, & Psaromiligkos (2018)'s study trains twenty-eight teachers following the Think–Pair–Share learning strategy and making use of the facilities of CADMOS LD tool with the aim of exploring how novice and pre-service teachers can become skilled LD designers for Moodle-based units of learning. The results of the study conducted with twenty-eight teachers revealed that the proposed method was easy to follow, led to the development of high-quality and re-usable LDs, and improved the teachers' design thinking of LD.

Zalavra, Eleni and Papanikolaou (2018)'s paper presents the reports of a study conducted with thirty-five pre-service teachers employing the Learning Designer tool. The data is gathered about the participants' perspective on the LD experience using the Learning Designer. The study found that the representation of LDs in the Learning Designer supports designers to structure LDs.

Papanikolaou et al. (2016) introduced PeerLAND allowing users to design TEL LDs and join the peer assessment activities to act as reviewers. The reviewers evaluate the LDs using the TPACK framework considering what information the designers have built on the technology integration into teaching. Thirteen students designed LDs in the Learning Designer tool, then they deployed LDs into Moodle, and then the student-designers transferred their LDs to PeerLAND platform to get them peer-reviewed. According to students who participated in the study, the support provided by PeerLAND improves the design process of LDs.

Prieto et al (2014) explored eighteen HE teachers' perception of two different LD tools (WebCollage and EDIT2) to examine whether there are common obstacles teachers face in LD tools adoption. Prieto et al (2014)'s study is distinct from other studies as it does not restrict to a single tool. The main finding of this study was that there is no single LD tool that covers all the needs of all teachers.

Conole (2014)'s study examines the usefulness of Compendium in helping teachers/designers to develop and share activities of learning through conducting forty-four case studies with teachers. The results of the study indicate that Compendium was easy to use and helpful in designing and sharing LDs.

Levy (2014)'s study explores HE teachers' approaches to create LDs for inquiry-based learning using the LAMS authoring tool. It is found that the teachers' approaches were varied, and the LDs created with LAMS were specifically compatible.

Hernández-leo et al. (2013) focused on the implementation of the ILDE tool and its evaluation in real settings with end-users. The data is collected through online interviews, surveys, and face-to-face group work with the end-users. The study found that the ILDE tool covers the full LD life cycle and indicated that the teachers/designers need support at various granularity level and steps of the LD process.

Masterman et al (2013) reviewed three LD tools namely Phoebe, the LAMS Activity Planner and The Learning Designer to reveal what kind of support these tools offer. The tools are examined by developers, teachers and institutions in terms of challenges faced in implications and deployment of the tools. The study found that in principle, all the tools are acceptable. But technological and socio-cultural challenges affect negatively the adoption of these tools by teachers and educational organisations.

Katsamani and Retalis (2013) aimed to give an overview of CADMOS and get an insight into how teachers use CADMOS by conducting evaluation case studies with thirty-six participants. CADMOS found to be user-friendly, allowing teachers to design learning activities flow.

Prieto et al. (2013)'s paper introduced GLUE!-PS and presented the results of an initial evaluation of the tool through two workshops with HE teachers, as well as the impact of the tool in an actual HE institution course. The data is collected through questionnaires from twenty-one HE teachers. The study found that GLUE!-PS enables teachers to “deploy, share, and reuse LDs, expressed using a range of LD authoring tools, while supporting a wide variety of distributed learning environments that incorporate already existing learning platforms” (Prieto et al., 2013, p.334)

Verbert et al. (2012) present a case study conducted with twenty teachers who used the LAMS learning activity environment. The main conclusion drawn by the study was that the perceived usefulness of the LD tool by both teachers and expertise was high: the recommendations helped participants in the designing LDs and they felt more comfortable when support is given.

Masterman and Manton (2011) aimed to reveal the added value of LD tools among a teachers’ community by making a summative evaluation of the PHOEBE tool. The study concluded that LD support tools have an impact on teachers’ practices and teachers like the ideas of having guidelines all-in-one-place, reference system, support materials available to draw on, access to peers, and the idea of building work of others (Masterman & Manton, 2011).

San Diego et al. (2008) described the London Pedagogy Planner (LPP) and illustrated this visual representation based on the principal evaluation with fifty-one HE lecturers through workshops. The various requirements for the design of such LD tools are drawn by the study.

Masterman & Vogel (2007) present lecturers’ LD-P in terms of what they do in their actual practice when they create designs either at unit level or course level. Masterman & Vogel (2007) consider empirical evidence retrieved by three research projects on LD involving UK participants from further, adult, and higher education. These projects were the Learning Design Tools Project, Evaluation of the Practitioner Trial of LAMS, and Design for Learning in VLEs.

2.3.3 Need Analysis of HE Lecturers from Empirical Evidence

In this section, we analyse the studies mentioned in Section 2.3.1 and Section 2.3.2 in terms of teachers' needs of their LD-P when using LD software tools. These studies highlighted various needs that teachers have when they practice LD and these should be accommodated by LD software designers.

Flexibility is defined as the main factor affecting the adoption of LD tools among HE lecturers' community (Arpetti, Baranauskas, & Leo, 2013; Conole, 2014; Prieto et al., 2014; Bennett et al., 2015; Laurillard et al, 2013; Levy, 2014). Masterman and Manton (2011)'s study highlighted the need for being flexible and providing guidance on how LD tools should be used. Levy (2014)'s study also supported these statements saying that LD tools should have a high level of flexibility regarding the pedagogical choices.

Support the retrieval, adaptation of users' learning designs, and editing are mentioned as key needs to be accommodated within LD tools (Arpetti, Baranauskas, & Leo, 2013; (Conole, 2014; Masterman and Manton, 2011; Hernández-leo et al., 2013).

Supporting peer evaluation of learning designs in the context of teachers' communities of practice by having relevant functionalities in the LD tools to enable teachers to evaluate colleagues' designs is highly valued by teachers (Papanikolaou et al., 2016; Hernández-Leo et al., 2018).

Support for reflection is about facilitating teacher's reflection about the rationale behind pedagogical choices. The studies by Arpetti, Baranauskas, & Leo (2014) and Prieto et al (2014) highlighted the need for LD tools to provide support for pedagogy reflection.

'Ease of use' in terms of usability of LD tools is highlighted as the most commonly valued feature by various studies (Arpetti, Baranauskas, & Leo, 2014; Bennett et al., 2011; Conole, 2014; Katsamani and Retalis, 2013; Levy, 2014).

Time-saving is another characteristic that has been highlighted as very important for an LD tool to have (Arpetti, Baranauskas, & Leo, 2014; Hernández-leo et al., 2013; Prieto et al, 2014; Verbert et al., 2012)

Regarding how designs are represented in LD tools, the evidence is diverging with one study claiming that teachers do not value graphical representations (Arpetti et al., 2014), while the others are showing that visual representation is positively valued among teachers' communities (Masterman and Manton, 2011; Katsamani and Retalis, 2013; Conole, 2014).

Supporting teachers in the way they design LDs is valued more by teachers when compared to introducing new LD practices and simply forcing teachers to follow them (Laurillard et al, 2013). Most of all, teachers value support from their colleagues (Bennett et al., 2015; Stark, 2000). Also, Bennett et al. (2015) pointed out that LD tools should adopt LA to improve teachers' understanding of their students, supporting flexibility within a design, allow teachers to be responsive to their students need and interest.

Other minor functionalities or features of LD tools, which should not be disregarded, are also pointed out in a study by Prieto et al. (2014), such as the option to work offline with the LD tool, libraries of LD templates, simplicity of use, and instantiation of resource automation.

2.4 Open Challenges in the LD field

Various open challenges are mentioned in the recent literature of the LD field.

First of all, a lack of an agreed common language used across all tools remains as one of the main concerns of the LD field (Mor & Craft, 2012). According to Mor & Craft (2012), representing teaching practice in meaningful ways for teachers to understand, discuss, and share ideas remains problematic and requires further investigation. Even though some attempts were made to solve this issue, the form of representation of LD has remained an important concern of the LD field (Dalziel et al., 2015). This view has been reinforced by Persico & Pozzi (2015a) who also agreed that a unified version for LD tools is missing. Although understandably, the increasing complexity of the LD process in technology-rich environments makes this issue very challenging, everyone agrees that creating a common language is an area that needs to be further explored.

Second, the need for empirical studies of the LD-P of HE lecturers is highlighted by several LD researchers. For example, Goodyear, Markauskaite, & Kali (2009) point out to the limited attention given to understanding what teachers need to develop effective LD-P, whilst Mor & Craft (2012) criticise LD studies for being focused on the evaluations of LD tools and representations rather than on the understanding of the actual LD-P. Supporting this statement, Bennett et al. (2014) and Nguyen & Bower (2018) mentioned that there have been limited studies regarding how teachers design for learning, what types of support they use, and what influences their design decisions. In the same vein, Dalziel et al. (2016) highlighted the need for identifying context factors influencing LD-P by conducting case studies. Bennett, Agostinho and Lockyer (Bennett et al., 2014) indicated the importance of a practical understanding of LD. Recently, Dalziel et al. (2016) said that further delimitation of actual LD-P, the factors affecting it, and understanding for efficient teaching-learning need to be studied.

Third, there is insufficient empirical work that examines how the tools are used and what influences their usefulness to the educators (Agostinho et al., 2009). There have been various attempts to analyse how HE lecturers perceive and adopt LD tools (Prieto et al., 2014). Masterman et al. (2009) conducted a series of case studies where lecturers' perceptions of LD tools were explored. They analysed new lecturers understanding of the LD domain and found out that new lecturers perceive as valuable features of LD tools that enable them to create well-structured sequences of learning activities (Masterman et al., 2009). Also, several studies have attempted to make a comparative analysis of LD tools (Vignollet et al, 2008; Katsamani & Retalis, 2013; Prieto et al., 2013). However, even though lecturers were the main target user group for LD tools, these works mostly validated the usability of a specific LD tool/approach by conducting studies with researchers and LD specialists trying to appraise the tool's expressiveness. Only a few pieces of research explored lecturers' perceptions of LD tools outside the constraints of a single LD tool/approach. Masterman and colleagues' work might be given as an example of this kind of study. In 2006, they investigated the use of tools for LD (Masterman et al., 2006), suggesting that future LD tools should be able to accommodate the needs of practitioners from diverse backgrounds and cultures, make the easy transition between various LD tools, and provide support for unplanned deviations during a learning session. Also, in (Masterman & Manton, 2011), although the researchers analysed the use of the PHOEBE tool, they were able to identify some essential factors that affect the use of LD tools in general: internal motivation, support of the institution, sense of ownership, and flexible support and guided paths for LD. Furthermore, in (Masterman, Walker, & Bower, 2013), they presented a study comparing the results of studies from three LD tools, namely the Learning Designer, LAMS, and PHOEBE, summarising that subjective criteria had the most value for lecturers so tools' acceptability was "largely a matter of personal style". Lastly, Prieto et al. (2014) highlighted that more research is needed on lecturers' perception and use of LD tools, highlighting the fact that available research and analyses of evaluation studies are usually restricted to the use of a single, or very few, LD tools.

Fourth, despite the widespread use of technology for learning, the wider adoption of LD theory-informed lessons and the embedding of LD tools in the daily practice of educational organisations remains limited (Prieto et al., 2014), which is considered as a matter that deserves further investigation in the LD field (Mor, Craft, & Hernández-Leo, 2013). Bennett et al. (2011) studied the Australian lecturers' context and concluded that there is a gap in the adoption of LD approaches. Various studies are conducted to explore the reasons behind the LD tools' low adoption among teachers. For example, Demetriadis et al. (2003)'s study interpreted the lack of adoption as a natural negotiation when new digital technology is embedded in the local culture of teaching. In another study, this lack of acceptance is associated with the way that many studies in the LD field are conducted typically considering and assessing a particular LD approach, or tool, which consequently makes hard to accumulate consistent information in order to generate a holistic view of the users' perceptions and engagement with LD tools (Dobozy, 2013).

Fifth, there is a gap between LD-P of HE lecturers and LD tools. Charlton, Magoulas, & Laurillard (2009)'s analysis of several LD tools, user studies and collecting the requirements of teachers from LD-P, and LD methodologies showed that there exists a gap between the requirements of teachers and the LD tools that have been developed. This gap is shown as a reason for low adoption of LD tools among teachers by (Charlton, Magoulas, & Laurillard, 2009). Supporting this argument, Bennett et al., 2015) said that LD tools are developed based on supposition about LD-P of teachers rather than empirical evidence on LD-P.

Sixth, so far there are not agreed design principles to inform the development of LD tools. Various studies attempted to gather some kind of design suggestions; however, they did not attempt to stabilize them. For example, Albó & Hernández-Leo (2018b) presented design principles for LD tools. However, their design principles were derived from conceptualisation and ongoing development of a particular LD tool rather than from examining HE lecturers' LD-P and stabilising some of the principles.

Last but not least, another issue highlighted by Persico and Pozzi (2015) is implementing teaching and learning analytics into the process of LD, and supporting designers to make informed decisions on the properties of their design (Persico & Pozzi, 2015). While some of the tools considered their representation from these perspectives, the majority has several gaps as the main theoretical foundations of LD studies so far have been, understandably, educational theory and pedagogy.

2.5 Summary and Contribution of the Chapter

This chapter presented the results of a systematic literature review of LD tools, LD approaches, and needs and perceptions of HE lecturers.

The chapter first explored the pedagogical dimension of the LD field. It identified and analysed eighteen LD theoretical models/approaches- with most of them related to constructivist theory. According to the literature, six of them, namely the 7Cs LD Framework, the Conversational Framework, ISiS, the 4SPPIces Model, the CADMOS approach, and IMS LD have influenced the development of well-known LD software tools more than others and were selected for further analysis. Then our review had a closed look at the technological dimension, focusing on LD software tools. More than 30 tools were analysed initially and 10 of them, namely ILDE, the Learning Designer, ScenEdit, LdShake, CADMOS, eXeLearning, LAMS, CompendiumLD, OpenGLM, and WebCollage, whose design has been influenced by the above-mentioned LD approaches, were considered for further investigation.

Having analysed the pedagogical and technological aspects of the LD field, the chapter focused on the human factors dimension by reviewing literature that studied HE lecturers' practices, their perceptions of the LD field and their needs.

The chapter contributed an updated view of the LD field by conducting analysis across three dimensions: pedagogical underpinnings, software tools and human factors. Another contribution lies in the introduction of a new framework for the analysis and organisation of LD software tools. In this context, the chapter proposed a reconceptualization of the framework proposed by Britain (2007), enriching it with additional dimensions that reflect current needs in modern HE institutions, such facilities for LD analytics, LD tools integration with virtual learning environments, and functionalities for sharing and reuse, exporting and importing learning designs of different file formats. The chapter also highlighted open challenges in the LD field and in particular the necessity to extend our understanding of LD practices in HE, identifying areas for improvement, as this can inform and strengthen further the way we design support tools for LD.

Lastly, the findings of this chapter offer a starting point for further investigations in the rest of the thesis. For example, our analysis of LD theoretical models and approaches feeds into the examination presented in Chapters 8.3 and 8.4, while the gap identified between lecturers' requirements and LD practice in HE, and how these are addressed in LD tools developed so far provides a good starting point for a study to extend our understanding of lecturers' needs and perceptions of LD in Chapter 5. Finally, the review of empirical studies offers useful insights for the design of interview questions and questionnaires- relevant examples are presented in Appendix A and Appendix B respectively- to explore the actual LD practice of HE lecturers in the thesis.

Chapter 3

Methodological Considerations

This chapter presents a methodological framework for the research of this thesis.

The chapter is organised as follows. The next section gives a brief overview of the components of a research paradigm. Section 3.2 explains the theoretical underpinnings of this research. Section 3.3 deals with the development of the Design-Based Research (DBR), which is the primary paradigm adopted in this thesis. It explains its characteristics and discusses the criticism of this approach and the practical challenges. The justifications for employing DBR in this research are presented in Section 3.4. Section 3.5 describes the use of multiple methods and its rationale while Section 3.6 looks at the implications of DBR and the various methods for this study. The rigour in DBR is discussed in Section 3.7. Ethical considerations are presented in Section 3.8. The assumptions are presented in Section 3.8. The summary is drawn in Section 3.10.

3.1 Research Approach of the Thesis

A research paradigm is a group of assumptions or conceptions of the world, used by researchers in a scientific field to create information, research methods and gauge the level of rigour that is common to all forms of research (Fossey et al., 2002). Crotty (1998) mentions that there are four elements in a research paradigm: epistemology, theoretical perspective, methodology, and methods (see Figure 3.1).

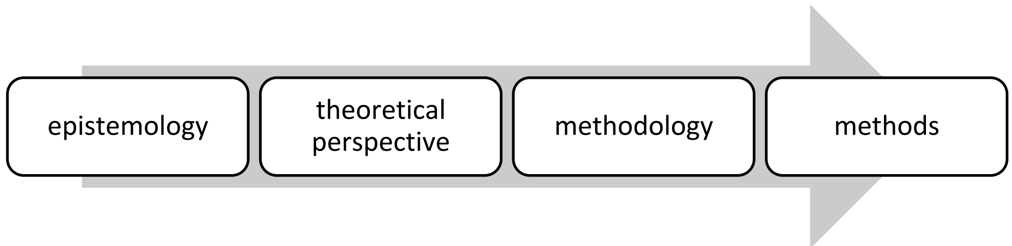

Figure 3. 1. The research paradigm's four elements (Crotty,1998)

Epistemology is a method of comprehension and elucidating "how I know what I know" (Crotty, 1998, p. 3). It is concerned with the characteristic of the communication among the notion of knowing and what can be known (Guba & Lincoln, 1994). According to Crotty (1998) ontological and epistemological issues tend to emerge together. Hence, ontology, which is defined as the research of being (Crotty, 1998), or the nature of authenticity (Guba & Lincoln, 1994), should not be considered as a separate element. A theoretical perspective is "the philosophical stance informing the methodology" (Crotty, 1998, p. 3), whilst methodology is the plan of practice which underlies the preference and use of specific methods (Crotty, 1998). The question of "how can the inquirer go about finding out whatever they believe can be known?" is answered in the methodology (Guba & Lincoln, 1994, p. 108). Methods are defined as the particular techniques used to collect and examine data (Crotty, 1998).

In this research, pragmatism as an ontological and epistemological basement, DBR as a methodology and mixed research method as a research method are employed. These will be described in detail in the following sections.

3.2 Philosophical Underpinnings

The most relevant and appropriate philosophical underpinning for DBR is pragmatism (Barab & Squire, 2004; Juuti & Lavonen, 2006), whose principles centre upon its capability to deal with problems or tasks in a practical way (Dewey, 1938). According to Barab & Squire (2004), DBR suggests a pragmatic philosophical standpoint that the value of this theory rests in its capacity to generate alterations in the world. Pragmatism is presented in the studies of Charles Sanders Peirce (1839–1914) firstly and it is further advanced by William James (1842–1910) and later on by John Dewey (1859–1952)) (Given, 2008). The philosophy of pragmatism has been invented to answer the question of how human beings interpret meaning in the world and how these influences practise and decision making (Juuti & Lavonen, 2006). Creswell (2014) used the views of Cherryholmes (1992) and Morgan (2007) on pragmatism and provided a philosophical basis for mixed research, which enables this study to achieve its research objectives:

- Pragmatism is not committed to a specific system of philosophy and reality. This applies to mixed research methods in that queries attract liberally from both qualitative and quantitative presumptions during their engagement in a study.
- An investigator has freedom of choice. An investigator is free to choose the procedures, methods, and techniques that best fit her aims and needs.
- According to the pragmatists, the world is not an absolute unity. In this context, mixed-methods researchers prefer using several methodologies for gathering and analysing data rather than employing only one technique of qualitative or quantitative.
- Pragmatism asserts that the truth is whatever runs at that time. Similarly, both qualitative and quantitative data is preferable for the mixed methods researchers as they are good in providing a valid understanding of the problem of research.
- The researchers of pragmatism seek for what and how to investigate, building upon the proposed results. Primarily, researchers who combine qualitative and quantitative in a study need to establish a rationale for mixing different data and following mixed-method research in their study.

- According to pragmatists, study always happens in political, social, and other contexts. Thus, mixed methods research may contain a postmodern turn, a theoretical perspective that is reflexive of social fairness and political goals.
- With regards to the pragmatists' belief, an outer world is lodged in the mind, and also it is free of the mind, and we need to stop asking questions about the reality and the rules of nature.

Therefore, pragmatism offers flexibility in adopting multiple methods, diverse world opinions, diverse presumptions, numerous data collection and data analysis techniques in a study for the mixed methods investigators, which is eminently suitable for this research.

3.3 Design-Based Research Methodology

Design-Based Research (DBR) is an emerging paradigm to the research of teaching-learning in the setting of methodical design and research of educational tools and approaches (Design-based Research Collective & Collective, 2002). According to Barab & Squire (2004), DBR is a methodological set of tools for obtaining evidence-based explanations from naturalistic educational settings that are processed by methods that allow generating cases to create new approaches, practices and artefacts, which justify and possibly affect teaching-learning. In the educational context, DBR has been considered a flexible and systematic methodology introduced to develop educational practices with iterative phases of analysis, design, development, and implementation, which are established with the cooperation of practitioners and investigators in a real-world environment (Wang & Hannafin, 2005). It also proposes to producing design principles that are contextually-sensitive (Wang & Hannafin, 2005).

DBR is built upon the firm foundation of the work of Ann Brown (1992) and Allan Collins (1990). Design studies, design experiments, and development research are the terms that have been used to define research methodologies that shared common traits with DBR. In the earlier stage of Collins (1990) and Brown (1992)`s work, it has been named 'design-experiments'. The need to improve education`s design science has been argued by Collins (1992) in order to reveal the effects on dependent variables in learning and teaching in the various design settings of the learning environment. Collins (1992) aimed to develop a more systematic methodology that would allow to include studying with teachers as co-investigators as well as the theory of design to guide practices of innovations in prosecuting design experiments. Design experimentation is described as a link between the study of complex instructional interventions and laboratory studies of learning by Brown (1992). Brown (1992) followed the steps of design experiments research methodology to study learning in rich, continually changing and complex classroom environments. Brown (1992) also discussed theoretical and methodological challenges when design experiments methods are used in research.

In the middle of 1990s, the Educational Development Corporation Group was founded by Jan Hawkins to improve the DBR methodology. However, DBR remained considerably underexplored. The following factors contribute to the fact the DBR remained underexplored; the poor quality of educational research invoked educational researcher to fill credibility gap (O'Donnell & Levin, 1999), improve more usable knowledge (Lagemann, 2002), and be more socially responsible (Reeves, Herrington, & Oliver, 2005).

In 1999, Christopher Hoadley founded the DBR collective- a group funded by Spencer Foundation. The group extended the research methodology in a way that addressed previous limitations and introduced the "Design-Based Research", which is currently in use (Design-based Research Collective & Collective, 2002). The rationale for choosing "Design-Based Research" as the name of the methodology instead of "design experiments", as it was originally called, was to avoid potential misidentification with other methods, such as studies of designers, trial teaching methods, and experimental design.

In Figure 3.2, four distinct phases of the Empirical Research methodology and the DBR are shown to illustrate the differences between the two approaches. The empirical research`s central assumption is that the practice is applied by practitioners. Reeves & Hedberg (2003) assert that this assumption stands in the wrong place, especially in educational research. They have removed this issue by defining the DBR process as a continuing cycle of the various phases. There are two significant benefits to this cyclic pattern. First, it enables researchers to become more engaged in the research process. Second, it allows practitioners and researchers to work together continually.

Akker (1999) clarifies the differences illustrated in Figure 3.2 as follows. The DBR approach makes both scientific and practical contributions compared to the Empirical Research methodology. When seeking a creative solution for an educational problem, cooperation with practitioners is fundamental. The main goal is not to examine if the theory is a good predictor of cases when engaged in the practice. The intercommunion of principles and practice is extra complicated and changing. The creative difficulty is often significant. To explain both the query at stake and the features of its possible resolution, interplay with practitioners is required. “An iterative process of ‘successive approximation’ or ‘evolutionary prototyping’ of the ‘ideal’ intervention is desirable” (Akker, 1999, p. 2). A direct application of the theory is not adequate in solving those complex problems.

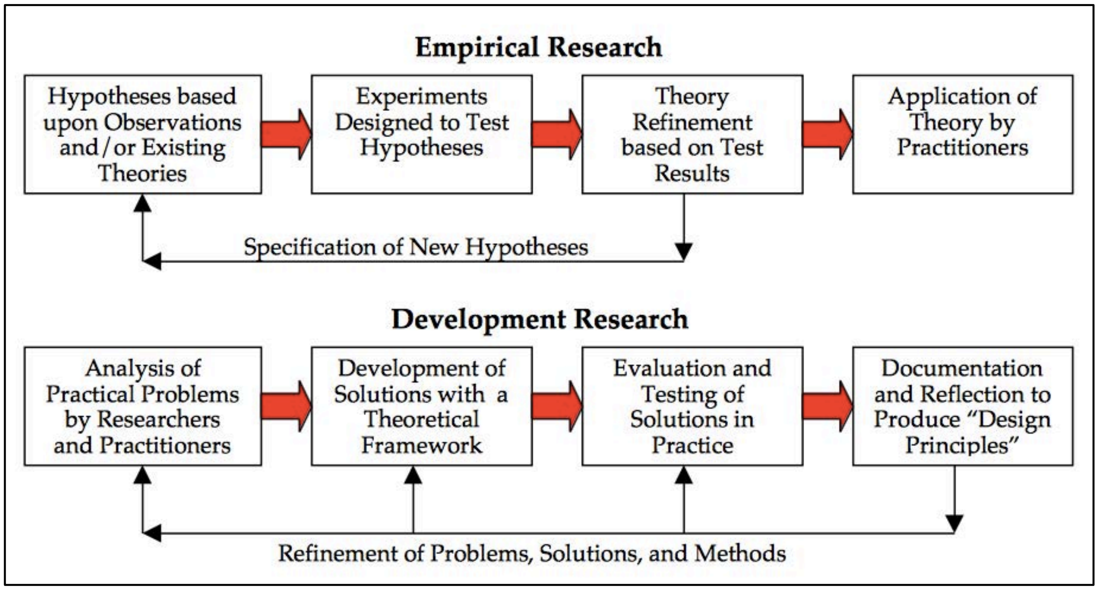

Figure 3.2. Differences between empirical research and DBR as defined by Reeves (2000).

In 2006, Reeves refined his DBR model transforming it into its current form. The newer model is structurally the same, but it has some significant features. An overview of the differences between Revees (2000)'s DBR model and Revees (2006)'s DBR model is portrayed in Figure 3.3.

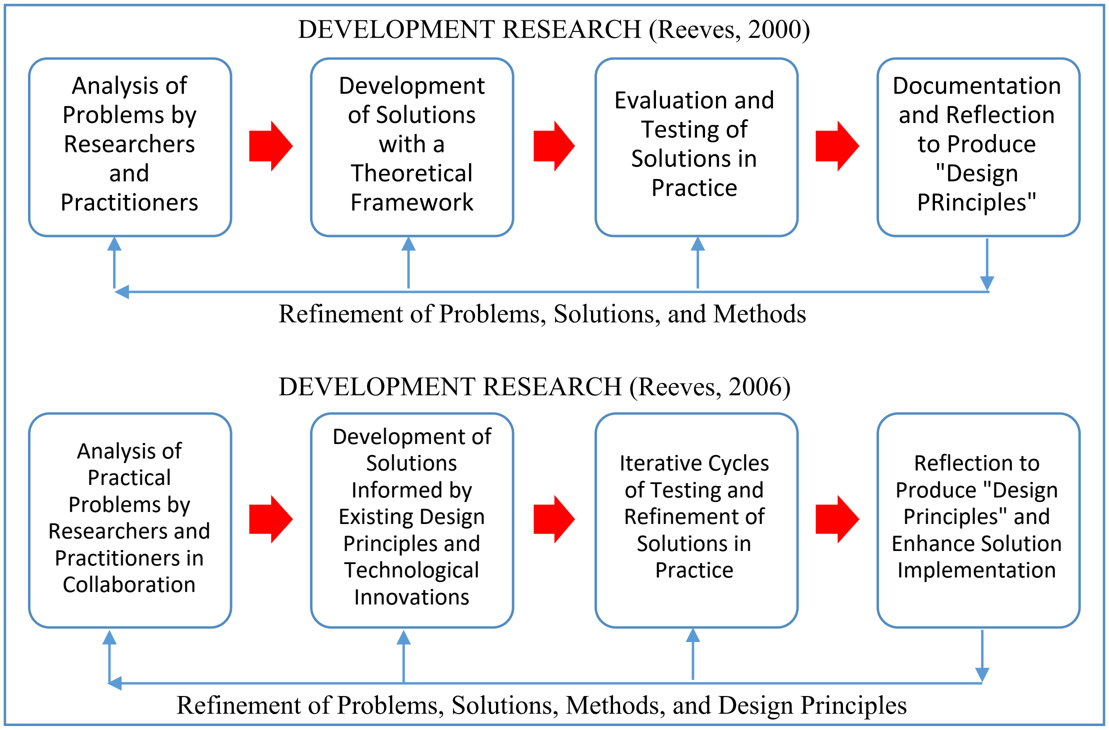

Figure 3.3. The evolution of “development research” into “design-based research.”

Thus, Reeves’s (2006) DBR model has four distinct phases: (1) analysis of practical problems by researchers and practitioners in collaboration, (2) development of solutions informed by existing design principles and technological innovations, (3) iterative cycles of testing and refinement of solutions in practice, and (4) reflection to produce design principles and enhancement of solution implementation. Therefore, the first phase of DBR deals with the identification of the real-world problem, literature search, and defining problem. In the second phase of DBR, a solution to the problem identified in the first phase is produced. Furthermore, in the second phase, the literature review goes deeply into the matter. Existing frameworks, design theories or any other relevant approaches are explored in-depth in order to be used in the solution of the problem. After the intervention have been designed and built, the next phase of DBR is to test the solution and evaluating it in practice. The final phase deals with the reflections on the intervention.

According to the literature, DBR possesses five main characteristics of: pragmatic, grounded, interactive, iterative and flexible, integrative, and contextual (Wang & Hannafin, 2005). First, DBR is pragmatic because it aims to find a solution to the real-world problems with enacting and designing interpositions, expanding theories, and distilling design principles (Design-based Research Collective, 2003; Akker et al., 2007). Unlike other research methodologies, DBR is about the development of both design and theory that mutually emerge through the process of design. Second, DBR is established on both real-world settings and philosophy (Wang & Hannafin, 2005). The theory forms the basis of DBR as well as its outcome. DBR is inherently theory-driven, and this theory evolves during the entire research process. Additionally, DBR is conducted in the settings of real-world filled with driving, intricacies, and limitations. An application of DBR to the real-world context draws research to produce efficient results. Third, DBR is interactive, iterative, and flexible from the standpoint of the research process. Without interaction with researchers and practitioners, it cannot argue that the outcome of the research changes the real-world context (Design-based Research Collective, 2003; Reeves et al., 2005; Wang & Hannafin, 2005). A researcher, a practitioner, the collaboration between researchers and practitioners, and an artefact are the critical elements involved in DBR (Juuti & Lavonen, 2006). In DBR, the practitioners are perceived as co-participants in the design and analysis rather than matter attached to treatments (Barab & Squire, 2004). In addition to this, in DBR, theory and interventions are consistently evolved and refined in the iterative design process (Design-based Research Collective, 2003; Bannan-ritland, 2003; Wang & Hannafin, 2005; Akker et al., 2007). This recursive nature of the DBR process provides practitioners and researchers with great flexibility. Fourth, based on the needs of the research, both qualitative and quantitative research methodologies can be integrated into DBR. So, DBR is integrative. The integration of multiple research methodologies in DBR allows gathering data from various sources, which substantially increases the credibility of the findings (Wang & Hannafin, 2005). There is no "gold standard" functionalities in DBR. Instead, DBR takes advantages of several mixed methods. Last, but not least, DBR is contextual, because the results of the research are coupled with both the design process, through which these results are created, and the setting where the research is applied (Wang & Hannafin, 2005). Keeping records of the outcomes to see if they have worked or not in every single iterative phase of the research process is imperative for applying DBR. This documentation allows researchers who conduct related studies to examine the findings in their own contexts. Guidance on the use of the results in the context of other studies in new settings is required to increase the adaptability of the research findings.

3.4 Rationale for Adopting DBR

DBR is the most appropriate approach to the research of this thesis among other similar approaches and methodologies, including design experiments (Collins, 1990), development research (Akker, 1999), developmental research (Richey, Klein, & Nelson, 1996), action research (Stringer, 2004), and formative research (Reigeluth & Frick, 1999). Even though there could be a common ground connecting these approaches, DBR stands as a distinct approach that has its peculiar characteristics. The following characteristics distinguish DBR from other similar approaches and justify its use in this research.

1. *DBR is driven by prior research*. In this study, a conceptual framework is built based on a substantive body of previous research in the LD field.
2. *DBR is iterative*. Therefore, this research is conducted through DBR's iterative cycles, as described in the following sections.
3. *DBR is integrative*. DBR researchers can use different research techniques that change as new requirements and problems arise, and the research focus improves (Wang & Hannafin, 2005). Thus, this study employs various research

methods and techniques for the collection and analysis of data, which are presented in the following section.

4. *DBR is collaborative*. This research is conducted with a close connection with experts and HE teachers in the development of the conceptual framework.
5. *DBR is founded on pragmatic enquiry.* There is an epistemological and ontological presumption of pragmatism behind DBR. Therefore, DBR has pragmatically guided in the sense that the aims and questions of the study decide the research methodology and design, (Creswell, 2014), which is useful for modelling real-world practices and perceptions.
6. *DBR seeks generalisation*. In this research, we attempt to develop a coherent underlying conceptual framework to inform the development of future LD software tools. Hence, generalisability is a useful feature.

It is worth noting that DBR has been used successfully for designing approaches that address rising innovations of technology (Wang & Hannafin, 2005). DBR has also been used in various research works that investigated ways to develop information and communication technologies' integration (Sandoval & Bell, 2004; Edelson, 2002; Wang & Hannafin, 2005), and it has been verified as beneficial for research proposing innovative technology-based solutions to educational problems (Kervin et al., 2006). It is considered suitable for investigating technology-based learning approaches in various contexts (Reeves et al., 2005; Sandoval & Bell, 2004). Lastly, DBR is seen as a promising way to explore possibilities for creating novel learning environments, develop theories of learning that are contextually based, advance and consolidate design knowledge, and increase the educational community's capacity for educational innovation (Design-based Research Collective & Collective, 2002).

3.5 Employing Multiple Methods

Data collection and analysis methods are typically utilised to collect and examine data associated with the particular research questions (Crotty, 1998). DBR uses the same to collect data as other research methodologies (Akker, 1999, p. 9). From the standpoint of pragmatism, researchers who employ DBR can use whatever methods meet their needs for data collection and analysis (Fraenkel & Wallen, 2009). As quantitative, qualitative, and mixed research methods are the general approaches used in research (Migiro & Magangi, 2011), a DBR researcher can adopt any of those research methods. DBR literature suggests using a mixed-methods approach to maximize the validity, objectivity, as well as the reliability of the research and its findings (Design-based Research Collective, 2003; Bell, 2004; Wang & Hannafin, 2005). A mixed research method is defined as a programme of enquiry which includes gathering both qualitative data and quantitative data, combining these two types of data, and applying different designs that may include presumptions of specific philosophy or theoretical frameworks (Creswell, 2014). The central hypothesis of this type of enquiry is that the mixture of qualitative and quantitative methods gives a comprehensive perception of a research problem than either method alone.

In this research, multiple qualitative and quantitative methods and techniques are integrated to collect data, whilst qualitative data analysis is used to achieve the research objectives and answer research questions of this thesis. Altogether, this work uses a literature review, interviews, and survey to collect data, qualitative data analysis, and sociomaterial theory as an analytical lens to investigate the analysed data.

In the following subsections, the details of the methods employed in this research are presented and the rationale for their use is specified.

3.5.1 Literature Review

Creswell (2014) defines literature review as an extensive study and analysis of the literature on a specific topic. According to Cooper (2010), there are four types of literature reviews: (1) combine what other researchers have studied and what they told, (2) criticise previous studies, (3) build connections among relevant issues, and (4) distinguish the fundamental topics in a study field. According to Jesson, Matheson, & Lacey (2011), most of the literature reviews can be grouped into two main kinds: traditional and systematic. When the literature review has no defined method, it is referred to as a traditional literature review. In contrast, a systematic review follows a rigid protocol and employs distinct and rigorous methods to define, critically evaluate, and synthesise related studies to answer a predefined question.

Reviewing the literature is a standard phase in any research project. Besides, it is considered a significant component of the DBR approach forming a basis for the development of an initial draft of the proposed innovation to address the defined problem (McKenney, 2007). Thus, in this study, both traditional and systematic literature reviews were used to collect and interpret relevant information about LD, LD approaches and LD tools. The literature review initiated the DBR process and formed the basis for the design of the initial intervention in this study.

3.5.2 Semi-structured Interviews

An interview is a common data gathering method used in qualitative research (Kvale, 2007). In the research methodology literature, there are four types of interview techniques: structured, unstructured, focus group, and semi-structured (Kvale, 2007). Structured interviews are commonly associated with survey research. This technique is considered as excessively limiting, firm, and eventually improper to this research. In unstructured interviews, questions are not prearranged and the time it normally takes to conduct the interview and analyse the data is longer. Therefore, unstructured interviews were not considered appropriate for this research. Another alternative is a focus group, which is very functional to generate knowledge on collective views. However, this requires organising participants in small groups which was not appropriate for this thesis as interviewees were professionals, living in different time zones, which limited our chances to reconcile their commitments. The semi-structured interviews, by contrast, provide an appropriate methodology for this research; while they are designed to obtain responses whereby open-ended and closed-ended questions, also provide an opportunity to further discussions. According to Kvale (1996), a semi-structured interview aims to acquire descriptions of the lived experiences of the interviewee to interpret the meaning of the defined phenomena. The semi-structured interview comprises of the central question and many related questions associated with the central question (Creswell, 2014). This kind of interview is conducted only once, with one person or group, and usually, cover 30 min to more than one hour. The data is recorded by audiotaping, handwriting, or videotaping during the interview. The face-to-face and online interviews conducted in this work enabled the interviewer to ask detailed questions during the interview process and promoted two-way communication, which encouraged interviewees to share their thoughts, ideas and opinions of LD practice and organisational and social contexts.

3.5.3 Online Survey

A survey method presents a quantitative definition of conventions, manners, or ideas of a community by researching a sample of the population (Creswell, 2014). It covers segmental and longitudinal research employing surveys to infer from a sample to a population (Fowler, 2014). There are several ways to conduct a survey including mail, internet, telephone, and face-to-face. Surveying by phone, mail, or face-to-face was considered as inappropriate to aggregate and analyse data from many respondents in the context of a PhD project. In contrast, the study employed an internet survey or online survey method as it allows to access a vast number of participants worldwide, hence preventing geographical dependence, and provides flexibility in data analysis by allowing to use survey tools that offer functionalities for applying advanced analysis techniques.

3.5.4 Qualitative Data Analysis

In data analysis, the intent is to make sense out of collected data (Creswell, 2014). Creswell (2014) suggests a bottom-up approach which is a linear and hierarchical approach for data analysis. There are seven steps involved in Creswell (2014)'s qualitative data analysis approach. The first step deals with the preparation and organisation of the data. This stage includes making clear transcriptions of interviews, ordering and arranging the data into various types regarding data's source (Creswell, 2014). The second phase covers the reading of all the transcripts to have an overall understanding of the data. In the third step, a researcher codes all the data. "Coding is the process of organising the data by bracketing chunks and writing a word representing a category in the margins" (Creswell, 2014, p. 247). Tesch (1990) presents the following eight steps involved in coding:

1. Reading all the transcriptions thoughtfully to obtain overall information and noting concepts as they attain to mind as read.
2. Choose one interview transcript — usually the shortest, the most attractive one. Look over it, thinking what it is about and its underlying purpose, but do not think about the essence of the knowledge. Note ideas in the border.
3. Record all the topics that arose when you follow the tasks mentioned by various interviewees. Group related topics. Put them into columns, reasonably listed as superior, novel, and leftover topics.
4. Taking the list, return to the transcriptions, shorten the topics as codes and put the codes next to the relevant sections in the text. Investigate if different sections and codes appear.
5. Discover the most representative expression for your topics and convert them into categories. Try ways to decrease the number of categories by merging

relevant topics. Reasonably draw borders among your categories to illustrate interconnection.

6. Finalise the abbreviation of each category and systematise codes.
7. Collect the data elements pertaining to each category in one area and conduct a preparatory analysis.
8. If needed, redo coding to your current data.

In the fourth step, above, Creswell (2014) suggests employing the coding procedure to create a definition of context or people as well as groups or topics for analysis (Creswell, 2014). In the fifth step, a researcher further develops the representation of the descriptions and themes. According to Creswell (2014), a commonly used approach is to employ a narrative paragraph to represent the outcomes of the analysis. The final step of the analysis includes interpreting the findings (Guba & Lincoln, 1994). This research took advantage of Creswell (2014)'s qualitative data analysis steps and Tesch (1990)'s coding guidelines in the data analysis process. It also took advantage of tools with data analysis and visualisation functionalities. For example, SurveyMonkey[4] was helpful in the design of the survey and the data collection and analysis. Microsoft Word[5] was used in the transcription and organisation of the data. QSR NVivo[6] functionalities were used in the organization and analysis of the interview and survey data, whilst ConceptDraw[7] was used to illustrate concepts based on `the analysed data.

3.5.5 Sociomateriality as an Analytic Lens and its Role in the Thesis

Sociomateriality is a theory established upon the intersection of technology, organization and work, that endeavours to understand "the constitutive entanglement

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[4] https://www.surveymonkey.co.uk
[5] https://products.office.com/en-gb/word
[6] https://www.qsrinternational.com/
[7] https://www.conceptdraw.com/

of the social and the material in everyday organizational life. (Orlikowski, 2007). According to Orlikowski & Scott (2008b), with sociomateriality the aim is to "examining how materiality is intrinsic to everyday activities and relations" (p. 455). According to Orlikowski (2007), in sociomateriality, "the social and the material are considered to be inextricably related - there is no social that is not also material and no material that is also social". From a sociomaterial perspective, the materials' means are not just tools to be used to do some tasks, but they are constitutive of both activities and identities (Orlikowski & Scott, 2008b). Latour's (2004) quote makes this point particularly clear:

> *"To distinguish a piori "material" and "social" ties before linking them together again makes about as much sense as to account for the dynamic of a battle by imagining, first, a group of soldiers and officers stark naked; second, a heap of paraphernalia—tanks, paperwork, uniforms—and then claim that "of course there exists some (dialectical) relation between the two". No! one should retort, there exists no relation whatsoever between the material and the social world because it is the division that is, first of all, a complete artefact. To abandon the division is not to "relate" the heap of naked soldiers with the heap of material stuff, it is to rethink the whole assemblage from top to bottom and from beginning to end." (*p. 227*)*

According to Orlikowski and Scott, sociomateriality can be characterized as comprising five main key points:

- *"a concern to (re)establish materiality as central to our understanding of contemporary organizations;*
- *an ontological claim about the inextricable entanglement of the social and the material;*
- *an anti-essentialist rejection of the notion that entities have inherent properties, viewing these rather as relational;*

- *a view of the relations and boundaries between the social and material as being enacted rather than given; and*
- *a focus on practices, rather than discourses or cognition." (Jones, 2017, p.897)*

3.5.5.1 Sociomateriality in TEL studies

The use of socio-materiality as a theoretical concept in educational studies have been brought to the agenda by several scientists: Fenwick et al. (2011) defined sociomateriality as an emergent approach in education studies, Sorensen (2009) indicated the importance of sociomateriality in educational studies as that there is a "blindness toward the question of how educational practice is affected by materials" (Sørensen, 2009, p. 2), and this understanding sometimes results in handling materials as minor instruments to further educational outcomes. Bayne (2014) illustrated the importance of the sociomateriality in TEL studies by saying that "what is material is often taken to be the background context against which educational practice takes place or within which it sits, and material artefacts are often taken to be simply tools that humans use or objects they investigate".

The importance of the use of sociomateriality in TEL studies is highlighted by several researchers. Sørensen (2009) reported that most studies of TEL in the classroom explore how technologies make learning more effective and more meaningful while the *technology* itself remains moderately disregarded. Fenwick et al. (2011) performed a study illustrating the importance of the sociomateriality in TEL studies and concluded that "what is material is often taken to be the background context against which educational practice takes place or within which it sits, and material artefacts are often taken to be simply tools that humans use or objects they investigate" (p.1). Later, Oliver (2012) said that the prevailing discourse on TEL is often seen as an instrument towards fixing educational issues, but has forgotten its material perspective by abstracting from their actual use. Furthermore, studies in TEL have usually focused on the affordances of unique technologies such as tablets, smartphones or interactive whiteboards; nonetheless, in the many learning environments, technologies are embedded in structures of the activities rather than stand-alone (Meyer, 2014).

In the literature, there are limited studies considering sociomateriality in TEL. Johri mentioned sociomateriality as a theoretical concept and sociomaterial bricolage as an analytic framework, and three case studies that demonstrate the application of sociomateriality (Johri, 2011). The first case study involved "the use of pen-based computing, tablet PCs, in large classrooms to improve student participation" (Johri, 2011, p.212). The socio-material assemblage in this case aimed to allow all students to participate and to guide their participation by providing them with an opportunity to write digitally on slides and share them with the instructor. In the second research study, the use of technology by engineering student teams studying on design projects were investigated. Students were equipped with tablet PCs in this study as well. Comparative analysis of two groups performed. One team had a meeting face to face to design their project and physical assemblage that included significant use of technology in the same place. The other team did a virtual design where they use messaging and tablet PC software to connect and design. A final empirical study focused on "geographically distributed software engineers that experimented with different assemblages to develop work practices that were aligned across locations and ensured knowledge sharing within the team" (Johri, 2011, p.214). Johri concluded that a socio-material account "makes a distinct contribution by allowing for equal and mutual emphasis of both social and material considerations" and "advances understanding compared with previous accounts of technology use by providing sufficient and necessary emphasis on both the social and material aspects of learning. (Johri, 2011, p.215).

In another study, Mifsud (2014) discussed the sociomaterial perspective of mobile learning and classroom practice to explore what sociomateriality can offer for mobile learning. The specific focus of this study was Actor-Network Theory (ANT). The study " illuminates the increase in complexity of mobile learning in classroom practices, with regards to space, time, region, networks and socio-material agency" (Mifsud, 2014, p. 147).

Lastly, in another empirical research study, Hustad and Bechina (2010) analyse the implementation of LMS to support the education of Norwegian athletic judges. Hustad and Bechina (2010) utilized the ANT perspective to demonstrate the "complex socio-technical environment which unfolds while transferring from an offline to an online learning context" (p. 1). Hustad and Bechina (2010) concluded that "ANT perspective is useful in providing an understanding of all the connections and influences involved. It also reveals conflicts, power relations, learning processes and the nature of the network."

These studies show that practices in education are also "inherently sociomaterial, and so to understand them, we must understand their sociomaterial configuration" (Orlikowski & Scott, 2008b).

3.5.5.2 *The Materiality of the things in LD-P*

Although technology has become an important element of modern educational practice, LD models do not consider the materiality of the things involved in learning and LD-P. This lack of consideration for materiality as one crucial dimension in LD frameworks can be illustrated in some cases. For example, the 7Cs framework is a teacher/designer-centric approach, and this feature is usually considered advantageous. According to the 7Cs' approach, a teacher/designer conceptualise, capture, create, communicate, collaborate, consider, and consolidate. Regarding the socio-material perspective, however, a teachers' actions are socio-material in the learning design process; a teacher/designer's actions are connected with several other factors that needs attention. In the conceptualise phase, institutions have a big influence and a teacher/designer does not articulate the module's core principles and set a vision for the learning intervention alone. The pedagogy chosen for a certain module or course is shaped by an institution's learning strategy. In the capture phase, a teacher/designer is again centralised as the founder of resources which essentially minimalize resources' essence. The create phase is another human-centric phase where the other things that will be involved in it are treated as only tools used for people's intentions. Phase 4 of the model (communicate) asks what types of communication the learners will be using; however, it does not consider how materials will be involved and what connections they will make and what trace they will leave on the flow of the teacher/designer actions. The consider and consolidate phases also focuse on humans and ignore the rest.

Laurillard's Conversational Framework is another human-centric learning design framework developed within the field. The framework articulates the dialogical exchange between teachers and students (Laurillard, 2002) and this is considered as a compelling feature and focuses on four interaction types between the learners and teachers: discussion, adaptation, communication and reflection. In these interactions, "materials" such as the learning environment and digital technologies are seen only as an instrument that enables teachers and learners to achieve educational aims, underestimating their socio-material dimensions and the fact that the impacts of the same technology can vary widely with the different social, economic or organizational characteristics depending on the time and place.

Furthermore, according to ISiS, design scenarios' exchange between the teachers/designers should be based on intentions, strategy, and interactional situations in which inherently privileges users and ignores the LD-P's materiality. However, the teacher/designers' practice of setting intentions, strategy and interactional situations involves interactions with materials. Moreover, the ISiS framework tends to centre users and does not consider the rest actors involved in the LD-P.

Similarly, socio-material dimensions have not been considered in the LD tools' development. This point will be explained using three authoring tools: the ILDE, which was developed based on the 7Cs framework, the Learning Designer, which was based on the Conversational Framework, and ScenEdit, which was built on the ISiS framework. Firstly, the ILDE tool integrates several LD tools. ILDE adopts LdShake to support co-design, OpenGLM, WebCollege, exeLearning, and CADMOS for authoring, GLUE!PS for implementation, and CompendiumLD for conceptualisation (Hernández-Leo et al., 2014). However, the impact of LD tools in the educational practice has remained limited with Persico & Pozzi (2015) pointing out that none of the LD tools has yet proved capable of becoming a standard and thus make its underlying approach more widespread than the others. Similarly, LD literature considers that the existing LD tools' adoption is restricted since existing tools' complexity and their non-alignment with the teachers/designers' actual practices. However, the socio-material view recognises that to understand how technology will be designed and used, its social and material constitutive entanglement should be considered. So, naturally, regarding the socio-material perspective, a tool like ILDE that integrates models, methods or approaches embedded already into existing LD tools, which have not been adopted sufficiently by the global teachers/designers' community could be proved problematic. This is because the technical characteristics, features or requirements of technology cannot be dissociated from the ways people perceive this technology and use it in their contexts. Likewise, the Learning Designer, another authoring environment, has also been developed as a tool that teachers/designers can use abandoning its materiality within LD-P. Lastly, the ScenEdit authoring tool also tends to see teachers/designers as the only consumers of the tool and it ignores the rest. It enables teachers/designers to structure the scenarios by eliciting intentions, strategies, and interactions.

This research advocate that understanding the LD-P of LD experts and HE lecturers from a sociomaterial perspective could be beneficial for moving LD forward for several reasons. First, in LD, sociomateriality provides exclusive vantage ground from which we can develop a more comprehensive socio-cognitive model, binding human and non-human actors involved in the LD-P and social elements, without privileging either one and considering for new features that emerge when these are combined.

Second, as mentioned above, a sociomaterial theory introduced into educational studies so far has offered a new standpoint to analyse and understand the role, benefits and adoption of educational technology. Those studies that approached learning technology from a sociomaterial perspective produced valuable findings, which demonstrated the value of sociomaterial theory in educational technology contexts. For instance, Johri (2011), as mentioned above, developed sociomaterial bricolage as an analytic framework and conducted three case studies. Johri (2011) argues that sociomateriality helps to understand what changes when a system or device transforms from physical to digital. Johri (2011) also considers "sociomateriality as a key theoretical perspective that can be leveraged to advance research, design and use of learning technologies in the practice tradition" (p. 210). In another example, in a mobile learning context, Mifsud (2014) takes up classroom practices from the sociomaterial perspective and mobile technology to reveal what sociomateriality can offer for mobile learning. On the other hand, studies of sociomateriality about VLEs resulted in valuable findings (Johannesen et al., 2012), which is quite encouraging for researching LD from the sociomaterial perspective.

Furthermore, in the LD literature, studies conducted so far had a different theoretical focus: the theoretical basement for the studies of LD was either behaviourist, constructivist, cognitivist, or connectivist. The field of LD is theoretically underpinned by a sociocultural perspective (Conole, 2015). Therefore, LD has not been studied about sociomateriality. The current thesis argues that such an approach could provide additional insight revealing misrepresentations of LD-P and may help to correct any misalignment of HE lecturers' LD-P with LD approaches and LD tools. The current thesis is an attempt to complement these studies, extending the design space of LD tools, by looking at LD-P and LD tools' design from a sociomaterial perspective.

We have not seen any study specifically considering sociomateriality within the field of LD. Yet, Conole (2013) presents ANT as theoretical perspectives that underpin learning design in his book titled *Designing for Learning in an Open World.* Conole defined the ANT as “ANT maps the relationships between material (between things) and semiotic (between concepts), assuming that many relations are both material and semiotic and that together they form a network” (Conole, 2013).

It is worth mentioning that in the context of Information Systems, there have been several cases where sociomateriality has been proven to be beneficial in studying an information system phenomenon that integrates entanglement of technological artefacts and social entities, e.g. (Owusu-Oware, Effah, & Boateng, 2018; Sesay, Ramirez, & Oh, 2017; Jones, 2017; Doolin & McLeod, 2012).

A range of theories that have appeared recently in contemporary studies of education is described as sociomaterial. This ranges from Actor-Network Theory (ANT) to activity theory, also known as cultural-historical activity theory, and from complexity theory to new geographies (Fenwick et al., 2011; Fenwick, 2015). Even though all these theories have very different ontological and theoretical roots and have built peculiar traditions in their various scholarly fields, such as organisation studies, science, technology studies, and human geography, they all constitute the umbrella of sociomateriality. Researchers can choose from those conceptual (and methodological) tools that fit the aim of their research agenda. Among those theories, the most relevant theory to this study is the ANT that points out that "actors themselves make everything, including own their frames, their own theories, their own contexts, their own metaphysics, even their own ontologies" (Latour, 2003, p. 63).

3.5.5.3 ***Actor-Network Theory***

Although called a theory, Actor-Network Theory does not explain a phenomenon but it is interested in exploring how actor-networks get formed, actors stay joined together or networks collapse. It maps the relationships between material, humans and abstract concepts, bringing together various actors whose actions are somehow aligned for a particular purpose.

ANT is one of the schools under sociomaterial theory and described as "a method, and mostly a negative one at that; it says nothing about the shape of what is being described with it" (Latour, 2003, p. 63). According to Latour (2003), "being connected, being interconnected, being heterogeneous is not enough" (p. 64) in ANT studies, and there should be a sort of action that is flowing from one to the other. "ANT can't tell you positively what the link is" and "ANT is about how to study things, or rather how not to study them—or rather, how to let the actors have some room to express themselves" (Latour, 2003, p. 63). "ANT's main tenet is that actors themselves make everything, including their frames, their theories, their contexts, their metaphysics, even their ontologies" (Latour, 2003, p. 63). According to Vurdubakis (2006), ANT helps us to explore issues such as " 'How did it come to turn out this way?' (through the changing alliances of [heterogeneous] actors), 'Who is influencing it?' (who has been doing what scripting?) or 'Why are some actors acting this way?' (what scripts are they carrying?)" (p.483).

ANT differs from social theories in a way that social theories "are good at saying substantive things about what the social world is made of. In most cases that's fine; the ingredients are known; their repertoire should be kept short. But that doesn't work when things are changing fast. Nor it is good for organization studies, information studies, marketing, science and technology studies or management studies, where boundaries are so terribly fuzzy." (Latour, 2003, p. 63). Unlike traditional theories, ANT "stops viewing technology and society as two separate but related domains and instead as different phases in the same action. We cannot, ANT claims, draw hard and fast distinctions between what is social and what is technological in order to try and find out which one determines the other: the social and the technological already presuppose and contain one another. " (Vurdubakis, 2006, p.477)

ANT comes with specific characteristics: symmetry, translations, and network. The notion of *symmetry* is used to describe that humans and nonhumans are treated similarly in ANT analyses (Latour, 1987). Latour (1987) used the term of *translation* to define what happens when human and nonhuman actors come together and connect, changing one another to create links. "In *translations,* one actor assigns another actor a new identity, a new role to play or new projects to carry out in order to reach its own goal, which however may change in the course of the translation process" (Vurdubakis, 2006, p.481). In ANT tradition, while 'actor' is referred to as the working entity, the worked-upon entity is called to as an 'actant'. A *network* is defined as an assemblage of materials brought together and connected with processes of translation that together perform a specific enactment (Fenwick & Edwards, 2011)

According to *Vurdubakis (2006)*, the key ideas in ANT are :

- *"The creation of both technology and organization involves the creation and maintenance of heterogeneous actor-networks involving both human and technological actors.*
- *'Actors' therefore may be either persons or things. It should not matter to researchers whether the various actors assembled in a network (say cars, drivers, roads) should be classified as 'social' or 'technological'. What matters is such entities' ability to act on one another.*
- *Every technological device is dependent on a heterogeneous network that supports the specific ways in which this device is being used.*

- *The different elements in a technology's actor-network are held together by chains of 'translations'. Translations build actor-networks out of otherwise unrelated entities.*
- *Key question: how can we best explain the processes whereby such relatively stable networks of aligned actors are created, maintained and dissolved?" (p.478)*

3.5.5.4 Critics of ANT

ANT has had its fair share of criticism. ANT has been argued for creating jargon-ridden accounts that provide descriptions but not explanations. Bromley (1997) mentions that ANT analysis offers a 'homogenous model, where everything is part of everything else and mutual influence is effective everywhere at once, [which] may be less misleading but at the cost of offering little guidance: how do you proceed and where do you look first?' (p. 14).

In ANT tradition, there is the asymmetrical treatment of human and non-human 'actors' therefore ANT determination does not make analytical distinctions between human actions and the behaviour of objects is, as we have seen, the symmetrical treatment of human and non-human 'actors'. "Critics find this intellectually and morally problematic, as reducing people to the status of objects (e.g., Collins and Yearley, 1992a, b)" (Vurdubakis, 2006, p.483). "While this flattening of human/non-human differences might make analytical sense it is not without political implications" (Vurdubakis, 2006, p.483).

Critics have also argued that ANT "seems to view and describe 'networks' from the standpoint of the manager, the innovator, the victor, the entrepreneur. From a critical viewpoint then, ANT has been criticized as 'apolitical' or even insensitive to those social structures and institutional sources of power and inequality and oppression –

such as gender inequalities (see Chapter 5) – which severely limit the spectrum of social actors' choices and behaviours." (Vurdubakis, 2006, p.483)

3.5.5.5 *Role of ANT in this Thesis*

In this thesis, ANT has been adopted:

- to let the actors have some room to express themselves in the LD-P domain,
- to explore kinds of relations and associations created among actors and concepts,
- to develop descriptions based on the networks of the actors and network that is drawn by the descriptions
- to explore the kinds and qualities of networks produced through these connections,
- to define what different ends are served through these networks.

Gaining insights about these matters will allow analysing how LD experts perceive the LD-P, their actions when they perform LD and how their perceptions are reflected in the design of LD software. It will also enable exploring the actual LD-P of HE lecturers, and investigate how existing LD tools accommodate their needs.

The procedure adopted for use of ANT is presented in detail in Chapter 6.1.2, while the rest of Chapter 6 focuses on an analysis of the LD-P through an ANT lens.

The ANT analysis is extended to Chapter 7, with the explorations of the actors that come into existence in the LD-P of the HE lecturers and exploration of HE lecturers' LD-P in their organisations.

The actors appeared in the LD experts and HE lecturers' LD-P, descriptions of them, and the networks created are compared in Chapter 8 to identify points of alignment and misalignment and are integrated into a new model of LD-P from an ANT perspective.

Lastly, in Chapter 9, the results of the ANT based analysis is used for a critical analysis of well-known LD tools and LD approaches in terms of how they accommodate the actors involved in the LD-P model.

3.6 DBR and the Methods of the Thesis

The study follows the iterative design process of DBR. Thus, there are four phases involved to achieve the research goals and objectives. These phases are (1) analysis of practical problems by researchers and practitioners in collaboration in practice, (2) development of solutions informed by existing design principles and technological innovations, (3) iterative cycles of testing and refinement of solutions in practice, and (4) reflection to produce design principles and enhance solution implementation. Various research methods are adopted in each phase to achieve the research objectives and the research questions as presented in Table 3.1. The first phase of this research helps us to accomplish Objectives 1-3. The second phase helps to achieve Objectives 2-5. In the third and fourth phases, Objective 5 is managed continuously.

Table 3. 1. Research methods employed at each DBR phase, targeted objectives and research questions

Phases	Methods Employed	Objectives Accomplished	RQ Answered
Phase 1	Literature Review Interview Survey Qualitative Analysis	Objective 1 Objective 2 Objective 3	RQ1 RQ2
Phase 2	Literature Review Interview Survey Qualitative Analysis Sociomateriality	Objective 2 Objective 3 Objective 4	RQ1 RQ2
Phase 3	Sociomateriality	Objective 4	RQ2
Phase 4	Reflections	Objective 5	RQ2

The methods are strategically employed in each phase of DBR as portrayed in Figure 3.4. The research framework of Figure 3.4 is explained in detail in the following sub-sections.

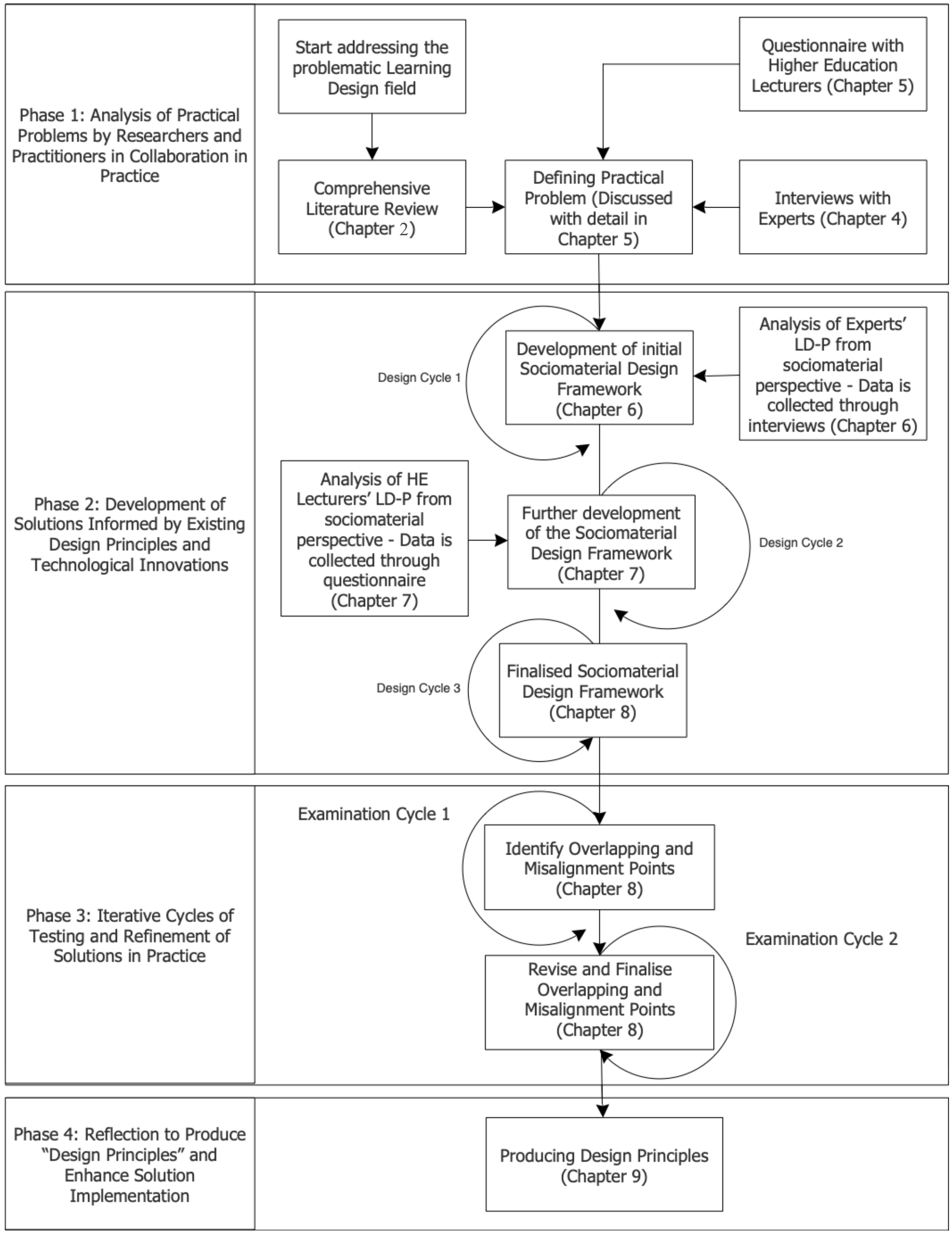

Figure 3.4. The methodological framework of the thesis

3.6.1 Analysis of Practical Problems by Researchers and Practitioners in Collaboration in Practice

The first step of DBR is embedded in essential study phases of problem determination, literature search, and problem description (Bannan-ritland, 2003). While these processes are typical to most research methodologies, they are highly valued in DBR more than in any other study.

This research started with a critical literature review of the LD field in order to explore how LD is interpreted, the available LD approaches and LD tools, the LD-P, the state-of-the-art in LD, and any gaps and problems within the field. A library of LD research works is built at the end of the literature search. All collected papers are read, and a critical review of LD field is laid out explaining the current state-of-the-art, the gap, and open problems and where this research fits in the big picture of the LD field.

After a literature review, interviews with experts and survey with HE lecturers are conducted to better understand the challenges of the LD field. Therefore, to triangulate the problems of the LD field, identifying the main challenges and factors, the thesis uses three sources of data: literature (presented in Chapter 2), LD experts (presented in Chapter 4), and HE lecturers (presented in Chapter 5).

3.6.2 Development of Solutions Informed by Existing Design Principles and Technological Innovations

Phase 2 of DBR centres upon designing and developing a solution to the problem. Existing frameworks, design theories or other relevant approaches are explored in-depth to be used in the solution of the problem (Seeto, Services, & Herrington, 2006). Phase 2 is the phase where the state of the problem and the underpinning theories of the proposed solution are explained.

To this end, Phase 2 aims to provide a deeper insight of the actual LD-P of lecturers in HE to create a more complete picture of LD-P, which is highlighted as an open problem in this area (Bennett et al., 2014). Apart from looking at the relevant literature, this phase analyses data from in-depth interviews with ten experts to reveal their conceptions of LD so that we can identify requirements and abilities for efficient LD. The semi-structured interview method is used in these interviews (see Chapter 6). Furthermore, to understand the actual LD-P of HE teachers, an online survey is designed using SurveyMonkey and its link is sent to the HE lecturers from all around the world to be completed (see Chapter 7). Open-ended and close-ended questions are included in this survey (See Appendix A). The interview data and survey data are viewed through the lens of sociomateriality. Based on this analysis Chapters 6 and 7 introduce parts of a sociomaterial evaluation framework, developed from different perspectives, which are then combined and finalised in Chapter 8 to generate the proposed sociomaterial design framework.

The whole process is depicted in Figure 3.4, including the design cycles that led to the development of the sociomaterial design framework.

3.6.3 Iterative Cycles of Testing and Refinement of Solutions in Practice

After developing the sociomaterial design framework in Phase 2, an examination of LD approaches and LD tools is made in two cycles using the framework. The findings of these two cycles of examination help identifying areas of overlap and misalignment between HE lecturers' LD-P, experts' LD-P, LD approaches, and LD tools (see Chapter 8).

3.6.4 Reflection to Produce "Design Principles" and Enhance Solution Implementation

Based on the two cycles of the examination from Phase 3, the design principles for LD software tools are derived. Two cycles of examination lead to the development of validated design principles for LD tools (see Chapter 9).

3.7 Rigour in DBR

In scientific research, rigour is defined as a prized quality. Research's rigour might be threatened by the challenges that research methodologies face. In scientific research, "the heart of the rigour" (Hoadley, 2004, p. 203) is data collection methods and analysis techniques. Like any other research methodology, the rigour in DBR might be threatened by various challenges (Design-based Research Collective, 2003). As noted by Design-based Research Collective (2003) "objectivity, reliability, and validity are all necessary to make DBR a scientifically sound enterprise" (p. 7). In DBR, there are no strict criteria to measure objectivity, reliability, and validity of research; but instead, there are discussions of these problems and some recommended methods that can help a researcher to achieve rigour (Juuti & Lavonen, 2006; Plomp, 2007).

The idea of neutrality, or objectivity, in scientific research, is about being free of bias in the operations and the explication of findings (Ary, Jacobs, Sorensen, & Walker, 2010). According to the University of Georgia's peer tutorial for DBR (Instructional Technology PhD students at the University of Georgia, 2006), investigators who use DBR usually, if not always, need to submerge themselves in the research context and genuinely interact with participants. As a result of this, it is difficult to keep being unbiased. Although accomplishing objectivity in DBR is not simple, use of multiple methods for data collection is typically suggested as a promising way to increase objectivity in the findings of DBR (O'Donnell & Levin, 1999; Design-based Research Collective, 2003; Wang & Hannafin, 2005; Akilli, 2008). Concerning this matter, the study of this thesis has adopted multiple methods in the collection and analysis of the data.

There are two aspects of validity, namely external validity and internal validity. External validity is about the ability to apply the results of research to a broader population. The findings and the implication in a generalisable study can be taken to a more broad application (Bloor & Wood, 2006). DBR researchers agree on that the findings of DBR are not capable to allow generalising the findings from a sample to population (Hoadley, 2002; O'Donnell, 2004; Barab & Squire, 2004; Akker et al., 2007; Akilli, 2008). This is because DBR has a very contextualised research agenda and it is very reliant on a full definition of the analysis of data (Instructional Technology PhD students at the University Of Georgia, 2006). To provide external validity in DBR and ensure against being misled by specific contextual features, surveys were conducted with HE lecturers from different institutions and countries to strengthen the degree to which findings of this study are reflective of current LD contexts. Also, the sample size of this study was sufficiently large compared to existing studies in the LD as discussed in Chapter 2. Internal validity is about the level to which the researcher' results precisely illustrates the data gathered in DBR (Bloor & Wood, 2006). To achieve internal validity in DBR, Alghamdi (2013) suggests adopting several iterations in DBR in the course of time and replicating the data analysis throughout periods of iterations. The research of this thesis comprises two cycles of iterations to increase internal validity as illustrated in the Figure 3.4.

Reliability is about the extent to which a study generates the same outcomes when repeated (Bloor & Wood, 2006). There are also challenges when accomplishing reliability in DBR. Triangulation by employing different methods for data gathering is suggested as a promising approach to achieve reliability in the outcomes of DBR (Design-based Research Collective, 2003; Instructional Technology PhD students at the University Of Georgia, 2006), and was adopted in this research.

3.8 Ethical Considerations

Any scientific study must pay heed to the questions of ethical considerations or the "code of behaviour appropriate to academics and the conduct of research" (Wells, 1994, p. 284 in Saunders, Lewis, & Thornhill, 2009, p. 129). This research adheres to the College Ethics Framework and Code of Practice on Research Integrity- details are available online at http://www.bbk.ac.uk/committees/research-integrity - and has received institutional ethics clearance. Accordingly, interview and survey were undertaken with informed consent, based on knowledge provided about the nature of the study, the requirements of the interviewees and survey participants, the applications of taking part, interviewees' and survey participants' rights, about the use of data gathered and the form in which it will be published (Saunders et al., 2009).

3.9 Assumptions

In almost every study there are certain assumptions about the theory, the methodology or the phenomenon under investigation (Walker, 2003)The fundamental assumptions of this study are made explicit in this subsection. They relate to three aspects of this research: theoretical assumptions, assumptions regarding data collection, and assumptions regarding data analysis.

Theoretical Assumptions relating to the use of sociomateriality and ANT in this research

- Social and the material are constitutively entangled (Leonardi et al., 2012);
- Human and non-human actors have equal value;
- Nothing exists before the enactment of human actors and non-human actors.

Methodological assumptions relate to how methods for data collection and data analysis are used in this research:

- All participants of the questionnaire give clear and honest answers;
- All interviewees give clear and honest answers.

- The analysis is done with objectiveness.

3.10 Summary and Contribution of the Chapter

In this chapter, the methodological concerns of this research were discussed. Philosophical background, research methodology, methods and techniques employed in data collection and analysis process were presented in detail and the rationale for their adoption in the context of the thesis was elaborated. The chapter also discussed the assumptions and implications of particular methodologies and methods.

The chapter contributed a methodological framework, which combines DBR and a mixed-methods approach, that will be used in the rest of the thesis. This research approach, particularly the adoption of sociomaterial analysis, constitutes a fresh perspective on LD in organisational settings. LD studies so far emphasised on the importance of human-centric factors, focusing, understandably, on analysing issues from educational theory and pedagogy perspectives. The proposed methodological framework is an attempt to complement these studies, extending the design space of LD tools, by looking LD and software tools' design from a sociomaterial perspective. Sociomateriality has been proven to be useful in studying an information system phenomenon that integrates the entanglement of social entities and technological artefacts. The thesis argues that this approach has the potential to extend researchers understanding of the LD practice, highlighting areas for improvement, and further inform the development of software for LD.

Chapter 4

A Need Analysis of Learning Design: Interviews with LD Experts

This chapter provides an analysis of the field of LD. It is part of our approach to triangulate three sources of data, as mentioned in Chapter 3. It exploits data from interviews conducted with LD experts in two ways: first, to understand the LD field better, in particular, the open issues and challenges within the field, and second, to facilitate understanding of experts' LD-P and their perspectives on LD-P from a sociomaterial perspective, later in Chapter 6. The findings of this chapter aim to extend our understanding of the LD process using software tools, the theoretical underpinnings, and the challenges of using these tools in practice, by exploring the LD experts' perceptions and design practice.

This chapter is organised as follows. The next section presents the details of the employed method covering the semi-structured interview design, participants' profiles and data analysis procedure. Section 4.2 presents the experts' view on existing LD tools, how to present LDs, and the challenges encountered using these tools, and suggestions for future works for the LD field. The discussion is presented in Section 4.3. Section 4.4 gives the summary and contribution of this chapter.

|4.1 Method

We conducted a set of interviews with senior LD experts in HE. The semi-structured open-ended interview methodology (Creswell, 2014) was employed. The interviews included eight open-ended questions followed by follow-up questions (see Appendix A). The contexts of the interview were experts' LD-P, their perspectives on LD-P, and the digital tools used in their LD-P. Interview questions were developed based on the requirements and gaps mentioned in the literature of the LD field. Interviews were conducted on Skype or in-person and took approximately between 60 and 120 minutes. The interview conversations were recorded using a voice recorder application producing in m4a format on the iPhone. The recordings were manually transcribed using Microsoft word processor.

4.1.1 Participants

Subject selection is typically purposeful in qualitative research (Creswell, 2014); participants who can best inform the research questions, enhance understanding the problem under investigation and provide experts' judgement of the problem structure are normally selected. Ten researchers with established 10+ research experience in LD and 10+ teaching experience in HE, who have played a leading role in LD software tools projects that attracted international interest, were selected for interviews. Five of the participants were female and the other five were male. The age of the participants ranged from 40 to 73 with a mean age of 49.89 years. In Table 4.1, details about the participants' profiles are presented. The number of publications and citations used in this table were retrieved from Google Scholar, apart from participants E6 and E9 where Research Gate was used since no public information was available on Google Scholar. These indicators provide a perspective on the level of attention that the participants' work has been given so far. According to researchers such as (Yu et al., 2016), Research Gate or Google Scholar score has been used as an "effective indicator for measuring an individual researcher's performance" (p. 1005).

Table 4. 1. The participants' profiles

Experts' Codes	Specialities	Number of Publications	Number of Citations	RGS
E1	Professor Dr	340	4,869	31.84
E2	Dr	120	1,378	20.12
E3	Associate Professor Dr	92	357	7.45
E4	Associate Professor Dr	295	2,140	25.66
E5	Professor Dr	496	9,315	33.07
E6	Professor Dr	116	5,686	26.77
E7	Associate Professor Dr	148	855	19.45
E8	Assistant Professor Dr	182	6,029	28.96
E9	Dr	5	71	3.69
E10	Associate Professor Dr	101	1,460	16.41

4.1.2 Data Analysis

Creswell (2014)'s qualitative data analysis steps were followed in the analysis of the data. These involve preparing the data for analysis, reading all the data, start coding, using coding to generate description, advancing how the themes will be presented, and interpretation.

Member checking was employed to ensure internal validity (Creswell, 2014) – this is a process where the interviewee serves as a checker at the end of the analysis process. A dialogue regarding our interpretations of the participants' reality and meanings ensures the truth of the data. Qualitative data analysis used the QSRNVivo software to investigate the data. The steps followed through the analysis of the data are presented in the subsections below.

4.1.2.1 Preparing data for the analysis

This step included the manual transcription of the recordings of the ten interviews' data using NVIVO software (see Figure 4.1) and Microsoft Word software (see Figure 4.2). NVIVO software is used to listen to the audio data and Microsoft Word is used to write transcribed data.

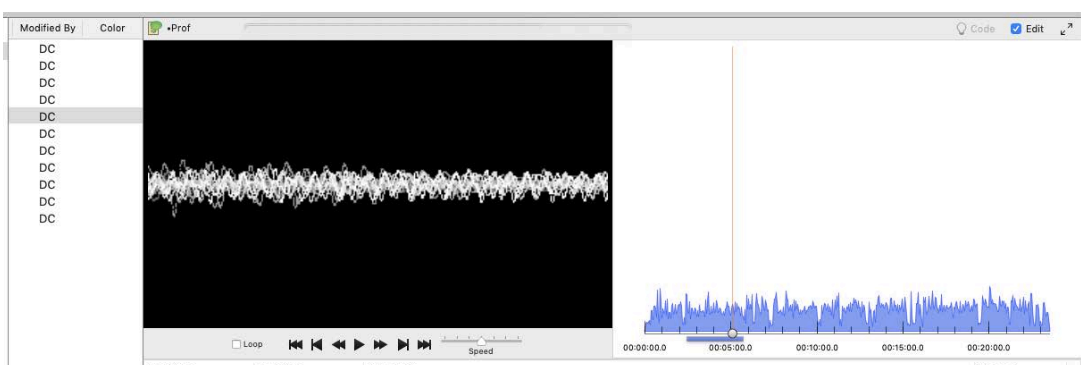

Figure 4. 1: Use of NVIVO Software to transcribe interview data

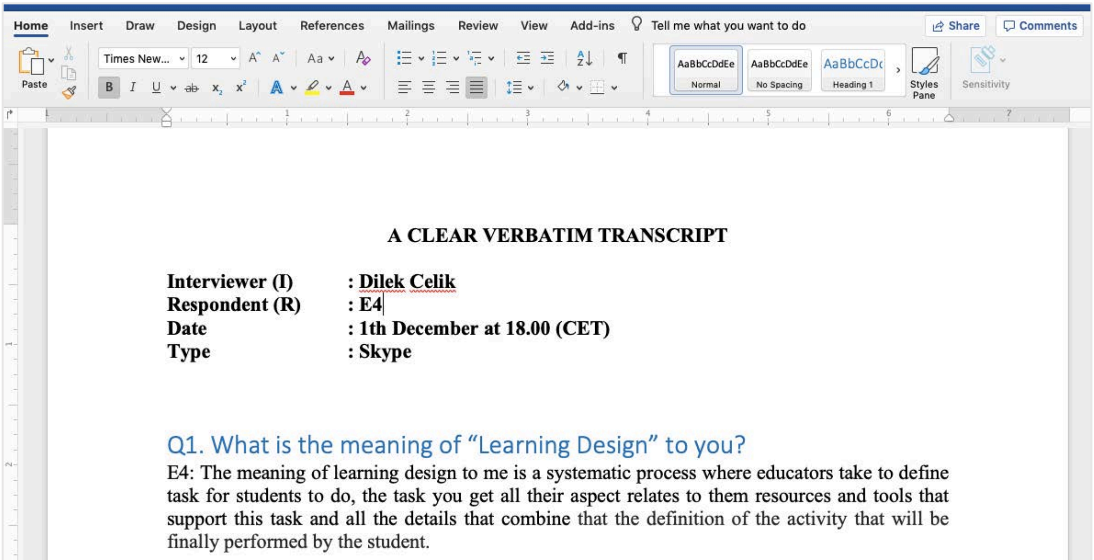

Figure 4. 2: Use of Microsoft Word to transcribe interview data

4.1.2.2 Start coding

The study followed Tesch's (1990) eight steps coding process, which has been presented with more details in Chapter 3.5.4.

Reading all the data thoughtfully. All the transcriptions were read to get a general understanding of the topics/issues mentioned by the interviewees.

Choose one interview transcript and look over it. The shortest transcript was picked and inspected and the investigator reflected on the content and the underlying purpose.

Record all the topics. Topics arisen from the initial reading were recorded in a Microsoft Word document. These were based on the interview questions.

Start coding. After transcribing all audio interview data, the coding process started in Nvivo, coding all the topics as Nodes (Figure 4.3).

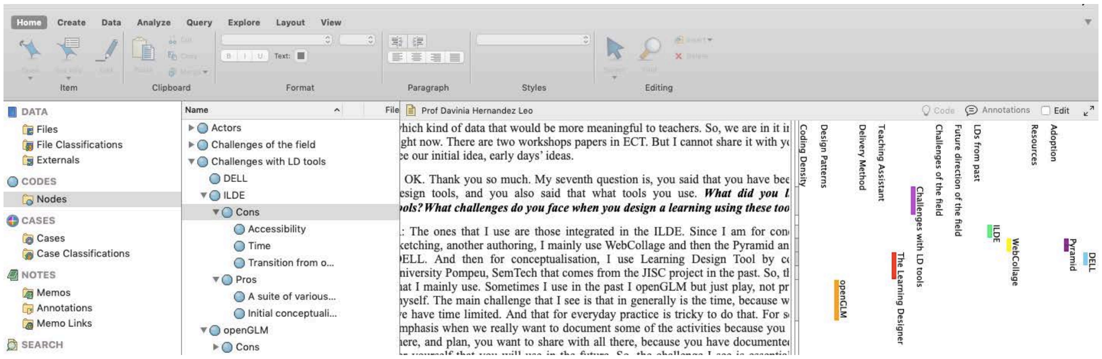

Figure 4. 3: Coding process

Record all the topics. All topics that emerged after the coding process were recorded and related topics were grouped. For example, one of the topics/concepts was about "challenges with LD tools", as can be seen in Figure 4.3. LD tools mentioned by the interviewees and their perceptions of the pros and cons of these tools were entered as sub-categories of the topic.

Re-investigating topics. The second round of investigation was conducted – looking at the transcriptions one more time to examine if different topics and codes could be identified.

Decrease the number of categories. The researcher attempted to decrease the number of categories by merging the relevant nodes(codes).

Finalise the abbreviation of each category. After checking one more time the data, the abbreviation of each category was finalised.

Collect the data elements. I saved the data elements (a part of transcribed data) under each node. NVIVO system helped us to define data elements while creating the nodes. As presented in Figure 4.4, the researcher can select a node and the system provides all data elements that refer to this node.

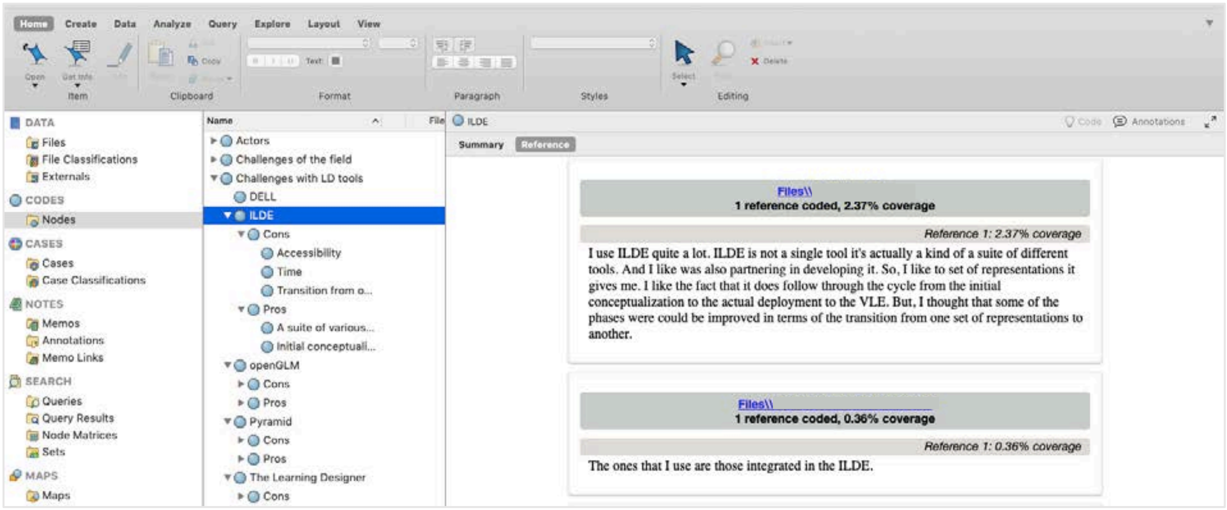

Figure 4. 4: Collecting the data elements

4.1.2.3 Using coding to generate description

The coded data is used in this chapter to make need analysis of learning design and in Chapter 6 to explore experts' LD-P.

4.1.2.4 Advancing how the themes will be presented

In line with the aim of this chapter which is to extend our understanding of the LD field from the experts' perspective, initial themes were created according to the relevant interview questions as presented in Table 4.2. As shown in Table 4.2, the first initial theme, LD tools – Pros, refers to the LD tools experienced by the experts and on their favourite features, whilst the second initial theme, LD Tools – Cons, focuses on the challenges experienced by the experts when they used LD tools. The third initial theme, Presenting LD tools, concerns the representation of LD in the online learning environments' functionalities as perceived by the experts. The final initial theme, Future of LD tools, is about the future direction of LD tools from the views of the experts.

Table 4. 2. Developing initial themes from five relevant interview questions

Interview Questions	Initial Themes

What are LD tools did you use and what are the things that you like about it?	LD Tools – Pros
What LD tools did you use and what challenges do you face when you design learning using these tools?	LD Tools – Cons
How Learning Design should be presented in an online learning design environment?	Presenting LDs
What should be the future direction of Learning Design tools?	Future of LD Tools

In the next step, the initial themes were merged according to their relevance. The final themes used in the analysis as presented in Table 4.3. Two of the initial themes, "LD Tools – Pros" and "LD Tools – Cons", were merged into "Learning Design Tools (Pros and Cons of LD Tools)" as presented in Table 4.3. "Presenting LDs" was changed to "How to present Learning Design", whilst "Challenges and Future of LD Tools" remained unchanged (see Table 4.3).

Table 4. 3. Final themes created after merging initial themes

Interview Questions	Initial Themes	Final Themes
What are LD tools did you use and what are the things that you like about it?	LD Tools – Pros	Learning Design Tools (Pros and Cons of LD tools)
What LD tools did you use and what challenges do you face when you design learning using these tools?	LD Tools – Cons	
How Learning Design should be presented in an online learning design environment?	Presenting LDs	How to present Learning Design

What should be the future direction of Learning Design tools?	Challenges and Future of LD Tools	Challenges and Future of LD Field

The themes creation process is also illustrated in Figure 4.5, which shows a screenshot from the Nvivo software with a visual representation of the themes.

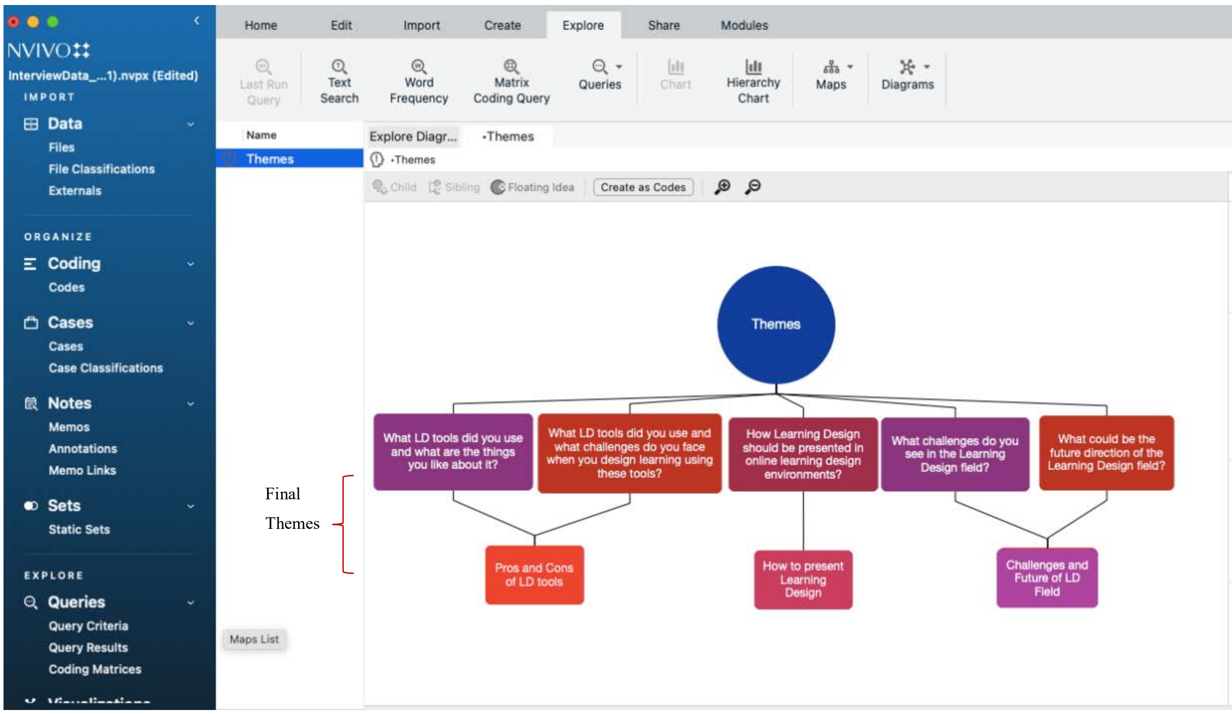

Figure 4. 5: Screenshot of initial and final themes in NVIVO

Next, the final themes are created as nodes in the exploratory diagram of Figure 4.6 using the NVIVO software. And then, the newly identified themes are created as codes in the NVIVO software and clustered under each final theme on NVIVO.

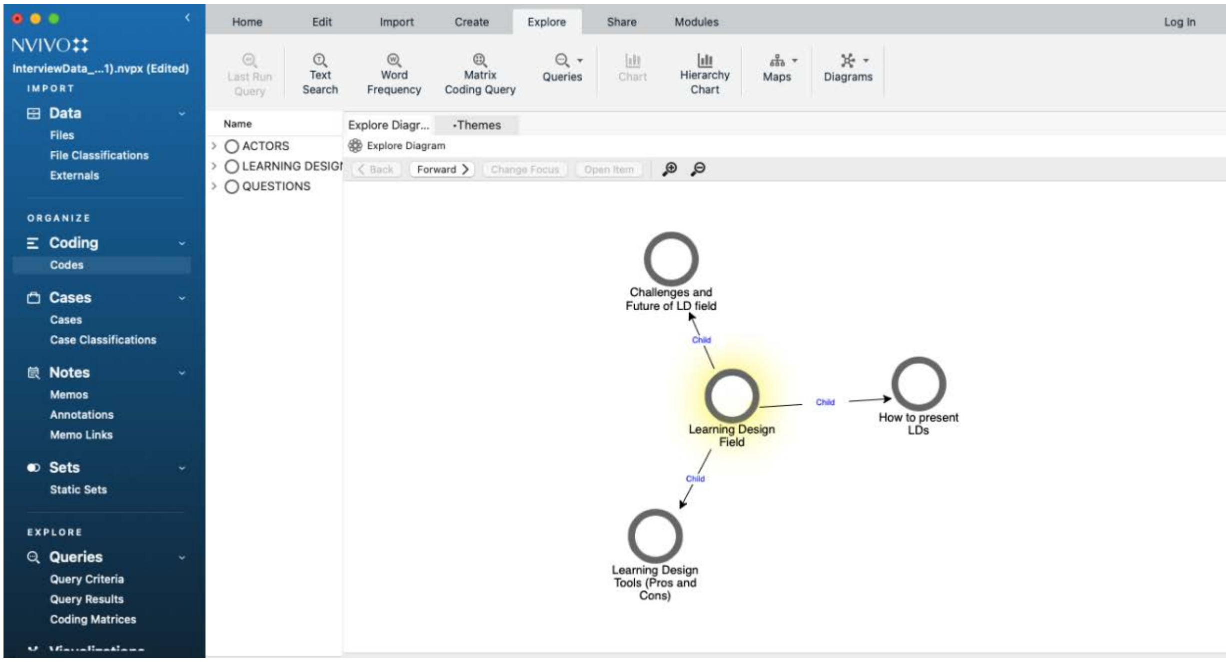

Figure 4. 6: Exploratory Diagram of final themes

In the coding process, subthemes were also emerged based on their relevance. The following examples illustrate the stages of the process in more detail.

EXAMPLE 1. Under the theme "Challenges with LD tools (Learning Design Tools (Pros and Cons))", the subthemes with the name of the LD tools are first created and then "Pros" and "Cons" for each tool (see Figure 4.7) are coded. In Figure 4.7, we can see the subtheme ILDE and its Cons and Pros (coded under ILDE), and three challenges experienced by experts using the ILDE tool.

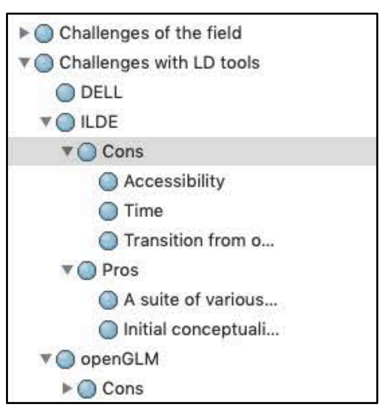

Figure 4. 7: Subthemes

EXAMPLE 2. LAMS is another tool added under "Challenges with LD tools (Learning Design Tools (Pros and Cons))" section. Under the subthemes, Pros and Cons, the relevant texts from the transcriptions are coded, as can be seen in Figure 4.8. Figure 4.8, we can see the subtheme LAMS and how the researcher coded the relevant text to LAMS's Pros' "Easy to Use" subtheme.

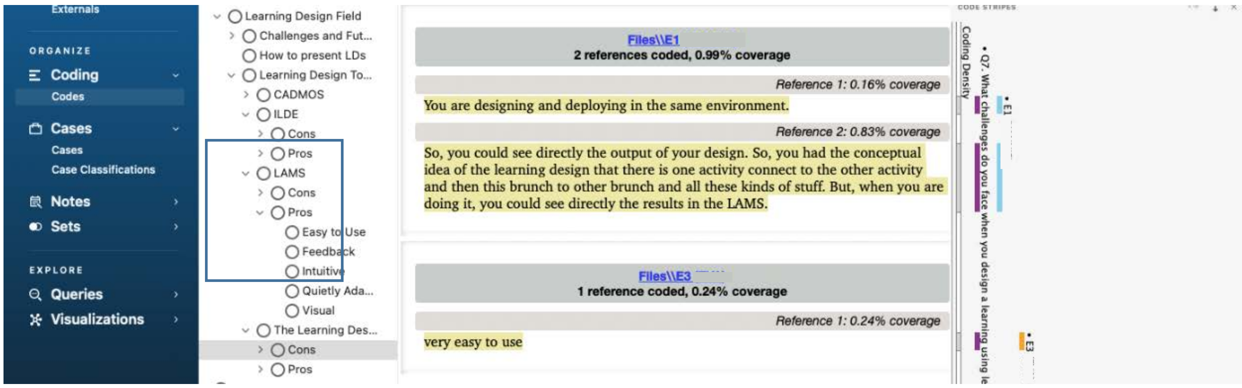

Figure 4. 8: Subthemes and texts

EXAMPLE 3. Under the Challenges and Future of LD field section, codes based on the transcripts are created and challenges of the LD field mentioned by the experts are defined. Figure 4.9 presents exploratory diagram of all the codes created under "Challenges and Future of LD field".

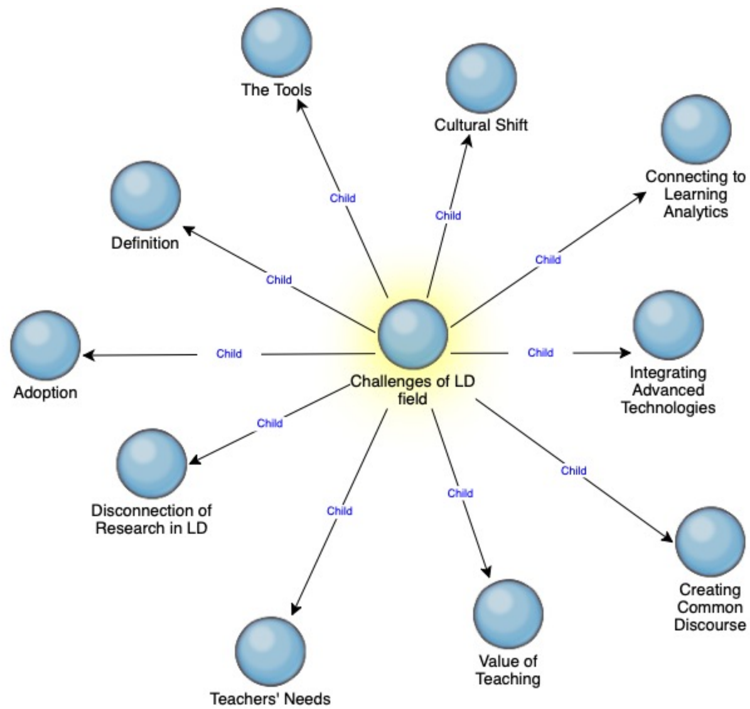

Figure 4. 9: The challenges of the LD field are created as codes

After creating the codes, the researcher went back to the transcripts and further read them all one by one and added the relevant texts under each code, as presented in Figure 4.10. This figure shows texts added under the "Teachers' needs" code. Various experts mentioned the challenge of “Teachers’ needs” and therefore “Teachers’ needs” code is created and the relevant texts are added under this code.

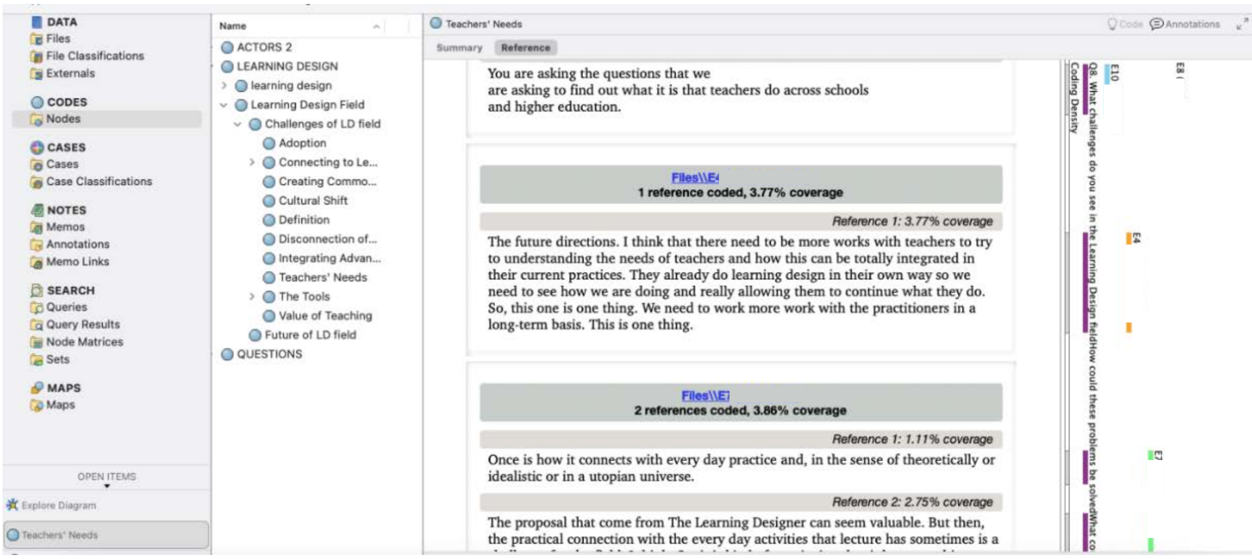

Figure 4. 10: Relevant texts are added to each code

To sum up, the results are presented in the next section according to the final themes, subthemes that emerged during the data analysis, and coded texts under each theme as demonstrated in this section.

4.1.2.5 Interpretation

The data is interpreted in Section 4.3 of this chapter.

4.2 Findings

In this section, the findings of our analysis of the experts' interview data are presented. The presentation is organised according to the themes that emerged from the data analysis: experts' views on LD tools; how to present LDs; challenges and future directions of the LD field.

4.2.1 Learning Design Tools

The experts experienced various LD tools to create learning designs, including the ones developed by their project teams, and mentioned several advantages and disadvantages for each LD tool that they had used. The pros and cons of the LD tools from LD experts' perspectives are presented in Table 4.4, and a sample of their representative comments is given in Table 4.5.

Table 4. 4. Pros and Cons of LD Tools according to the experts

Experts	LD Tools	Pros	Cons
E1	Collage		Flexibility Timing A disconnection between LD-P and the tool
	Learning Designer		No deployment Ontology-based Usability
	LAMS	Adapted by several teachers Design environment Deployment environment	Usability problem Disconnection with other LD tools Visual clarity
E2	Learning Designer	Visual clarity Review of the pedagogy	Too constraining Earlier conceptual phases No export function
	ILDE	A suite of different tools initial conceptualisation to the actual deployment	The transition from one set of representations to another could be improved
	CADMOS	Interesting design	LD process is very particular No flexibility
E3	LAMS	Visual design Very intuitive Easy to use	Not many people know about it
E4	ILDE WebCollege Pyramid DELL Learning Designer OpenGLM	Sketching Conceptualisation	Time Limited Knowledge Too Specific
E5	LD tools		Discontinuous development
E6	Learning Designer	Shows LD preparation time	Time
E7	Learning Designer	Forces to specify some parts of the lesson Visualisation of the activities	Force to work on the computer Time constraints No time to engage with it
E8			LD Tools are not accessible
E9	Learning Designer	Networking with other designers	Not practical
E10	ILDE	Flexible	LD tools are not accessible No portability between LD tools and LMS
	Other LD Tools		

Table 4. 5. Representative comments for the pros and cons of each tool

Experts	LD Tools	Pros	Cons
E1	Collage		**Flexibility** **Timing** **A disconnection between LD-P and the tool** *"We see still these classical problems of flexibility, how much time it takes to do these representations and these disconnections between your conceptual design and the authoring environment."*
	Learning Designer		**No deployment** *"The Learning Designer from London Knowledge Lab was a classic case of learning design tool that is mostly conceptual plan, organization oriented and much less concrete even authoring face nothing at all about deployment and implementation."* **Ontology-based** *"the second problem I had to do with the Learning Designer was the problem that is related to ontology-oriented approaches. Although it is not a formal ontology, it is an ontology. And many of the decisions, conclusions and all the other things were carried out based on this ontology. So, one of my main concerns with this ontology was that people probably do not have some understanding as to the one who designed the tool."* **Usability** *"Then, there are some other things, usability."*
	LAMS	**Adapted by several teachers** **Design environment Deployment environment** *"The advantage of the LAMS, that was very promising, that was quietly adopted by several teachers and researchers was that it was a design environment and deployment environment were the same. You are designing and deploying in the same environment. So, you could see directly the output of your design. So, you had the conceptual idea of the learning design that there*	***Usability problem*** *"…usability but not only.* ***Disconnection with other LD tools*** *"I mean it cannot use external tools, it cannot use WebCollege, it cannot have incorporated other things, it cannot use the GLUE!PS, I mean it could not use anything,"* ***Visual clarity*** *"There is a visual problem. We have a design, for example, several versions very visual process and it was not that successful. Because it is also a complex cognitive process. The process of designing something is complex. And, we are providing patterns so that people can understand how they can put together assessment and learning. And*

		is one activity connect to the other activity."	*people lost in the visual world of concept maps and so on."*
E2	Learning Designer	**Visual clarity** **Review of the pedagogy** *"I liked the sort of the visual clarity, they have the kind of the dashboard that gives you a kind of review of the sort of the pedagogical mix."*	**Too constraining** **Earlier conceptual phases** *"But I thought it was a bit too constraining. I thought it was good where you already have a very good idea of what you want to do but it wasn't good for the kind of earlier conceptual phases."* **No export function** *"And also, there was not an option to export the design to any other tool. So, if I want to then say OK this is my design, now, I want to implement it in Moodle or Google courses or XL Learning and or Canvas or whatever. There wasn't that integration." "I could not export it into an actual learning environment."*
	ILDE	**A suite of different tools** **initial conceptualisation to the actual deployment** *"I like to set of representations it gives me. I like the fact that it does follow through the cycle from the initial conceptualization to the actual deployment to the VLE."*	**The transition from one set of representations to another could be improved** *"But, I thought that some of the phases were could be improved in terms of the transition from one set of representations to another."*
	CADMOS	**Interesting design** *"I thought the general design was interesting but I thought it is kind of reflected."*	**LD process is very particular** **No flexibility** *"A very particular learning design process and you know which is good if you follow that process well. I didn't feel that I have the flexibility to do other work in different ways."*
E3	LAMS	**Visual design** **Very intuitive** **Easy to use** *"What I like about LAMS is a very visual design tool, very intuitive, very easy to use."*	**Not many people know about it** *"Challenges are that not many people know about this. Another challenge is that because not many people know about it. It's very hard to get buy-in from people too. So, if you use a learning design tool then you want people to work with you within that environment. But if they don't know about it and it's very hard to get buy-in for people to do that."*
E4	ILDE WebCollege	**Sketching** **Conceptualisation**	**Time** "The main challenge that I see is that generally is the time, because we are professors, we have time-limited."

	Pyramid DELL Learning Designer OpenGLM	*"The ones that I use are those integrated into the ILDE. Since I am for conceptualisation or sketching, another authoring, I mainly use WebCollage and then the Pyramid and then the one is DELL. And then for conceptualisation, I use Learning Design Tool So, those are the ones that I mainly use. Sometimes I use in the pat openGLM just play with it."*	"So, the challenge I see is essentially the timing of teachers in that." **Limited Knowledge** *"In many cases the knowledge that is implemented in the tools is also limited."* **Too Specific** *"However they are limited in terms of features. Because you can only design the specific things."*
E5	LD tools		**Discontinuous development** *"And so there's discontinuous development when I look at what we want to improve in the new tools"*
E6	Learning Designer	**Shows LD preparation time** *"The tool that I am using records how much time I created as I do online, and just adding it up as I go. So, I have the opportunity to see how much time I am putting into it"*	**Time** *"I am always over the provided amount of time."*
E7	Learning Designer	**Forces to specify some parts of the lesson** *"I like the thing that kind of forces me to specify some parts of the lesson. But on the other hand, I don't like that force to do that on the computer necessarily because of time constraints and so on like I could achieve the same thing just writing something on the piece of paper. Or, I could see how these, in general, this would valuable, you know, time constraints sometimes problematic."* **Visualisation of the activities** *"It was a tool that helps you visualize, apart from visualizing, and also understand by breaking it down the different activities in your module to understand the course involved."*	**Force to work on the computer Time constraints** *"I like the thing that kind of forces me to specify some parts of the lesson. But on the other hand, I don't like that force to do that on the computer necessarily because of time constraints and so on like I could achieve the same thing just writing something on the piece of paper. Or, I could see how these, in general, this would valuable, you know, time constraints sometimes problematic."* **No time to engage with it** *"I just do not have time to engage in it"*
E8			**LD Tools are not accessible** *"I have probably done more kind of trialling of those tools."*
E9	Learning Designer	**Networking with other designers** *"The only thing I really appreciated was the networking*	**Not practical** *"I realize that a lot of people don't care about it, they just want to use it*

		because they did a great job. He puts it on the networking .. and people go online and your patterns are there and you share with others you give them rights and so on. So, I like that idea."	*for practical purposes."*
E10	ILDE	**Flexible "***ILDE (integrated learning design environment) provides flexibility as there is a whole bunch of other tools, and pedagogical patterns and things like that."*	**LD tools are not accessible** *"I have not used those tools, because they have not been really accessible to me."* **No portability between LD tools and LMS** *"We have created a tool and called it ILDE tool. And I didn't use it as such. Maybe because I'm very familiar with the idea . I can just do paper sketches. So, I can use that. Or, I can use a word document. I can just write that down. I suppose the challenge is that they can help you with your thinking but then it requires you to then summarize that thinking in a document that is the institution requires."* *"There is no portability between that tool and my Moodle site. I can use it to help my thinking, but then I have to create everything from scratch in my Moodle site."*
	Other LD Tools		

In the following paragraphs, we expand and explain the information presented in Table 4.5 elaborating more on the tools and the experts' experiences.

E1 experienced COLLAGE, the Learning Designer, and LAMS. E1 thinks that *"LD tools still have classical problems of flexibility, how much time it takes to do the representations and disconnections between your conceptual design and the authoring environment" (E1, 2017).* According to E1, in COLLAGE, it takes a lot of time to create a design. E1 also mentions the problem of disconnection between HE lecturers' conceptual design and the authoring environment. E1 believes that the Learning Designer is mostly a conceptual, plan, and ontology-oriented tool. One of the disadvantages of the Learning Designer is that it does not have any functions for the deployment and implementation of the LDs to LMS/VLEs. Another problem with the Learning Designer was that it is related to the ontology-oriented approaches. Although users do not have to deal with a formal ontology, the system uses a kind of ontology. *"The Learning Designer has ontology-oriented approaches. And many of the decisions, conclusions and all the other things that were carried out were based on this ontology. So, one of my main concerns with this ontology was that people probably do not have the same understanding as to the one who designs the tool." (E1, 2017)* Another problem with the Learning Designer is usability. LAMS is another LD tool experienced by E1. *"The advantage of the LAMS, that was very promising, that was quietly adopted by several teachers and researchers, that was design environment and deployment environment were the same." (E1, 2017)* In LAMS, a designer creates an LD and deploys it in the same environment, which allows seeing the output of the design directly. *"You are designing and deploying in the same environment in LAMS. So, you could see directly the output of your design." (E1, 2017)* However, this is one of the disadvantages of LAMS as well, because it does not allow users to deploy LDs into other LMS/VLEs. Another disadvantage with LAMS is that it cannot communicate with other LD tools (e.g. WebCollege or GLUE!PS). *"It cannot use external tools, it cannot use WebCollege, it cannot have incorporated other things, it cannot use the GLUE!PS, I mean it could not use anything". (E1, 2017)* Other problems with LAMS are usability and visual complexity. *"The process of designing is complex." (E1, 2017)*

E2 likes the visual clarity, the dashboard, and the review function of the pedagogical mix in the Learning Designer. However, E2 thinks that the Learning Designer was too constraining. According to E2, *"the Learning Designer is good where the lecturer already has a very good idea of what to do regarding LD, but it is not good for the earlier conceptual phases" (E2, 2017).* Moreover, there is no option to export the design to LMS or other LD tools. E2 also points out that there is no integration functionality in the Learning Designer to allow an LD created in the Learning Designer to be implemented or transferred to an LMS or another LD tool. Another LD tool experienced by E2 was the ILDE. One of the advantages of the ILDE is the set of representations provided to the users. *"I like the fact that ILDE does follow through the cycle from the initial conceptualization to the actual deployment to the VLE." (E2, 2017).* However, E2 thinks that certain aspects of the phases could be improved regarding the transition from one set of representations to another in the ILDE. CADMOS is another LD tool that was used by E2. E2 thinks that the general design of CADMOS was interesting. According to E2, *"CADMOS follows a very particular learning design process which is good if you follow that process well" (E2, 2017).* On the other hand, E2 says that the tool is not flexible enough to create LDs in different ways.

E3 experienced the LAMS tool and states that "*LAMS is a very visual design tool, very intuitive, very easy to use." (E3, 2017).* According to E3, the challenge of LAMS is that the tool is not accepted widely yet among the learning designers' community. *"Challenges are that not many people know about this. Another challenge is that* *because not many people know about it, it is very hard to get people in it too." (E3, 2017).* E3 says that as a lecturer *"if you use a learning design tool then you want people to work with you within that environment" (E3, 2017).* However, E3 adds that if lecturers are not aware of it then it is very hard to get people to use the tool.

E4 experienced various LD tools including the ILDE, WebCollage, Pyramid, the Learning Designer, and openGLM. E4 explained that he has used LD tools that were integrated into the ILDE. For conceptualisation or sketching, E4 mainly uses WebCollage and the Pyramid. For conceptualisation, E4 uses the Learning Designer. E4 had also limited experience with the openGLM tool. E4 did not mention the advantages and disadvantages of each of these LD tools. However, E4 considers that the main challenge with using LD tools is time because the target users of these tools are professors who have limited time. *"The challenge I see is essentially the timing of teachers in that." (E4, 2017)* So, using LD tools in everyday practice is tricky. Another challenge E4 sees in the LD tools is that *"in many cases, the knowledge that is implemented in the tools is also limited" (E4, 2017).* According to E4, LD tools are *"limited in terms of features, because you can only design the specific things" (E4, 2017).*

E5 mentions that there are many different LD tools, including those developed by E5. According to E5, the most recent LD tools that are used nowadays have many historical cycles. E5 was one of the inventors of the first LD tool created at the end of the nineties. The issue E5 sees with the existing LD tools is that *"there is discontinuous development when I look at what we want to improve in the new tools" (E5, 2017).*

The Learning Designer is the LD tool that was experienced by E6. E6 likes that the Learning Designer records how much time is spent when creating LDs. So, the tool allows lecturers to analyse how much time they put on their LD-P. *"The tool that I am using records how much time I created as I do online, and just adding it up as I go. So, I have the opportunity to see how much time I am putting into it." (E6, 2017)*

E7 experienced the Learning Designer. *"I like kind of forces by the tool to specify some parts of the lesson, but on the other hand, I do not like that force to do that on the computer necessarily because of time constraints as I could achieve the same thing just writing something on the piece of paper." (E7, 2017)* E7 adds that the same thing could be achieved by just writing on a piece of paper. Nevertheless, E7 likes the visualisation feature and the breaking in down of the different activities in the module that help to understand the design of the course. *"It was a tool that helps you visualize, apart from visualizing, and also understand by breaking it down the different activities in your module to understand the course involved. So, I found this really helpful, because something that I would not be able to do on paper compared to the other activities of The Learning Designer." (E7, 2017)* Lastly, E7 reveals that there is just not enough time to engage with the tool in daily learning design practice.

E8 had a chance to experience various LD tools as the LD is E8's research area. *"I have used a lot of learning design tools over the years partly because that's my research area. So, I have probably done more kind of trialling of those tools." (E8, 2017)* E8 provides a general overview of the LD tools. According to E8, LD tools help users to think about the overall structure of the lesson. *"I suppose the thing that it helps me to do most is to think about the overall structure of the lesson, of the workshop, of the subject." (E8, 2017)* So, having a structured and coherent design is essential especially for students as they would like to see the things that they will be doing. Thus, structuring the lesson *"helps you explain to students why they do things in a particular order in that the activities you get them to do build on each other rather than being disconnected" (E8, 2017).*

E9 experienced the Learning Designer. E9 likes the networking function of the Learning Designer, which allows lecturers and designers to connect and share their design ideas and patterns. *"What I like about the Learning Designer, was the networking." (E9, 2017)* On the other hand, E9 who teaches in Postgraduate

Certificate in Higher Education (PGCHE) mentioned that his students would like to see the practical tool. *"I realize you know a lot of people don't care about it, they just want to use it for practical purposes." (E9, 2017)*

E10 experienced the ILDE tool. According to E10, the ILDE *"is a very flexible tool in the sense that it has been developed as an online tool" (E10, 2017)*. E10 mentions that there exist several other LD tools; however, those tools are not accessible to others such as the Learning Designer. *"I have not used those tools, because they have not been really accessible to me." (E10, 2017)* Even though E10 is one of the designers of the ILDE tool, E10 is not able to use it in his LD-P. However, E10 does paper sketches or uses a word document for LD. One of the main challenges according to E10 is that LD tools can help users with their thinking, but then they require users to summarise that thinking in a document that is required by the institution. *"We have created a tool and called it ILDE tool. And I didn't use it as such. Maybe because I'm very familiar with the idea. I can just do paper sketches. So, I can use that. Or, I can use a word document. I can just write that down. I suppose the challenge is that they can help you with your thinking but then it requires you to then summarize that thinking in a document that is the institution requires." (E10, 2017)* For example, E10 can use an LD tool to think about LD. However, the design has then to be transformed in some other format (unit outline) because this is required in E10's institution. So, even though E10 acknowledges there are benefits when using LD tools, E10 does not find it feasible to use them in LD-P as s the institution requires to redo the LD and retype things in a document. Moreover, there is no portability between designs in the LD tools and the LMS/VLE. *"There is no portability between that tool and my Moodle site. I can use it to help my thinking, but then I have to create everything from scratch in my Moodle side." (E10, 2017)*

4.2.2 How to Present Learning Design

The experts mentioned various ways of presenting LDs in LD tools.

E2 thinks that it is very important to have multiple representations. E2 says that the various phases involved in LD-P require different representations. For example, in the conceptualization phase, open and graphical representation are needed as sketching the things is important in the conceptualization phase when starting LD. In the authoring phase, a shift to more formal representations is needed. However, at the same time, users need to be able to toggle between the kind of graphics or visual representation and textual representation. E2 also suggests not to be too formalistic to engage teachers with LD tools. According to E2, IMS LD and EML did not catch teachers because they were over formalistic. Teachers just refused to work with those representations, find them useless and difficult to understand. E2 thinks that in LD representations, a switch between very intuitive and very formal representations is needed. E2 also highlights that the different human actors involved in the LD-P require different representations. For example, if a teacher is just doing a quick sketch of a lesson plan and he/she wants to discuss it with other teachers, then graphical storyboard is very powerful. If a teacher writes LD for academic institutions, then he/she needs to write it up using word processors.

E3 points to an inherent problem in using LD tools for design purposes and then for teaching purposes as the runtime. According to E3, if teachers use LD tools as a runtime environment, it has to be the same as the design environment. So, this makes LD tools inherently problematic when teachers would like to use other LMS/VLEs and LD tools do not have the function to deploy LDs in LMS/VLEs.

E4 thinks that LD tools should comprise a combination of visual and text representations.

According to E5, how to represent LD in LD tools depends on the pedagogical aspects of the design and the formality of the design. For instance, some people prefer a more visual representation, while others favour more textual representation. It also depends on the discipline.

According to E6, teachers like the visual channel because it suits the way that teachers think about teaching. E6 thinks that LD tools have to be visual, online, interactive, and easy to edit. For example, teachers would be able to share LD with other teachers which means that a teacher can easily borrow someone else's LD. Moreover, when a teacher borrows from someone else's learning designing, a teacher should be able to edit it. E6 also thinks that LD tool has to be able to output LD directly into any LMS/VLE.

E7 thinks that how to represent LD in LD tools depends on the context, the situation, the content matter, the students, and the teachers.

E9 highlights several aspects that could be enhanced about the way LD is presented in LD tools. One of the points is thinking about how to make LD, how to make LD clear to the students who are working in that course, and how to present the underlying design to students. One of the ways of doing this, according to E9, is to try to use representation to explain to students the steps that they are going through. For example, E9 designed a course based on "explore, describe, and apply" methodology. In this way, E9 could be able to communicate with other teachers and his/her students. So, E9 thinks that as long as the underlying design of LD is expressed to the relevant stakeholders, the representation of LD in LD tools can be either visual or textual. So, that means if you are a student, you can understand what the flow of activities is; if you are a teacher you can understand that as well what student should be doing. If you are a teacher and you are going to come and use the design that the subject is based on, then you can easily see what that is rather than having to try to work it out for yourself. According to E9, this is one side of it. Another possibility that might be useful is to explore how LDs or LD supports could be added to LMS.

According to E10, there is an opportunity representing LD in all modes, i.e. visually, textually or formally, because students need to understand the LD designed for them. For example, E10's students get a unit outline, so they see the high-level design in the unit outline. Then, E10 shows the students visual aspects regarding the tasks, resources and supports. Moreover, then E10 explains and provides a textual description as well. E10 wants students to see how the classes are integrated with the assessment tasks. Therefore, E10 thinks that there is an opportunity for all those modes to explain the design better, display the design and better help students to understand LD. Admittedly, it is difficult to extract what LD is about from a unit outline that does not just tell you very much from what this unit is about, assessment tasks, and how the unit will be delivered, what the pedagogical thinking. It is usually explicitly explained by a lecturer at the beginning of the semester.

4.2.3 Challenges and Future of LD Field

In this subsection, the challenges and future direction of the LD field from the experts' perspectives are presented.

E1 mentions several obstacles in the LD field. First, E1 tells that the LD field needs to understand what LD means as LD is more than a science. Another issue in the LD field is about how much time one dedicates to do that LD. E1 considers that LD is a bureaucratic process, which means teachers as learning designers have to produce documents comprised of several pages which include learning objectives, structure, references and resources. E1 mentions other issues with LD as well, such as flexibility, adaptation, restrictions of the curriculum, attitude of the students. E1 thinks that LD is very sophisticated, because, it affects many of the aspects of the core of the educational process. LD goes to the core of the design approach and educational philosophy and contexts. So, any change or advancement on the LD can be very influential but very much related to the restrictions of the contexts, and it depends a lot on innovation. With fifteen years of experiences as a researcher in the LD field, E1 does not have answers to these issues. However, E1 thinks that the LD field is worthwhile to pursue it. For the future direction of the LD field, E1 suggests connecting LD with LA considering machine learning (ML) algorithms and artificial intelligence (AI).

According to E1, LA needs to be considered as a mechanism to inform lesson redesign or support decision making when performing LD.

According to E2, one challenge in the LD field is creating a common discourse, enlarging the community of learning designers, moving more education practitioners into scenes as learning designers, and getting institutional and societal recognition that a teacher is not someone who delivers content because the content is available redundantly in high quality on the internet, but the teacher is someone who designs a learning experience. So, according to E2, this requires a huge cultural shift, and this is one of the biggest challenges of the LD field at this moment. According to E2, the other challenge is to develop LD tools and representations that support these processes. E2 also points out that LD tools should make the process of LD easy, which has not been done yet. E2 provides other digital tools as an example to illustrate how they make the easy process for the functions they provide. For example, when writing a paper, a word processor is used. In accounting, a spreadsheet is preferred. For designing surveys, survey tools are used. So, when designing for learning, there is not any single tool that HE lecturers can choose and make the LD process easy. According to E2, the last challenge of the LD field is connecting LD to LA.

E3 mentions the issue of a definition of LD that all experts can agree upon. Then, E3 tells that definitions of LD made from different people working in this field seem to quite well aligned with each other. E3 mentions that there is no agreed understanding of a framework that could be used to build LDs among experts in the LD field. According to E3, the LD field needs better alignment of epistemological and ontological understandings. Neutrality is another central challenge to LD tools and LD approaches for their adoption in LD practice.

E4 thinks that there are challenges in LD at many levels. There are challenges for adoption that is about the ecological constraints of the teachers, their time, and their cultural practices. Moreover, there are other challenges with the resources which are about developing a high-quality LD tool. LD tools are usually research prototype and immature because the market does not seem to value LD tools enough. Moreover, there are also technical challenges which are about interpretability. There are certain solutions to this challenge, but these solutions have limitations. There are also standing cultural things. For example, teachers are not supported in building their materials.

According to E4, there needs to be more work with teachers to try to understand their needs. Teachers already design for learning in their way, so experts need to understand how they are currently doing LD and allow them to continue to do so in terms of LD-P using LD tools. E4 highlights the need for more research with the practitioners on a long-term basis regarding understanding their LD-P. Moreover, LD tools need to be easy to use, and they should become richer regarding the pedagogical knowledge that they provide for inspiration. In the LD tools, high-quality sharable examples should be included. Understanding how teachers will be willing to share and use their LDs is also another challenge. Furthermore, the evaluation of LD is another future direction.

According to E5, most of the challenges of the LD field are solved. One of the challenges at this moment is integrating more advanced technologies such as augmented reality, series gaming, and virtual reality. Another challenging issue is to create LA tools within the LD tools which would automatically correct LD flows and issues. Moreover, using machine learning algorithms to train and analyse LD data and suggesting design ideas to teachers based on this analysis appears to be a promising area for future work.

E6 thinks that the main challenge of the LD field is getting the right level of investment into creating LD tools that teachers need. Another challenge is getting teachers to work in that sort of way to give enough time to LD and to be prepared to see what other people have done. So, it is about getting teachers into LD tools, searching for what is already there, incorporating it, adapting it, experimenting with LD tool and publishing, and sharing back with the community. The future direction of LD tools would be to become the front end of the institutional system. However, VLEs are not good on the LD process. So, what the LD field has to do is to create the tools for teachers to do LD well and share them, but also interface with institutional systems.

According to E7, the practical connection with the everyday activities that lecturers perform is challenging for LD tools and the whole LD field in general. According to E7, the future direction of LD tools would be to ease the LD process, to identify the ways to do that, to constantly update the tools with the innovations happening in the education in order to be able to cover different types of activities, assessments, and exploit digital technology in different ways.

According to E8, one of the problems in the LD field is that good teaching is not necessarily highly valued in HE. So, it is hard to convince HE lecturers that good LD that leads to better teaching is important. E8 thinks that number one problem in the field of LD is that there is a need to make a stronger case for why LD is important, and this needs to be made to the people who make decisions and the people who are on the ground who would have to do design work. The second thing is that the LD tools are developed based on assumptions of experts about what teachers should be doing. However, there is very little research into both what teachers already do, what they already know, what they are willing to do and how best to support them. Furthermore, LD tools are not connected enough with the people who are going to use them. The third challenge is creating a network of experts around the world to get different ideas about how they work in practice. So, there are people from computer science and education, and there are people that try to bring those two together. However, what is happening at the moment, E8 believes, is that there is some kind of competition between people about promoting their way of doing LD without considering the bigger picture, which requires people co-operation to deal with LD challenges. Thus, the LD field needs unifying principles that experts can all agree on. According to E8, one of the future directions of the LD field would be getting good evidence and convincing people that LD is important.

According to E9, one of the challenges of the LD field is political. HE lecturers' LD-P should be eased with LD tools otherwise asking them to change their way of designing LDs is going to encounter the resistance in everyday practice. Another challenge is that HE academics need to understand that their job includes teaching as well as doing research. As a future direction, LD technologies need to be promoted as part of professional development in HE to teach HE lecturers that their job is lecturing as well as researching.

According to E10, in the LD field, many LD initiatives are all about helping teachers to improve their design ideas. However, they are mostly based on what researchers think that HE teachers need and often find themselves lacking know-how on what HE teachers need and what HE lecturers do in practice. So, the first thing to do is to find out what teachers do regarding LD and better understand their practice. E10's suggestion for future work is investigating what HE teachers do when they design for learning from start to finish and designing LD tools to support them to be better in their LD-P.

4.3 Discussion

Interviews conducted with LD experts provide insights that are important for understanding the LD field in general, the challenges and open issues, and at the same time help to address research questions of the thesis.

Several challenges are encountered when using LD tools, and the experts offered insights for future research directions in the LD field. Experts had the experience of several LD tools, including the one they had developed, and described several challenges when using these tools. As mentioned in the literature, the adoption of LD tools remains low (Charlton, Magoulas, & Laurillard, 2009; Bennett et al., 2015), and experts interviewed also expressed similar views. For example, E10 said that “the tools do not connect enough with the people who are going to use them”. E3 mentioned that “not many people know about the tools”. The experts stated the reasons why the tools are not adopted widely. One of the underlying reasons behind their low adoption is the time constraint of HE lecturers. In this context, E5 said that the main challenge that he/she see is that in general HE lecturers lack the time necessary to learn and consistently use a new tool adapting their daily practice. E5 also stated that “there are challenges for adoption that have to do with the ecological constraints of the teachers and their time”. E10 also indicated how much time LD takes matters for a lecturer. Moreover, existing LD tools are not easy to use and flexible enough for lecturers to tailor them into the daily practice. Furthermore, they are constraining lecturers creativity, clash with existing practices and require higher technology competencies. Thus, as the lecturers have very limited time, they see the use of existing LD tools as a time-consuming process. Experts mentioned this gap and “disconnections between lecturers’ conceptual design and the authoring environment” several times.

According to the experts, the tools are designed in a way that reflects researchers way of thinking about how LD should be performed, and this aligns with the literature (Nguyen & Bower, 2018; Dalziel et al., 2016; Bennett et al., 2014). This view is echoed by many experts. For example, one stated that “there is very little research into what HE lecturers already do in terms of LD, what they already know, what they willing to do, and how best to support them”, while others expressed the views that “there need to be more works with teachers to understand the needs of teachers and how this can be integrated into their current LD-P” and that “we need to work more work with the practitioners on a long-term basis”.

Overall, LD experts think that better understanding of the lecturers' actual LD-P and introducing innovative ways that would help to increase their engagement with LD tools are critical- a view which aligns with the literature presented in Chapter 2.

4.4 Summary and Contribution of the Chapter

This chapter presented a study that analysed data from interviews with LD experts to better understand the needs and the challenges in the LD field. The design of the interview questions was informed by the LD literature presented in Chapter 2. The qualitative data gathered through interviews was analysed following Creswell (2014)'s qualitative data analysis steps using NVivo qualitative data analysis software. The findings were presented according to the themes that emerged from the data in the analysis process.

This chapter contributes to the LD field presenting a new study that explores LD experts' perceptions of the field and of the way LD tools are designed and used in practice. It improves our initial literature-based understanding of the LD domain, open issues, and future directions. In particular, the analysis of the interview data reveals that experts perceive that there is a mismatch between the actual LD practice of the HE lecturers and what LD tools currently offer. Although their work and tools have focused on supporting the LD process, experts recognise that LD models used in the available tools do not fully capture the complexities of the LD process as performed in HE organisations and that a deeper understanding of the LD-P, looking at the process of LD from different perspectives, would be beneficial.

The findings of this chapter contribute to the triangulation of LD's problem, identifying the main challenges and factors, using three sources of data: literature (presented in Chapter 2), LD experts (presented in this chapter), and HE lecturers (presented in Chapter 5). As a next step, a survey with HE lecturers is described in the next chapter to illustrate how they experience LD in their organisations, their views on the open problems in this field and their perceptions of LD tools.

Chapter 5

A Need Analysis of Learning Design: Survey with HE Lecturers

This chapter presents the findings of a survey regarding HE lecturers' expectations of LD tools and perceived advantages and limitations. One hundred ten HE lecturers from different continents participated. The findings contribute to the triangulation of LD's problem, identifying the main challenges and factors influencing LD choices and tools from the HE lecturers' perspective. Section 5.1 presents the details of the survey design including the selection of the participants, data collection and analysis procedure, and ethical considerations. Section 5.2 presents the results of the survey under the six themes that emerged in the analysis process of the questionnaires. In Section 5.3, we discuss the findings and their contribution to the triangulation process of the data analysis. Finally, Section 5.4 presents the summary and the contribution of this chapter.

5.1 Method

5.1.1 Participants

The target population of the survey were both female and male HE lecturers from a variety of countries, disciplines, and levels of teaching.

5.1.2 Instrument

An online survey research method was adopted as it allows obtaining data from a wide range of participants, prevents geographical dependence, and provides flexibility in data analysis by allowing the use of surveying software which offers the possibility of using advanced analysis techniques. Also, an online survey method helps to understand how the findings from a sample extend to a population (Fowler, 2014).

The survey instrument was developed based on the key elements revealed in LD literature. Then, three pilot studies were conducted to determine and further advance the survey instrument. The pilot testing also helped us to establish content validity.

The resulting survey comprised of three sections. The first section, titled "Demographics", contained three multiple-choice questions about sex, teaching experience of participants, and country, one open-ended question on lecturing domains and one checkbox question about levels of teaching. Another section of the survey was "LD tools" that contained one checkbox question, one multiple-choice question, four open-ended questions, and matrix/rating scale question. The "LD tools" section examined what LD tools HE lecturers are aware of, what factors motivate HE lecturers' to use LD tools, what benefits are perceived from using LD tools, what challenges HE lecturers face when using LD tools in HE settings, how likely it is that HE lecturers would use the tools in their daily LD-P, and how LD tools to be improved to meet the expectations of HE lecturers. The participants could refer to up to three LD tools that they had used, and they were asked specific questions about these tools. The third section, "LD-P of HE lecturers", contained five open-ended questions, five checkbox questions, and one matrix/rating scale question to examine how HE lecturers design for learning, what factors influence their design decisions, and what tools they use. In total, there were thirty-five questions; these are presented in Appendix B.

5.1.3 Procedure

The target population of the online survey was HE lecturers from a variety of countries, disciplines, and levels of teaching. A successive independent sample study was chosen to collect data from HE lecturers at one time, as well as to reach the broadest participation across the world. The random sampling method was adopted (Creswell, 2014). The participants were randomly selected, and the online survey was sent to them via his/her institutional email address using an online survey tool, Survey Monkey (https://www.surveymonkey.com/). The survey was conducted individually, where participants filled the online survey in their appropriate time (Creswell, 2014). The numbers of the participant to our survey was 110 HE lecturers – in the most recent LD literature, 32 was one of the largest sample sizes identified (Bennett et al., 2011).

5.1.4 Analysis

In the analysis, we followed Creswell (2014)'s approach which includes preparing the data for analysis, reading all the data, start coding, using coding to generate description, advancing how the themes will be presented, and interpretation. In the analysis, the data analysis program QSR NVivo is used.

5.1.4.1 Preparing data for the analysis

This step included getting all the data in PDF and Excel file formats from the SurveyMonkey web application, importing the PDF files into the NVIVO software as presented in Figure 5.1.

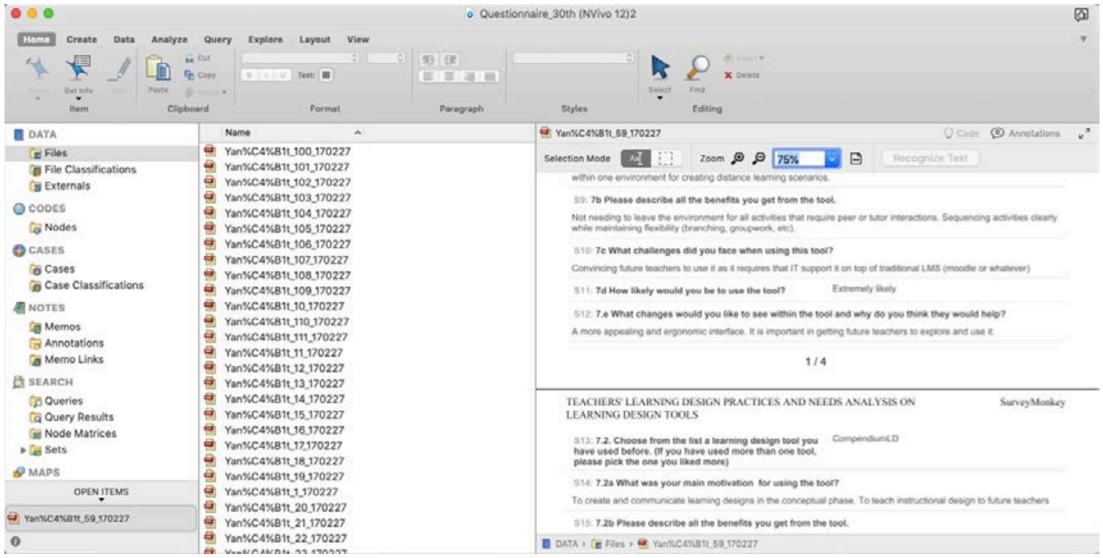

Figure 5.1: Inserting data in NVIVO

5.1.4.2 Start coding

We have followed Tesch (1990)'s eight steps of coding, presented in Chapter 3.5.4.

Reading all the data thoughtfully. First, the generated PDF files were read to get a general understanding of the issues mentioned by the participants. A sample of the questionnaire data is presented in Appendix D. The data in the Excel files were also explored and graphs were produced to get insight from the data (see Figure 5.2).

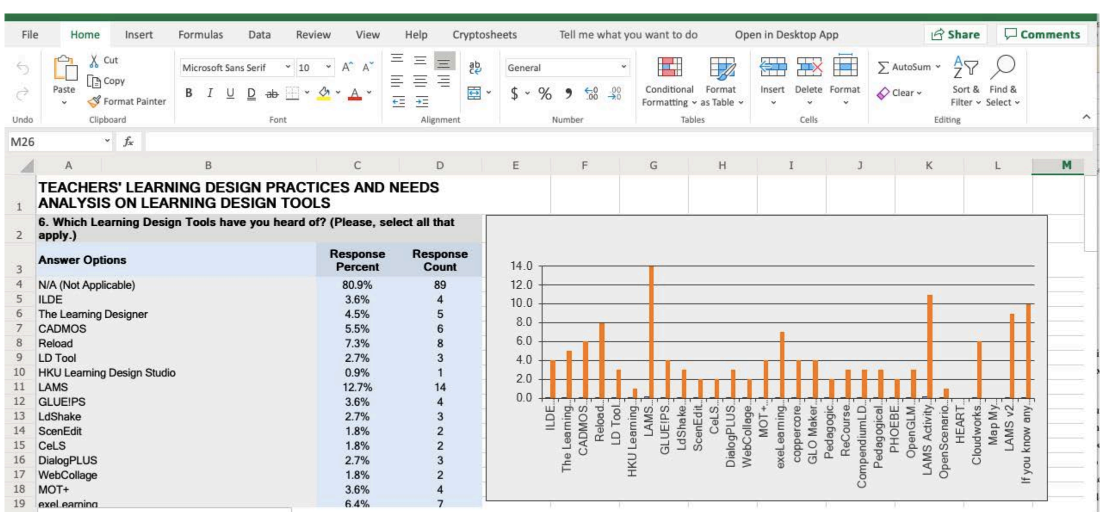

Figure 5.2: Excel Version of Questionnaire Data

Choose one interview transcript and look over it. The shortest questionnaire data set was selected and inspected carefully to get insights from the content and the underlying purpose.

Record all the topics. Topics emerging from the initial reading were recorded in a Microsoft document.

Start coding. Nvivo software was used for coding, all the topics as nodes (Figure 5.3).

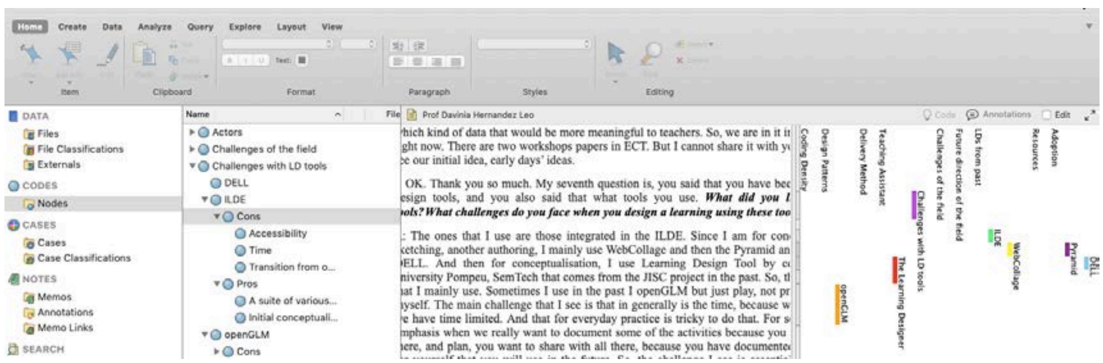

Figure 5.3: Coding process

Record all the topics. All topics identified after the coding process were recorded and grouped into related topics (see Figure 5.3).

Re-investigating topics. The second round of examination of questionnaire data was performed to ensure there were no additional topics and codes.

Decrease the number of listed categories. The investigator attempted to reduce the number of listed categories by merging relevant nodes (codes).

Finalise the abbreviation of each category. After checking one more time the data, the abbreviation of each category was finalised.

Collect the data elements. I saved the data elements (a part of transcribed data) under each node. NVIVO system helped us to define data elements while creating the nodes.

As presented in Figure 5.4, the researcher can select a node and the system provides all data elements that refer to this node.

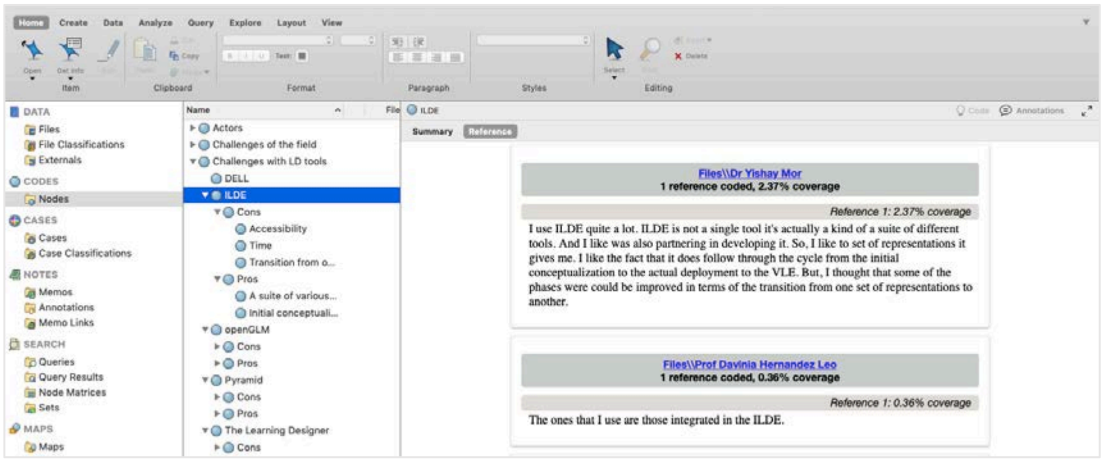

Figure 5.4: Collecting the data elements

5.1.4.3 Using coding to generate description

The coded data is used in this chapter to make need analysis of learning design from HE lecturers' perspective and in Chapter 7 to explore HE lecturers' LD-P.

5.1.4.4 Advancing how the themes will be presented

The data were organised into themes according to the survey questions and are presented in the next section. The Excel data files helped to create graphs which are presented below.

5.1.4.5 Interpretation

The findings are presented in Section 5.3 below. Participants were coded asP1, P2, P3, …, P110 to preserve anonymity, where, for example, P1 represents the first participant who responded to the survey.

5.2 Findings

5.2.1 Demographics

The study included 61 males and 49 females respondents. Lecturers from twenty-seven countries participated to the survey, including Australia (1), Austria (1), Brazil (1), Canada (3), Colombia (1), Cyprus (1), Denmark (2), Finland (2), France (1), Greece (3), India (1), Ireland (2), Italy (1), Netherlands (1), New Zealand (1), Portugal (1), Russian Federation (4), Saudi Arabia (1), Spain (5), Sweden (1), Switzerland (2), Thailand (1), Turkey (8), United Arab Emirates (2), United Kingdom of Great Britain and Northern Ireland (55), United States of America (7), and Vietnam (1).

The participants had taught courses at various levels at HE institutions: Bachelor's (66), Master's (75), Doctorate (63). Also, some participants were engaged in teachers' professional development, continuing education, postgraduate certificate courses, and foundation degrees.

The range of the courses taught by the participants was also quite diverse. We identified two hundred eleven domains mentioned by the participants. "Education" and "Research Methods" are the most frequently taught subjects, followed by "Mathematics", "History Education", "Mathematics Education", "Statistics", "Economics", "Computer Science", "Educational Technology", "Social Theory" and "Law". The wide variety of the subjects taught by the participants can be considered as a positive feature of this survey study as it enhances the generalizability of its findings.

With regards to the teaching experiences of the participants, 21 of the participants had 1-5 years teaching experiences while 20 of them had 6-10 years, 22 of them had 11-15 years, and 47 of them had more than 15 years teaching experiences. Most of the respondents were well established and experienced lecturers.

In the following sub-sections, the results are presented according to the themes created in the data analysis. Section 5.2.2 refers to all participants while Sections 5.2.3- 5.2.7 refer to those who used the particular LD tools (17 of the participant).

5.2.2 Awareness of LD Tools

The results of the survey indicate that there is a lack of awareness of LD tools that are available with 89 of the respondents saying that they do not know of any LD tool that could assist them in LD-P. The most well-known LD tools among the participants appear to be LAMS (14), LAMS Activity Planner (11), LAMSv2 (9), Reload (8), and exeLearning (7) as presented in Figure 5.5. Blackboard, Moodle, 4Ts, OUNL EML were also considered as LD tools by some participants. Blackboard and Moodle are popular LMS/VLE, but they do not provide adequate support for LD-P, while 4Ts is a framework for LD. These answers could indicate that there is certain confusion between LD tools and VLEs.

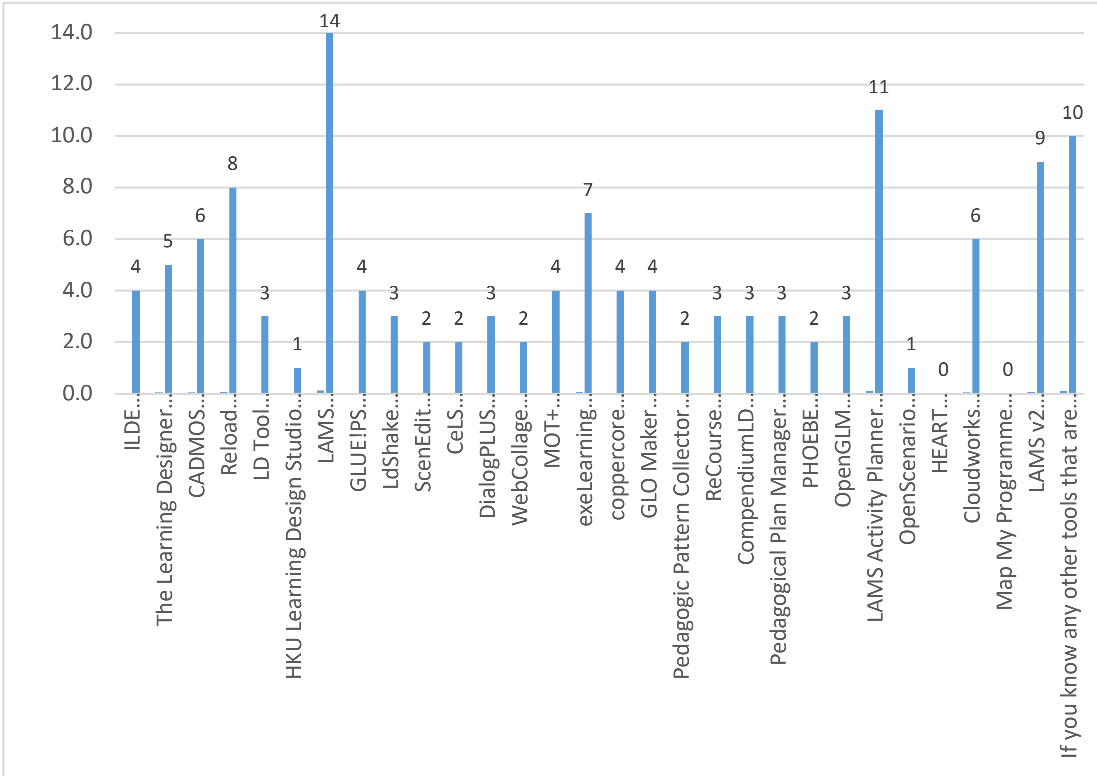

Figure 5.5. LD tools and number of participants that were aware of them.

17 of the participants indicated their views on a maximum of three LD tools they had experienced on a long-term basis. Seventeen LD tools were mentioned by the various participants in this way. The tools, their ranking in terms of participants' preference and the number of participants who expressed their views on them are presented in Figure 5.6. In the first place in terms of preference, the Learning Designer, CADMOS, Reload, LAMS, MOT+, exeLearning, Pedagogical Plan Manager, PHOEBE, LAMSv2, and an "Other" tool were included. Second, ILDE, CompendiumLD, LAMS Activity Manager, and an "Other" tool were placed. In the third place, Reload, and exeLearning were listed.

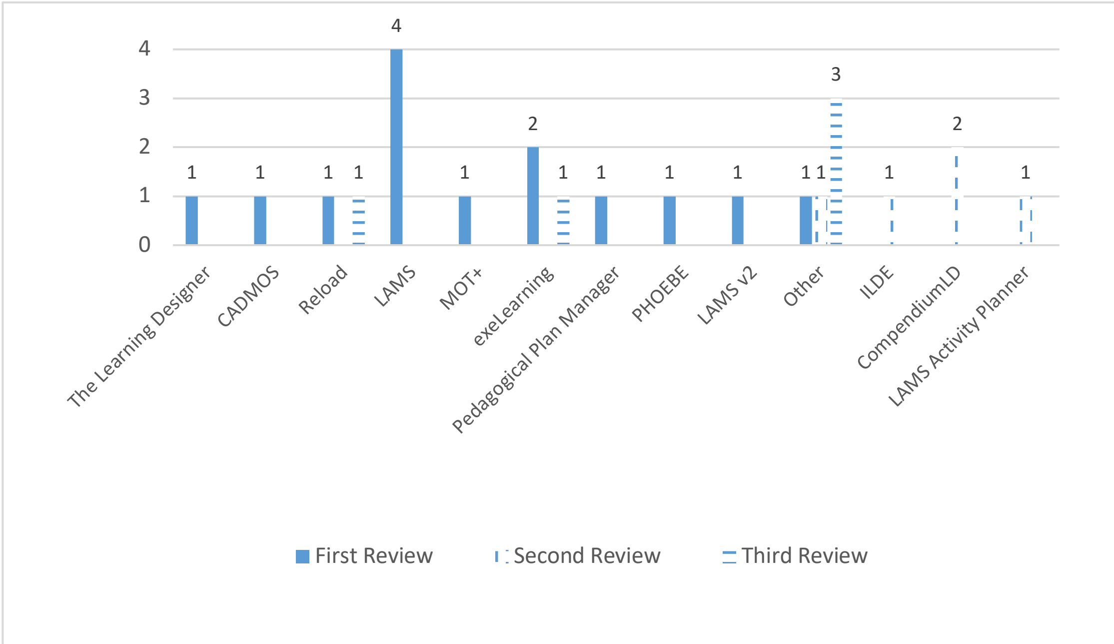

Figure 5.6. The LD tools that lecturers expressed their views on them

5.2.3 The Motivation for Using LD Tools

The participants provided various reasons for using a specific LD tool. The motivating factors were organised into two groups: internal motivation factors and external motivation factors.

Internal motivation relates to the personal curiosity and enthusiasm of HE lecturers to advance their course design further. For example, P89 use LAMS to implement an activity for distance education, and P74 experienced the Learning Designer because of its features and efficiency. In another example, P59 used CompendiumLD to create and communicate LDs in the conceptual phase and exeLearning in creating standalone learning objects, P51 used Reload to create IMS LD compliant courses to upload to LMS, and P49 use LAMS Activity Manager to organise his subject and Reload. The lecturers' curiosity also leads them to experience specific LD tools. For example, P56 experimented with MOT+ to see what it was like and P19 used PHOEBE because P19 wondered the project.

External motivation refers to factors that drive the lecturers to use LD tools. For example, P81 said that he had to use LAMS because it was suggested by his/her institution and P12 experienced CADMOS as he/she was one of the developers of the CADMOS. Also, P59 used the second version of LAMS to show future teachers how a tool can integrate design and execution, how good LA tools look like, while P49 used LAMS as part of his master's degree program. P16 used the Pedagogical Plan Manager for the design of activities in the context of teacher training, the ILDE to use different tools to cover the whole LD cycle, and 4Ts to support the design of collaborative activities by groups of teachers using tangibles. The facilities of the tools also draw researchers to use a particular LD tool, such as being easy to use and providing export facilities made exeLearning the preferred LD tool for P64.

5.2.4 Perceived benefits from LD tools

Participants perceive LD tools as beneficial as they enable them to improve their practice in several ways. For example, the main advantage that P89 got from LAMS is proper planning. P81 said that LAMS helps to put the material available to students and provide collaborative tools. According to P74, the Learning Designer helps in the organisation, getting new ideas and new ways for lesson planning, and sharing lesson plans with other teachers. P19 stated that PHOEBE provides a series of reflective prompts. P16 found ILDE beneficial because one can use a variety of LD tools and benefit from community support, and 4Ts useful for designing collaborative activities. CADMOS' features aligned well with P12's graphics-based layered driven LD-P.

Some of the participants referred to user interface features of the tools as a key factor. For instance, P64 and P59 valued high that the exeLearning tool was user-friendly and cloud-based. Also, P59 found CompendiumLD easy to use and mentioned that LD stencils structure the design process in the tool. Furthermore, P49 said that LAMS Activity Planner was easy to use. Other participants mentioned LD tools' functionality for data integration/transfer, particularly with respect to other VLEs. For instance, P51 stated that the LD created in Reload could be transferred to other platforms, which is essential for HE lecturers. P12 found the export capabilities of CADMOS quite beneficial. P59 indicated that LAMS integrates collaborative and interactive activities such as wiki, forums and feedback into scenarios within one environment for creating distance learning scenarios. Participants were familiar with different versions of the LAMS tool and mentioned several benefits from their use in LD-P. For instance, regarding P59, the second version of LAMS allows users for sequencing activities clearly while maintaining flexibility such as branching and group work. P49 said that LAMS provided motivation and achieving the learning goals in a significant way.

Another perceived benefit of using the tools is the variety of representations supporting the various stages of LD (mind maps for conceptualisation; activity flow and text for authoring). For example, according to P16, the Pedagogical Plan Manager can support the whole LD cycle (from conceptualisation down to delivery to learners).

5.2.5 Challenges of LD Tools

There are also challenges faced by the participants when using LD tools: some find interaction with the user interface of the tools to be problematic, while others believe that educational organisations should provide users with appropriate information technology support. For instance, P89 considered that LAMS interface is problematic, while P51 found Reload too complicated to use. Also, P59 considered that the second version of LAMS requires information technology support on top of the traditional LMS assistance.

Some of the respondents mentioned that they encountered pedagogical challenges when using the tools. For instance, P74 perceived the methodologies and pedagogical approaches embedded in the Learning Designer as challenging. Also, according to P59, exeLearning requires several dynamic pedagogical interactions to be done outside of the environment.

The gap between LD tools and real-world LD-P of HE lecturers was another issue highlighted by the participants. For example, P51 found challenging to establish connections between the functionalities in the Reload tool and what is needed in a real application of the tool in their LD-P. In another example, P19 argued that PHOEBE appears more formal than it should be, so it takes more time to design for learning.

Besides those challenges, there were also other difficulties faced by the participants when using LD tools. For example, P59 found that CompendiumLD provides little adaptability in graphic displays for outputs and no possibility to collaborate on designs without manipulations, usually beyond the effort most stakeholders are willing to make. The learning curve of MOT+ is not instinctively obvious, as stated by P56. According to P49, LAMS Activity Planner is the traditional habit of students. P16 mentioned that the designs created in the Pedagogical Plan Manager could be implemented either in a Moodle through Glue!-PS, or in Chamilo (another LMS, less popular than Moodle). However, the passage from the Pedagogical Plan Manager to Chamilo was far more straightforward, as it required fewer intermediate steps. According to P16, a difficulty when using the ILDE is that advocated integration among the tools is not actual technical integration and interoperability. P12 considered the followings aspects as challenging when using CADMOS: the synchronisation of layers, the export capability, and the level of guidance for novice designers.

5.2.6 Intention to Adopt LD tools

The respondents were asked to indicate how likely they were to adopt an LD tool. To this end, the scale extremely likely, very likely, moderately likely, slightly likely, and not at all likely was used. The findings regarding thirteen LD tools from seventeen participants, who were positively inclined, are illustrated in Figure 5.7 and Figure 5.8.

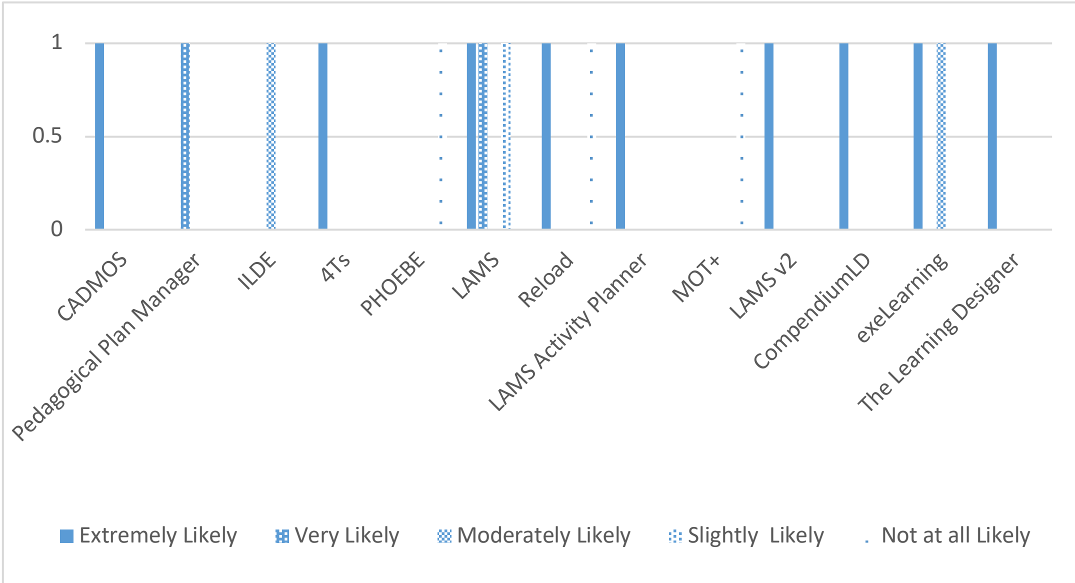

Figure 5.7. Participants' intention to adopt a particular LD tool permanently

In Figure 5.7, the vertical axis shows the number of participants that were in favour of each tool, while the tools considered is shown in the horizontal axis. For instance, one respondent indicated that it was not at all likely that they would adopt MOT+. In contrast, one participant was positively inclined towards LAMS, stating that it was extremely likely to adopt it permanently; another one thought that it was very likely to adopt LAMS v2, while one other considered it slightly likely.

Figure 5.8 summarises the results of Figure 5.7, presenting the participants' overall belief in adopting an LD tool. It shows that most of the respondents (9) believe that it is extremely likely that they will adopt a tool in their LD-P, while one of them think that it is slightly likely, which still shows that this possibility should not be neglected. Lastly, three of the respondents were less satisfied, feeling that it is not at all likely that they would adopt a tool.

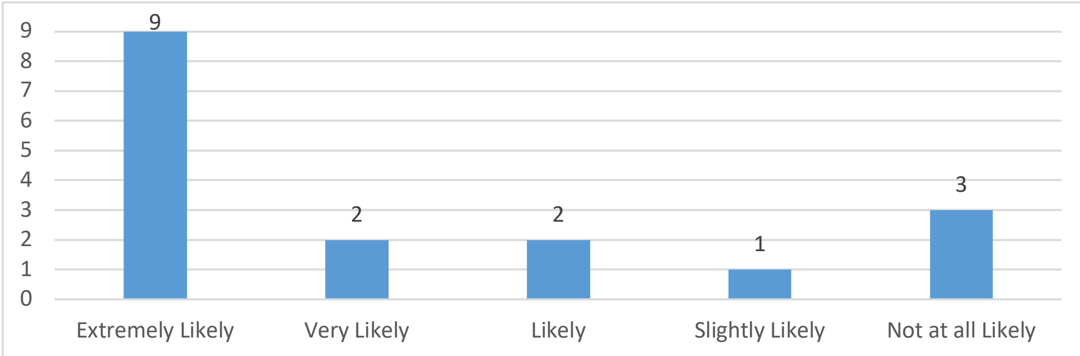

Figure 5.8. Participants overall belief in adopting an LD tool in their daily practice

5.2.7 Enhancement and Additions to LD Tools to Meet Users' Expectations

Several suggestions were given by the participants who reviewed the tools intending to improve their adoption and acceptability. These suggestions were related to interface features, usability, and integration or interoperability issues. For example, P89 indicated that LAMS would benefit from integration with other tools, a revamping of its interface and usability enhancements. According to P59, LAMS v2 should have a more appealing and ergonomic interface to get future teachers to explore and use it. In P12's opinion, CADMOS needs several improvements in its usability and software performance, and according to P81 most of LD tools are designed for technically inclined teachers, and they are not usable by people without high digital competences. The Pedagogical Plan Manager needs improvements in the graphical layout and more flexibility in the activity flow representation in P16's view. P74 thought that the Learning Designer should have an option to print LDs.

Participants also made a wide range of other suggestions such as P59's idea that CompendiumLD should be enhanced with collaboration tools as an instructional designer is rarely working alone in the design process, especially when this involves designing both at the macro-level (curriculum, modules, courses, lessons, scenarios) and the micro-level (activity). In another example, P51 thought that the design process of Reload should also be considered with terms different from those required to encode the experience in IMS LD. Additionally, P16 suggested that ILDE should provide more tight technical integration among the tools while the 4Ts should be enriched with a digital counterpart to continue working on it even after the training sessions.

Some of the lecturers were satisfied with the existing facilities of LD tools. For instance, P19 said that PHOEBE was fine for what it was intended for and P19 did not feel the need to formalise the LD-P most of the time using PHOEBE.

5.3 Discussion

The study conducted is a step in exploring the factors that shape HE lecturers' engagement with LD and LD tools. As mentioned, the survey serves two purposes: first, understanding the HE lecturers' expectations of LD tools, their perceived advantages and limitations; second, looking at the LD-P of HE lecturers with the lenses of sociomateriality. The previous sections presented the findings regarding the first purpose.

The most apparent finding to emerge from the analysis is that most of the lecturers were not aware of the existence of LD tools. In line with the LD literature (Charlton, Magoulas, & Laurillard, 2009; Bennett et al., 2015), this study statistically found that 89 of the participants were not aware of the existence of LD tools.

The motivations that draw lecturers to use LD tools were either internal or external. One factor that motivates HE lecturers to use LD tools is institutional requirements. Sharing and getting LD ideas from other lecturers are two popular features of LD tools, which were highly valued by the participants of this survey study.

Another important finding, which adds on the results of (Masterman et al., 2013; Charlton, Magoulas, & Laurillard, 2009) is the fact that there is a mismatch between LD tools and the actual LD-P of the HE lecturers. For example, P19 said that PHOEBE was more formal than P19 was otherwise required to be, so took more time to design for learning. In another example, P51 found Reload difficult to establish connections between the items in the tool and what is needed in a real application. On the other hand, HE lecturers would like to adopt LD tools in their LD-P if these have been designed in a way that supports their current LD-P, they are less technical adding minimum overhead, or extra workload, and in general, they are designed to make LD-P easy and reduce time and effort. This mismatching issue aligns with the findings of the interviews that were conducted with experts (Chapter 4) and also with the literature. Therefore, a mismatch between HE lecturers' LD-P and LD tools is one of the problems in the LD field that it is triangulated using three sources of data, as discussed in the next subsection.

Another interesting finding is that there is a link between HE lecturers' perceptions and factors affecting their willingness to use LD tools in their everyday LD-P with the pedagogy, representation and context dimensions of any framework for designing learning. Understanding these perceptions, how lecturers design for learning and the barriers encountered is essential and deserves further investigation as mentioned in the literature as well by (Nguyen & Bower, 2018), (Dalziel et al., 2016), and (Bennett et al., 2014). These are all issues that shape HE lecturers' engagement with LD tools and can be used to inform the development of future studies of LD tools and LD approaches for learning.

The findings of this study are subject to some limitations due to the nature of data, and methodological choices. It is essential to bear in mind the possible bias in the responses and analysis process. In order to avoid bias, increase objectivity, explore the credibility and therefore to improve transferability of the results of the study, the number of the participants to the survey is kept high. The sample size of this study was sufficiently large compared to the existing studies in the LD. As most of the participants were from the United Kingdom, any attempt to large the sample should focus on participants from other countries and replicate the study findings.

Notwithstanding this apparent limitation, this work offers valuable insights into the LD and LD tools domain, adding to our understanding of the LD-P of HE lecturers as inadequate empirical works towards HE lecturers' engagement with LD tools and their LD-P is highlighted in LD literature. Furthermore, understanding HE lecturers' views on existing LD tools, their willingness to use them, and how they design for their learning are also raised as important topics to be researched. Therefore, surveying with HE lecturers' use of LD tools and their LD-P is important to the LD field to inform the development of future LD tools and LD approaches.

5.3.1 Triangulating the problems of LD field

The connection gap between the LD tools and actual LD-P of HE lecturers was the agreed issue by literature, experts, and the lecturers. As presented in Chapter 2, limited attention has been given to what teachers actually need and what they actually do in their LD-P - as many works in the literature acknowledge, that is an issue that should be normally explored before even starting the design of an LD tool (Dalziel et al., 2016; Mor & Craft, 2012; Bennett et al., 2014). As discussed in Chapter 4, experts also pointed out that more investigations are needed to understand HE teachers' needs, and how LD tools can be integrated into their existing LD-P. They also indicated that LD tools rely mostly on experts' perceptions of their potential use, and not on adequate needs analysis and understanding of the current LD-P. HE lecturers' view on existing LD tools has also highlighted this gap. The HE lecturers' agreed perspective on existing LD tools was that the tools were more formal when it compared to lecturers' actual LD-P and it was difficult to build connections between the functionals in the tools and what is needed in a real application. Three sources of data confirmed this mismatching between the LD tools and the actual LD-P of HE lecturers.

LD approaches play an intermediary role between the LD-P of lecturers and the LD tools. As LD tools were developed based on these frameworks, in practice this can lead to a misalignment between LD-P of lecturers, LD approaches and LD tools (see Figure 5.9).

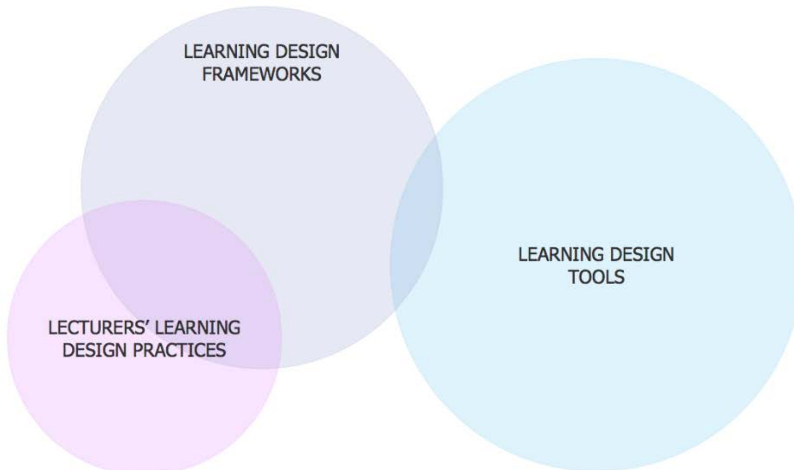

Figure 5.9. The disconnection between the LD-P, LD approaches, and LD tools

Furthermore, to align LD-P of lecturers, LD approaches and LD tools (see Figure 5.10), the reasons behind their misalignment needs to be investigated further.

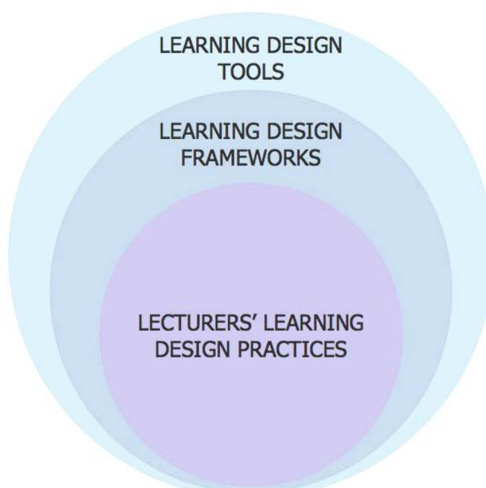

Figure 5.10. Aligning actual LD-P of lecturers, LD approaches and LD tools

5.4 Summary and Contribution of the Chapter

The chapter presented a study that aimed to offer insight into HE lecturers' expectations of LD tools, their perceived advantages and limitations. An online survey of one hundred ten HE lecturers from several countries in various disciplines were used. The participants were selected randomly, contacted using their institutional emails, and asked to complete the survey. Once a sufficient number of participants was reached, the survey closed and the data were exported from the Survey Monkey tool and imported to NVivo qualitative data analysis tool. The data analysis process followed Creswell's (2014) qualitative data analysis steps. The findings were organised into themes that emerged from the answers.

The primary results are summarised as follows. Firstly, HE lecturers are not aware of the existence of LD tools that could help their LD-P. Secondly, according to participants who had used some of LD tools and provided feedback about them, there are several benefits of the tools including but not limited to allowing collaboration with other teachers and getting new teaching-learning ideas. Thirdly, several factors prevented participants from adopting these tools in the long term, such as the level of technical competence required to use them on top of other LMS used in the lecturers' institutions, such as Moodle. Also, there are several different LMS used in educational organisations, which complicates matters of integration of LD tools in institutional infrastructure. Lastly, one of the most important issues that emerged from the data is that HE lecturers' way of LD-P is not as formal as it is represented in LD tools.

The findings of this chapter contribute to the triangulation of the problems of the LD field, enhancing our understanding of the needs of HE lecturers regarding LD and LD tools and they reveal misalignments between tools and LD-P. The outcomes of the analysis can be useful for relevant stakeholders working in LD and on the design of tools who want to strengthen methods and tools and better meet the expectations of users.

In the next chapters, the analysis continues by exploring the data from sociomaterial perspective. First, in the following chapter sociomaterial theory is used to analyse the LD-P of the experts and then, in Chapter 7, the LD-P of the HE lecturers. Outcomes of this analysis will be used to develop a new sociomaterial design framework and inform the design of LD software tools so hat misalignments identified in Chapters 4 and 5 are minimised.

Chapter 6

Experts' LD-P: A Sociomaterial Perspective

This chapter aims to expand our understanding of LD-P and explore how it can be used to inform the design of LD tools. The analysis is based on a set of semi-structured interviews of ten LD experts (as mentioned in Chapter 4, experts are also teachers in HE and have been involved in core projects of LD tools as project directors or co-investigators). They were asked about their LD-P, their preferred LD digital tools, and the actors that influence their LD-P. The data is analysed using qualitative methods from a sociomaterial perspective. Sociomaterial analysis helps us to understand what experts think about how LD tools might be designed. We identify the actors involved in the LD-P, their entwined relations, and the boundaries that appear when the actors are enacted in the LD-P of the interviewees when they are using digital tools. Furthermore, in this chapter, we develop a sociomaterial design framework for LD tools an LD approaches.

The next section gives the methodological details for the interviews. In Section 6.2, the research identifies actors, their relationships in the LD context, and the networks and boundaries, as perceived by the experts interviewed. In Section 6.3, a sociomaterial design framework for LD tools and LD approaches is created based on the results of Section 6.2. Section 6.4 presents the discussion. Finally, Section 6.5 presents the summary and contribution of the chapter.

6.1 Method

As the methodological procedure for conducting the interviews was presented in Section 4.1, in the following subsections concentrate on the procedure for data processing and the sociomaterial analysis.

6.1.1 Procedure for Data Processing

As in previous chapters, Creswell (2014)'s process was followed: preparing the data for analysis; reading all the data; start coding; using coding to generate description; advancing how the themes will be presented; interpretation. These are summarised below.

6.1.1.1 Preparing data for the analysis

This step included the manual transcription of the ten recordings of the ten interviews' data. The NVIVO software (Figure 6.1) was used to play the audio files and then written records were produced using the Microsoft Word software (Figure 6.2).

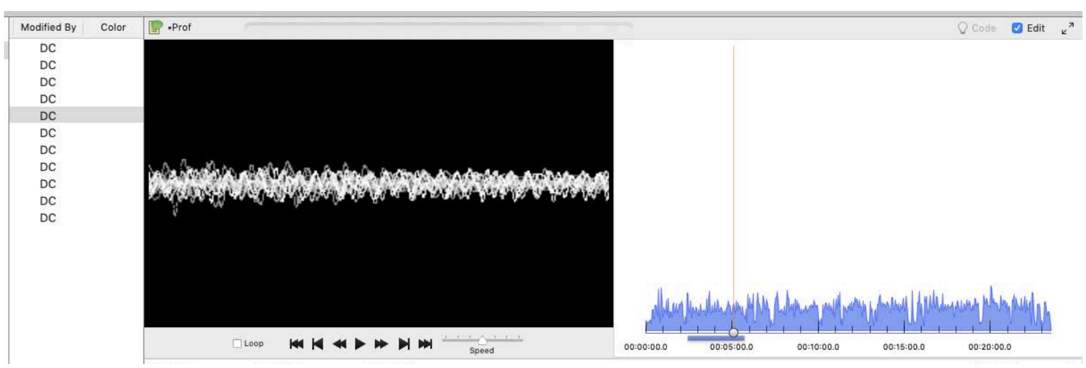

Figure 6.1: Use of NVIVO Software to transcribe interview data

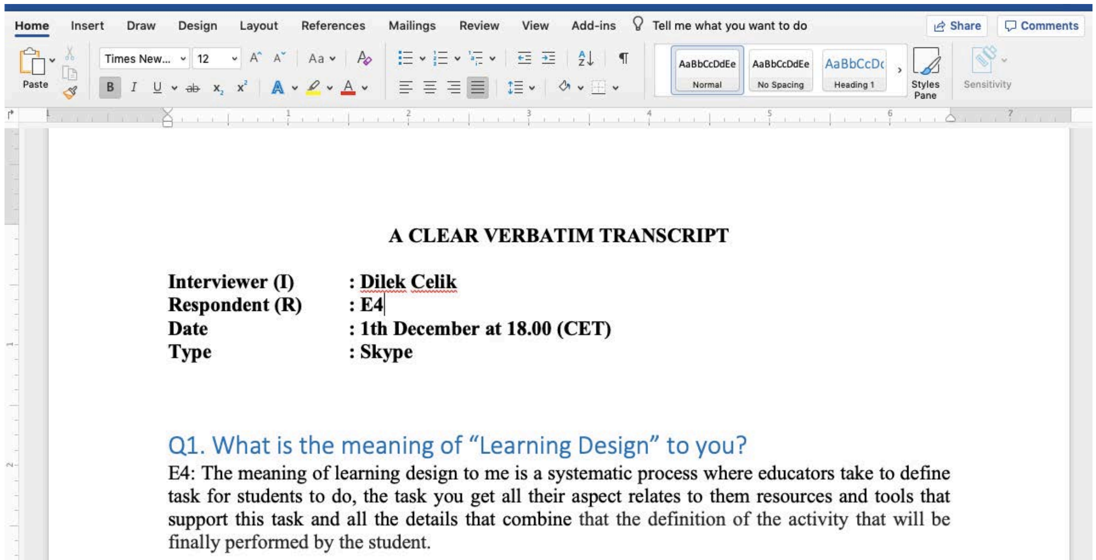

Figure 6.2: Use of Microsoft Word to transcribe interview data

6.1.1.2 Start coding

As before Tesch (1990)'s process for coding was used (see Chapter 3.5.4 for details).

Reading all the data thoughtfully. The researcher read all the transcriptions to get a general understanding of the issues mentioned by the interviewees.

Choose one interview transcript and look over it. The shortest transcript was selected and the material was inspected to get insight from the content and the underlying purpose.

Record all the topics. the researcher recorded in a Microsoft Word document all topics that emerged from the initial reading.

Start coding. After transcribing all audio interview data, the researcher used Nvivo to code all the factors that might affect LD-P as nodes (Figure 6.3).

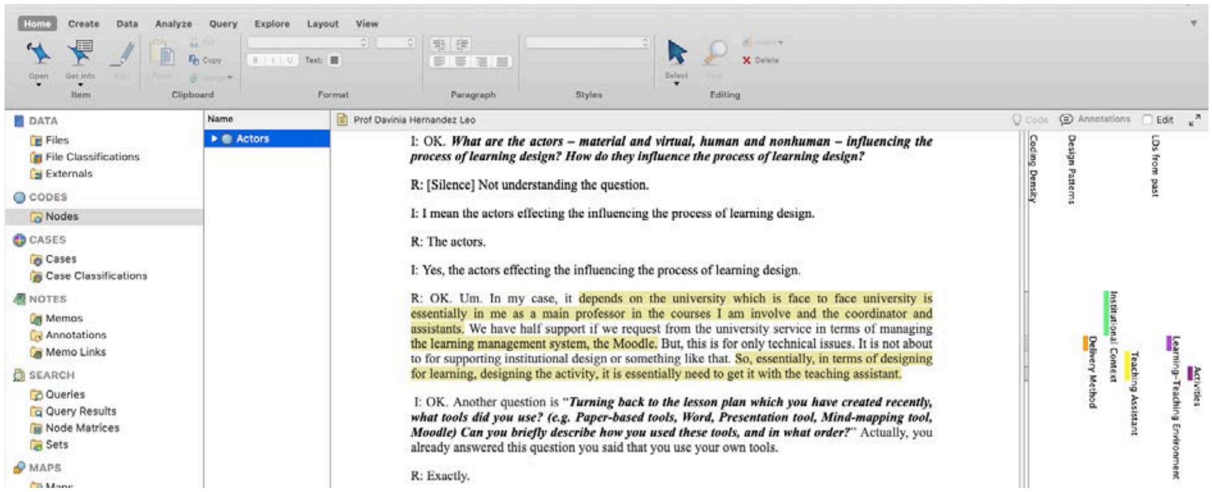

Figure 6.3: Coding the actors

Record all the topics. All the topics identified after the coding process are grouped into related topics and recorded as presented in Figure 6.4.

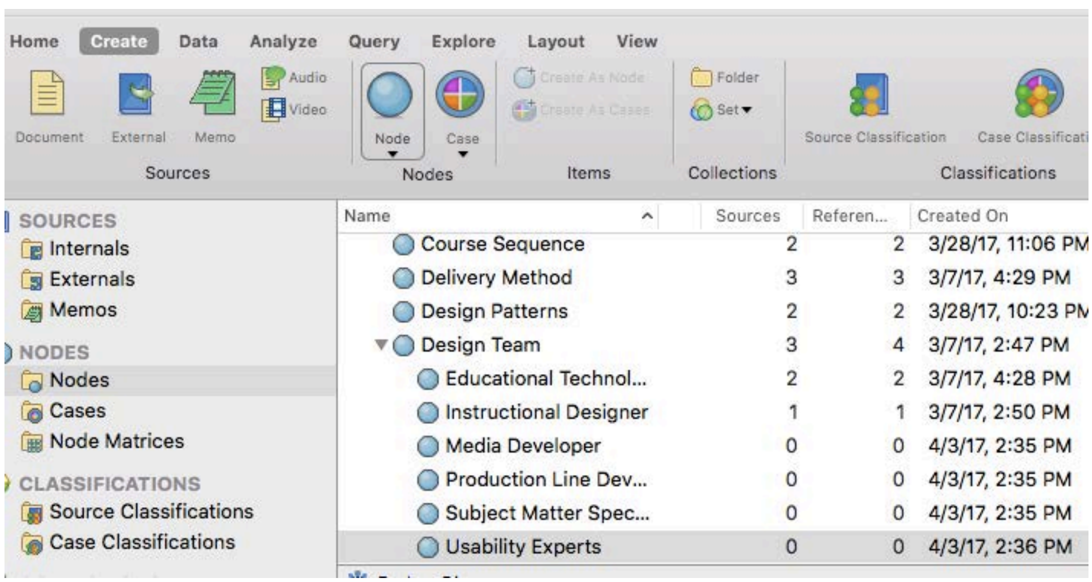

Figure 6.4: Recording topics

For example, one of the topics arisen is "Design Team", which includes actors involved in the LD-P as presented in Figure 6.5.

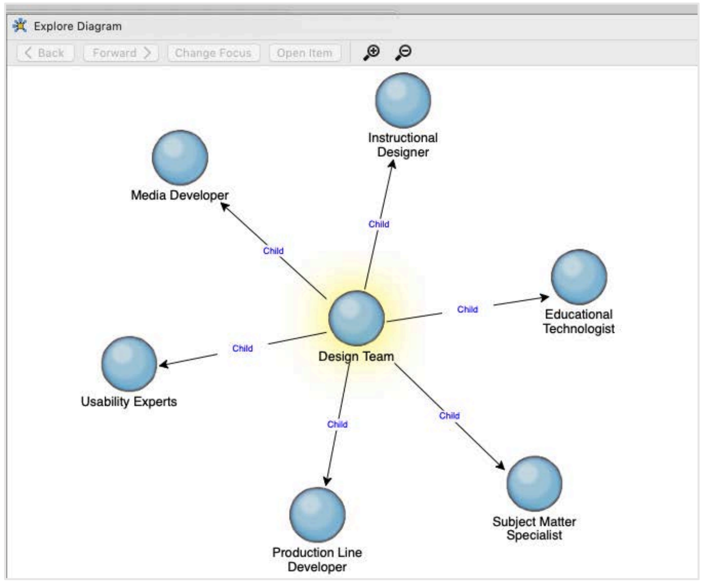

Figure 6.5: One of the topics arisen during the coding process, and its sub-components

Re-investigating topics. The second round of inspection of the transcriptions was performed to ensure that there were no additional sections and codes.

Decrease the number of listed categories. The investigator attempted to decrease the number of listed categories by regrouping closely relevant nodes (codes). ***Finalise the abbreviation of each category.*** After checking one more time the data, the abbreviation of each category was finalised (Figure 6.6).

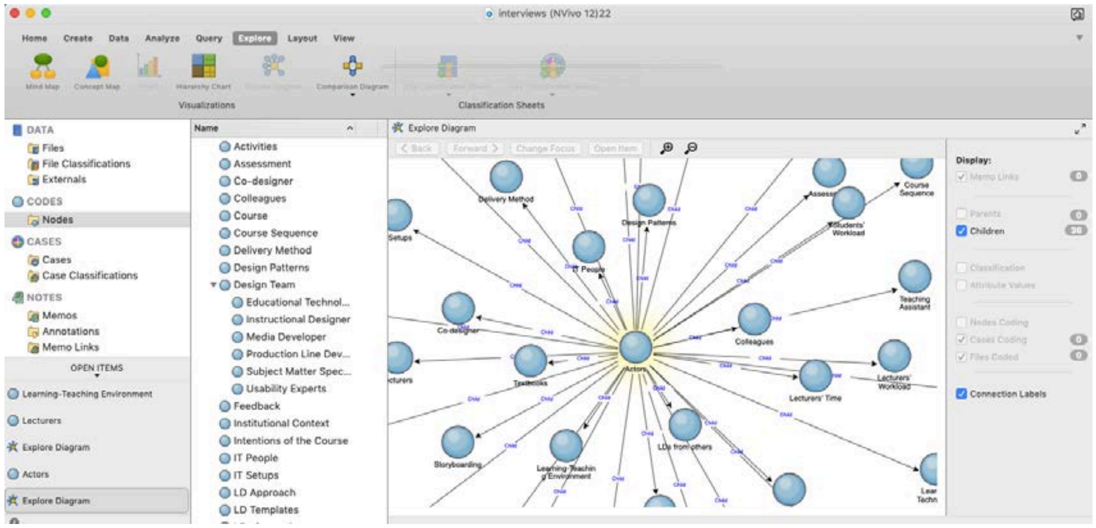

Figure 6.6: Finalise the abbreviation of each category

Collect the data elements. I saved the data elements (a part of transcribed data) under each node. NVIVO system helped us to define data elements while creating the nodes. As presented in Figure 6.7, the researcher can select nodes and the system provides all data elements that refer to this node.

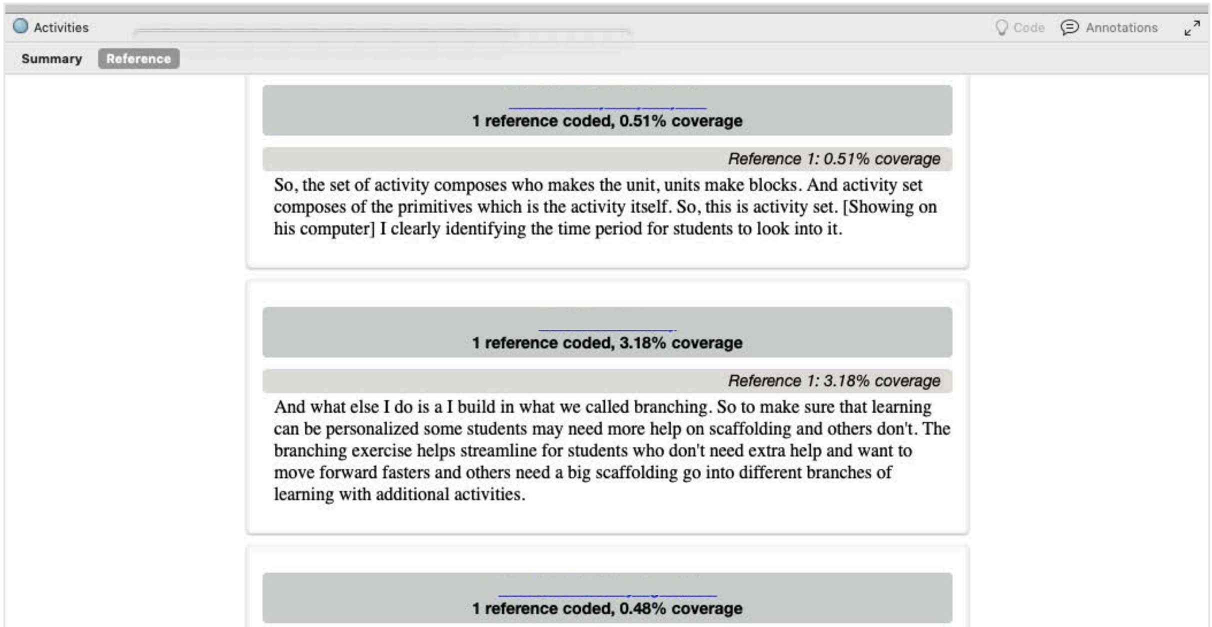

Figure 6.7: Collecting the data elements

6.1.1.3 Using coding to generate description

Coded data are examined from a sociomaterial perspective to create descriptions. The procedure for sociomaterial analysis is presented in 6.1.2.

6.1.1.4 Advancing how the themes will be presented

This step is informed by the sociomaterial analysis, as described in Section 6.1.2.

6.1.1.5 Interpretation

Data analysis and interpretation are informed by sociomateriality, as described in the following subsection, and insights are presented in the discussion section of this chapter.

6.1.2 Procedure for Sociomaterial Analysis

In this step, data are examined, focusing on responses to the questions that provide insights on LD-P from a sociomaterial angle. ANT has been adopted in the analysis process to:

- let the actors have some room to express themselves in the LD-P domain,
- explore kinds of relations and associations created among actors and concepts,
- develop descriptions based on the networks of the actors and network that is drawn by the descriptions,
- explore the kinds and qualities of networks produced through these connections,
- define what different ends are served through these networks.

The findings are presented and discussed in Section 6.2.

Member checking was employed to ensure internal validity (Creswell, 2014) – this is a process where the interviewee serves as a checker at the end of the analysis process. A dialogue regarding our interpretations of the participants' reality and meanings ensures the truth of the data. Qualitative data analysis used the QSR NVivo software and sociomateriality as an analytic lens to investigate the data.

To determine the actors involved in the LD-P, the interview data were scrutinised. The actors were defined by looking at the interview transcription, and the views of the participants about each actor were coded. In NVivo, nodes define actors as shown in Figure 6.8.

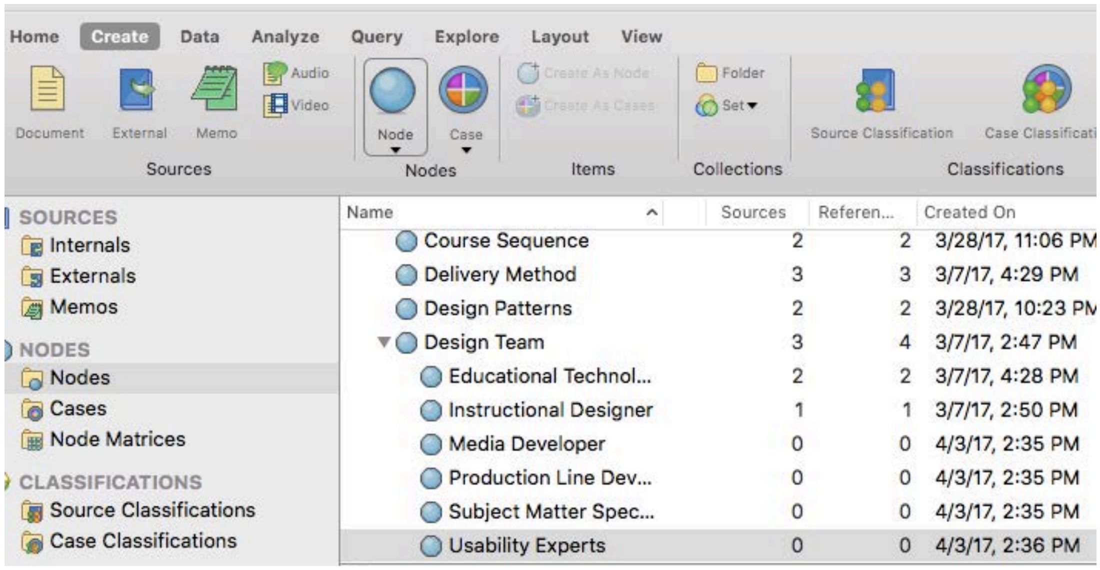

Figure 6.8. Use of NVivo to identify the actors.

To determine the entangled relations of these actors in the LD-P, the relations between actors were identified and a relational ontology of actors involved in the LD-P was developed using the Concept Draw tool as illustrated in Figure 6.9.

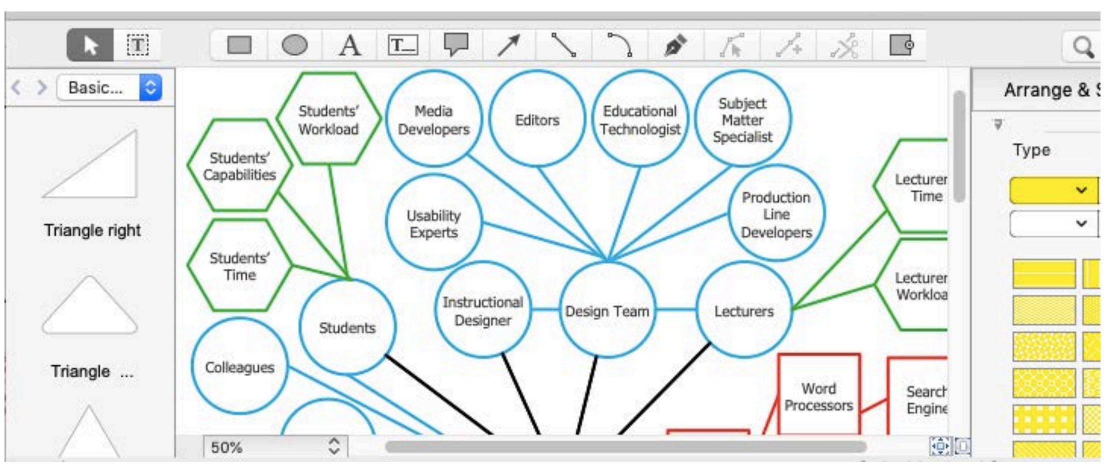

Figure 6.9. Use of Concept Draw tool to illustrate actor-networks.

To determine what boundaries or networks are created when human and non-human elements are enacted in the LD-P, LD scenarios of experts' LD-P were developed using the NVivo analysis tool and the ConceptDraw illustration tool (Figure 6.10) to predetermine boundaries of LD-P. According to sociomaterial theory, boundaries only come into being when enacted in practice, and these boundaries tell us how technology should be designed.

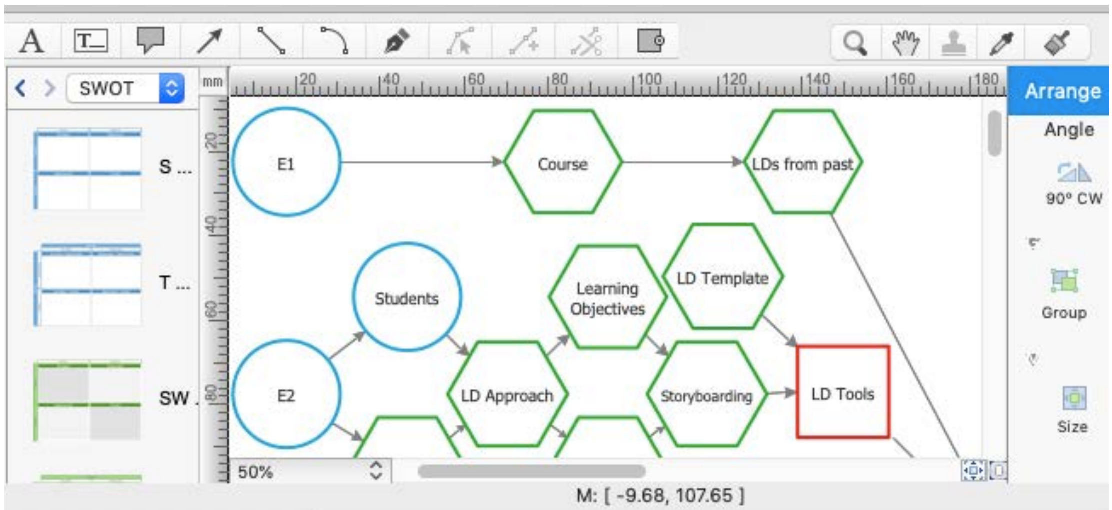

Figure 6.10. Use of a ConceptDraw tool to create LD scenarios.

The findings are presented in detail in the next section. They will inform a proposal for a new framework to design and examine LD tools and LD approaches from sociomaterial perspective in order to support the local and situated practices better.

6.2 Findings

The interview results are presented in three subsections below, according to the themes that emerged from the three sociomaterial questions, namely determining the actors, identifying the entangled relations of the actors, and defining networks and boundaries.

6.2.1 Determine the Actors of the LD-P

Analysis of the interviews led to the identification of fifty-three actors involved in LD-P; these are shown in Table 6.1. These include human actors but also technological artefacts, e.g. tools, digital objects/products, software, methods, and abstract concepts. Table 6.1 presents actors, their descriptions, number of files coded, number of references and files by codes. In Table 6.1, the term "Actor" refers to anything that "makes a difference" in LD-P (Latour, 2007, p. 71), "Description" refers to the definition of the actors given by the experts, "Files" refers to the number of participants who mentioned that specific actor, "References" refers to the numbers of times an actor was mentioned by the experts, and "Files by codes" refers to the code of the experts who mentioned the specific actors. For example, the actor, *LD Tools*, was mentioned six times by five participants. Some of the actors were mentioned by many participants, while others were pointed out by just one or two. To determine the prominent actors, we have put all actors in order according to coding references, as an indicator of consensus between the experts about the actors involved in LD-P. In fact, "Students", "LD tools", "Search Engine", "Word Processor", "Activities", "Lecturers", and "Institutional Context" are the main actors mentioned by the participants, as presented in Table 6.1.

Table 6.1. Actors, their descriptions, number of files coded, number of references and files by codes

Actors	Description	Files	References	Files by Codes
Actors in LD-P	All the actors having an influence on LD-P.	116	10	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10
Students	Students are the main target of LD and the main actors of LD-P.	5	6	E2, E3, E6, E8, E9
LD Tools	LD tools are one of the digital tools used for LD-P.	5	6	E2, E3, E4, E6, E9
Search Engine	Search engines are used to research relevant information to the LD.	5	5	E2, E3, E4, E6, E9
Word Processor	Word Processing software is commonly used in LD-P.	5	5	E2, E3, E4, E6, E9

Activities	Learning activities are an essential part of LD.	4	5	E3, E8, E9, E10
Lecturers	The lecturer is defined as the main actor of LD-P.	4	4	E1, E2, E3, E7
Institutional Context	LD-P is highly dependent on the institutional context. The institution creates conditions that shape the lecturers' roles and LD-P.	4	4	E1, E2, E8, E10
Learning Objectives	Defining the learning objectives is one of the first steps in LD-P.	3	3	E2, E9, E10
IT Setups	The learning systems, available technologies, and speed of available infrastructure are affecting how lecturers think about LD.	3	3	E3, E6, E9
Design Team	A design team normally includes various lecturers, educational technologists, usability experts, editors, instructional designer, subject matter specialist, media developers, production line, and developers.	3	4	E1, E2, E5
Teaching Assistant	Teaching Assistant influences the level of support provided in LD-P.	3	3	E1, E4, E7
Feedback	Getting feedback is an important part of LD-P.	3	3	E2, E3, E6
Delivery Method	How the course is delivered influences the LD-P.	3	3	E4, E8, E10
Learning Management System (LMS)	LDs need to be deployed into the LMS at the end.	3	3	E4, E6, E8
Learning Technology	The technology to enact teaching and enhance the learning experience influences LD-P.	3	3	E2, E8, E9
Learning-Teaching Environment	Where you are teaching, and the type of learning-teaching environment have an influence on LD-P.	3	4	E1, E3, E9
LDs from past	Lecturers sometimes use LDs used in the past by either themselves or other colleagues.	3	3	E1, E4, E9
Tools for LD	The tools used in LD-P such as word processors.	3	3	E2, E3, E9
Digital Artefacts	Digital artefacts are the digital tools used in LD-P.	3	3	E2, E3, E9
Course	LD-P is driven mainly by the overall course requirements.	2	3	E6, E8
Assessment	LD-P involves planning formative and summative assessment.	2	2	E8, E10
Course Aims	In LD-P, course aim represents what lecturers want their students to achieve in terms of the learning experience.	2	2	E2, E6
Design Patterns	Design patterns are higher-order representations of LD and sharing design patterns is an effective strategy.	2	2	E2, E4
Learning	The learning outcome is thinking of what	2	2	E9, E10

Outcomes	lecturers want students to be able to do at the end of a unit. It is one of the first aspects of LD-P.			
Resources	The resources that are available in the institutions influence LD-P.	2	2	E1, E7
Sequencing	Sequencing the topics and the activities is part of LD-P.	2	2	E8, E10
Educational Technologist	An expert in educational technology involves in the design team of LD.	2	2	E5
Co-designer	In LD-P, the co-designer influences the creation of an LD.	2	2	E1, E8
Lecturers' Time	Time influences LD-P a lot. How much time can be allocated to designing for learning relates to lecturers' workload.	2	2	E1, E7
Co-teacher	Following a co-teaching model has an influence on LD-P as sessions and assessments are planned together.	2	2	E6, E8
LDs of others	Lecturers sometimes adapt LDs created by other lecturers.	2	2	E3, E8
Students' Capabilities	Considering students' skills, abilities and competencies are required in LD-P.	2	2	E3, E9
Learning-Teaching Approach	The learning-teaching approach chosen for a course influences LD-P.	1	1	E8
IT People	Availability of IT people for support has an impact on LD-P.	1	1	E1
Storyboarding	Storyboarding is a method that can be used in pre-planning of LD.	1	3	E2
Textbooks	A core text chosen for a course affects LD-P.	1	1	E1
Editors	Editors are members of the Design Team.	1	1	E2, E5
Instructional Designer	Instructional designer sets up the online environment and actually produces the content online as a member of the Design Team of the HE institution.	2	2	E2, E5
Colleagues	Colleagues are usually involved in LD-P informally discussing LD ideas in a social network.	1	1	E1
Lecturers' Workload	Lecturers' workload has an effect on their LD-P.	1	1	E1
Team of People from Different Institutions	In some cases, a team of people from different institutions, such as external advisors, gets involved in LD-P.	1	1	E2
Media Developer	A media developer can be a member of the Design Team.	1	1	E5
Production Line Developer	Production line developer can be involved in the LD-P as a member of the Design Team.	1	1	E5
Subject	Subject matter specialist is engaged in LD-P as	1	1	E5

Matter Specialist	part of the design team.			
Usability Experts	Usability Experts are involved in LD-P as part of the design team.	1	1	E5
Personas	Students' personas are also considered when design LDs.	1	1	E2
Taking Notes	Lecturers sometimes take notes on the things that are not going well regarding LD plan while students are discussing during the class time.	1	1	E6
Cultural Norms	Workplace culture shapes LD-P as it drives innovation and engagement with LD but may also impose constraints or create reluctance in sharing ideas and changing existing practices.	1	1	E8
LD Approach	The approach/model used for LD influences LD-P.	1	1	E3
LD Templates	LD templates available in an action in the LD tools influence LD-P.	1	1	E2
Students' Time	Students' time is about how much time students are supposed to spend studying particular content depending on the credits of the module.	1	1	E7
Students' Workload	LDs need to be aligned with the workload of the students depending on the course/module.	1	1	E1
Paper and Pen	Paper and pen are used in the storyboarding phase of LD-P.	1	1	E2

6.2.2 Identifying the Entangled Relations of the Actors

This subsection focuses on the identification of entangled relations among the actors; categorising the actors into human and non-human, and also distinguishing among non-human actors, digital artefacts and abstract concepts. In the tradition of the sociomateriality, human actors are people; non-human actors refer to technological artefacts and any other actors that might have an influence on the domain under investigation. The analysis resulted in the identification of sixteen human actors, twenty-eight abstract concepts, and nine digital artefacts. Figure 6.11 shows the actors and their entangled relations highlighting human and non-human actors and abstract concepts using different shapes and colours (blue circle for human actors, red square for digital/technological artefacts, and green hexagon for abstract concepts).

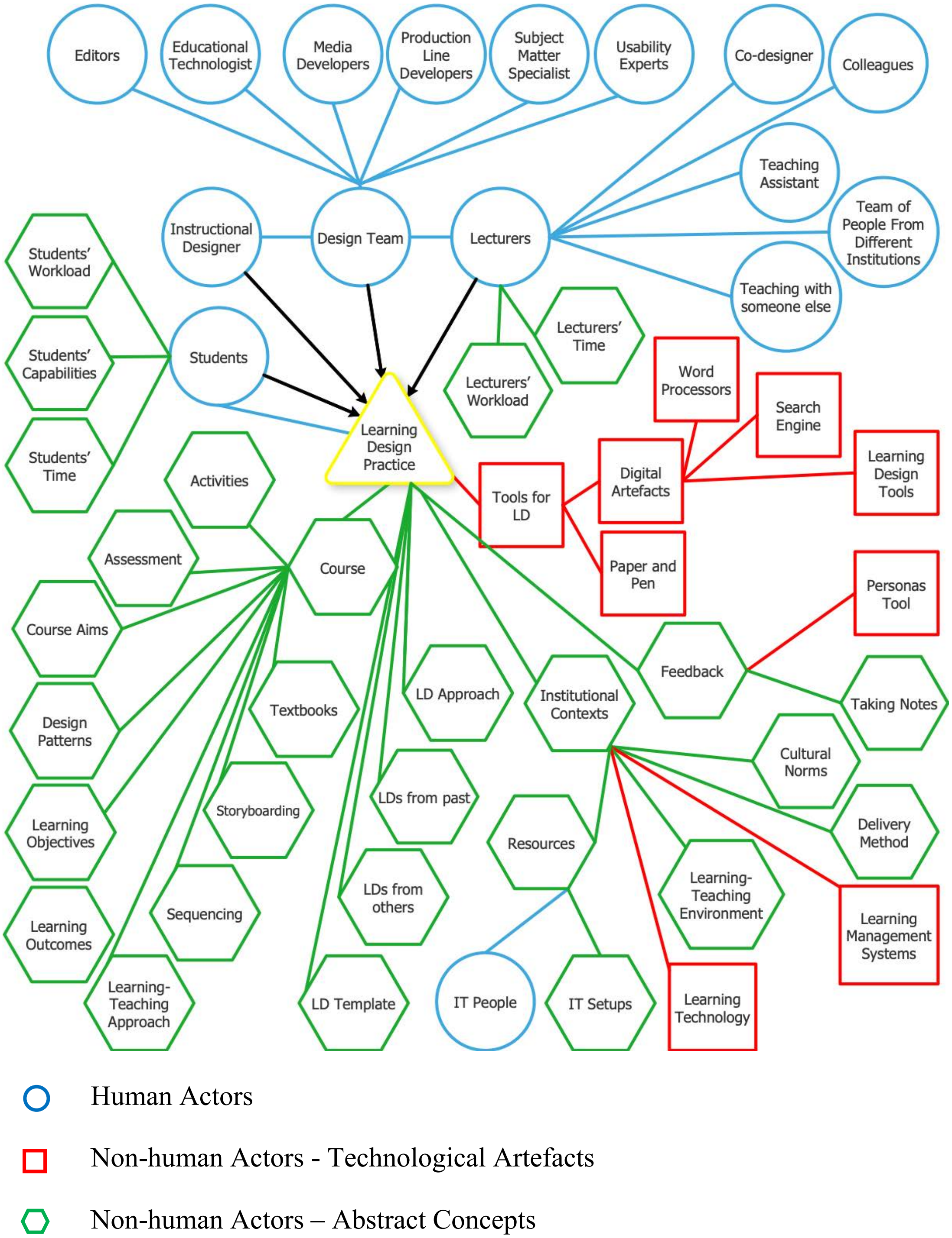

Figure 6.11. Entangled relations of the actors involved in the LD-P

Experts perceive students as key actors of the LD-P. Most participants perceive LD-P is brought into action by a design team, individual lecturers, or instructional designers. However, students can also act as designers of learning as pointed out by participant E2: "I would like to have my students involved in LD". Nevertheless, this view has been challenged in literature; for example, Masterman et al. (2009) consider the idea of "students as learning designers" as an adventurous pedagogic approach that is still an "embryonic thought". When we look at the existing LD tools and LD approaches, none of them assigns students a designer role in LD-P.

In educational institutions, human actors, artefacts, and activities are linked together forming different types of relationships at different times. These relations create sociomaterial entities of a combined nature that engage HE lecturers in bounding practices, as analysed in the following subsection.

6.2.3 Defining Networks and Boundaries

The experts interviewed are also active lecturers, working in a complex organisational environment. LD is interwoven in experts' everyday educational activities and their LD-P goes beyond their relationship with an LD tool. The sociomaterial perspective implies that LD practices are intertwined with the organisation's practice networks and other organisational practices that continually evolve. Moreover, boundaries and networks among actors – human and non-human – have temporal nature, are enacted in practice, and they are made and remade. This happens when experts put into practice their LD ideas using technological artefacts, as they engage in bounding practices. Hence, it would be beneficial to examine the LD practices that emerge, their dynamics and their impact on the embedding of LD tools, and how they are influenced by organisational realities and practices of other actors, as communicated by the participants during the interviews.

However, there are multitudinous bounding practices, emerging from artefacts within institutional LD-P, and these are temporal in nature. Although it may not be possible to create a holistic view and derive the complete set of them based on a small number of interviews, we can still gain insight by examining instances of LD-P of the experts interviewed that illustrate boundaries and actor-networks that emerge when these actors are enacted in LD-P.

Describing these practices could provide further insight into the design of LD technologies that will support better LD-P networks in HE. To this end, LD-P scenarios of the participants were created, as presented in Figure 6.12, 6.13, 6.14, 6.15, 6.16, 6.17, 6.18, 6.19, 6.20 and 6.21. These illustrate what actors come together in experts' LD-P, as captured at the interviews, and compared with the actors identified in the previous subsection. The results are presented in Figure 6.22 and Figure 6.23. As can be seen from Figure 6.22 and Figure 6.23, the number of actors in the LD practices of the experts differ considerably from the previous findings illustrated in Figure 6.11. Comparing the networks reveals a misalignment between the experts' views of LD tools, LD approaches and LD tools, and the bounding practices that emerge in educational institutions when these experts perform LD activities.

Participants' bounding practices enact LD artefacts by engaging in mutual relations with other actors and linking together various technological artefact and concepts. They enact artefacts in diverse ways through bounding practices connecting and disconnecting relations in a timely manner. In Figure 6.12, one can see, for example, that E1 has taught two modules, designing and running one of these courses for the last five years, and the other course for 20 years. E1 has already established experience on the design of these modules and adapts LDs from previous years. Therefore, in E1's LD-P, three actors come together as illustrated in Figure 6.12 (see also Figure 6.22).

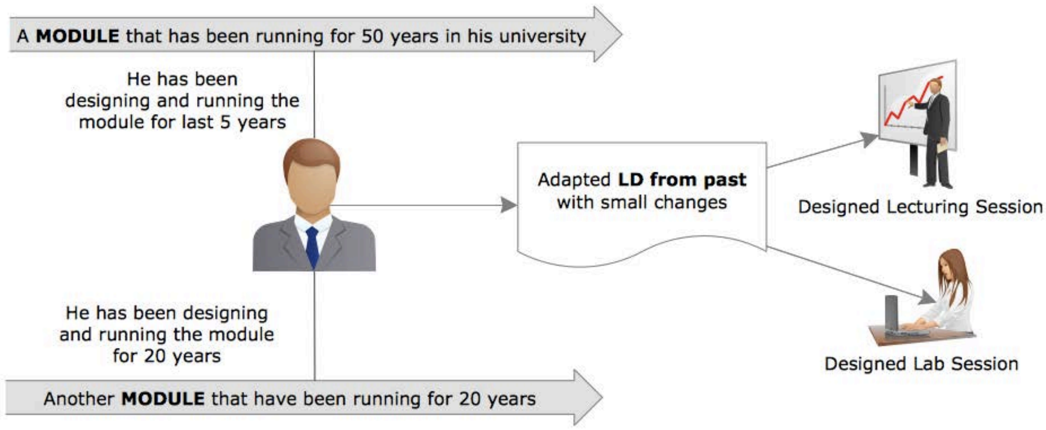

Figure 6.12 E1's LD-P

In contrast, as presented in Figure 6.13, E2 follows more complex approach enacting a network of relations among human and non-human actors (see also Figure 6.22): understand the needs of the learners and what course is taught first, then decide on the LD approach that should be used, and define the learning objectives and the intentions of the course. E2' LD-P includes artefacts, like storyboarding and, sometimes, LD templates from previous years. Furthermore, E2 uses LD tools to create LDs.

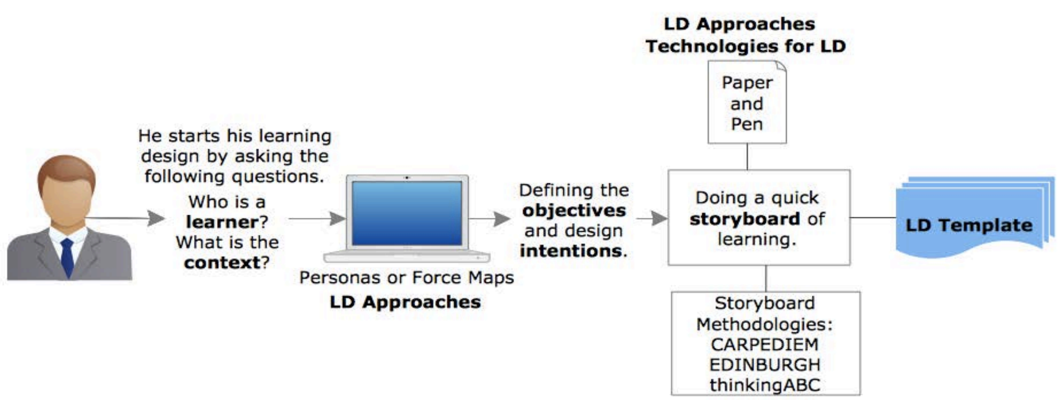

Figure 6.13. E2's LD-P

E3 uses the backward planning sequence approach and learning–teaching approaches to LD (Figure 6.14). E3 identifies desired results, determines acceptable evidence, plans to learn experiences and instruction, and considers branching learning activities to make sure that learning is personalised.

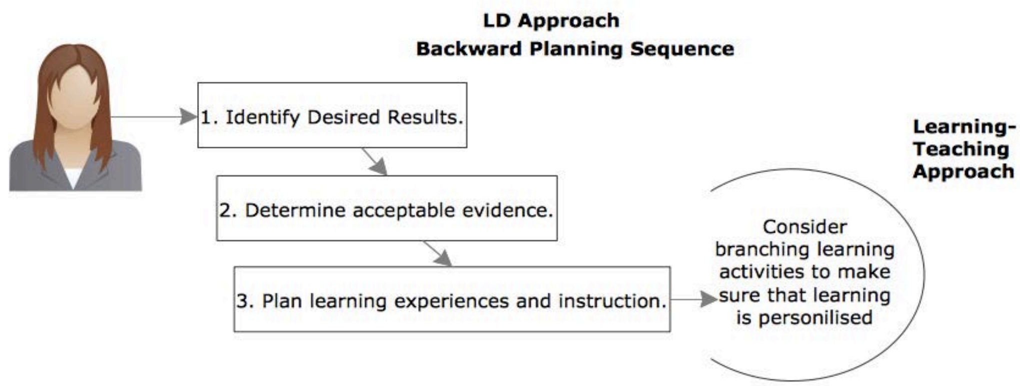

Figure 6.14. E3's LD-P

As portrayed in Figure 6.15, E4 adapts LDs from past and redesigns activities using LD approaches and LD tools. Then, E4 deploys the design into the learning-teaching environment. Several actors are enacted in this instance of E4's LD-P as shown in Figure 6.22.

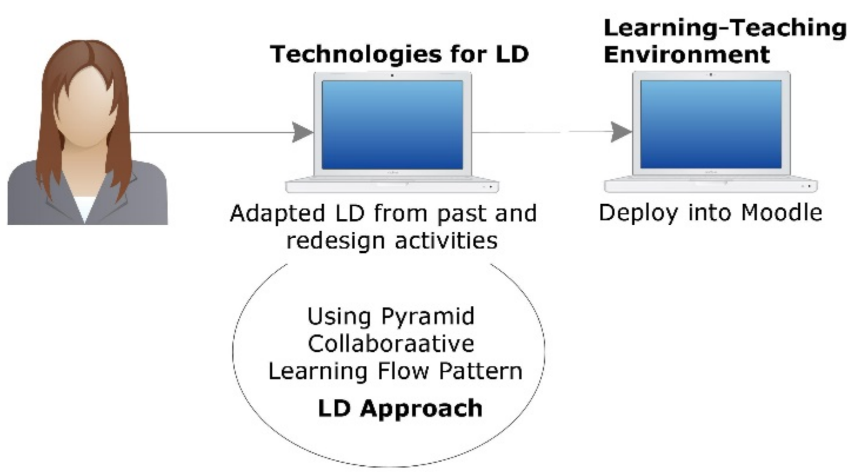

Figure 6.15. E4's LD-P

E5 starts designing LDs by asking questions about what the context is, who the learners are, what the criteria of the learners are, what the characteristics of the learning objectives are, what type of learning objectives should be obtained, and what technology will be used. This practice is illustrated in Figure 6.16, while actors and relations are shown in Figure 6.22.

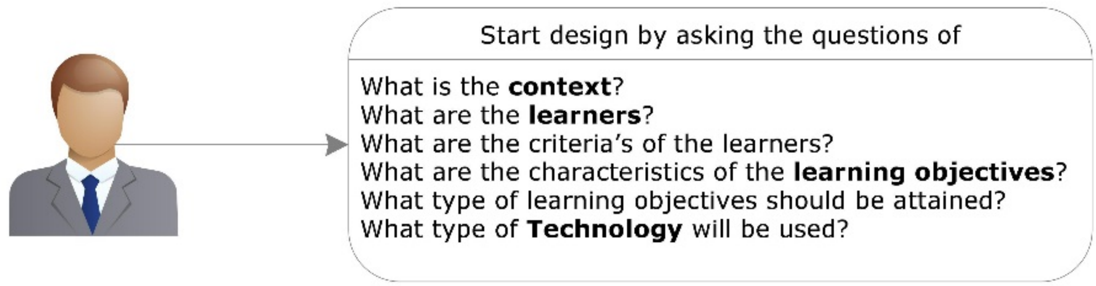

Figure 6.16. E5's LD-P

E6 considers feedback from the previous year, uses LD tools, and deploys materials into Moodle. The LD-P of E6 is illustrated in Figure 6.17 and the actors involved are shown in Figure 6.23.

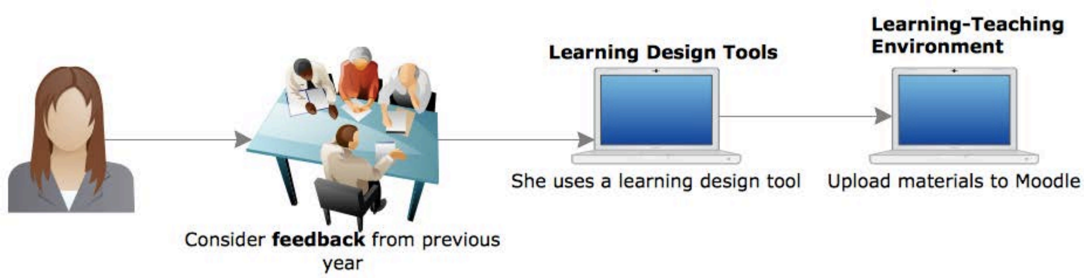

Figure 6.17. E6's LD-P

E7 starts LD by defining the learning objectives (see Figure 6.18). Then, E7 thinks about how objectives would map to a particular week, the topic that would be covered, how the assessment will be, how to map the activities and students' expertise, skills, and how to bring them together to take the activities. Finally, E7 designs the content and the activities that students would like to take for that week. E7's LD-P is supported by technological artefacts (see Figure 6.23).

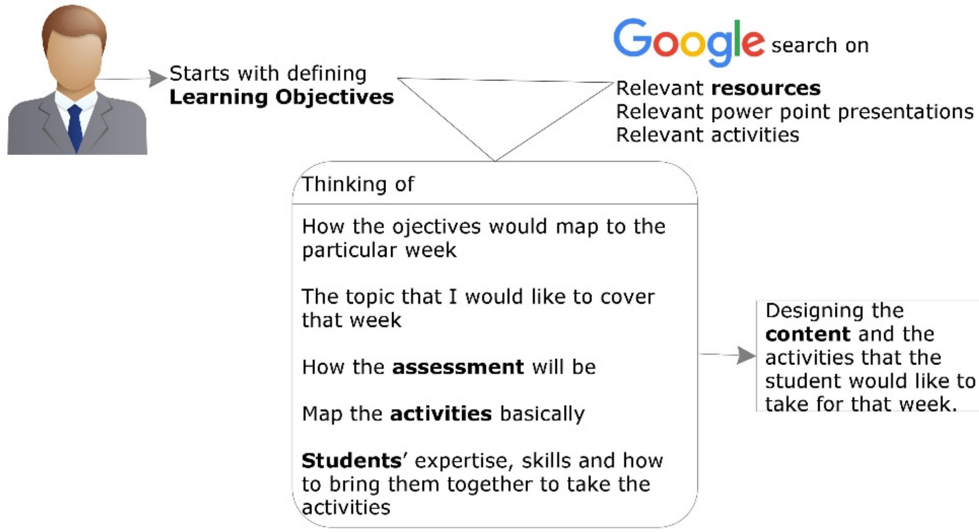

Figure 6.18. E7's LD-P

E8's LD-P is presented in Figure 6.19. The LD-P starts with an adaptation of LDs from the past. It involves designing activities, which are associated with assessments, setting timings, revising learning objectives, and considering students' prior knowledge and skills. Sequencing is another critical aspect of the LD process. Lastly, E8 deploys LDs into the institutional VLE. E8's LD-P network is influenced by organisational standards for VLE content creation and is supported by technological artefacts, as shown in Figure 6.23.

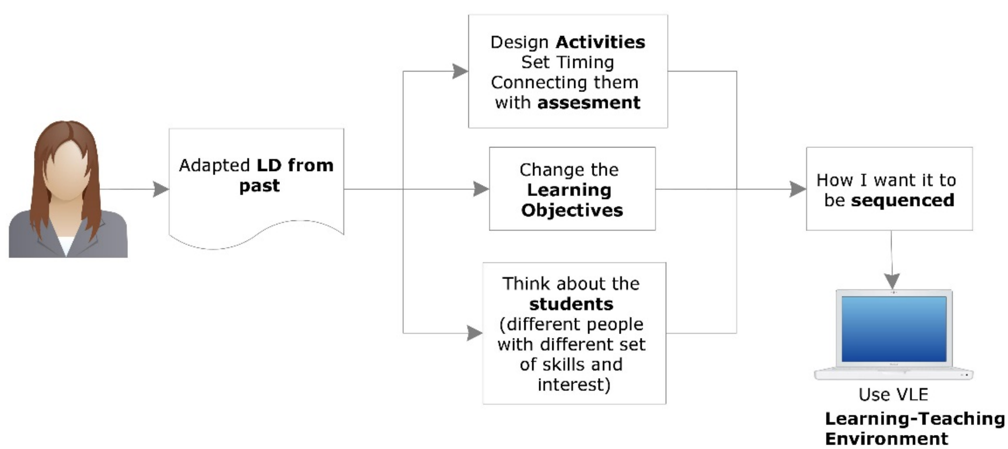

Figure 6.19. E8's LD-P

E9 uses LD technological artefacts to guide their LD thinking about the aims of the course, the learning outcomes, the design of the activities and the allocated resources (see Figure 6.20). The last action for E9 is to export the LDs into the institutional learning-teaching environment. The actors involved in E9's LD-P are depicted in Figure 6.23.

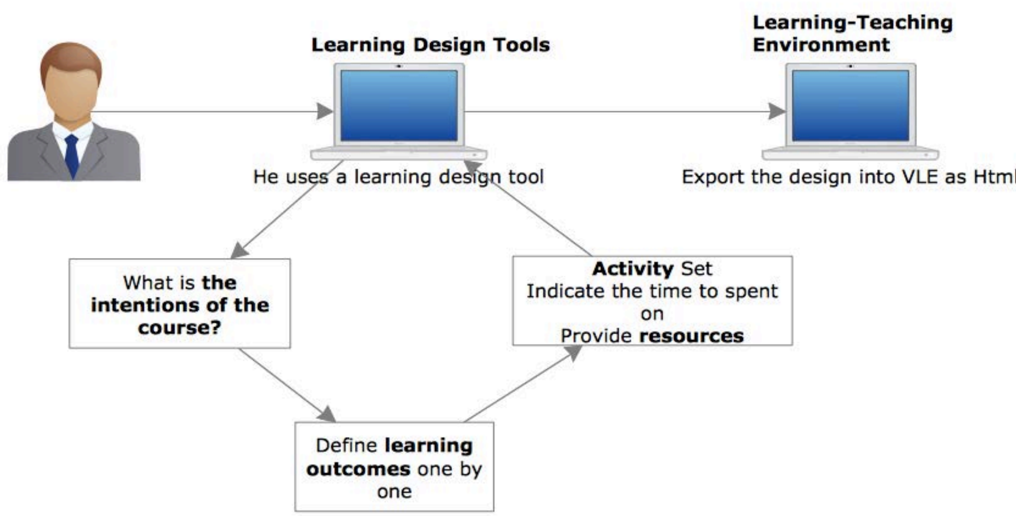

Figure 6.20. E9's LD-P

In a similar vein, E10 starts thinking about the learning objectives and the aims of the course, and then, about the learning outcomes but no LD technological artefacts are used. Assessments that align with learning objectives and course sequencing of the designed activities are produced. E10's LD-P is given in Figure 6.21. Although LD technological artefacts are not used in E10's LD-P, there is the use of technology as indicated by the relevant non-human actors in E10's LD-P network shown in Figure 6.23.

Figure 6.21. E10's LD-P

As already mentioned, in all cases there is little overlap between the actors in the LD-P networks of the experts and the actors identified in the previous subsection. One can easily compare the LD-P network of Figure 6.11 with experts' LD-P networks presented in Figure 6.22 and Figure 6.23, which show that there are three actors in E1's LD-P; nine actors in E2's LD-P; two actors in E3's LD-P; four actors in E4's LD-P; four actors in E5's LD-P; three actors in E6's LD-P; six actors in E7's LD-P; seven actors in E8's LD-P; six actors in E9's LD-P, and five actors in E10's LD-P.

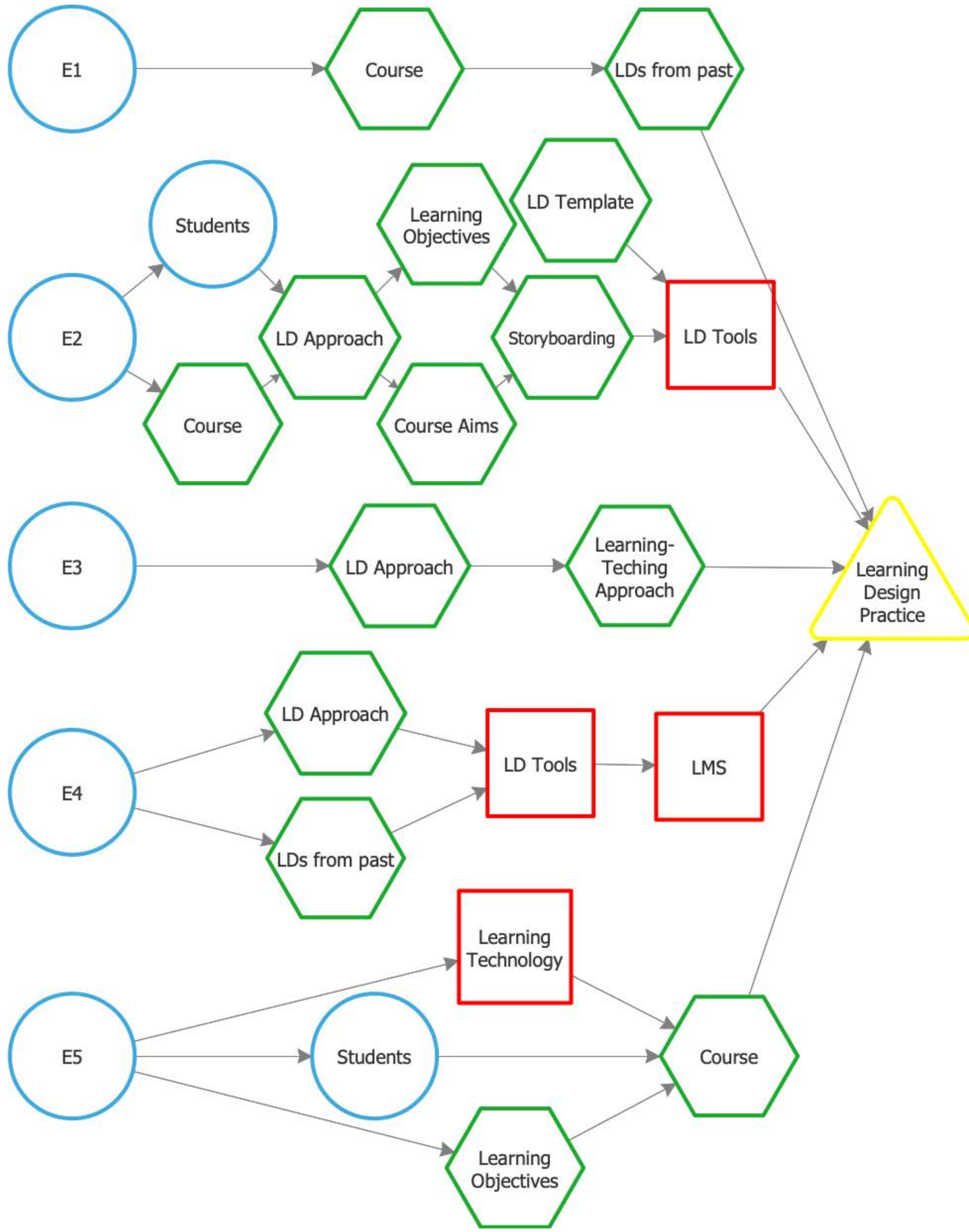

Figure 6.22. Actors and their relations in experts' LD-P

One of the interesting points to highlight here is that experts do not necessarily use the LD tools they developed in their daily LD-P. In Figure 6.22 and Figure 6.23, we see that only E2, E4, E6, and E9 use LD tools in their LD-P. This finding reinforces the view (see Chapter 2) that LD tools embedding in HE organisations remains limited. Moreover, the data presented in this chapter, as well as in Chapters 4-5, reveal that the existence of heterogeneous work practices in HE, the varying technical competencies of HE staff and the complex organisational arrangements of HE institutions generate a misalignment between LD tools and HE practices which impacts the adoption of LD technologies.

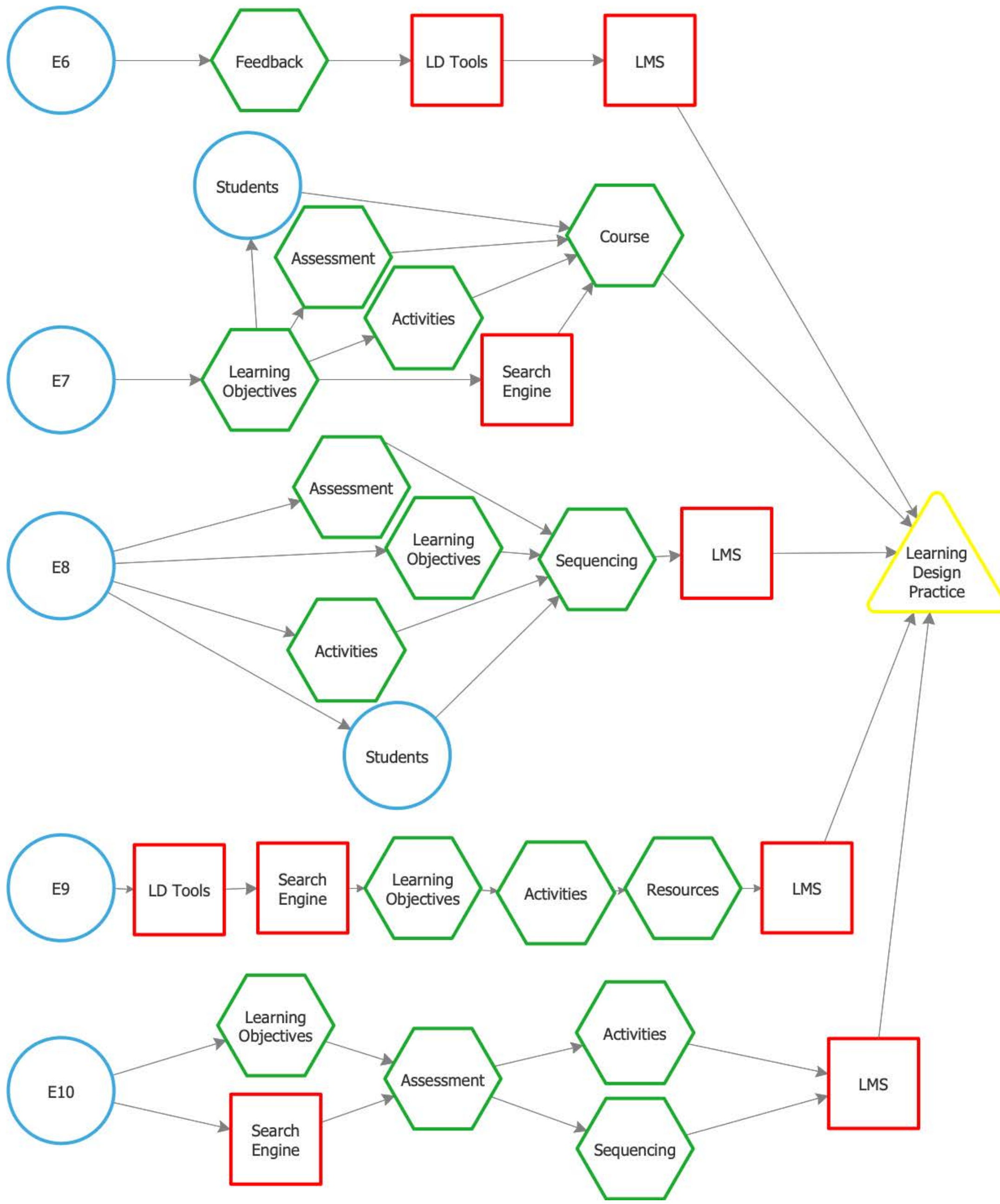

Figure 6.23. Actors and their relations in experts' LD-P

Another point to highlight here is that, in HE institutions, some of the courses offered are very well structured. For example, they have been taught for several years, as they are core subjects in the particular discipline, like in the case of E1 who mentioned that "it is a course that has been designed and enacted for last fifty years". The module, its topics, and the objectives that will be covered each week of a module are already known for years in this case. E1 adds that the course "suffered from several changes; then, it became stable regarding lecturing and problems". This is in line with practice encountered in some educational institutions to assign lecturers already prepared modules as happened in E1's case. Although this cannot be generalised, it does not change the fact that sometimes lecturers are not seen as designers of their modules. E1 states that "on the other hand, I was in charge of another course in computer education for twenty years, so, I was the main designer and responsible for everything".

6.3 Towards a Sociomaterial Design Framework: the LD experts' perspective

This section takes a first step towards constructing a framework for designing and evaluating LD tools from sociomaterial perspective. It builds on the findings and analyses of the previous sections to introduce a new conceptual framework (model 1). The dimensions of the conceptual model have been formed from the analysis of the experts' views on LD-P and their LD-P presented in the previous sections. From the fifty-three actors identified in the previous section, the ones considered closely related were combined and then associated with twenty-five elements, in the form of exploratory questions, as shown in Table 6.2. The formed dimensions of *designers*, *students*, *institution*, *course*, and *technology* are defined in the following paragraphs.

The *Designers* dimension aims to explore relevant actors and their needs in LD-P. It is about the considerations of LD-P from the designers' perspective. According to the results given in the previous section, lecturers' time and workload are two important factors that need attention, and a lecturer practises LD often in collaboration with a design team, co-designer, colleagues, people from other institutions, or co-teachers. Therefore, there are two elements/questions that can be used to guide our exploration of this dimension when examining LD artefacts, as shown in Table 6.2.

The *Students* dimension aims to deal with whether the artefact (e.g. LD tool) meets students' expectations. Students' time, workload, and competencies are factors for consideration when taking up LD-P.

The *Institution* dimension is about considering the institutional requirements when a designer practises LD. According to experts' view, delivery method, institutional context, work culture at an institution, and availability of IT setups, IT people, Learning Technologies and LMS all have an influence on LD-P in institutional contexts.

The *Course* dimension covers aspects of a course and the actors related to it. Course aims, learning objectives, learning outcomes, assessment, and activities are the main components of LD at the course level and they need to be defined. Besides those components of LD, other actors need attention in LD-P. These actors are textbooks, learning-teaching approach, sequencing, storyboarding, design patterns, feedback, and LD approach, LD from Past, LD Template and LDs from others.

Lastly, the *Technology* dimension is concerned with the requirements of technology in LD-P, such as desirable features of LD tools (exporting/importing LDs in different file formats, communication and interoperability tools, advice, guidance and recommendation capabilities), and other technological artefacts relevant to LD-P.

Table 6.2. The conceptual framework for LD tools

Dimensions	Actors	Exploratory Questions
Designers/ Lecturers	Lecturers' Time and Workload	Is time spent on LD reduced?
	Design Team	How is the nature of the designers/lecturers' collaborative practice, e.g. when discussing ideas or co-designing, accommodated?
	Co-designer	
	Colleagues	
	People from other Universities	
	Teaching Assistant	
	Co-teacher	
Students	Students' Time and Workload	How are students' workload and study time organised and monitored?
	Students' Capabilities	How are students' skills, abilities, and competencies

		presented and accommodated?
Institution	Delivery Method	Is the delivery method of the course considered?
	Cultural Norms / Institutional Contexts	How are workplace requirements and institutional context of LD-P considered?
	Resources	Is information about learning resources available at the institution provided?
	IT Setups	What information about IT setups at the institutions is made available?
	IT People	What information about IT support at the institutions is given?
	Learning Technologies	Are there any recommendation functionalities to help lecturers to decide what learning technology to use?
	LMS	Are functionalities to import/export LDs and exchange data with LMS/VLEs provided?
Course	Course Aims	Is it possible to define and align course aims, learning objectives, learning outcomes, assessment, and activities?
	Learning Objectives	
	Learning Outcomes	
	Assessment	
	Activities	
	Textbooks	Are LDs based on the core reading text provided, or can they be easily created?
	Learning-Teaching Approach	What features/functions are provided to enable defining learning-teaching approaches?
	Sequencing	Is the sequencing of the course and activities considered?
	Storyboarding	What tools for storyboarding are available?
	Design Patterns	What editable and sharable design patterns and LDs are available?
	Feedback	Is feedback from students regarding LD experiences considered?
	LD Approach	What guidance and support for various LD approaches are provided?
	LD from Past	What tools/functions are available to import and edit past LDs?
	LD Template	Are LD templates provided?
	LDs from others	What tools for browsing and customizing other people's LDs are available?
Technology	Word Processors	Are facilities to export LDs in various file formats available?
	LD Tools	What features for communication, interoperability and data exchange with other LD tools are available?
	Search Engine	How is searching for LDs, digital objects and artefacts supported?

6.4 Discussion

The sociomaterial perspective analyses how technology is enacted into LD endeavours, revealing the actors' complex interrelations and the boundaries that come into existence in LD-P. In the literature, there have been studies that investigated LD-P of the HE lecturers, such as (Prieto et al., 2014; Stark, 2000; Norton et al., 2005; Bennett et al., 2008; Bennett et al., 2011; Bennett et al., 2014; Nguyen & Bower, 2018). However, these studies did not consider the complex sociomaterial environment and all the actors. Unlike these studies, which were mainly human-centric in LD, this study contributes by considering all the human and non-human actors as a matter in the LD-P.

Studying the LD-P from sociomaterial perspective presents us new insights about the LD-P of HE lecturers, which can be used to create new conceptual models for the LD process and inform the design of LD tools. One of the findings is that there is a difference between experts' perceptions of the LD-P and their LD-P when they design their course. When we looked at the boundaries and networks that emerge from the participants' LD-P, we realised that only a subset of the actors involved in LD-P emerged, i.e. 20 out of 53 actors. When the analysis of actors and bounding practices was extended to LD artefacts, e.g. tools and approaches, again a partial overlap was also detected with the sixteen human actors and thirty-seven non-human actors (these include twenty-eight abstract concepts and nine digital artefacts) originally defined by the experts.

Analysing these networks and bounding practices and the gaps between experts' perceptions of the LD-P and how this is materialised in organisational contexts helped us to introduce a new conceptual framework for LD. This a first step towards the development of a sociomaterial design framework for the examination of LD tools and LD approaches and the derivation of design principles for LD tools later in Chapter 8 and Chapter 9. As mentioned above, although in LD literature, there have been studies on understanding LD-P (Prieto et al., 2014; Bennett et al., 2011; Charlton et al., 2009), albeit not from sociomaterial perspective, there has been no attempt to provide general design principles for LD tools. An exception is a study by Albó & Hernández-Leo

(2018) that derived design principles for a very specific LD tool that targeted high school teachers.

In contrast to previous work that considered LD-P as something that is merely happening between teachers and students, this study explored both human and non-human actors, including abstract concepts and digital artefacts, and identified sixteen human actors and thirty-seven non-human actors. All these actors connect in a complex manner and engage in bounding practices.

Looking at the field of LD through the lenses of sociomateriality helps to identify the actors involving in LD-P and understanding all the factors that shape LD-P matters. This holistic view of LD and LD-P through sociomateriality can potentially help LD practitioners and researchers, in general, as well as decision-makers, to develop an enhanced conceptual understanding of factors influencing LD tools adoption and embedding in educational institutions, and of the requirements for these tools. However, it is essential to bear in mind the possible bias in the responses and analysis process. In order to avoid bias, increase objectivity and explore the credibility of the results member checking, also known as informant feedback, was used as a way to validate and improve transferability of the results of the study. To develop a full picture of LD-P from the sociomaterial perspective, in the next chapter, we conduct a survey of HE lecturers with a broader population.

6.5 Summary and Contribution of the Chapter

In this chapter, we explored experts' LD-P and their views on LD-P in HE from sociomaterial perspective. Data were collected through ten interviews with well-established professionals within the LD field. The qualitative data analysis was guided by the fundamental principles of the sociomaterial theory, and member-checking methods to ensure internal validity were adopted. This allowed identifying human and non-human actors involved in the process of LD, and their entangled relations. Understanding human and non-human relationships can help to reflect on the particular realities of the LD-P in HE and can potentially highlight opportunities for change. Moreover, the chapter developed a conceptual model as a first step toward the development of a sociomaterial design framework for LD tools and approaches.

LD literature has already highlighted the need for better understanding of the actual LD-P and the realities in HE. In this vein, the chapter contributed a new perspective of analysis inspired from sociomateriality to explore LD experts perceptions of the LD-P in HE and of their own LD-P. Looking at the data from a sociomaterial angle enhances our understanding of LD-P phenomena. The results of this study can contribute to the field by informing the design of new LD tools that will support better LD-P in HE. The findings revealed that there is a gap between the actual LD-P of the HE lecturers and the LD-P models used in existing LD tools and LD approaches, and this seems to be one of the main issues that prevent the adoption of LD tools in daily LD-P. Also, they highlight the complexities of the LD-P in HE as different actors are engaged in LD following heterogeneous work practices and the LD-P is influenced by organisational arrangements, local practices, technologies, and level of support. To further understand LD-P of HE lecturers, an online survey designed and conducted with a wider population of HE lecturers is presented in the next chapter along with the findings from sociomaterial perspective.

Chapter 7

HE Lecturers' LD-P: A Sociomaterial Perspective

To get a deep insight into the LD-P of HE lecturers, we surveyed 110 HE lecturers and explored their LD-P from sociomaterial perspective. The findings can be potentially useful to elicit HE lecturers' requirements for LD and analyse their current practices and perceptions of LD and LD tools. Relevant methodological issues for conducting the survey were presented in Section 5.1 and the steps undertaken for data analysis in Section 5.1.4. The analysis in this chapter follows a similar approach to the procedure for sociomaterial analysis described in Section 6.1.2.

The chapter is organised as follows. We proceed in Section 7.1 with a presentation of the results of the survey including identification of the actors involved in the HE lecturers' LD-P, entangled relations of the actors, and networks that come to existence when the actors are enacted in LD-P. Section 7.2 contributes a second step towards constructing a sociomaterial design framework for LD tools and LD approaches by exploiting the findings of the survey. Section 7.3 discusses the findings and Section 7.4 gives the summary and contribution of this chapter.

7.1 Findings

The survey results are presented in three subsections below, according to the themes that emerged from sociomaterial perspective, as discussed in Section 6.1, namely determining the actors, identifying the entangled relations of the actors, and defining networks and boundaries.

7.1.1 Determine the Actors of the LD-P

The investigation revealed sixty-one actors are involved in the HE lecturers' LD-P: four of them are identified as human actors; fourteen are technological artefacts; forty-three are abstract concepts.

The actors, their descriptions, the number of files (number of respondents who mentioned that specific actor) coded, number of references (number of times respondents referred to that actor) for human actors and digital artefacts are presented in Table 7.1 and Table 7.2 respectively.

Table 7.1. Human Actors

Human Actors	Description	Files	References
Lecturers	The main actors of LD-P.	110	110
Students	The main target audience and a key actor of LD-P.	4	4
Co-lecturer	Following a co-teaching model has an influence on LD-P as sessions and assessments are planned together.	1	1
Colleagues	Colleagues are involved in LD-P informally discussing LD ideas in a social network.	7	8

Table 7.2. Technological Artefacts

Technological Artefacts	Description	Files	References
Virtual Learning Environment (VLE)	LDs need to be deployed into VLEs at the end of the LD process.	28	28
Website	Lecturers create websites to share courses or lesson designs.	3	3
Whiteboard	Whiteboards are used to draw the overall LD structure.	7	7
Wiki	Wiki is used to share LDs.	1	1
Google Docs	They are used to develop LDs together with colleagues.	1	1
Mind Map Tools	Lecturers create a mind map of LDs using the tools.	6	6
Note-taking tool	Note-taking tools are used to create outlines of the LDs.	1	1
Paper-based tools	Paper-based tools facilitate drafting a plan of LDs.	39	40
Post-it	It is used to brainstorm LD ideas and organise them.	1	1

Video Tools	Video tools are used to create content for the class.	2	2
Slide Tools	Software for creating presentations and mock-ups and bringing LD ideas together.	68	67
LD Tools	LD tools are used to create LDs.	3	3
Word Processors	Word processing software is commonly used to produce LDs.	2	2
Learning Technologies	Technologies that can be used to enhance the learning experience.	3	3

Abstract concepts are grouped into four themes: human-related, course-related, institutional, and feedback related - these are presented in Table 7.3, Table 7.4, Table 7.5, and Table 7.6 respectively.

Table 7.3. Human-Related Abstract Concepts

Abstract Concepts related to Human Actors	Description	Files	References
Lecturers' Values	Lecturers' values influence LD-P.	1	1
Students' Prior Knowledge	Students' prior learning is important in LD-P.	4	4
Students' Needs	Lecturers consider students' needs in LD-P.	2	2
Students' Access to Resources	Availability of institutional or remotely accessible resources is important.	1	1
Students' Motivation	Students' motivation influences LD-P.	1	1
Time	Lecturers and students' time affect LD-P.	1	1

Table 7.4. Course Related Abstract Concepts

Abstract Concepts related to Course	Description	Files	References
Course	LD is driven by overall course requirements.	17	17
Course Aims	Lecturers specify the aims of a course in terms of the learning experience and student achievement.	10	10
Educational Level	LDs are created according to the level of the course.	1	1
Learning Objectives	The learning objective is a starting point in LD-P.	5	5
Learning Outcomes	The learning outcome represents what students should be able to do at the end of a unit.	71	71
Activities	Lecturers need to think about and design activities.	32	38
Assessment	Assessment serves also as a starting point for LD-P.	18	19
Teaching-learning Approach	The type of learning influences LD-P.	1	1
Course Sequence	Sequencing the topics and activities is part of LD-P.	4	4
Course Timing	Timing of the LD and activities is part of LD-P.	2	2

Existing Slides	Lecturers reuse existing slides and refine them.	5	5
Online Research	Search online for materials relevant to the LDs.	2	2
Existing LDs	Lecturers adopt and refine previous LDs.	6	6

Table 7.5. Institutional Abstract Concepts

Abstract Concepts related to Institutions	Description	Files	References
National Standards	LDs need to align with national standards.	1	1
Cultural Norms	Workplace culture shapes LD-P.	1	1
Institutional Standards	LDs need to align with institutional standards.	3	3
Resources	Availability of learning resources influences LD-P.	1	1
Syllabus	The syllabus influences LD-P.	4	4
Course Book	Some lecturers adopt a core textbook and follow it in their course.	4	4
Availability of Technology	Availability of technology in the classroom affects LD-P.	1	1
Curriculum	The curriculum influences LD-P.	3	4
Delivery Method	How the course is delivered influences LD-P.	15	15

Table 7.6. Feedback-Related Abstract Concepts

Abstract Concepts related to Feedback	Description	Files	References
Feedback	Feedback about how well the lesson went in relation to LD aspects.	3	3
Personal Notes	Lecturers notes about aspects that need improvement during class time.	1	1
Observation	Lecturers observe the way students react in class to indirectly get feedback.	10	10
Course/module review at the end	Lecturers review LDs at the end of a course.	1	1
Success Criteria	Lecturers measure LDs according to their effectiveness for supporting students to meet the specified success criteria.	1	1
Self-reflection	Lecturers reflect on LDs at the end of a course.	10	10
Learning Analytics	LA can be exploited as a feedback mechanism.	1	1
Formal Students' Evaluation	This is a standard formal evaluation method, formative or summative.	21	22
Examination	Exam results are also used as feedback.	3	3
Feedback Form	The institutional feedback forms are used.	10	10
Survey	A survey is a way of getting feedback.	22	22
Informal Students'	Feedback is received via informal methods.	38	38

Evaluation			
Written Students' Evaluation	Students write anonymous comments to the lecturers about the course.	6	6
Discuss with Students	Lecturers discuss the lesson with students.	38	38
Word of mouth	Word of mouth is a way of getting students' feedback on the course.	1	1

From Tables 7.3-7.6, it can be seen that some of the actors are frequently mentioned while others are highlighted by very few HE lecturers. From a sociomaterial perspective, anything that has an influence on the practice matters and should not be neglected. Therefore, all the actors mentioned here are considered equally valued in LD-P. To better understand the actors, in the next section we explore actors' entangled relations in more details.

7.1.2 Identifying the entangled relations of the actors

As the actors have been categorised in the previous section, this section presents the actors' entangled relations highlighting human and non-human actors, and abstract concepts and digital artefacts using different shapes and colours (the notation introduced in Chapter 6 is an adopted blue circle for human actors, red square for digital artefacts, and green hexagon for abstract concepts). Their entangled relations are illustrated in Figure 7.1.

According to the lecturers, there are four human actors involved in LD-P namely lecturers, co-lecturers, colleagues, and students. Lecturers and co-lecturers are usually involved in the LD-P. However, colleagues are also considered as highly influential for lecturers LD-P as they provide design ideas. Students are always seen as the people who are LDs created for, and they do not normally get involved directly in the design process, so they are not considered as learning designers.

Various technological artefacts are involved in the LD-P of the HE lecturers- many are digital but there are also some non-digital artefacts. Paper-based tools and whiteboard are used in practice for noting initial thoughts and post-it for mind-mapping. Then, lecturers employ digital tools to create a digital version of their LDs. However, there are several participants whose practice is heavily based on digital tools: word processor or Google Docs to textually represent their LDs, mind mapping tools to map their design ideas, LD tools to design for their learning, note-taking tools in the conceptualisation of their LD, video tools to produce videos for their classroom, learning technologies to enrich the classroom activities and to improve learning outcomes. Lecturers also use a website, VLE or Wiki to publish their LDs and supporting documents. Furthermore, slides are popular elements of LD-P to present content to students. They are used to present learning aims, learning objectives, learning outcomes, details about how the course will be evaluated, activities, duration of course, and roles of the teachers and students during the course.

According to the HE lecturers, there are also various abstract concepts in LD-P. These concepts can be categorised as students related, lecturers related, concepts related to feedback, pedagogy related concepts, institutional concepts, and other concepts- see also green hexagons for abstract concepts in Figure 7.1.

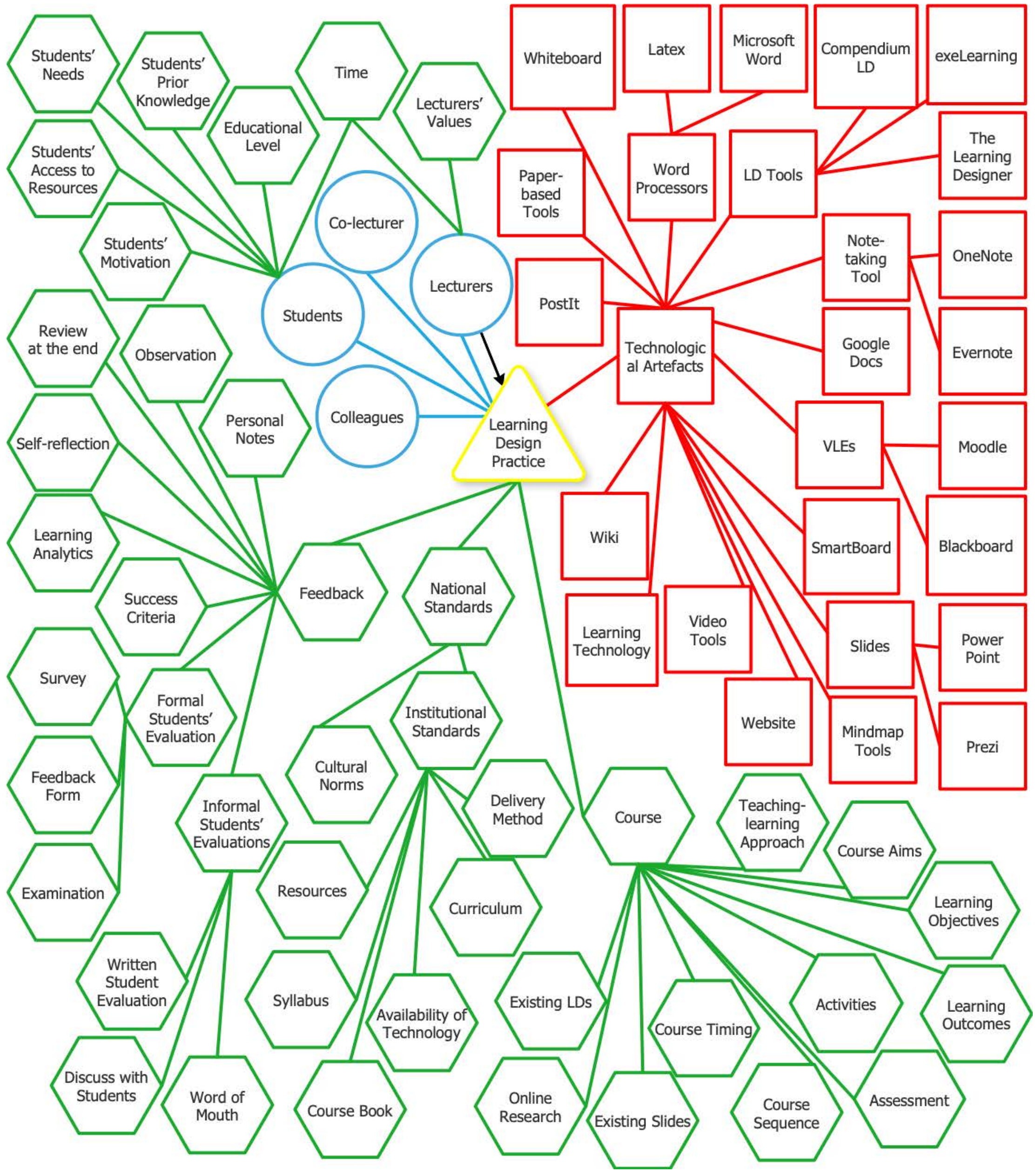

Figure 7.1. Entangled relations between the actors involved in lecturers' LD-P.

7.1.3 Defining Networks and Boundaries

This section presents the practices that emerge when lecturers who participated in the survey put into practice their LD ideas. Their practices are intertwined with practices of other actors, organisational realities and available technologies forming networks that emerge when all these actors are enacted in LD-P. . As there are one hundred ten participants involved in our survey, in this section, we can only present a sample of ten HE lecturers' LD-P that are selected randomly to illustrate how various actors come together in LD-P. This is illustrated with LD-P scenarios, which are based on analysis of survey data, in Figures 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10 and 7.11. These can be compared with actors identified in the previous subsection (see Figure 7.1 for an overview). The results are presented in Figure 7.12 and Figure 7.13. Even though HE lecturers mention the existence of sixty-one actors in the LD-P (Figure 7.1), in their LD activities they enact LD artefacts by engaging in mutual relations with a subset of those actors. In the following paragraphs, we explore some of these cases using as identifiers the code for each participant i.e. P1, P2, P3, …P110, where, for example, P1 represents the first lecturer who responded to our survey. These cases provide various instances of networks enacted in lecturers' LD-P demonstrating differences in LD approaches and tools adopted.

P6 follows a long-existing method for LD enacting a network of relations with two actors: lecturer and word processor. as illustrated in Figures 7.2 and 7.12.

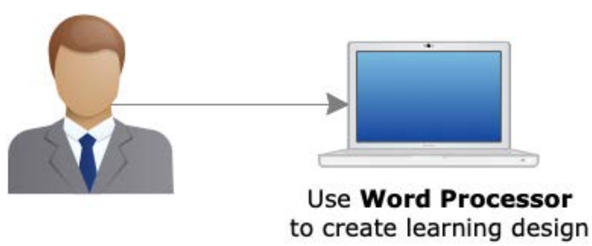

Figure 7.2. P6's LD-P

P8 considers curriculum-related requirements as the starting point for LD activities (Figure 7.3). In P8's case, the topics for each lesson are already defined, so P8's approach enacts a network of relations among human and non-human actors (see Figure 7.12) as the LD product should include engaging activities to get the students to practice those topics individually and in groups in meaningful ways. From Figure 7.3, we see that there are five actors in P8's LD-P namely lecturer, curriculum, students, course, and learning and teaching approach. Actors are relations are shown in Figure 7.12.

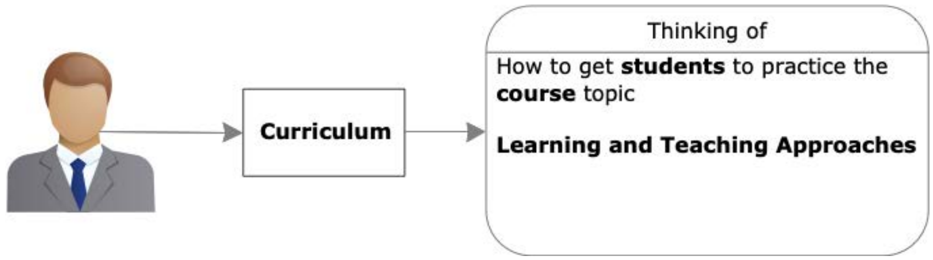

Figure 7.3. P8's LD-P

P21's LD-P is based on a set of slides. The first for P21 is to draft the different elements of the lesson in a couple of slides, and then builds on this draft to come up with a full presentation that will be used as background material for the lesson. Therefore, only two actors are appearing in P21's LD-P, namely the lecturer and the slides (Figure 7.4), while this practice enacts a simple network of relations between human and non-human actors, as shown in Figure 7.12.

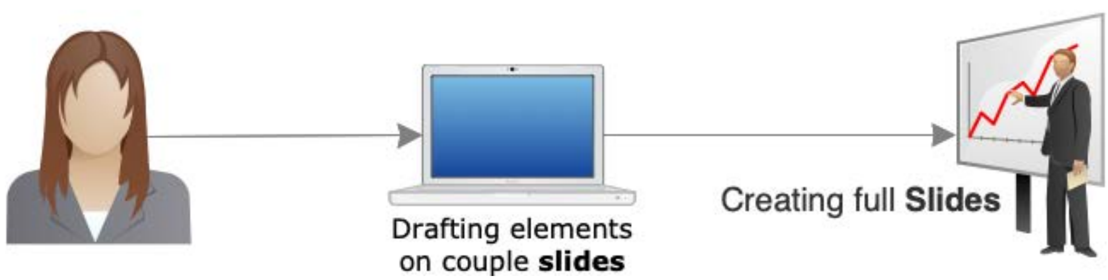

Figure 7.4. P21's LD-P

P35 follows a traditional approach working with paper-based tools, such as pen and paper, to develop the overall picture of the course and to define the structural elements of each session, such as activities. Once the overall plan was formed, P35 uses a word processor to develop more detailed support materials and refine the plan. Then, P35 uses a presentation tool to develop the plan into a session structure which would then lead into supporting slides. Therefore, there are six actors (one human and five non-humans, mainly technological artefacts) involved in LD-P of P35: lecturer, paper-based tools, activities, word processor, resources, and slides as illustrated in Figure 7.5. The networks of relations between human actors and technological artefacts that are enacted in this case are exhibited in Figure 7.12.

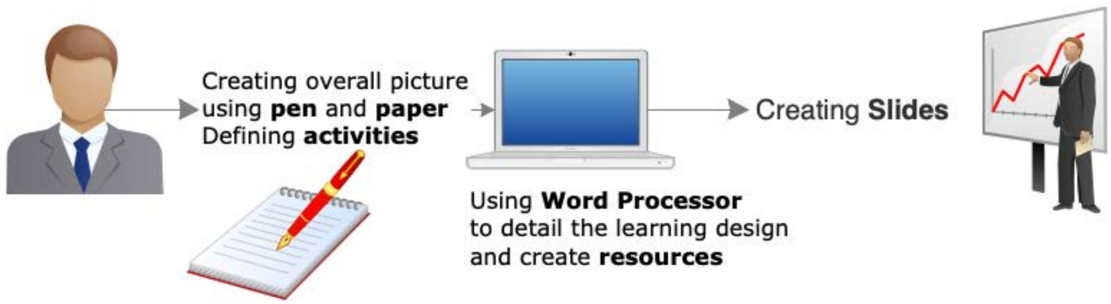

Figure 7.5. P35's LD-P

Unlike the lecturers mentioned above, P52 uses one of the LD tools, compendiumLD, to set objectives, outputs and outcomes for LD. Then, it is time to add the required resources and tools. P52 doublechecks to make sure that content-based objectives stipulated in the syllabus are met and adds resources or adapts activities accordingly. Then P52 builds the course in a VLE. It should be mentioned that P52 considers that technology influences the way LD is practised- for example, P52 believes course and LD or planning to be greatly hindered by LMS. Sequencing is always a hassle especially if a course does not follow the traditional weekly delivery schedule that most HE courses adopt. According to P52, blended learning and project-based learning are particularly difficult. The LD-P of P52 is presented in Figure 7.6 highlighting the actors that involve in P52's LD-P: lecturer, LD tools, learning objectives, learning outcomes, activities, resources, learning technologies, and sequence. The practice network that emerges is illustrated in Figure 7.12.

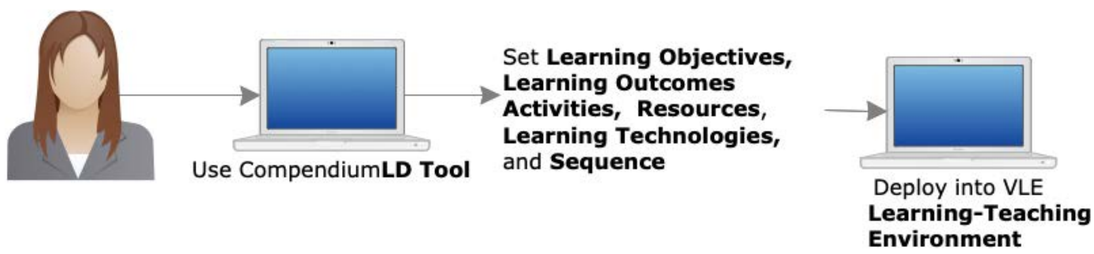

Figure 7.6. P52's LD-P

P58 uses a note-taking tool to outline the lesson and then develops a presentation from the outline. This LD-P follows a simple model involving three actors, as presented in Figure 7.7, namely lecturer, a note-taking tool, and slides. The practice network is shown in Figure 7.13.

Figure 7.7. P58's LD-P

P69's LD-P is another example of a long-existing practice which is template-based and uses a plain-text editor to map out the activities, timing, and objectives. Later, P69 cuts and adds ideas to a presentation tool for the class. The LD-P of P69 is illustrated in Figure 7.8, while the actors are shown in Figure 7.13. Human actors, i.e, lecturer, and non-human actors, including a word processor, learning objectives, activities, timing, and slides, are engaged in LD-P of P69.

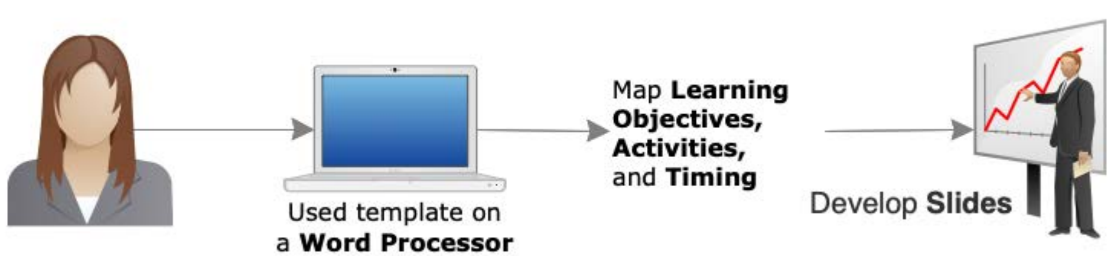

Figure 7.8. P69's LD-P

P78 outlines the plan for a course using traditional tools, first paper-based and then digital (word processor). Finally, P78 transfers and adds all the information to a presentation tool. P78's LD-P is illustrated in Figure 7.9, while the network of actors, namely lecturer, paper-based tools, word processor, and slides is presented in Figure 7.13.

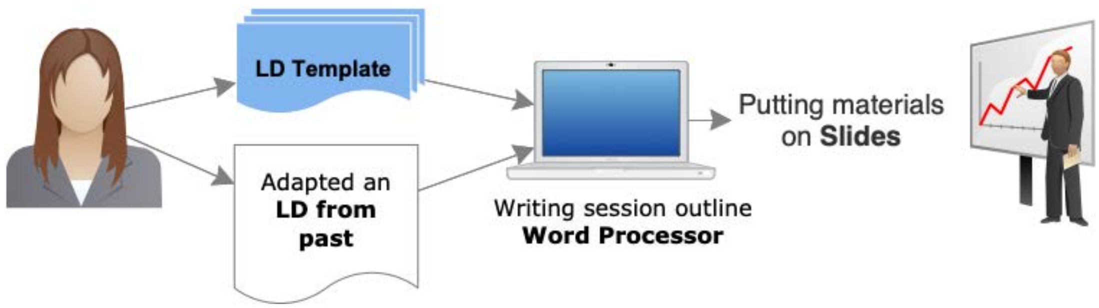

Figure 7.9. P78's LD-P

P82 starts with a lesson plan template provided or reuses a lesson plan from the previous year. P82 is also required to write out a lesson outline for the module handbook, which includes title, session description, specific learning outcomes, questions, and readings. When working on a lesson, P82 starts with the outline, then moves over to put the material on PowerPoint. There are six actors entangled in LD-P of P82 as pictured in Figure 7.10. These actors are a lecturer, LD template, LD from past, word processor, learning outcomes and slides and then enacted networks of relations is shown in Figure 7.13.

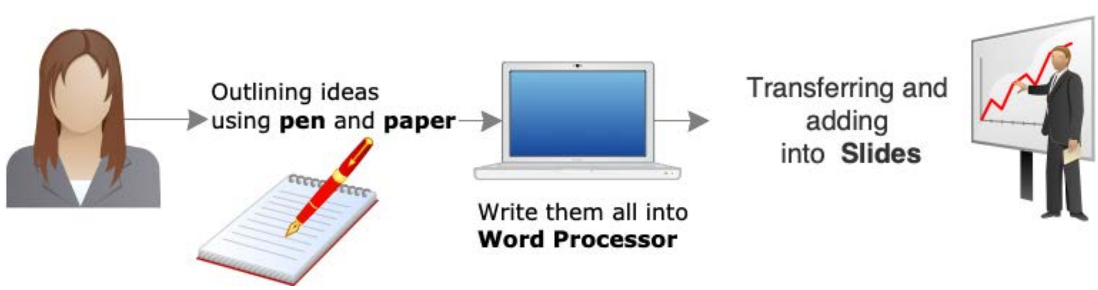

Figure 7.10. P82's LD-P

P103 works through an existing plan with paper-based tools, talks it through with colleagues, and transfers the agreed plan into a word processor for distribution to the students as illustrated in Figure 7.11. There are five actors in the LD-P of P103. These actors are a lecturer, existing plan, paper-based tools, colleagues, and word processor and the network is shown in Figure 7.13.

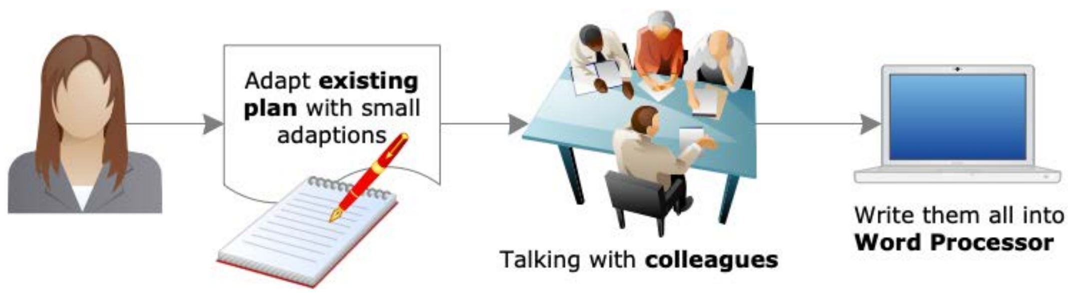

Figure 7.11. P103's LD-P

Figure 7.12 and Figure 7.13 present the above conceptual scenarios from an alternative perspective illustrating how various actors get involved in the LD-P of these HE lecturers and what relations emerge between them. That is only a small sample from the data collected and analysed from a sociomaterial perspective to explore the various ways technology is enacted into LD endeavours in HE institutions. This analysis aims to inform the formulation of a proposal for the design of LD tools based on sociomaterial design principles in Chapters 8 and 9. The next section is a step in that direction. It builds on the sociomaterial perspective for the analysis of the lecturers' data to introduce a conceptual framework for LD tools that are used in the rest of the chapters.

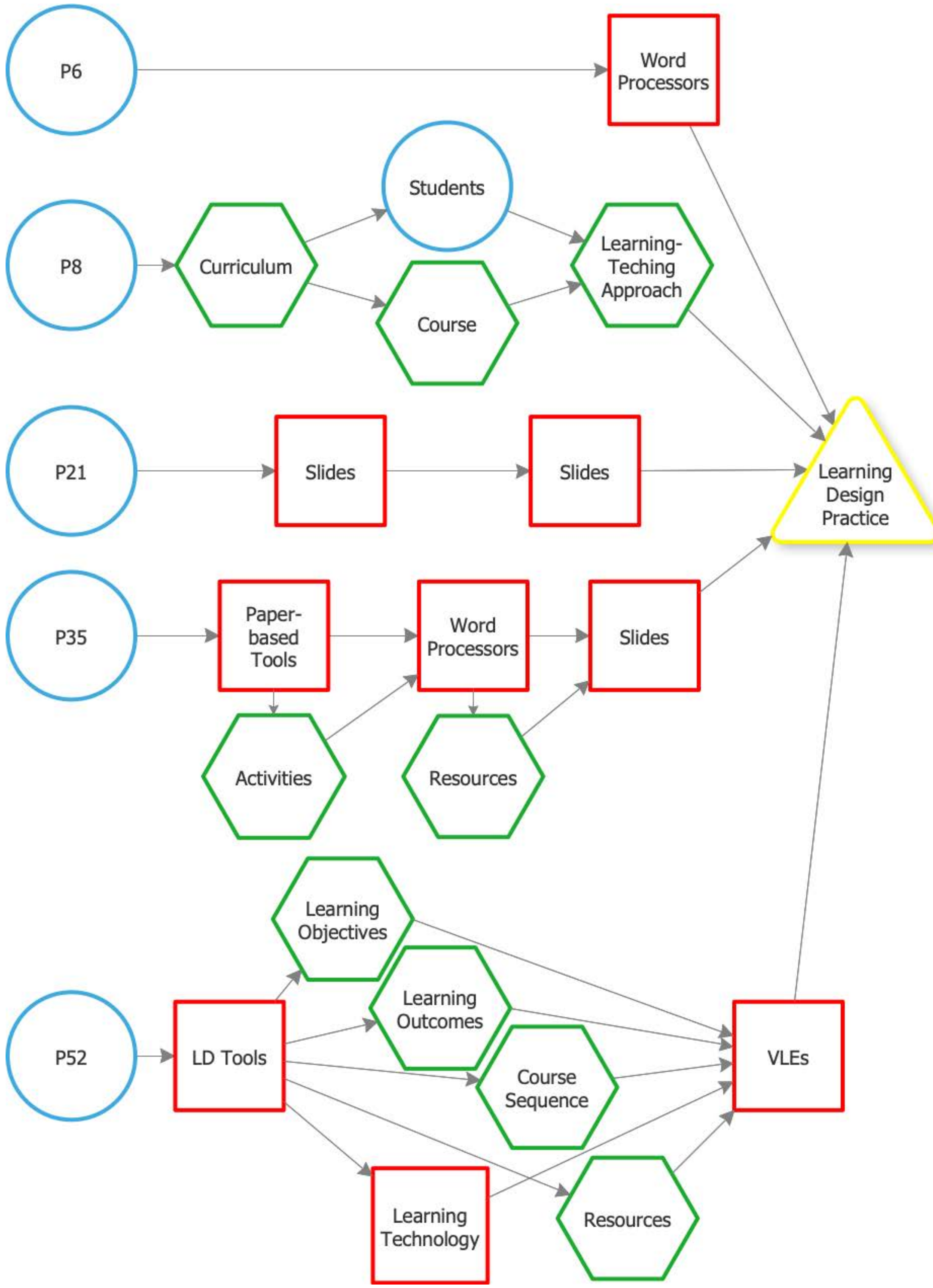
P6
Word Processors
P8
Curriculum
Students
Course
Learning-Teching Approach
P21
Slides
Slides
Learning Design Practice
P35
Paper-based Tools
Word Processors
Slides
Activities
Resources
Learning Objectives
Learning Outcomes
P52
LD Tools
Course Sequence
VLEs
Learning Technology
Resources

Figure 7.12. Actors and their relations in the HE lecturers' LD-P

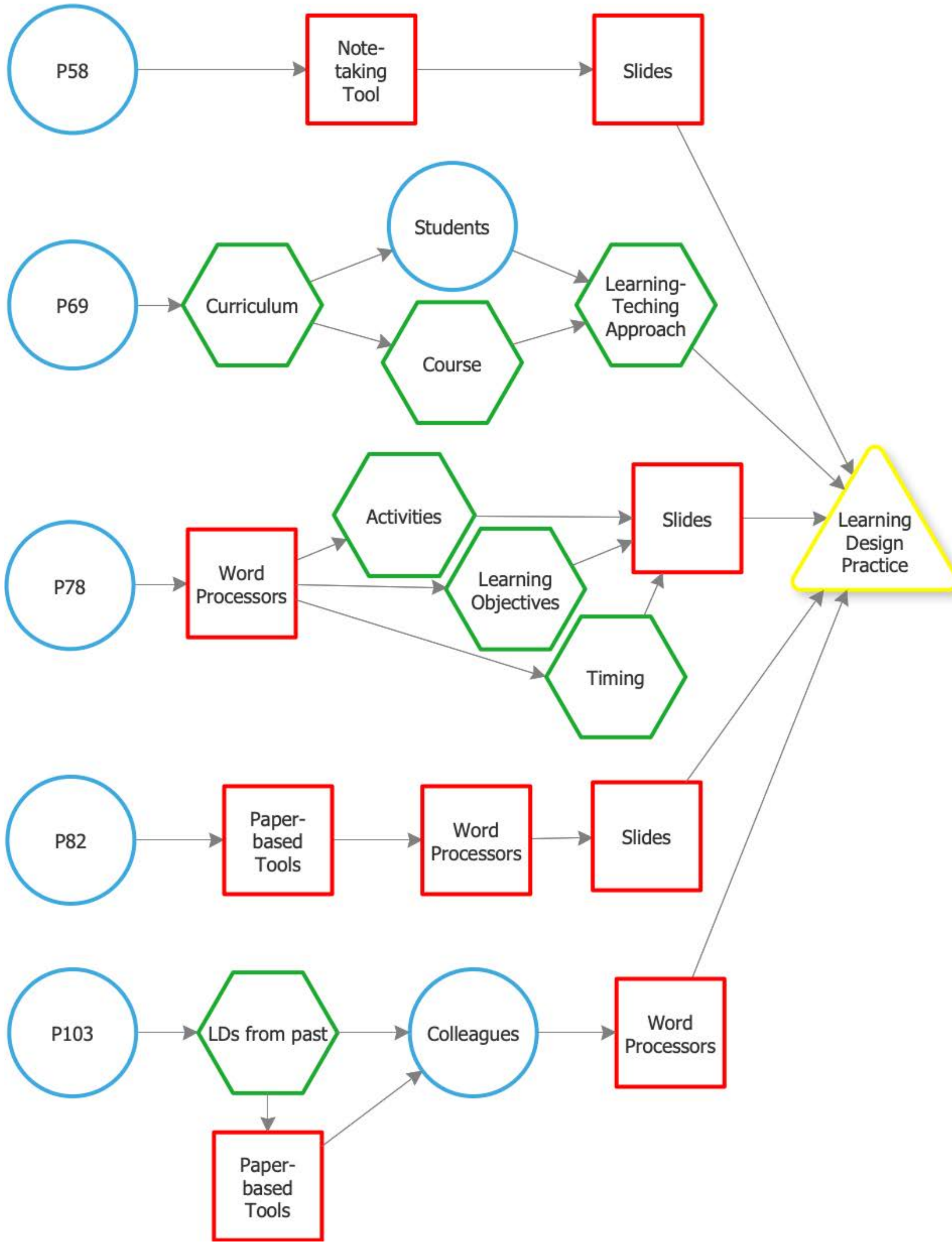

Figure 7.13. Actors and their relations in the HE lecturers' LD-P

7.2 Towards a Sociomaterial Design Framework: the HE lecturers' perspective

This section takes another step towards constructing a framework for designing and evaluating LD tools from sociomaterial perspective. It builds on the findings and analyses of the previous sections to introduce a new conceptual framework (model 2). The dimensions of this conceptual model are presented in Table 7.7. They have been formed from the analysis of Section 7.1.1 and the definition and meaning given to each actor by HE lecturers who participated in the study. The model comprises of six dimensions: lecturers/designers, students, institution, course, technology, and feedback. Even though HE lecturers mentioned sixty-one actors, the ones considered closely related were combined and then associated with thirty-four elements in the form of questions, which can be used to explore the various aspects of LD-P and inform the design features of LD tools. The formed dimensions are defined as follows.

- The "Designers/Lecturers" dimension considers aspects of lecturers' LD-P and their needs. The analysis presented in Section 7.1.1 (see relevant tables) reveals that lecturers' time and values are two important actors that need attention, and HE lecturers practise LD in collaboration with a design co-lecturer and colleagues. Questions like the three questions shown in Table 7.7 can be used to explore the role of these actors in LD tools.
- The "Students" dimension deals with whether the artefact (e.g. LD tool) offers features that enable designers to meet students' expectations. Students' prior knowledge, needs, access to resources, motivation, and time are the factors for consideration when taking up LD-P.
- The "Institution" dimension is about considering the organisational requirements and national education standards when a designer practises LD. According to HE lecturers' view, national standards, cultural norms, institutional standards, resources, syllabus, coursebook, availability of

technology, curriculum, and delivery method all have an influence on LD-P in organisational contexts.

- The "Course" dimension considers the actors related to the various aspects of a course. Course title, course aims, learning objectives, learning outcomes, activities, assessment, educational level, teaching-learning approach, course sequence, course timing, existing slides, online research, existing LDs are the main components of LD at the course level and they need to be defined.
- The "Technology" dimension is concerned with the requirements or impact of technology in LD-P, such as desirable features of LD tools (exporting/importing LDs in different file formats, communication and interoperability tools, advice, guidance and recommendation capabilities), and other technological artefacts relevant to LD-P.
- The "Feedback" dimension considers if LD tools integrate any kind of feedback mechanism. Personal feedback, formal students' evaluation, informal students' evaluation, and LA are the kind of feedback used by HE lecturers.

Table 7.7. Conceptual Framework for LD tools

Dimensions	Actors	Exploratory Question
Designers/ Lecturers	Lecturers' Time	Is time spent on LD reduced?
	Lecturers' Values	How are lecturers' values considered?
	Co-lecturer	Is the nature of the lecturers' collaborative practice, e.g. when discussing ideas or co-designing, accommodated?
	Colleagues	
Students	Prior Knowledge	How are students' prior knowledge, needs, access to resources, and motivation presented and accommodated?
	Needs	
	Access to Resources	
	Motivation	
	Time	How is students' study time organised?
Institution	National Standards	How are national standards of LD-P considered?
	Cultural Norms	How are the cultural norms of LD-P considered?
	Institutional Standards	How are institutional standards of LD-P considered?
	Resources	Is information about learning resources available at the institution provided?
	Syllabus	How is the syllabus considered?
	Course Book	Are LDs based on the core reading text provided or can they be easily created?
	Availability of	How is information about learning technologies available

	Technology	at the institutions considered?
	Curriculum	How is the curriculum considered?
	Delivery Method	Is the delivery method of the course considered?
Course	Course Course Aims Learning Objectives Learning Outcomes Activities Assessment	Is it possible to define and align course aims, learning objectives, learning outcomes, assessment, and activities?
	Educational Level	Is it possible to design based on educational level?
	Teaching-learning Approach	What features/functions are provided to enable defining learning-teaching approaches?
	Course Sequence	Are course and activities sequencing considered?
	Course Timing	Is the arrangement of course timing considered?
	Existing Slides	What tools/functions are available to import and edit existing slides?
	Online Research	What tools/functions are available for online research?
	Existing LDs	What functions are available to edit past LDs?
Technology	VLE	Are functionalities to import/export LDs and exchange data with VLEs provided?
	Website	Is it possible to publish LDs as a webpage?
	Wiki	Is it possible to publish LDs as a Wiki?
	Whiteboard Mind Map Tools Post-it Note-taking tool Paper-based tools	Whiteboard, mind-map tools, post-it, note-taking tools, and paper-based tools are used in the conceptualization phase of LD. Is it possible to draft the ideas in the LD tool?
	Google Docs Word Processors Slides Making Tools	Are facilities to export LDs in various file formats available?
	Video Tools	What feature to enable video integration is provided?
	LD Tools	What features for communication, interoperability and data exchange with other LD tools are available?
	Learning Technology	What feature to suggest appropriate learning technology is provided?
Feedback	Personal Feedback	Is it possible to put notes about LDs in the LD tool?
	Formal Students' Evaluation	Is it possible to integrate the results of formal evaluations in the tool to inform the designers?
	Informal Students' Evaluation	Is it possible to integrate the results of informal evaluations in the tool to inform the designers?
	Learning Analytics	Is it possible to integrate LA into LD tools?

7.3 Discussion

Understanding the actual-LD-P of the HE of lecturers is one of the biggest concerns of the LD field. This chapter strengthens our understanding of the lecturers' LD-P and their needs contributing a new analytical perspective. Analysing the LD-P of HE lecturers from a sociomaterial perspective allows extending our understanding of the LD-P by revealing the actors' complex interrelations and the boundaries that come into existence in LD-P. As mentioned there exists studies that investigated LD-P of the HE lecturers, such as (Prieto et al., 2014; Stark, 2000; Norton et al., 2005; Bennett et al., 2008; Bennett et al., 2011; Bennett et al., 2014; Nguyen & Bower, 2018). However, these studies did not consider the complex sociomaterial environment and all the actors. Unlike these studies, where the main emphasis was on human-centric factors, this study contributes by considering all the human and non-human actors as a matter in LD-P. The analysis was based on a survey designed and conducted with one hundred ten HE lecturers on their LD-P to identify relevant actors and inform the design of a sociomaterial design framework for LD tools.

One of the findings that emerged from this study is that there are sixty-one actors involved in the LD-P of the HE lecturers. This finding challenges the findings of the previous chapter where experts' perspective was presented. According to the HE lecturers, there are many more actors involved in LD-P than experts indicated.

Another interesting finding is that the HE lecturers use non-digital artefacts besides digital artefacts in their LD-P. These non-digital artefacts are whiteboard, post-it and paper-based tools such as pen and paper. For example, they use post-it as a mind map tool and paper-based tools to put all the ideas they have regarding their LD. These non-digital artefacts help them to organise their initial thoughts about their LDs. The reason given for their use is that lecturers feel more comfortable using these non-digital tools.

Another finding of this study is that several technological artefacts appear in LD-P of the HE lecturers surveyed. The lecturers mention that they use fourteen different technological artefacts in their LD-P, unlike experts. Among these technological artefacts three of are non-digital artefacts.

The current study also explored how various actors come together and connect in the lecturers' LD-P. The LD-P of the lecturers comprised of drafting initial ideas about LD either using non-digital artefacts or digital tools, planning activities, gathering information about the content, and creating slides.

The findings are subject to some limitations due to the nature of the data, and methodological choices. It is essential to bear in mind the possible bias in the responses and analysis process. In order to avoid bias, increase objectivity, explore the credibility and therefore to improve transferability of the results of the study, the number of the participants to the survey is kept high with sample size sufficiently larger than previous studies in the LD - 32 was the one of the largest sample size identified in the most recent LD literature (Bennett et al., 2011).

7.4 Summary and Contribution of the Chapter

In this chapter, the LD-P of the HE lecturers was explored through the lens of sociomaterial theory. A survey designed and conducted with one hundred ten HE lecturers on their LD-P helped us to identify relevant actors, their entangled relations, networks and boundaries and informed the design of a sociomaterial design framework for LD tools.

This chapter contributes to LD by augmenting the current picture of HE lecturers' LD-P from a sociomaterial perspective. It considers all actors that shape the LD-P of the HE lecturers as equally important. This chapter was the final step in understanding the actual LD-P of the HE lecturers in this thesis. As presented in the need analysis chapters (Chapter 2, Chapter 4, and Chapter 5), there was a gap between the actual LD-P of the HE lecturers and existing LD tools and LD approaches.

In the next chapter, the conceptual frameworks developed in Chapters 6 and 7 are compared and a new unified sociomaterial design framework is derived.

Chapter 8

Sociomaterial Design Framework and Alignment of LD Software Tools and Approaches

The previous chapters explored how we can un-pack complex learning design practices in HE as perceived by LD experts and HE lecturers and develop a more informed understanding of their needs and of the factors that influence their practices. This chapter starts with a comparison of the results of Chapters 6 (experts' LD-P) and 7 (HE lecturers' LD-P). The conceptual models developed in these chapters are analysed and used to create a unified sociomaterial design framework for LD software tools. Equipped with a more holistic view of the LD-P in HE and the sociomaterial design framework we examine well-known LD approaches, which have influenced the design of LD software, and the corresponding LD tools.

The chapter is organised as follows. Experts' LD-P and HE lecturers' LD-P are compared in Section 8.1. Section 8.2 proposes a unified framework for sociomaterial design. Six well-known LD approaches and ten popular LD tools are examined in the context of the proposed sociomaterial framework in Sections 8.3 and 8.4 respectively. The discussion is presented in Section 8.5. Finally, the summary and contributions of the chapter are given in Section 8.6.

8.1 Comparison of HE Lecturers' LD-P with Experts' LD-P

This section investigates how experts' LD-P aligns with the HE lecturers' LD-P. In Figure 8.1, experts' LD-P on the left side and HE lecturers' LD-P on the right side are presented. Figure 8.1 shows the actors and their entangled relations highlighting human and non-human actors and abstract concepts using different shapes with different colours (blue circle for human actors, red square for digital/technological artefacts, and green hexagon for abstract concepts). The shapes with filled colours represent the actors that were mentioned by both experts and lecturers. Therefore, these are the points where experts' LD-P and the HE lecturers' LD-P overlap (see Figure 8.1)

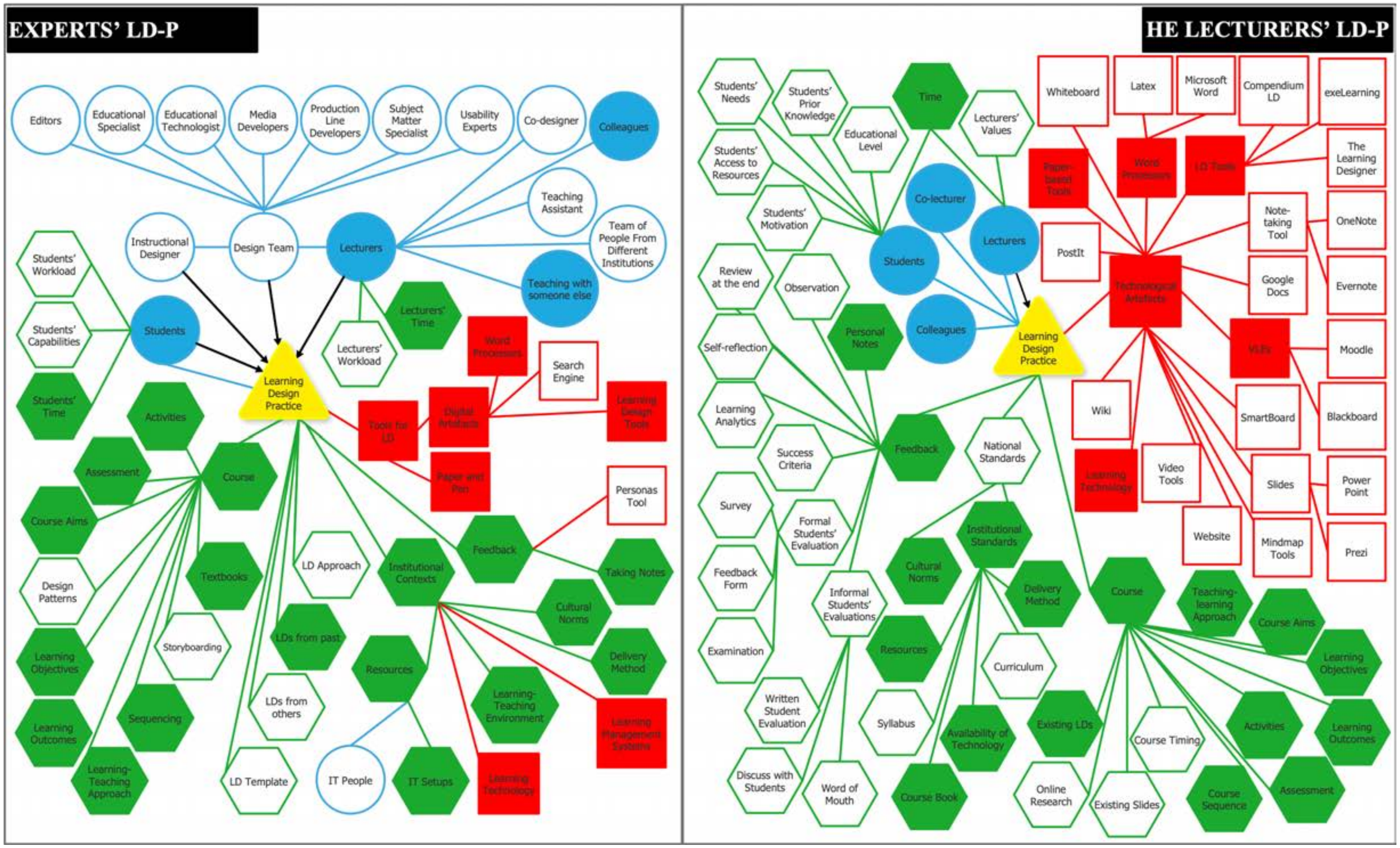

Figure 8. 1. The comparison of LD-P of the HE lecturers and the experts

As we are investigating how the LD-P is impacted by technologies, actors' relations, and working and institutional practices, it would be useful to examine the common elements/similarities between the LD-P networks of experts and HE lecturers. In Figure 8.1, common actors are highlighted by filling an actor's shape with a solid colour. Both the HE lecturers and experts think that lecturers, co-lecturer, students and colleagues influence LD-P. They both believe that technological artefacts used for LD play a role in LD-P. These are tools for LD, digital artefacts, paper and pen, word processor, LD tools, LMS/VLE, word processors and learning technology. Experts and HE lecturers also agree that there are abstract concepts that affect the LD-P (see the hexagon shapes filled with green colour in Figure 8.1). As can be seen from Figure 8.1, these actors are lecturers' time, students' time, course, activities, course aims, learning objectives, learning outcomes, learning-teaching approach, sequencing, textbooks, LDs from past, institutional contexts, resources, IT setups, cultural norms, delivery method, cultural norms, feedback, and taking notes.

However, the LD-P of the experts and that of the HE lecturers contradict in several ways. First of all, as can be seen in Figure 8.1, their understanding and practice of LD show differences regarding the number of actors involved in LD-P. Second, experts think that students should also be considered as learning designers. However, there is no mention of this issue by the HE teachers.

Third, experts think that LD-P is done either by a lecturer, learning designer, or a design team. However, when we look at the HE lecturers' LD-P in Figure 8.1, lecturers are seen as the only learning designer of their module.

Fourth, according to the experts' LD-P from Figure 8.1, there are nine digital artefacts involved in LD-P. In contrast, HE lecturers consider that their LD-P is influenced by twenty-seven technological artefacts overall.

Furthermore, experts think that feedback is important and there should be a feedback mechanism incorporated in LD software tools. However, the HE lecturers value student feedback more than the experts do and consider several ways for acquiring it, either on a formal or informal basis. For example, student surveys, student forms and student evaluations are formal ways used by the HE lecturers to get feedback on their courses. For informal feedback HE lecturers use observations, word of mouth, and interactive feedback sessions.

8.2 Sociomaterial Design Framework: a unified model

In this section, we combine the two models of sociomaterial design developed in Chapters 6 and 7, respectively. The unified sociomaterial design framework keeps the same dimensions, namely *designers*, *students*, *institution*, *course*, *technology, and feedback.* The dimensions of the unified framework along with the actors associated with each dimension and the specific questions that explore each dimension and the needs of LD-P of its actors are presented in Table 8.1.

- The "Designers" dimension explores LD-P from the instructor's perspective. According to the experts and HE lecturers, lecturers' time and workload, lecturers' values, design team, co-designer, colleagues, people from other universities, teaching assistant, and co-lecturer are the actors considered in this dimension. Therefore, it would be essential to explore the roles of these actors in LD approaches and LD tools using questions like the three questions given in Table 8.1.
- The "Students" dimension considers whether the artefact (e.g. LD tool) provides functionalities that enable designers to meet students-related requirements. Students' time, workload, prior knowledge, needs, access to resources, motivation, and capabilities are all the actors given as an influencer of LD-P by the experts and HE lecturers. In Table 8.1, three questions that

examine LD approaches and LD tools from the students' perspective are presented.

- The "Institution" dimension deals with organisational and national educational requirements when a designer creates LDs. According to the experts and the HE lecturers, the actors belonging to this dimension are national standards, delivery method, cultural norms / institutional contexts, syllabus, curriculum, textbooks, resources, IT setups, and IT people. Nine questions are assigned and presented in Table 8.1 to analyse LD approaches and LD tools regarding the institution dimension and its actors.
- The "Course" dimension explores course-related aspects. It includes course aims, learning objectives, learning outcomes, assessment, activities, educational level, learning-teaching approach, sequencing, course timing, storyboarding, design patterns, existing slides, LD approach, LD from past, LD template, LDs from others are the actors involved in LD-P related to the course level and they need to be defined. To examine how LD approaches and LD tools include those actors, twelve questions are developed as presented in Table 8.1.
- The "Technology" dimension is concerned with technological features influencing LD-P. There are various actors that are associated with this dimension: VLE, website, Wiki, whiteboard, mind map tools, post-it, note-taking tool, paper-based tools, google docs, word processors, slides making tools, video tools, LD tools, search engine and learning technology. Nine questions are included to examine LD tools and LD approaches regarding how they accommodate requirements relevant to these actors, as presented in Table 8.1.
- The "Feedback" dimension explores alternative ways feedback can be used in LD-P to enhance LD artefacts. There are four actors involved in this dimension

namely personal feedback, formal students' evaluation, informal students' evaluation, and learning analytics. Therefore, we examine how LD approaches and LD tools accommodate the requirement regarding feedback in the LD-P using four questions, as presented in Table 8.1.

Table 8. 1. Sociomaterial Design framework for LD tools and LD Approaches

Dimension	Actors	Exploratory Questions
Designers	Lecturers' Time and Workload	Is time spent on LD reduced?
	Lecturers' Values	How are lecturers' values considered?
	Design Team	How is the nature of the designers/lecturers' collaborative practice, e.g. when discussing ideas or co-designing, accommodated?
	Co-designer	
	Colleagues	
	People from other Universities	
	Teaching Assistant	
	Co-lecturer	
Students	Students' Time and Workload	How are students' workload and study time organised and monitored?
	Prior Knowledge	How are students' prior knowledge, needs, access to resources, and motivation presented and accommodated?
	Needs	
	Access to Resources	
	Motivation	
	Students' Capabilities	How are students' skills, abilities, and competencies considered in the LD and accommodated?
Institution	National Standards	How are national standards of LD-P considered?
	Delivery Method	Is the delivery method of the course considered?
	Cultural Norms / Institutional Contexts	How are workplace requirements and institutional context of LD-P considered?
	Syllabus	How is the syllabus considered?
	Curriculum	How is the curriculum considered?
	Textbooks	Are LDs based on the core reading text provided or can they be easily created?
	Resources	Is information about learning resources available at the institution provided?
	IT Setups	What information about IT setups at the institutions is made available?
	IT People	What information about IT support the institutions are given?
Course	Course Aims	Is it possible to define and align course aims, learning objectives, learning outcomes, assessment, and activities?
	Learning Objectives	
	Learning Outcomes	
	Assessment	

	Activities	
	Educational Level	Is it possible to design based on educational level?
	Learning-Teaching Approach	What features/functions are provided to enable defining learning-teaching approaches?
	Sequencing	Is the sequencing of the course and activities considered?
	Course Timing	Is the arrangement of course timing considered?
	Storyboarding	What tools for storyboarding are available?
	Design Patterns	What editable and sharable design patterns and LDs are available?
	Existing Slides	What tools/functions are available to import and edit existing slides?
	LD Approach	What guidance and support for various LD approaches are provided?
	LD from Past	What tools/functions are available to import and edit past LDs?
	LD Template	Are LD templates provided?
	LDs from others	What tools for browsing and customizing other people's LDs are available?
Technology	Website	Is it possible to publish LDs as a webpage?
	Wiki	Is it possible to publish LDs as a Wiki?
	Whiteboard	Whiteboard, mind-map tools, post-it, note-taking tools, and paper-based tools are used in the conceptualization of LD. Is it possible to draft the ideas in the LD tool?
	Mind Map Tools	
	Post-it	
	Note-taking tool	
	Paper-based tools	
	Google Docs	Are facilities to export LDs in various file formats available?
	Word Processors	
	Slides Making Tools	
	Video Tools	What feature is available to enable video integration?
	LD Tools	What features for communication, interoperability and data exchange with other LD tools are available?
	Search Engine	How is searching for LDs, digital objects and artefacts supported?
	Learning Technology	What feature is available to recommend appropriate learning technology to be used in a particular teaching/learning context?
	VLE	Are functionalities to import/export LDs and exchange data with VLEs provided?
Feedback	Personal Feedback	Is it possible to put notes about LDs in the LD tool?
	Formal Students' Evaluation	Is it possible to integrate the results of formal evaluations in the tool to inform the designers?
	Informal Students' Evaluation	Is it possible to integrate the results of informal evaluations in the tool to inform the designers?
	Learning Analytics	Is it possible to integrate LA into LD tools?

8.3 Examining the Alignment of LD Approaches with LD-P

In this section, we critically examine six LD approaches that play an intermediary role between the LD tools and LD-P to see how they are aligned with the LD-P of the HE lecturers and experts using the framework presented in the previous section. The LD approaches examined in this section are: the 7Cs Conceptual Framework (Gráinne Conole, 2014), the Conversational Framework (Diana Laurillard, 1999), the ISIS Framework (Emin, 2008), the 4SPPces Model (Pérez-Sanagustín, Santos et al., 2012a), the CADMOS Approach (Katsamani & Retalis, 2011), and the IMS LD Representation (Jeffery & Currier, 2003). For every approach, the version presented in the cited paper was considered for the analysis.

To analyse these LD approaches, we gathered all the detailed information about LD tools and frameworks from the original papers. Starting from higher-level information about each LD approach, we analysed more detailed level information and we were able to identify all the factors that influence LD-P, which were highlighted by each LD approach. Then, we coded all the actors considered in those frameworks and categorised them as human and non-human and created networks to illustrate how those actors are connected. DBR suggests having several iterations over time in the analysis to increase the validity of the results. Therefore, several iterations were included in the examination of LD tools to make sure that all the actors highlighted by each LD approach were covered. Therefore, the results of the sociomaterial analysis of the LD approaches are validated.

8.3.1 Examining the Alignment of the 7Cs Framework

Various actors are considered in each phase of the 7Cs LD framework. According to the 7Cs examination results, the seven phases of the 7Cs framework cover a total of fourteen non-human and eleven human actors that are engaged in bounding practices when LD ideas are put into practice using 7Cs. All non-human actors are abstract concepts and there is no mention of technological artefacts in the 7Cs framework. In the “conceptualise” phase, there are eleven human and five non-human actors that appear. One non-human actor engages in the “capture” phase. Two non-human actors are seen in “create” phase. There is one human actor in “communicate” phase and one another actor in the “collaborate” phase. In the “consider” phase, three non-human actors are seen. And the final phase, “consolidate”, includes three non-human actors.

In Figure 8.2, we illustrate how various actors are engaged in each phase of the 7Cs of LD approach. The types (human-non-human) of the actors along with their names are also presented in Figure 8.2.

In Figure 8.3, the actors involved in the 7Cs LD framework are depicted on the networks of experts’ LD-P and HE lecturers’ LD-P by those actors’ shapes that are filled with a solid colour. From Figure 8.3, we see that the experts’ map overlaps with twenty-five actors of the 7Cs framework while the HE lecturers’ map overlaps with eleven actors of the 7Cs framework. This finding may be explained by considering that the 7Cs framework reflects more the experts’ LD-P than the HE lecturers’ LD-P.

Besides, it appears that a large number of actors that influence LD-P are not considered by the 7Cs framework’s representation of the LD activities, as shown in Figure 8.3.

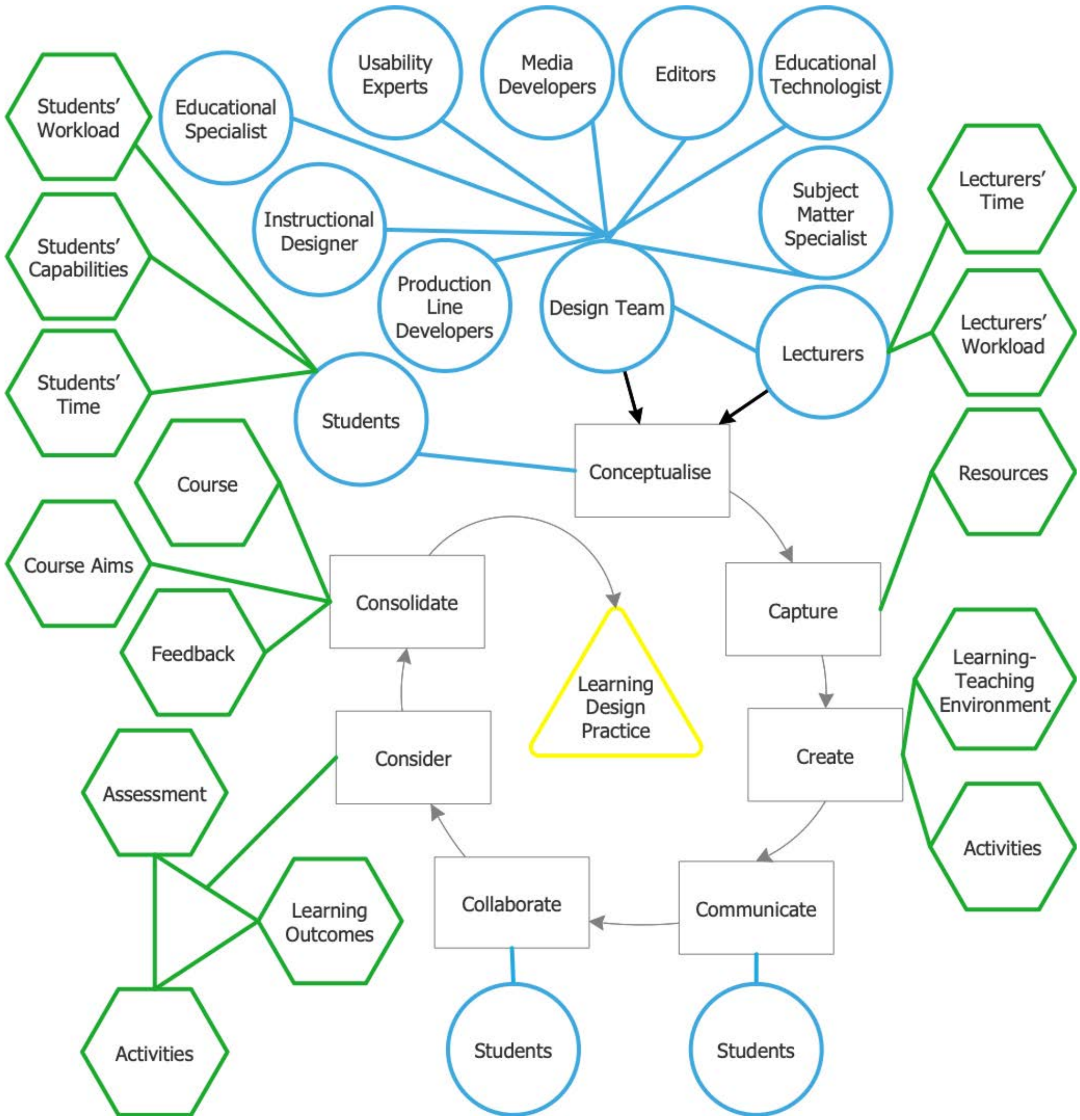

Figure 8. 2. Sociomaterial view of 7Cs LD Framework

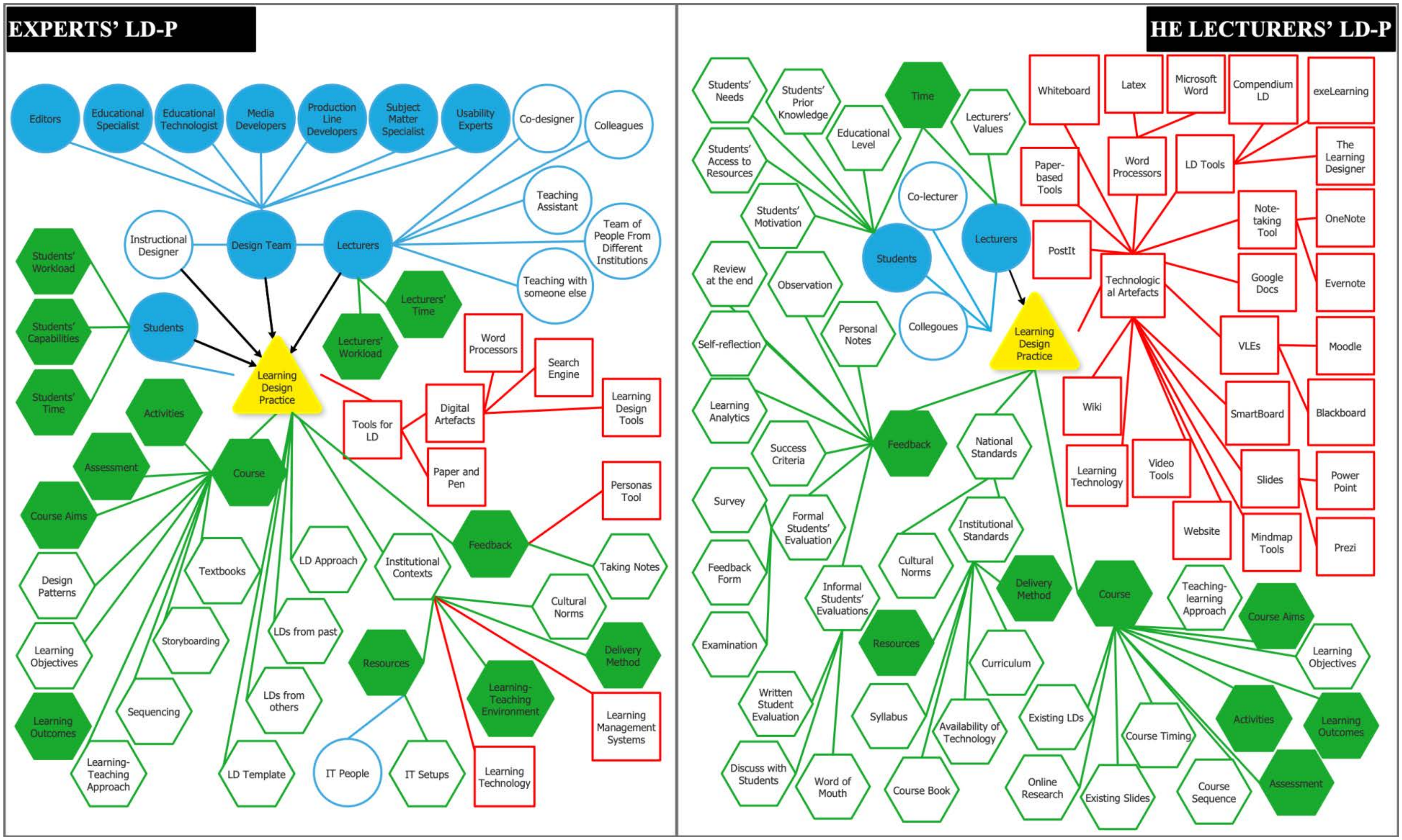

Figure 8. 3. Alignment of the 7Cs Framework

8.3.2 Examining the Alignment of the Conversational Framework

Another well-known LD approach is the conversational framework which was the basis for the development of the Learning Designer software tool. In line with the sociomaterial view, the original conversational framework recognises two human actors and eight non-human actors engaged in the LD-P and considers that learning happens among the interactions of these actors as illustrated in Figure 8.4.

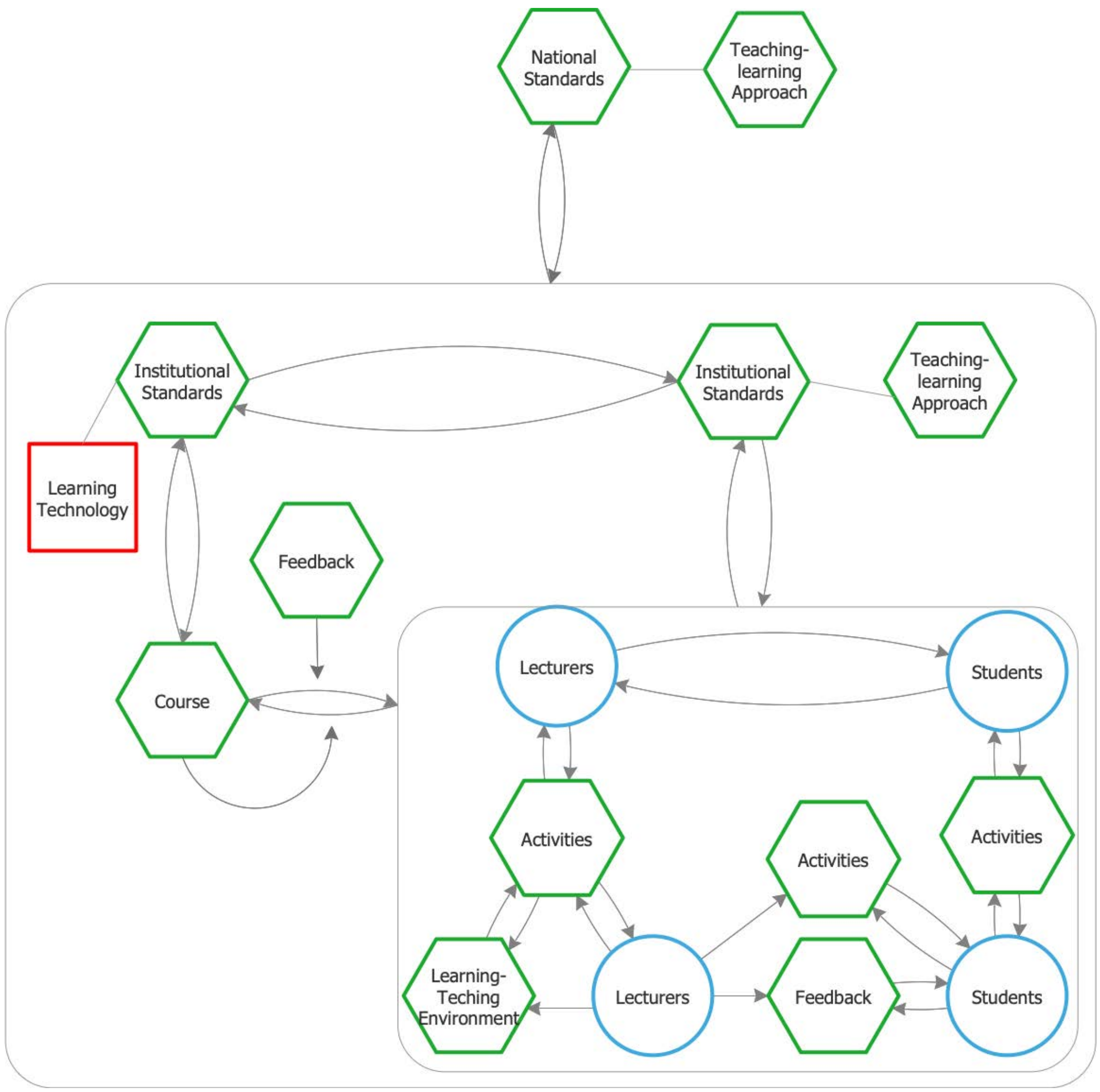

Figure 8.4. Sociomaterial view of the Conversational Framework

In Figure 8.5, the sociomaterial view of the conversational framework is depicted on the LD-P networks of experts and HE lecturers. From Figure 8.5, we see that seven actors included in the conversational framework are covered by both the LD-P maps of the experts and that of the HE lecturers. The actor named “national standards” is only covered by HE lecturers’ LD-P map. Also, we see that there is a big gap in between the actors that influence LD-P and the actors covered by the conversational framework.

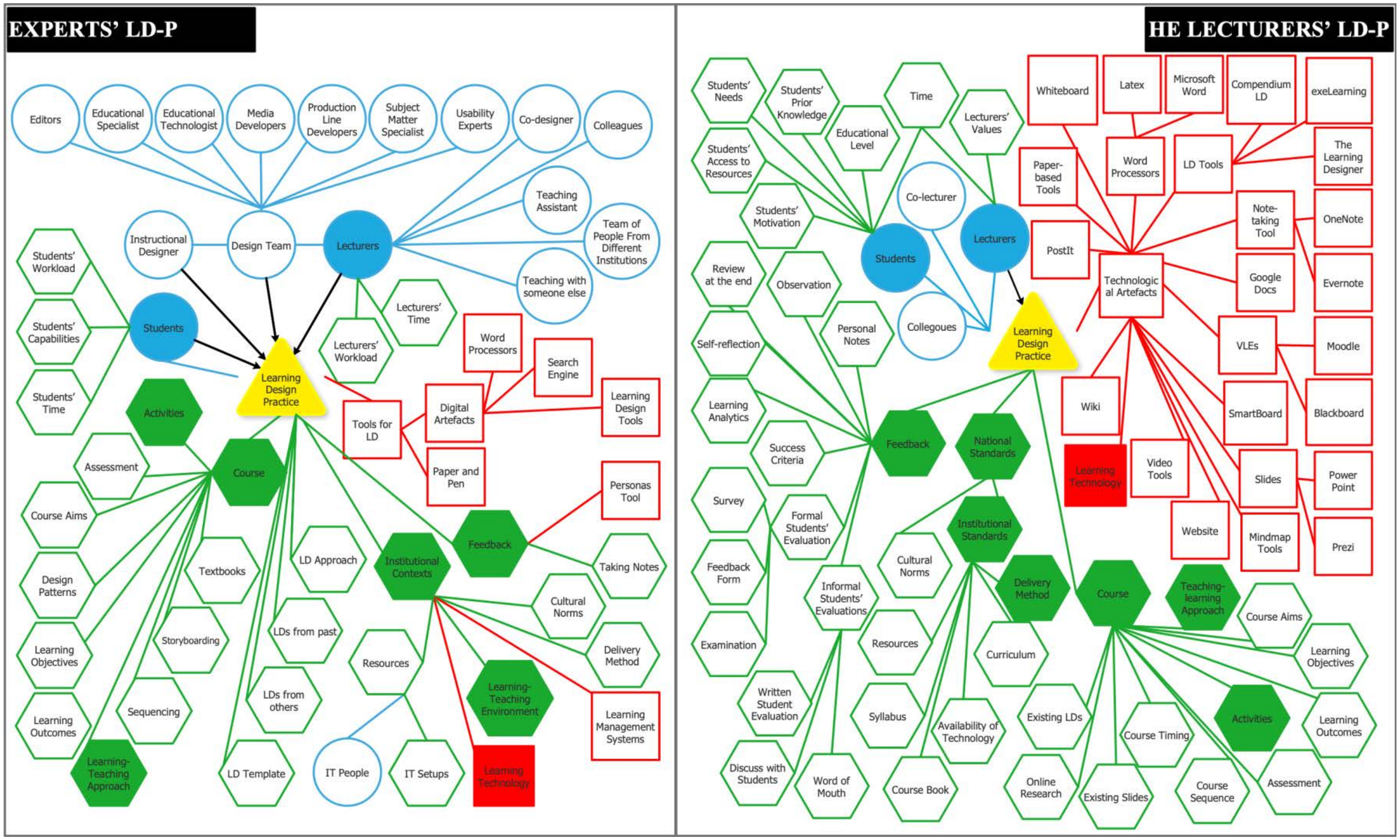

Figure 8.5. Alignment of the Conversational Framework

8.3.3 Examining the Alignment of the ISIS Framework

ISIS framework is another well-known LD approach which has inspired the development of the ScenEdit LD software tool. Sociomaterial analysis of the ISIS framework reveals that there is one human actor and six non-human actors get involved in the LD-P as presented in Figure 8.6. Among the non-human actors, one is a digital artefact, while the other five are abstract concepts.

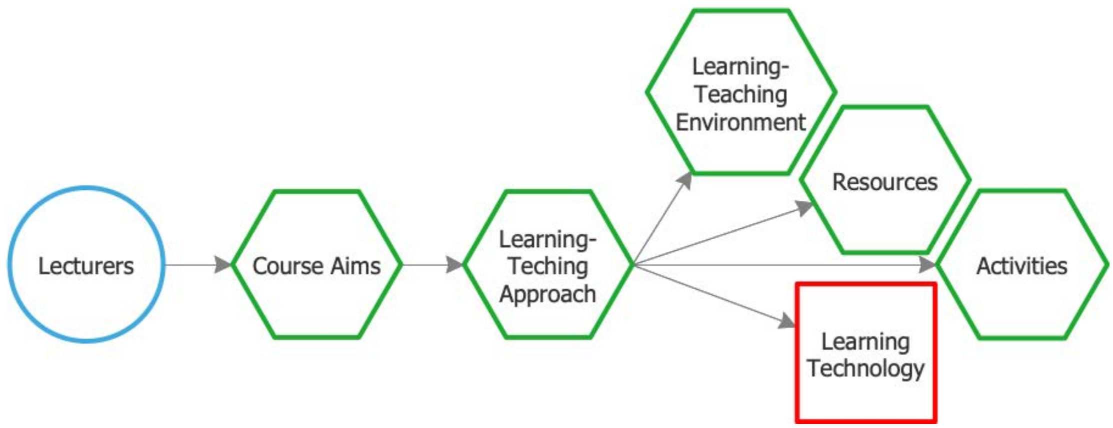

Figure 8.6. Sociomaterial view of ISIS Framework

Figure 8.7 identifies the actors (shapes filled with solid colour) where the ISIS framework and the networks of experts' LD-P and HE lecturers' LD-P overlap. Figure 8.7 shows that the ISIS framework considers much fewer actors than those included in the experts and the HE lecturers' LD-P networks.

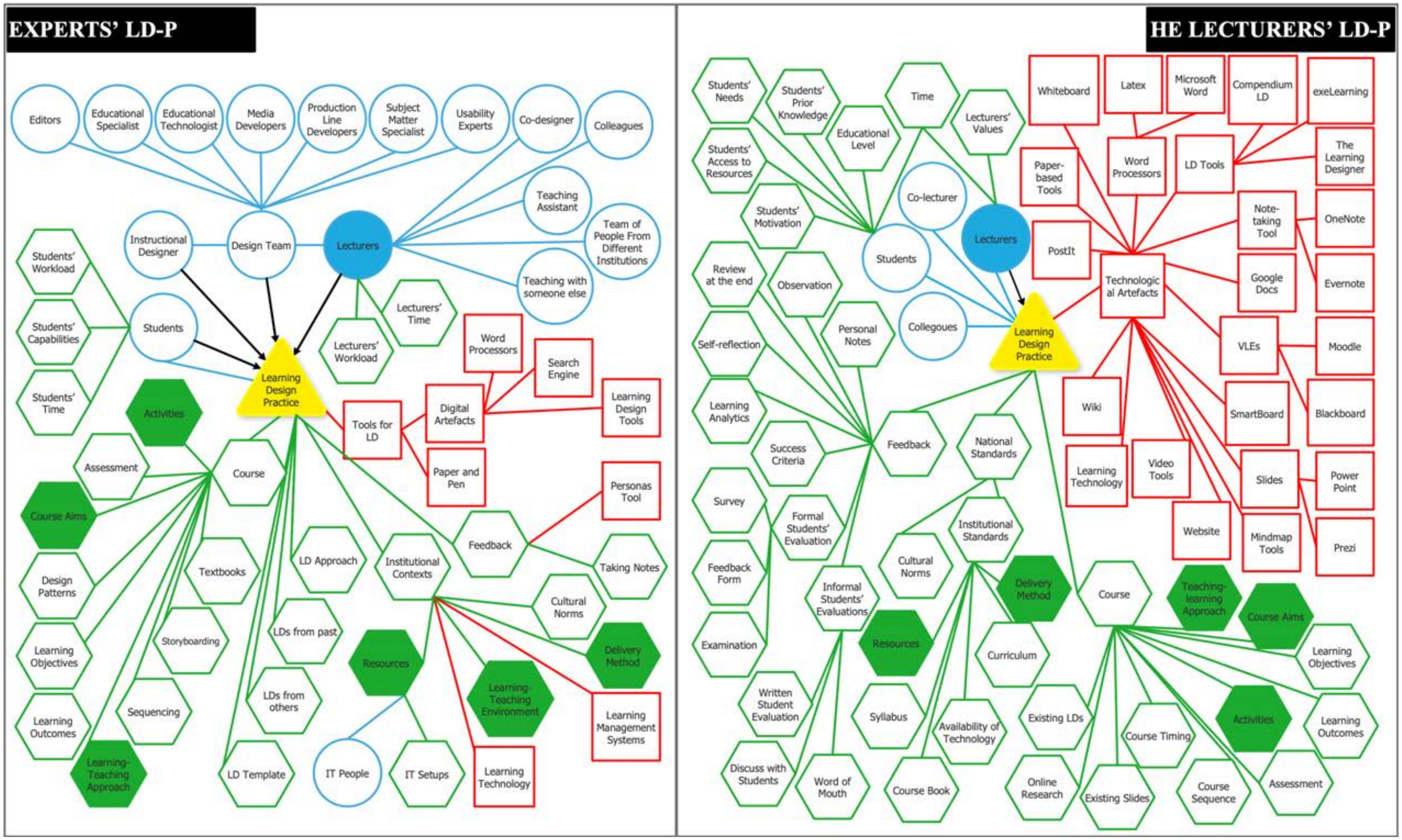

Figure 8. 7. Alignment of ISIS Framework

8.3.4 Examining the Alignment of the 4SPPIces Model

The 4SPPIces LD approach has provided a pedagogically underpinned theory for the development of the LdShake LD tool. In alignment with the sociomaterial view, the 4SPPIces model recognises seven non-human actors and two human actors as presented in Figure 8.8. Five of the non-human actors are abstract concepts, and two of the non-human actors are digital artefacts.

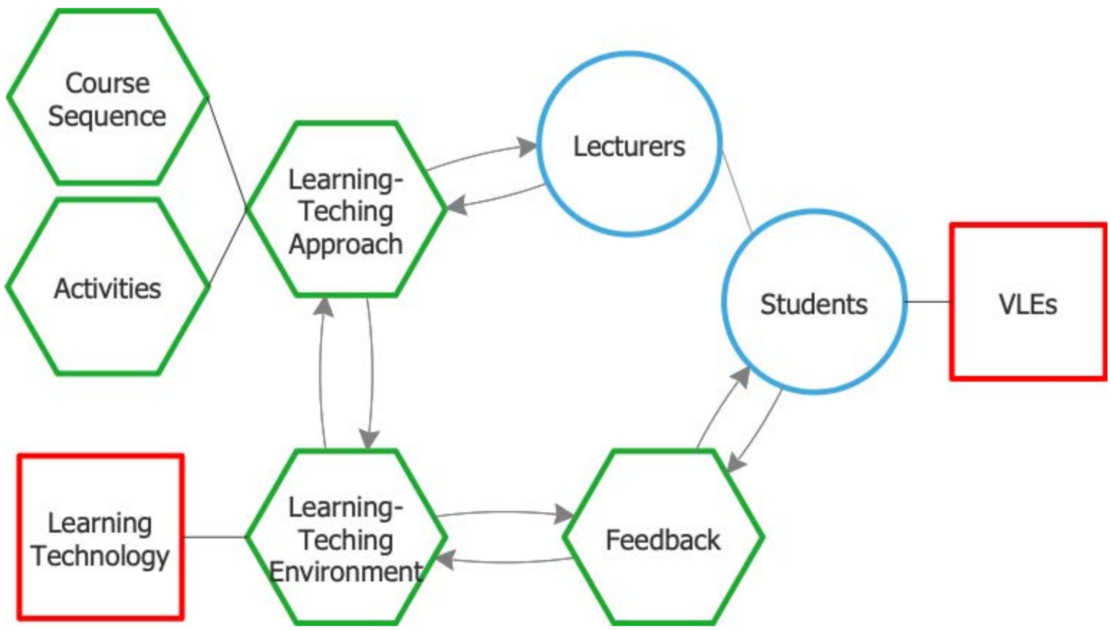

Figure 8.8. Sociomaterial view of 4SPPIces Model

Figure 8.9 presents the mapping of the sociomaterial view of 4SPPIces model over the maps of experts' LD-P and HE lecturers' LD-P, highlighting the small overlap with LD-P as perceived by experts and HE lecturers.

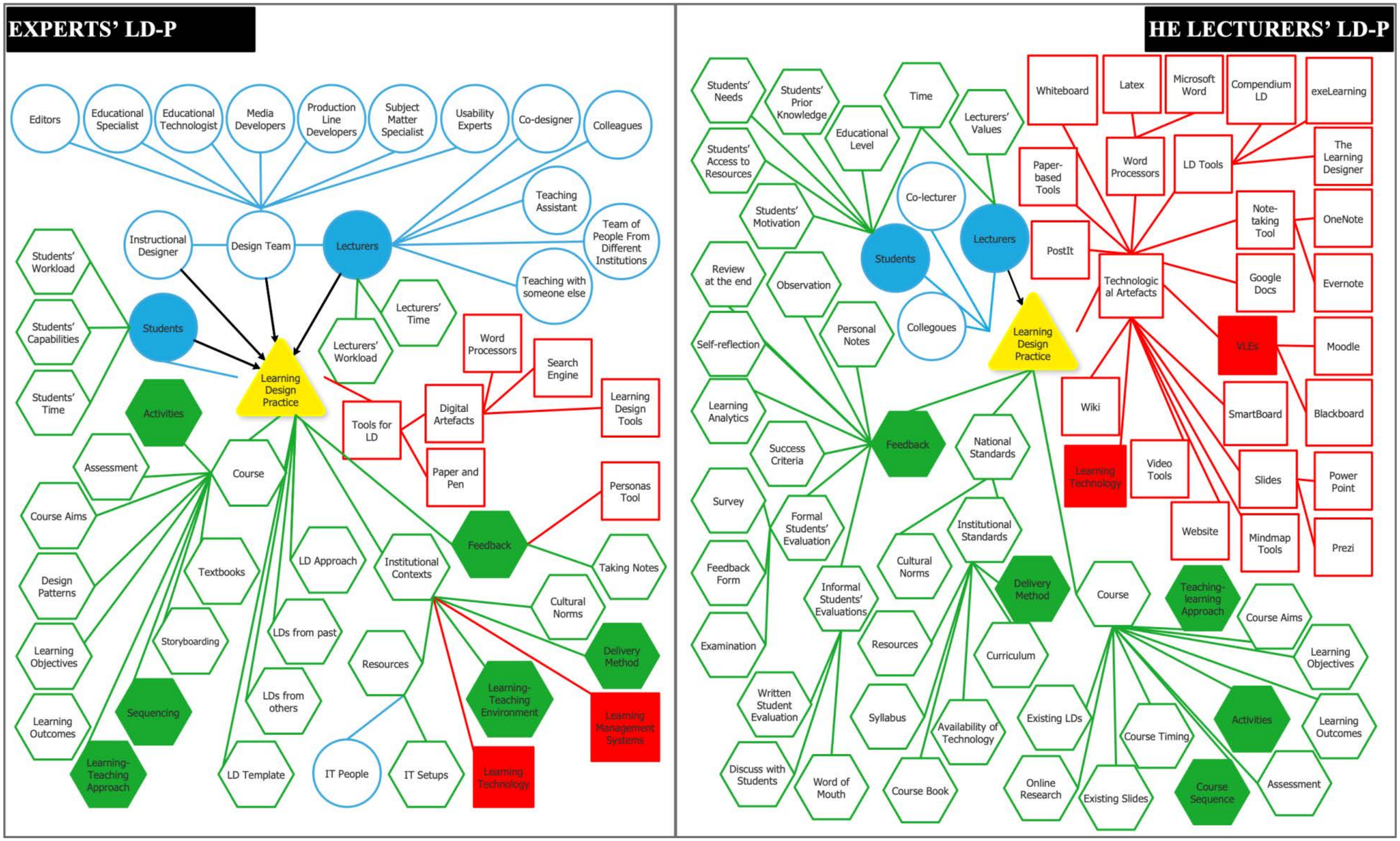

Figure 8.9. Alignment of 4SPPIces Framework

8.3.5 Examining the Alignment of the CADMOS Approach

The CADMOS approach is another well-known conceptual framework adopted by the CADMOS LD authoring environment. Sociomaterial analysis of the CADMOS approach resulted in the identification of six actors (see Figure 8.10). Four of these actors are abstract concepts, while two of them are human-actors. It is worth noticing that in the CADMOS approach, there is no mention of technological artefacts.

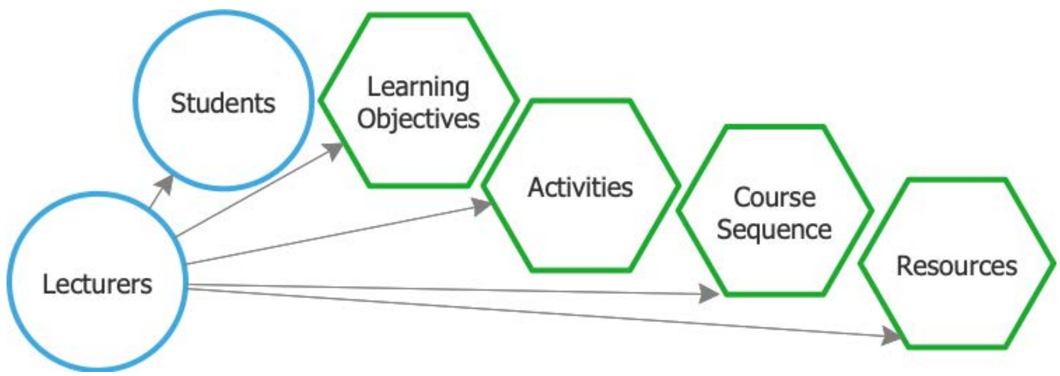

Figure 8.10. Sociomaterial view of CADMOS Approach

A comparison between the CADMOS approach and the LD-P networks of experts and HE lecturers in Figure 8.11shows that the actors covered by the CADMOS approach are mentioned by both experts and HE lecturers. However, there are several other actors mentioned by the experts and the HE lecturers that are not considered in CADMOS.

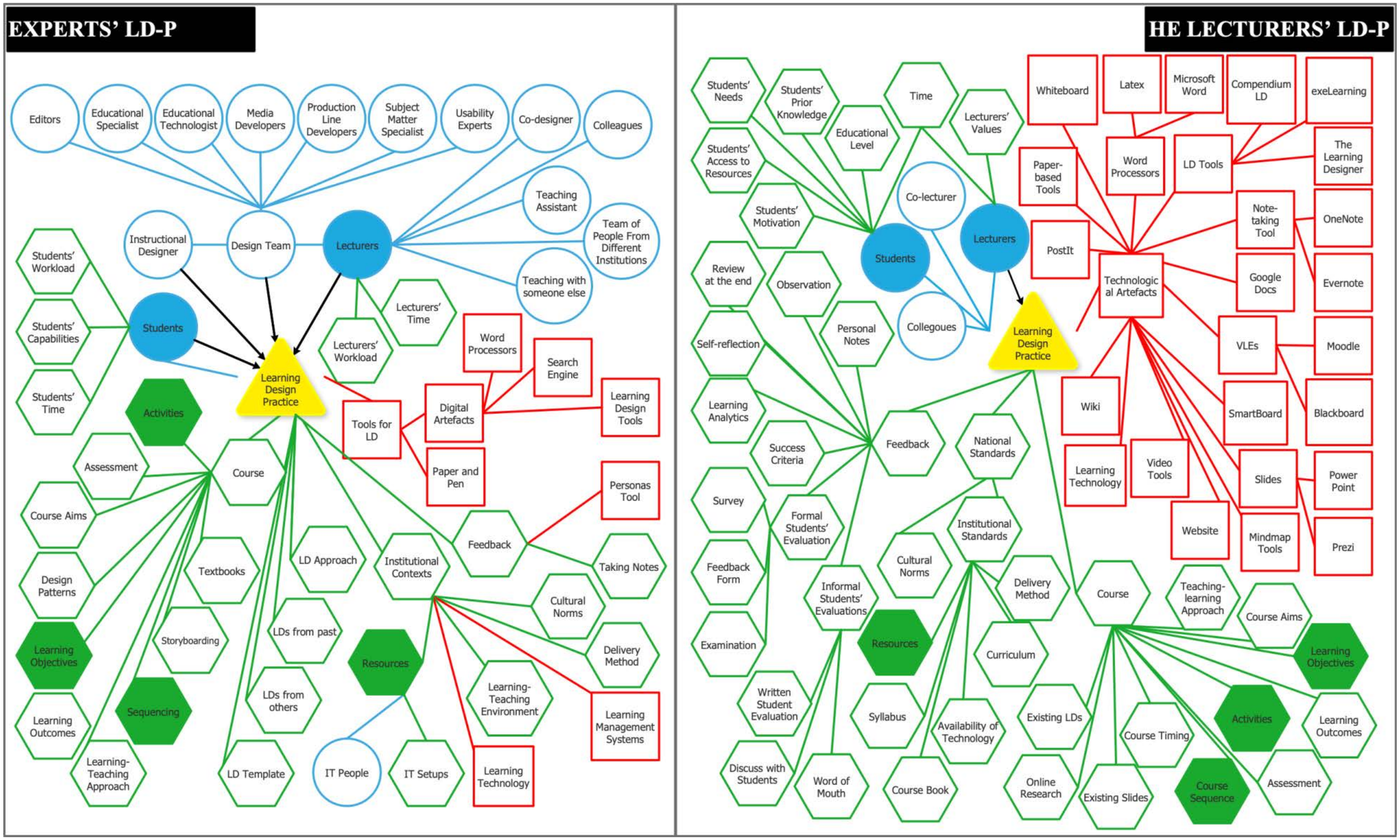

Figure 8. 11. Alignment of the CADMOS Approach

8.3.6 Examining the Alignment of the IMS LD Representation

IMS LD is a well-known metalanguage to describe LDs. Various LD tools have adopted the IMS LD specification. IMS LD considers five non-human actors and two human actors involved in the LD-P as presented in Figure 8.12.

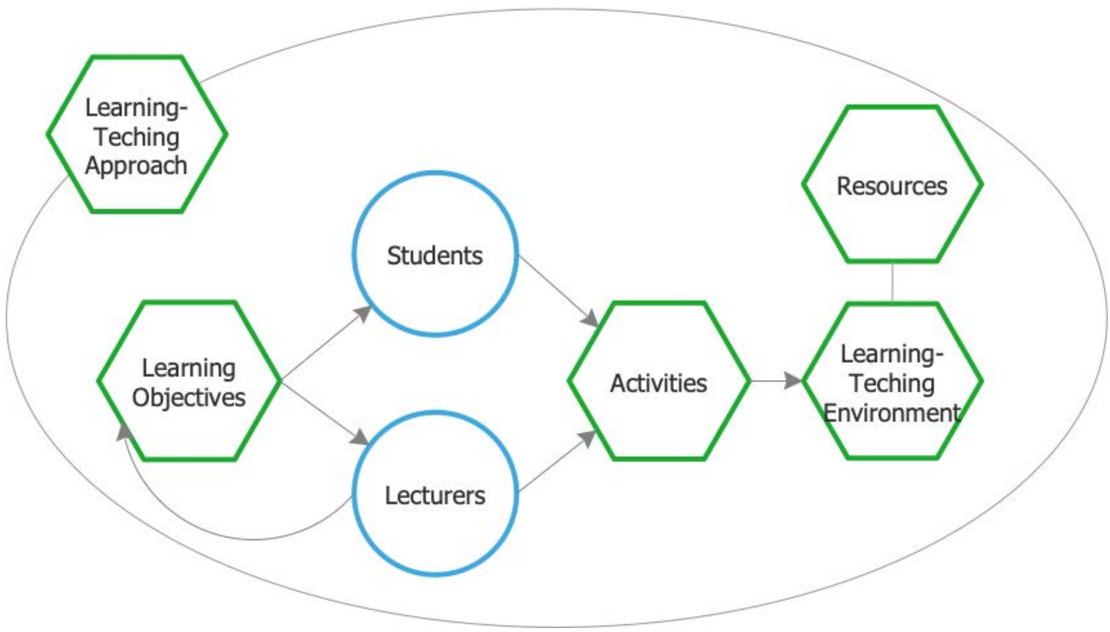

Figure 8.12. Sociomaterial view of IMS LD

Figure 8.13 presents the mapping of the IMS LD specification over the maps of the experts' LD-P and the lecturers' LD-P. Although IMS LD captures some of the actors perceived by both experts and HE lecturers, the number of actors considered by IMS LD is rather limited when compared with the actors engaged in the LD-P according to the views of experts and HE lecturers.

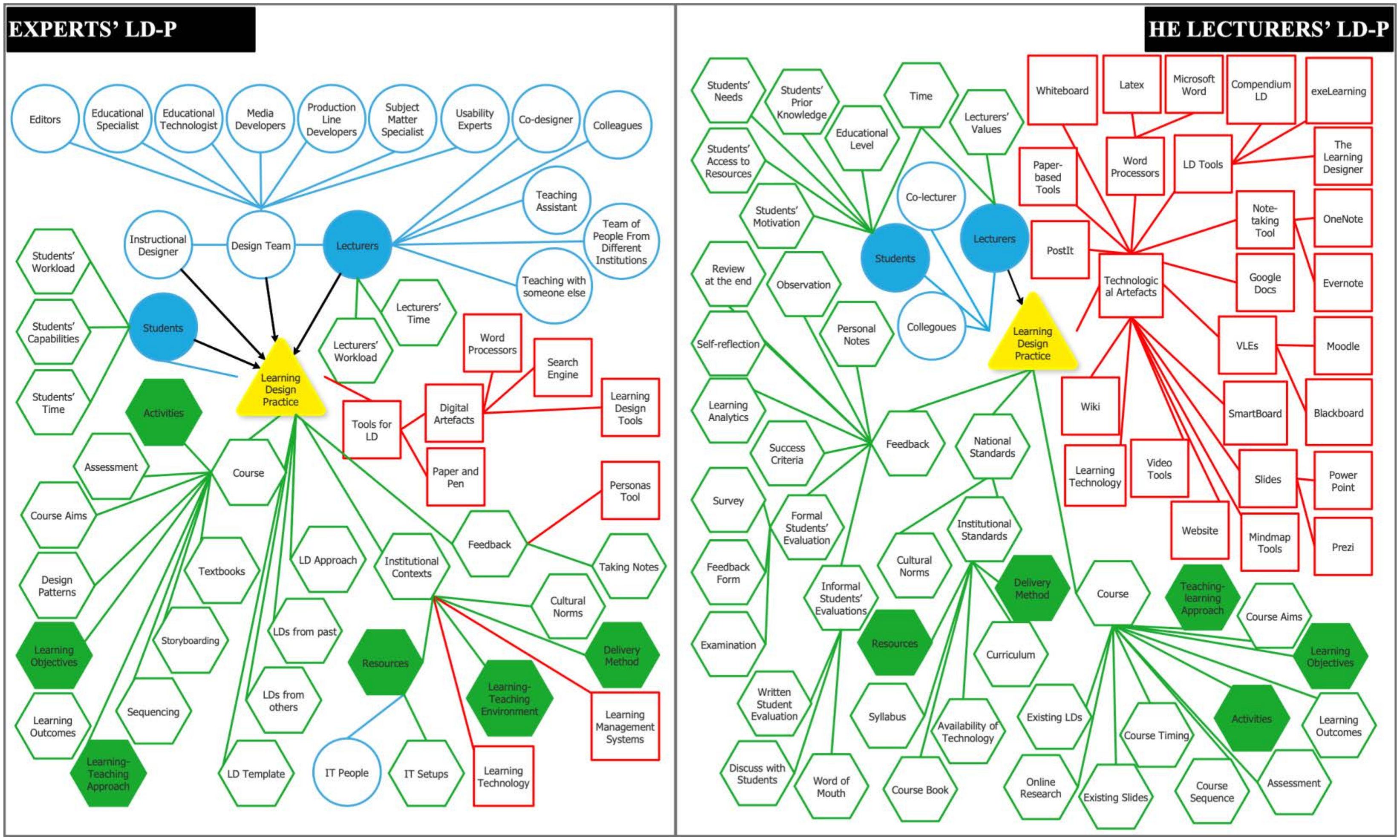

Figure 8. 13. Alignment of IMS LD

8.4 Examining the Alignment of LD Software with LD-P

At this point, it would be useful to extend our analysis to the LD tools by examining the alignment of a small subset of them with LD-P in the context of the sociomaterial framework. The LD software analysed are ILDE (Hernández-leo et al., 2013), OpenGLM (Derntl, 2015), WebCollege (Villasclaras-Fernández et al., 2013), exeLearning (Britain, 2004), CADMOS (Boloudakis et al., 2012), the Learning Designer (Laurillard et al., 2013), ScenEdit (Emin et al., 2010), LdShake (Hernandez-Leo et al., 2011), LAMS (Dalziel, 2006), CompendiumLD (Brasher et al., 2008), and Reload (Griffiths et al., 2009) - the version presented in the cited paper was considered for the analysis of each tool.

Table 8.2 provides an overview of the alignment/misalignment identified: the alignment points are indicated with a “+” and the misalignment points are indicated with a “- and highlighted with a grey background colour.

From Table 8.2, we see that even though there are various human and non-human actors engaged in the LD-P of HE lecturers and experts’ LD-P and they all have explanatory value when trying to understand the various ways technology is enacted into LD in HE, we see barely overlap of these actors with existing LD tools.

There is no LD tool from the ones compared that meets all the dimensions of the sociomaterial framework. There is a clear focus on the “course” dimension with all tools considering the relevant actors. However, LD tools barely cover the actors of the other dimensions. The ILDE/ ILDE2/edCrumble is comprised of a combination of various LD tools, as shown in Table 8.2, but remains incomplete at addressing various actors.

Table 8.2. Alignment of LD tools with LD-P

		ILDE Tool									
Dimensions	Related Actors	OpenGLM	WebCollege	exeLearning	CADMOS	ILDE Tool	Learning Designer	ScenEdit	LDShake	LAMS	CompendiumLD
Designers	Lecturers' Time and Workload	-	-	-	-	-	+	-	-	-	-
	Design Team	-	-	-	-	-	-	-	-	-	-
	Co-designer	-	-	-	-	-	-	-	-	-	-
	Colleagues	-	-	-	-	-	-	-	-	-	-
	People from other Universities	-	-	-	-	-	-	-	-	-	-
	Teaching Assistant	-	-	-	-	-	-	-	-	-	-
	Co-teachers	-	-	-	-	-	-	-	-	-	-
Students	Time and Workload	-	-	-	-	+	+	-	-	-	-
	Prior Knowledge	-	-	+	-	-	-	-	-	-	-
	Needs	-	-	-	-	-	-	-	-	-	-
	Access to Resources	-	-	-	-	-	-	-	-	-	-
	Motivation	-	-	-	-	-	-	-	-	-	-
	Capabilities	-	-	+	-	+	-	-	-	-	-
Institution	National Standards	-	-	-	-	-	-	-	-	-	-
	Delivery Method	+	+	+	+	+	+	-	-	+	+
	Cultural Norms/ Institutional Contexts	-	-	-	-	-	-	-	-	-	-
	Syllabus	-	-	-	-	-	-	-	-	-	-
	Curriculum	-	-	-	-	-	-	-	-	-	-
	Textbooks	+	+	+	+	+	+	+	+	+	+
	Resources	-	-	-	-	-	-	-	-	-	-
	IT Setups	-	-	-	-	-	-	-	-	-	-
	IT People	-	-	-	-	-	-	-	-	-	-
Course	Course Aims	+	+	+	+	+	+	+	-	+	+
	Learning	+	+	+	+	+	+	+	+	+	+

	Objectives										
	Learning Outcomes	+	+	+	+	+	+	+	+	+	+
	Assessment	+	+	+	+	+	+	+	+	+	+
	Activities	+	+	+	+	+	+	+	+	+	+
	Educational Level	+	+	+	+	+	+	+	+	+	+
	Learning-Teaching Approach	-	+	+	+	+	+	+	+	+	-
	Sequencing	+	+	+	+	+	+	+	+	+	+
	Course Timing	-	-	-	-	-	+	-	-	-	-
	Storyboarding	-	-	-	+	+	+	+	-	+	-
	Design Patterns	-	-	-	-	-	-	-	-	+	-
	Existing Slides	+	+	+	+	+	+	-	-	-	+
	LD Approach	-	+	+	+	+	+	+	-	+	-
	LD from Past	+	+	+	+	+	+	-	-	+	+
	LD Template	+	+	+	+	+	+	-	+	+	+
	LDs from others	+	+	+	+	+	+	-	+	+	+
Technology	Website	-	-	-	-	-	-	-	-	-	-
	Wiki	-	-	-	-	-	-	-	-	-	-
	Whiteboard	-	-	-	-	-	-	-	-	-	-
	Mind Map Tools	-	-	-	-	-	-	-	-	-	-
	Post-it	-	-	-	-	-	-	-	-	-	-
	Note-taking tool	-	-	-	-	-	-	-	-	+	-
	Paper-based tools	+	+	-	-	+	+	-	-	-	+
	Google Docs	-	-	-	-	-	-	-	-	-	-
	Word Processors	+	+	-	-	+	+	-	-	-	+
	Slides Making Tools	-	-	-	-	-	-	-	-	-	-
	Video Tools	-	-	-	-	-	-	-	-	-	-
	LD Tools	-	-	-	-	+	-	-	-	-	-
	Search Engine	-	-	-	-	+	+	-	+	-	-
	Learning Technology	-	-	-	-	-	-	-	+	-	-
	VLE	+	+	+	+	+	+	-	+	+	+
Feedback	Personal Feedback	-	-	-	-	-	-	-	-	+	-
	Formal Students' Evaluation	-	-	-	-	-	-	-	-	+	-
	Informal	-	-	-	-	-	-	-	-	-	-

	Students' Evaluation										
	Learning Analytics	-	-	-	-	+	+	-	-	-	-

From Table 8.2, we see that the "Designers" dimension is slightly covered by the Learning Designer. The other tools did not take into account the actors related to that dimension.

The actors related with the "Students" dimension are barely covered by the Learning Designer, exeLearning and the ILDE tool. The other tools did not consider the students-related actors that influence LD at all.

Among the "Institution" related actors, the delivery method was the subject of all the LD tools examined except ScenEdit and LdShake tools. The Textbooks actor of the "Institution" dimension was considered by all the tools. The other actors of this category are not covered by any of the LD tools examined.

The "Course" dimension with its relevant actors are the most covered actors by the LD tools. Among the course-related actors, course timing is not taken into account by any LD tools except the Learning Designer. Another point to highlight is here is that ScenEdit partially covered course-related actors: course timing, design patterns, existing slides, and adopting and editing LDs are not adequately represented. The "design patterns" actor is only considered by the LAMS tool.

Among "Technology" related actors, the VLE is the actor covered by all LD tools except ScenEdit. The LD tools that consider VLE offer features to deploy LDs created within the tool to VLE/LMS. OpenGLM, WebCollege, the ILDE and the Learning Designer also covered Google Docs and Word Processor dimensions meaning that these tools can export LDs in various file formats. Other "Technology" related actors are not considered by the LD tools. These ten LD tools do not offer any functionalities to gather direct feedback about the course. Only the ILDE tool recently announced edCrumble (Albó & Hernández-Leo, 2018b) that considers integrating LA into LD tools. Besides, the Learning Designer provided analytical pie chart to inform the lecturers about the proportion of the TEL pedagogy included in the LD.

Lastly, the “Feedback” dimension is barely considered by LAMS, the Learning Designer, and ILDE tool. Other LD tools did not provide any feedback mechanism.

8.5 Discussion

Comparison of experts’ LD-P map with the HE lecturers’ LD-P map and alignment of these maps with the existing LD approaches and LD tools is an essential element of the research described in this thesis. Further examining LD approaches and LD tools using the sociomaterial design framework developed based on LD-P of HE lecturers and experts reveals a significant gap between the actual LD-P and how this is considered in LD models and LD tools. It also helps to identify whether LD approaches and LD tools reflect experts’ LD-P or HE lecturers’ LD-P.

First of all, an analysis of LD-P of HE lecturers and experts showed that there are various actors involved in LD-P and LD is not an as simple process as presented by LD approaches and LD tools.

Second, LD-P understanding and practices of experts and the actual LD-P of HE lecturers show a significant difference. HE lecturers’ LD-P includes more actors than experts’ LD-P (see Figure 8.1) revealing the complexities of the LD process and the realities of HE organisations.

Third, existing LD approaches’ and LD tools’ comprehension of the actors involved in LD-P is narrow focusing on specific aspects of the LD process. Existing LD approaches and LD tools only consider the tip of the iceberg of LD-P. However, there is an unseen part of the LD-P iceberg of HE lecturers which should also be considered in the design of LD approaches and LD tools. Even though there are various human and non-human actors engaged in the LD-P and they all have explanatory value when trying to understand the various ways technology is enacted into LD in HE, we see barely overlap of these actors with existing LD approaches and LD tools. Although human actors, e.g. lecturers/designers, are at the core of the LD networks and bounding practices and perceived to be the most important ones in educational technology systems, this view can be problematic when other actors involved in LD-P are ignored or are given little value. From the sociomaterial perspective, understanding the LD-P requires considering all of the human and non-human actors involve in LD-P.

Fourth, LD tools and LD approaches reflect more on experts' LD-P rather than HE lecturers' LD-P. This aligns with the literature saying that available tools for LD are developed based on supposition about LD-P rather than empirical evidence on LD-P (Bennett et al., 2014). It also aligns with the experts' view on LD tools saying that LD tools are developed based on what experts think about how they should be designed.

All in all, experts' perceptions of the LD-P, available LD tools and LD approaches, and actual LD-P of HE lecturers appear to have significant differences. We found what experts thinking of LD practice, how this is reflected in LD approaches and LD tools, and what HE lecturers do in terms of LD-P were significantly different.

According to the literature, none of the available LD tools and LD approaches has become a de facto standard (Persico & Pozzi, 2015). This could be explained by the misalignments, or gap identified above between LD approaches/tools. This may be attributed to some factors, e.g. the educational setting envisaged or the context of the use of these tools, which were not considered adequately during the design and development of these tools. However, according to the sociomaterial theory, it is not only networks between human actors that help to achieve the desired goals, but it is the network of all the actors involved in the LD-P that should be considered to develop effective LD approaches and LD tools.

Mapping the actual LD-P of lecturers and experts with existing LD approaches and LD tools was one of the essential outputs of the research of this thesis. The comparison identified common factors and revealed areas where LD approaches and tools should be strengthened to better support practice. Moreover, the findings inform the development of design principles for LD tools that will support better LD practices, as described in the next chapter.

8.6 Summary and Contribution of the Chapter

In this chapter, we compared the networks of HE lecturers' LD-P and experts' LD-P to identify overlaps and misalignments. The analysis led to introducing a unified sociomaterial design framework that was used as an instrument to examine how existing LD approaches and LD tools represent LD-P. Finally, the findings were discussed.

The contribution of this chapter and also one key contribution of the thesis is a more holistic view of the LD-P in HE presented in the form of a sociomaterial design framework that can inform the development of future LD tools. This chapter offers a new basis for the development of design principles for LD software tools.

Chapter 9

Design Principles for LD Tools: a Sociomaterial Perspective

Equipped with a more holistic view of the LD-P in HE and the sociomaterial design framework, this chapter examines the points of overlap and misalignment between LD tools and LD approaches and the LD-P of HE lecturers and experts. The findings will inform the derivation of design principles for LD tools that align with the sociomaterial view of LD-P.

The rest of this chapter is organised as follows. The next section presents the points of overlap and misalignments. Section 9.2 presents the design principles for LD tools. Section 9.3 gives the sample implementation of the design principles. Finally, this chapter ends with the summary and the contribution of this chapter in Section 9.4.

9.1 The Points of Alignment

In this section, in Table 9.1, we summarise points of overlap or misalignment with LD-P that have been identified across the various dimensions of the sociomaterial design framework based on the previous discussion. We also define desirable features and functionalities for LD software tools.

Table 9. 1. Areas of overlap and misalignment, and suggested features and functionalities for LD tools

	Related Actors	Overlap/Misalignment with LD-P identified	Desirable tool feature/ functionality
Designers	Lecturers' Time and Workload	The time LD-P takes when using LD tools is an important factor that influences the adoption of LD tools. However, as participants highlighted, HE lecturers perceive usage of existing LD tools as time-consuming.	Ease of use and the time-efficient Good understanding of existing tasks. Customization of task model to institutional LD requirements.
	Lecturers' Values	Lecturers' values are another factor influencing LD-P and are not considered by LD tools.	Flexible support for designing different types of learning experiences following any kind of LD approach
	Design Team Co-designer Colleagues People from other Universities Teaching Assistant Co-lecturer	Participants acknowledge that collaboration and co-design, in their various forms, are inherent features of the LD-P. Among LD tools, the Learning Designer and LAMS created a community of designers sharing their LDs and editing others' LDs. ILDE, OpenGLM, WebCollege, exeLearning, CADMOS and the Learning Designer provide a function for only adapting and sharing LDs from others and editing them. However, HE lecturers collaborate with colleagues or co-teachers in the design of the LDs. However, even in these tools, there is no advanced collaboration functionality.	Collaborative editing functionalities exploiting cloud infrastructure; communications tools, e.g. chatting, networking groups, bring designers together to talk LD ideas and develop LDs together.
Students	Time and Workload	Strengthening the alignment between students' workload and credits value, e.g. when designing activities or assessments, depending on the course/programme of study.	Personas based on realistic user-profiles Customization to audience
	Prior Knowledge Needs Access to Resources Motivation	The information regarding students' prior knowledge, needs, access to resources, motivation, and time are influencers of LD-P. Although these actors are widely	Customization based on students' prior knowledge, needs, access to resources, and motivation

		acknowledged, they are not adequately accommodated in the LD tools.	
	Students' Capabilities	Aligning learning activities with students' skills, abilities, and competencies. LD tools do not have any function regarding students' capabilities.	Functionalities to create LDs that accommodate different types of students and contexts of use
Institution	National Standards	HE lecturers' LD-P is shaped by national and institutional standards and their LDs are deployed into VLEs chosen by the institutions. The LD tools evaluated in this study do not consider national and institutional standards.	Customisation to national and institutional standards
	Delivery Method	Various course delivery methods were considered by the participants. This is an aspect that LD tools should further support.	Set of default LD templates to accommodate different delivery methods
	Cultural Norms / Institutional Contexts	The institutional context has a big influence on the emergence of bounding practices. It has an impact on the adoption of LDs developed using LD tools and on the influence of both institutional technologies and teaching/learning strategies on how lecturers think about LD.	LD templates that meet institutional requirements for standards and quality purposes; functionalities for saving or converting LDs to institutional formats
	Syllabus	HE lecturers usually design LDs based on the syllabus specified by their institutions	Functionality to automatically analyse LDs and match them with particular content or textbook
	Curriculum	HE lecturers usually design LDs based on curriculum requirements specified by their institutions	
	Textbooks	It is common practice to adopt a core textbook for a course.	
	Resources	The availability of the resources that will be used in teaching-learning influences how HE lecturers design LDs. Existing LD tools do not support the lecturers regarding resources.	Functionality to show what kind of learning requires what type of resources
	IT Setups	The availability of the IT setups in the classrooms of the institutions affects LD-P in terms of what the teaching-learning approach will be	Guidance functionalities about what IT setups needed to design certain type teaching-learning.

		chosen.	
	IT People	The availability of IT people when needed influences LD-P, which is not considered by LD tools.	Providing IT support or guidance.
Course	Course Aims	Although course aims, learning objectives, learning outcomes, assessment, and activities are in general adequately addressed in LD tools, there is no way to control the alignment of these actors.	Functionalities to check the alignment of course aims, objectives, assessment, and learning outcomes.
	Learning Objectives		
	Learning Outcomes		
	Assessment		
	Activities		
	Educational Level	A certain level of teaching-learning requires the adoption of a different set of teaching-learning approaches. Existing LD tools allow to design LDs to a certain level of education; however, they do not list LDs to the users of the tools according to educational level	Grouping LDs according to the educational level they are designed for.
	Learning-Teaching Approach	A variety of learning-teaching approaches are used by HE lecturers - sometimes depending on their discipline, the type of course or the mode of delivery. LD tools should meet a diverse set of requirements regarding various learning-teaching approaches in an effective way.	Smart recommendations; Design Guidelines; Advice and support.
	Sequencing	Sequencing learning units, activities, or courses is an important part of the LD-P, when using tools to design at the level of individual lesson, course, or study programme.	Tools for sequencing at different levels.
	Course Timing	Course timing is an important component of LD. However, it is rarely considered in LD tools - see the Learning Designer.	Timing sessions and activities happening in a unit of learning.
	Storyboarding	Storyboarding is a widely used method for design; nevertheless, it is not fully exploited in the context of LD as only a subset of these tools accommodates it.	Storyboarding tools or other relevant functionalities.
	Design Patterns	According to the participants, sharing and editing design patterns is as important as sharing and editing LDs;	Functionalities for creating and sharing LD patterns.

		however, it is a practice that is not currently supported by LD tools adequately.	
	Existing Slides	HE lecturers' LDs are usually in the form slides and every year they adopt existing slides and revise them.	Features to convert LDs that are stored as slides into the format of LD tools in order to revise and adjust them.
	LD Approach	Strengthening the guidance about LD approaches that are usually provided in LD tools.	Advice and guidance about LDs and LD approach.
	LD from Past	HE lecturers and experts mention that they usually adopt LDs from the previous year.	Supporting users to adopt and edit existing LDs.
	LD Template	HE lecturers and experts agreed that providing LD templates in the LD tools will ease LD-P.	Providing LD templates of all kind of teaching-learning approaches.
	LD from others	LD-P is benefitted from sharing LDs with others and adopting LDs from others. Some LD tools, like the Learning Designer, provide features for browsing and editing other lecturers' LDs.	Functionalities for adopting suitable LDs, editing and sharing LDs from templates, previous usage, or other colleagues.
Technology	Website	HE lecturers would like to share LDs with their students who are LDs designed for. They sometimes prefer to share the structure of the course and LDs in a webpage. Therefore, it is essential to provide this functionality.	Allowing to sharing LDs as websites and embedding LDs in websites.
	Wiki	Some lecturers mention that they publish LDs in Wikis.	Allowing LDs to be published in a Wiki.
	Whiteboard Mind Map Tools Post-it Note-taking tool Paper-based tools	Whiteboard, mind-map tools, post-it, note-taking tools, and paper-based tools are used in the conceptualization of LD. Even though, existing tools support HE lecturers in this direction, further improvements are needed.	Function to allow users to draft LD ideas in the LD tool.
	Google Docs Word Processors	Participants indicate that they sometimes just want to export	Download LDs as commonly used file

	Slides Making Tools	the LD they created in a different file format. The HE lecturers' LDs are usually in the form of slides or word processor file. Even though, some of the tools export LDs in Word format, they do not support any other formats.	formats (Docs, PDF).
	Video Tools	HE lecturers produce videos for a course they will be teaching and there is a need to enable video integration in LD tools.	Providing a function to enable video integration.
	LD Tools	Despite the use of metadata standards, it is not straightforward for practitioners to exchange data and communicate between different LD tools.	Facilities to easily transfer complete designed LDs between tools.
	Search Engine	Search functionalities in LD tools help practitioners to locate relevant LDs and other information related to their LDs.	Searching across available LDs.
	Learning Technology	HE lecturers integrate various learning technologies and would like to learn about new technologies and how to incorporate them into their modules. Existing LD tools do not provide support to users regarding learning technologies.	Functionality that will suggest and guide about learning technologies and how to integrate them into the module.
	VLE	At the end of the design process, HE lecturers deploy their LDs into the VLE, but LD tools encounter several challenges in terms of data exchange and interoperability and offer limited functionality. The LD tools are not adequately equipped to support all kind of VLE to easily deploy LDs developed with the tools. Various LD tools allow deploying LDs into VLEs. However, they still do not support all kind of VLEs.	Easy transfer of LDs into LMS/VLE.
Feedback	Personal Feedback	Personal notes, observation of the students during the class time, review at the end of the class, self-reflection, and student criteria are the forms of getting personal feedback used by HE	Adding personal notes to each LD

		lecturers. However, LD tools are not sufficiently equipped to provide relevant functionalities.	
	Formal Students' Evaluation	Although student feedback is an important mechanism to improve LD-P, it has not been considered adequately in LD tools. HE lecturers use several ways to get feedback from students regarding how well the lesson went in relation to LD formally and informally. Examination, feedback forms, and survey are the kinds of receiving formal feedback from students used by HE lecturers.	Functionalities to exploit student feedback (through tests, forms or indirectly).
	Informal Students' Evaluation	HE lecturers use several ways to get feedback from students regarding how well the lesson went in relation to LD formally and informally. The informal ways of getting feedback from students are written students' evaluation, discussing with students, and word of mouth.	Adding informal students' feedback as notes (gathered through discussing with students and word of mouth).
	Learning Analytics	HE lecturers care about LA. HE lecturers see LA as an additional feedback mechanism to get valuable information about their students' performance and learning experience. However, even though there is an effort such as (Albó & Hernández-Leo, 2018b), more research is needed to link LA with LD.	Supporting the design of LDs with the use of LA.

The points of overlap and misalignment presented in Table 9.1 can formulate a set of sociomaterial design principles that can be used to inform the development of future LD tools that will be aligned with LD-P and support users better. These are described in the next section.

9.2 Design Principles

Building upon our effort in exploring LD-P and technologies and approaches for LD from sociomaterial perspective, in this section we present design principles for developing LD software tools that follow sociomateriality. The principles cover the design space of LD tools across all dimensions of the sociomaterial design framework.

Principle 1. One of the factors, which prevents HE lecturers from using available LD tools is time. HE lecturers are researchers as well as teachers in their disciplines at their institutions. Therefore, they have limited time. They would like to see an LD tool that reduces the time spent on LD-P.

Principle 2. The findings of this study showed that HE lecturers collaborate with a design team or colleagues to share and discuss LD ideas. LD tools should provide functionality that will allow designers to collaborate for designing LDs as well as sharing and discussing the LD ideas.

Principle 3. Learning-teaching strategies are chosen based on the students' time and workload. Therefore, they all influence LD-P in terms of how LD will be designed. LD tools should consider the time and workload of students.

Principle 4. Among the students-related actors, students' prior knowledge, needs, access to resources, motivation, and capabilities are other influencers of LD-P and should be accommodated in LD tools.

Principle 5. HE lecturers design LDs under the requirements of national and institutional standards. LD tools should support HE lecturers in customising LDs according to the requirements of national and institutional standards.

Principle 6. At the end of the LD-P, LDs are deployed in various ways to the various platforms. There should be a set of default LD templates to accommodate different delivery methods in LD tools.

Principle 7. The institutional context / cultural norms have a big influence on the emergence of bounding practices. This has an impact on the adoption of LDs developed using LD tools and on the influence of both institutional technologies and teaching/learning strategies on how lecturers think about LD. LD tools can have LD templates that meet institutional requirements for standards and quality purposes and functionalities for saving or converting LDs to institutional formats.

Principle 8. Syllabus and curriculum are specified by their institutions and HE lecturers are required to produces LDs that follow those. LD tools should consider all the requirements of institutions regarding syllabus and curriculum to meet their standards.

Principle 9. HE lecturers adopt core textbooks for their course and produce LDs based on these textbooks. LD tools would support the design of textbook-based LDs.

Principle 10. LD tools should provide information about the institutional context of designers. Specifically, the information provided should include resources, IT setups, and IT people at the institutions to enable designers to make informed decisions when choosing a teaching-learning strategy that meets institutional support level.

Principle 11. Course, course aims, learning objectives and learning outcomes, assessments, and activities are the general requirements for LD; therefore, there should be always space for them to be defined within LD tools and functionality to align them.

Principle 12. Learning activities are an important part of LDs and HE lecturers design activities as part of LD. LD tools should allow designers to design, share, and adapt learning activities as well as LDs.

Principle 13. Educational level indicates the level an LD has been designed for (e.g. bachelor’s degree or master degree). LD tools might accommodate a function that will present the level of LDs to ascertain the level of teaching-learning that will require to use different kinds of teaching-learning approaches. They should also present the lists of LDs according to their level of teaching-learning as it will ease the search of LDs for HE lecturers.

Principle 14. As there is a variety of learning-teaching approaches and their use in different disciplines varies, LD tools should support a diverse set of requirements regarding various learning-teaching approaches and disciplines.

Principle 15. Sequencing is an important part of LD. LD tools should allow designers to sequence the content and the activities in terms of what order they should be presented to the students.

Principle 16. Course timing is an important component of LD. How the timing of activities and sessions is organised within a unit of learning matters and needs to be well planned and designed. LD tools should provide a function to indicate the duration of all events placed in a unit of learning and give a proportion of timing to the users.

Principle 17. HE lecturers value storyboarding and use storyboarding tools in their LD-P. LD tools should allow designers storyboarding. An integration of LD tools with storyboarding tools would be beneficial.

Principle 18. Experts highlight the importance of designing, sharing, editing, and adopting design patterns as well as LDs. LD software functionalities should enable designers to design, share, adapt, and edit design patterns.

Principle 19. The LDs of HE lecturers are usually in the form of slides and every year they adopt existing slides and adjust them to the current year's material. Tools to convert LDs, which are in the form of slides, into a format compatible with the LD software's representation in order to revise and adjust would increase the adoption of LD tools.

Principle 20. There exist a vast number of LD tools with various underlying LD approaches. LD tools should be able to communicate with each other to maximise their benefits.

Principle 21. LD tools should provide a function to design, share and adapt existing LDs. The LDs might be built-in and ready to use, from the past or others.

Principle 22. HE lecturers and experts agreed that providing LD templates in LD tools will ease LD-P for HE lecturers.

Principle 23. There should be informative guidance about LD approaches and designing LDs within LD tools.

Principle 24. HE lecturers want their students to be able to see the LDs designed for them. Lecturers want to share the structure of the course and LDs with students making them available on their personal or institutional webpage. Therefore, LD tools should have a function to publish LDs as a webpage.

Principle 25. LD tools should support conceptualisation requirements. HE lecturers value conceptualisation of LD before they start designing. They are using various technological innovations in the conceptualisation phase of LDs; for example, whiteboard, mind-map tools, post-it, note-taking tools, and paper-based tools.

Principle 26. HE lecturers are required to turn LDs into institutional formats/templates at the end of the process of LD. Therefore, they need to turn the LDs into commonly used word processing file formats. LD tools should be able to convert LDs into various files formats.

Principle 27. HE lecturers record videos and use them in their LDs. Therefore, it would be useful for LD tools to accommodate a function that will allow users to record and integrate videos in LDs.

Principle 28. Despite the use of metadata standards, it is not straightforward for HE lecturers to exchange data and communicate between different LD tools. The real transfer of LDs among LD tools is required to take advantages of the various LD tools developed based on various LD approaches.

Principle 29. HE lecturers search for relevant information and LDs using search engines. LD tools should have search capability among available, either public or in the context of an educational organisation, LDs to retrieve and present the most relevant LDs to the designers.

Principle 30. HE lecturers integrate various learning technologies and are willing to learn new technologies and how these can be effectively integrated into LDs. LD tools should provide guidance and support about innovative and efficient learning technologies and how to integrate them into various kinds of subject modules.

Principle 31. At the end of the LD-P, LDs are deployed into an LMS/VLE and institutions use various LMSs. Therefore, LD software should be able to support the easy deployment of designs in different LMS/VLEs.

Principle 32. Personal feedback is also essential for HE lecturers. They take notes about their LDs' effectiveness, and the learning experience in the class in order to inform future development of LDs. Therefore, LD tools should offer feedback/self-reflection mechanisms that will support designers in noting ideas about each LD.

Principle 33. Students' formal feedback is very important to improve the LDs; therefore there needs to be a feedback mechanism to allow designers to get students' feedback on each LD. LD software should support features that will exploit students' feedback gathered through the results of the examination, feedback forms, or survey**.**

Principle 34. Another type of feedback that HE lecturers get from their students is informal feedback. Written students' evaluation, discussions with students, and word of mouth are some of the types of students' informal feedback. Having functionalities to exploit students' informal feedback might increase the engagement with LD tools in HE lecturers' communities.

Principle 35. According to HE lecturers, LA is another mechanism to get feedback through analytical results about each students' performance and learning experience.

As LA is trending, supporting the design of LDs using LA would increase adoption of LD tools.

9.3 A Sample Implementation of the Design Principles

In this section, we illustrate using an example of the application of the sociomaterial design principles to the LD tools. In this design exercise, the Learning Designer and an earlier software the Pedagogical Pattern Collector are used to illustrating how the design principles are accommodated or might be accommodated in the software tool.

The Pedagogical Pattern Collector (PPC) was developed for designing, abstraction, and representation of pedagogical patterns based on the Conversational Framework (Laurillard, 2002)- the same LD approach that later guided the development of the Learning Designer (Laurillard et al., 2013). As PPC (http://tinyurl.com/ppcollector) is not available anymore to look for the features of the tool in more detail, the relevant information was retrieved from the literature, (Ljubojevic & Laurillard, 2011) Information on the Learning Designer is available online – at https://sites.google.com/a/lkl.ac.uk/ldse/ for the standalone software version, and https://www.ucl.ac.uk/learning-designer/index.php for the web-based application- and also in the literature (Laurillard et al., 2013).

As presented in Figure 9.1, the “Designer” interface in the Learning Designer provides several functions for lecturers/designers/teams and other relevant actors of the “Designer” dimension (see Table 9.1) to create LDs. The “Designer” screen offers Timeline and Analysis features to support designers’ decision making during course design establishing a link between actors of the “Designer” dimension and those of the “Course” dimension. The Timeline feature (see Figure 9.1) enables users to get a view of the teaching/learning activities and course timing. The Analysis feature (see Figure 9.2) offers a feedback mechanism in the form of LD analytics. LD analytics are based on types of learning activities and course features, establishing a link with the “Course” dimension (see Table 9.1). The “Browser” feature of the Learning Designer allows users to explore LDs designed by others and adopt them. More detailed information regarding all the features of the Learning Designer is presented in Figure 9.3.

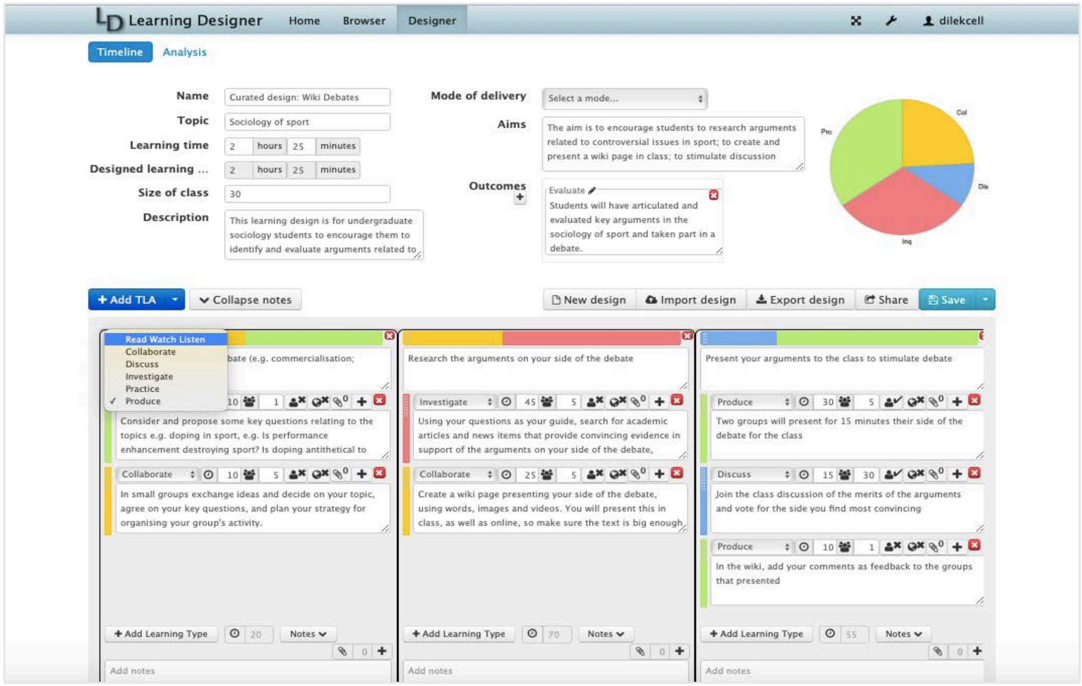

Figure 9.1: The Timeline of the designer page of the Learning Designer

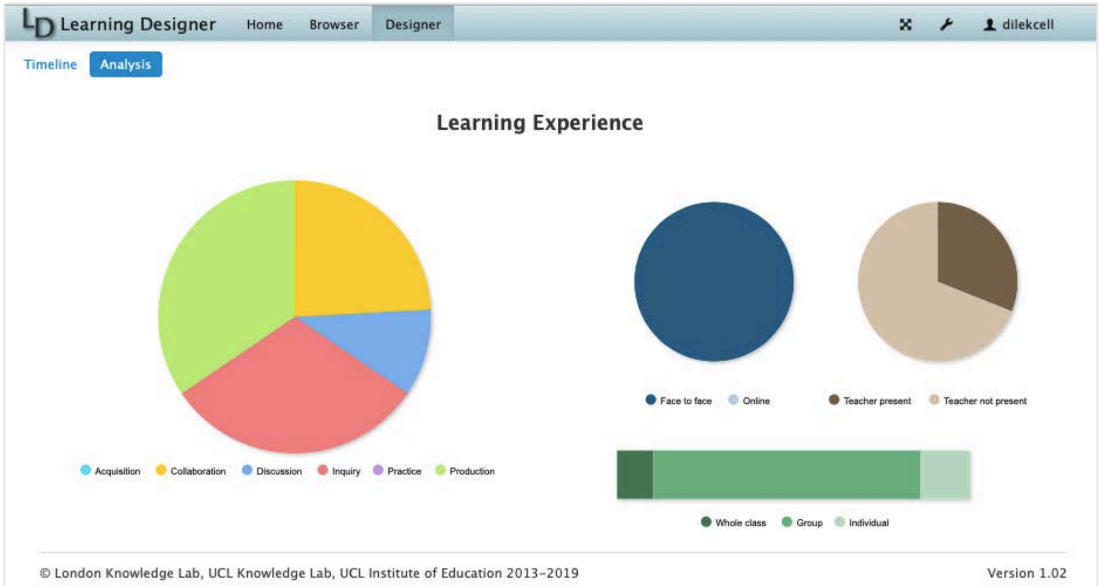

Figure 9.2: The Analysis of designer page of the Learning Designer

Both the Learning Designer and the PPC have a designer interface as presented in Figure 9.3 and Figure 9.4, respectively. The Learning Designer puts more focus on the design and sharing of LDs, which consist of sequences of Teaching-Learning activities (TLAs), offering users the option to reuse a TLA or create their own, whilst the PPC's focus is on designing and sharing TLAs organised as educational/learning patterns (Peter Goodyear, 2005; Fassbinder et al., 2017; De Oliveira Fassbinder, Fassbinder, Barbosa, & Magoulas, 2017; Fassbinder et al., 2017).

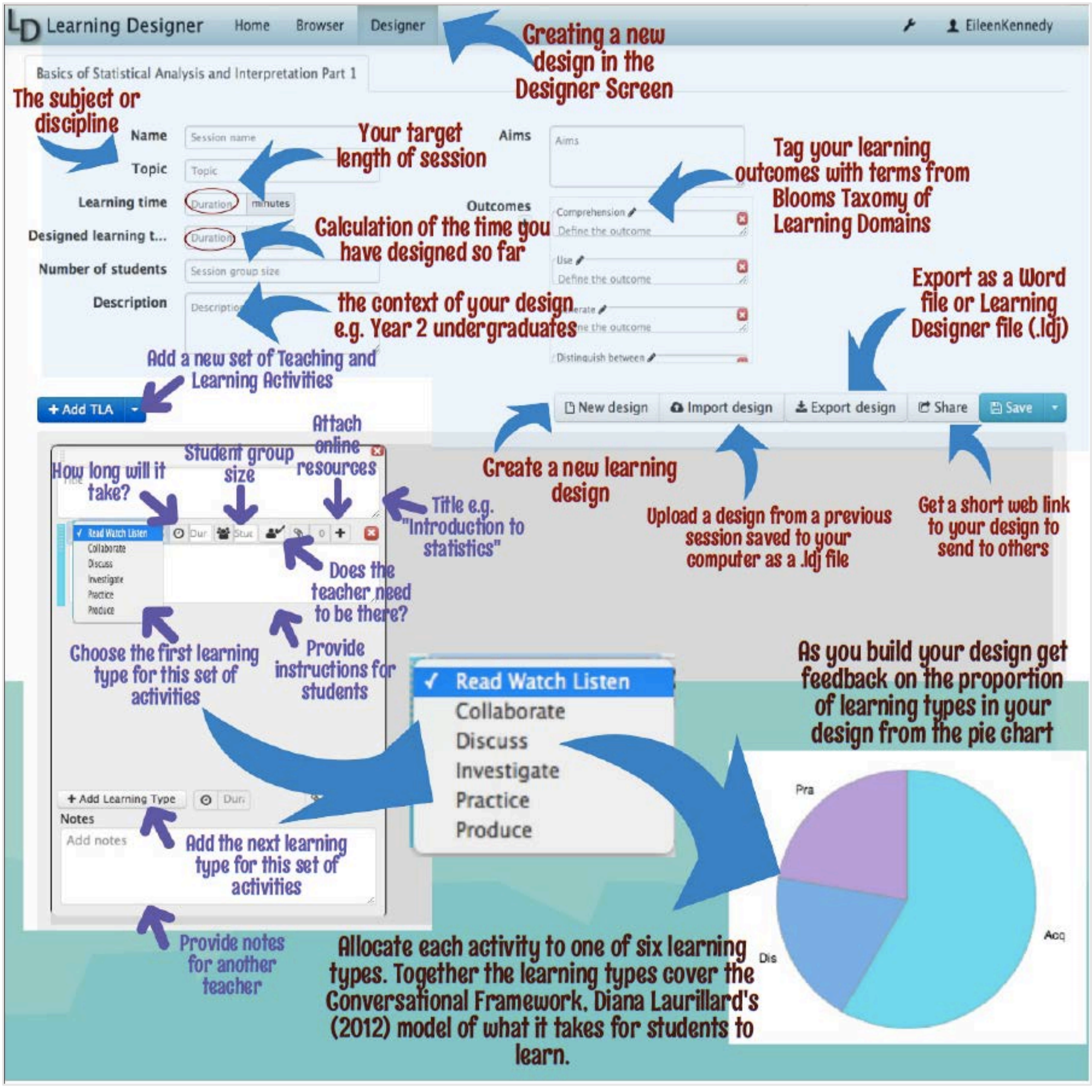

Figure 9.3: The designer screen of the Learning Designer - retrieved from (learningdesigner.org, 2013)

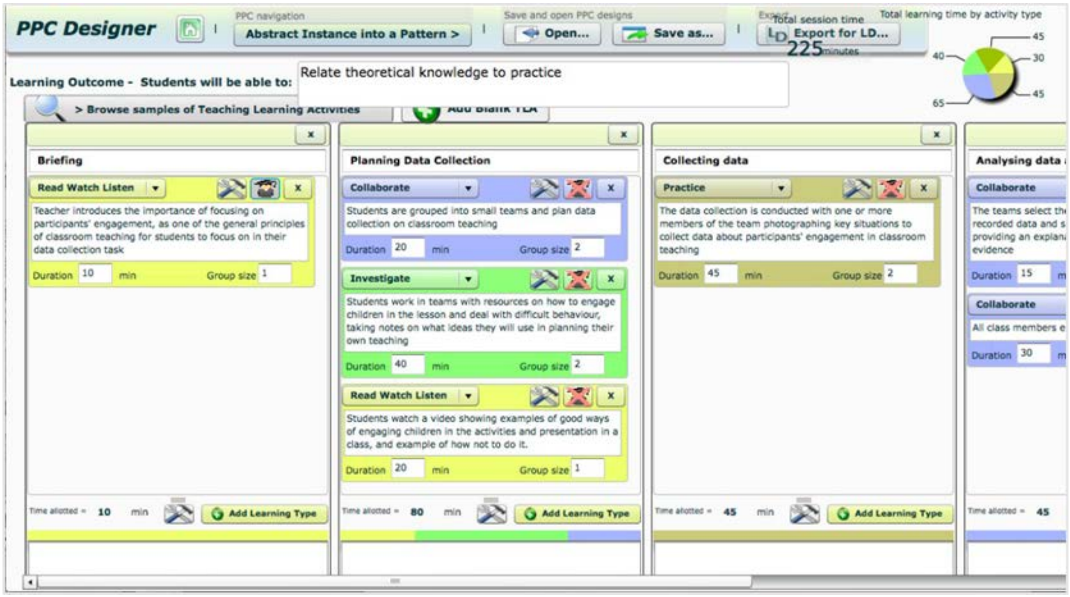

Figure 9.4: The designer screen of PPC Software (the screenshot is retrieved from (Diana Laurillard, 2012b))

An example of browsing existing templates on the Learning Designer is provided in Figure 9.5 and on the PPC in Figure 9.6.

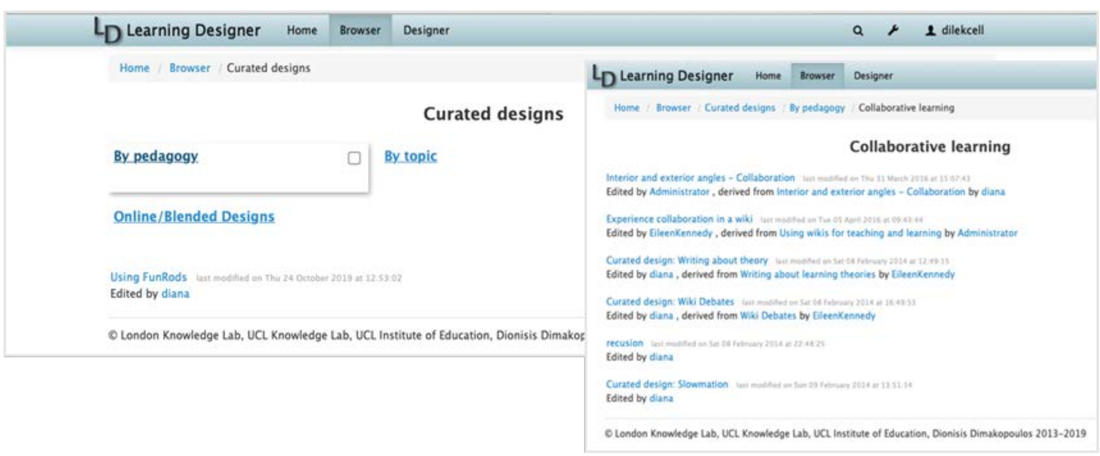

Figure 9.5: The browser feature of the Learning Designer

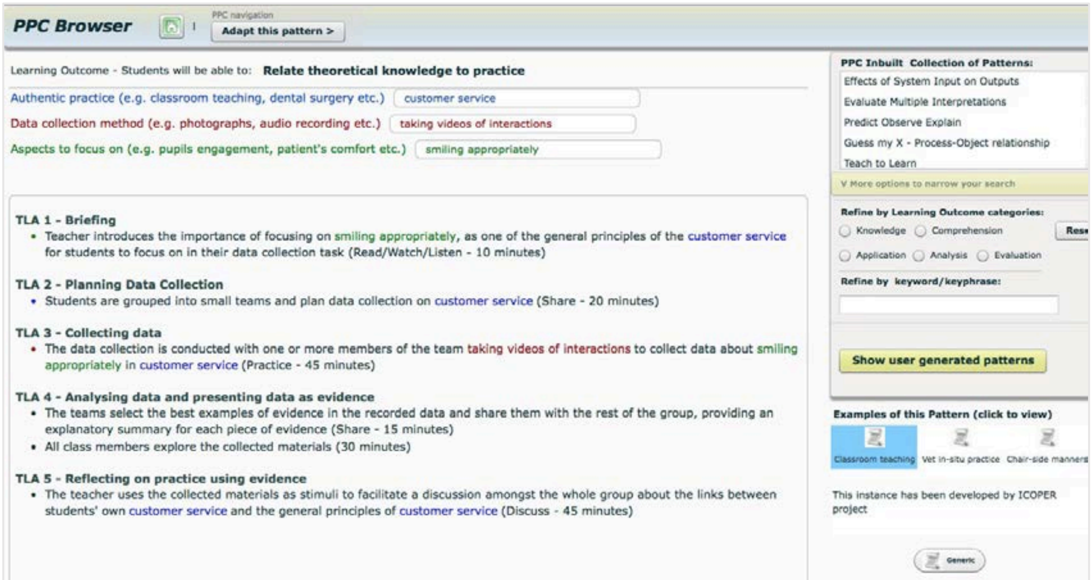

Figure 9.6: The browser feature of PPC Software (the screenshot is retrieved from (Diana Laurillard, 2012b))

Table 9.2 uses the Learning Designer as an example to illustrate how the design principles of Section 9.2 can be applied to support LD-P. It identifies areas where LD-P is already sufficiently supported in the tool and discusses how considering additional actors of the LD-P can increase the value of the Learning Designer compared with the earlier software PPC.

Table 9. 2. Applying the sociomaterial design principles to the Learning Designer and the PPC tool

Design Principle	**Learning Designer and PPC features**
Principle 1	The designer interface of the Learning Designer is presented in Figure 9.3 and the interface of PPC is provided in Figure 9.4. The Learning Designer is easy to use and saves times for HE lecturers. However, there is no evidence that it reduces the time spent on LD-P, which is a key factor influencing tool adoption. Adding the "Time" actor in these tools could improve the adoption of these tools by HE lecturers.

Principle 2	To accommodate "colleagues" and "design team" actors, the Learning Designer could have collaborative editing functionalities exploiting cloud infrastructure; communications tools, e.g. chatting, networking groups, bring designers and colleagues together to talk LD ideas and develop LDs together. Both the Learning Designer and the PPC do not accommodate this feature.
Principle 3	Both the Learning Designer and the PPC offer flexibility allowing users to customize activities according to "student workloads" and " "students' time" actors.
Principle 4	The Learning Designer could support the customization of the LDs based on students related actors including "students' prior knowledge", "students' needs", "students' access to resources", and "students' motivation". PPC also does not accommodate these actors.
Principle 5	LD tools should support HE lecturers in customising LDs according to the requirements of "national standards" and "institutional standards". Both tools do not accommodate these "national standards" and "institutional standards" actors.
Principle 6	The Learning Designer accommodates "LD templates" actor to provide different delivery methods as presented in Figure 9.5. PPC also accommodates "LD templates" actor to provide sample LDs to the users as presented in Figure 9.6
Principle 7	The Learning Designer could improve the provision of "LD templates" (actor) that meet institutional requirements for standards and quality purposes ("institutional standard" actor); functionalities for saving or converting LDs to institutional formats. PPC also does not accommodate "institutional standard" actor.
Principle 8	The Learning Designer could consider all the requirements of institutions regarding "syllabus" actor and "curriculum" actor to meet their standards. These actors are not considered in PPC as well.

Principle 9	Functionality to automatically analyse LDs and match them with a particular topic or "textbooks" could be useful for The Learning Designer. This actor is not considered in PPC as well.
Principle 10	Functionality to show what kind of learning requires what type of "resources" could be useful in The Learning Designer. Specifically, the information provided should include "resources", "IT setups", and "IT people" at the "institutional context" (institutional standard actor) to enable designers to make informed decisions when choosing a "teaching-learning approach" that meets institutional support level. PPC also do not accommodate these actors as well.
Principle 11	The Learning Designer has the functionality to check the alignment of the following actors: "course aims", "learning objectives", "assessment", and "learning outcomes" as presented in Figure 9.3. However, there are no such features in PPC.
Principle 12.	The Learning Designer supports to design, share, and adapt individual learning "activities" as well as LDs. PPC provides users with this actor.
Principle 13	The Learning Designer could have a function that will present the level of LDs to ascertain the level of study that will require to use different kinds of "teaching-learning approaches" and grouping LDs according to the "educational level" they are designed for. As presented in Figure 9.5, it is possible to search for LDs according to pedagogy or type, however, LDs are not grouped according to levels of study. The target level of study could be defined in the TLA section in the Learning Designer (such as inserting it to TLA section Figure 9.3). PPC also does not accommodate these actors as well.
Principle 14	The Learning Designer supports a diverse set of requirements regarding various "teaching-learning approaches" (actor) and disciplines. However, intelligent functionalities such as smart recommendations could advance the tool. In the browser page (Figure 9.5), this feature could be integrated. PPC also does not have this function.
Principle 15	Both the Learning Designer and the PPC allow designers to design "course sequence" and the sequence of "activities" in terms of what order they should

	be presented to the students. “Course sequence” and “activities” actors are accommodated in these tools.
Principle 16	The Learning Designer supports “course timing” including the timing of activities within a unit of learning as presented in Figure 9.3. PPC also accommodates “course timing” in TLAs.
Principle 17	The Learning Designer could accommodate “storyboarding” actor to allow designers to create a storyboard of their LDs. PPC also does not accommodate this feature either.
Principle 18	The Learning Designer software does not have a function that will enable designers to design, share, adapt, and edit “design patterns” (actor). PPC is mainly about designing and sharing “design patterns”.
Principle 19	The Learning Designer software could convert LDs that is in the form of “existing slides” (actor) into the format of LD tools to revise and adjust. PPC also does not support this feature.
Principle 20	The Learning Designer software could facilitate easy transfer of complete LDs to other “LD tools” (actor). It is not possible to transfer “design pattern”s from PPC to other “LD tools” as well.
Principle 21	The Learning Designer supports users to adopt and edit “LDs from past” (actor) as presented in Figure 9.5. PPC also allows to save “design patterns” (actor), adopt and edit them later on. These two actors are provided in both tools.
Principle 22	The Learning Designer provides “LD Templates” (actor) of various ”teaching-learning approaches” (actor) as presented in Figure 9.5.
Principle 23	The tool could provide informative guidance about “LD approaches” (actor) and designing LDsin “LD tools” (actor). The Learning Designer crib sheet (https://eileenkennedylearningtech.files.wordpress.com/2017/04/learning-designer-crib-sheet.docx) shows how to design LDs in the tool; however, this is not available in the tools as Help option.
Principle 24	The Learning Designer accommodates “delivery method” actor to allow sharing LDs as URL and embedding LDs in websites, and allows user to create a link of the LD and share it with others. For instance, this is an example LD

	(http://v.gd/B1J9Jm) from the Learning Designer, anyone who has this link can see that LD. PPC does not accommodate this feature.
Principle 25	The tool could have a feature that will allow users to draft LD ideas in the LD tool and to integrate with such a tool (for example, “whiteboard”, “mind-map tools”, “post-it”, and “note-taking tools” actors). Both the Learning Designer and the PPC does not accommodate these actors that will allow HE lecturers to conceptualise the requirements of LDs.
Principle 26	The tool allows exporting LDs as Docs file formats as presented in Figure 9.3 so that HE lecturers can modify it according to “institutional standards” (actor). However, this feature is not available in PPC.
Principle 27	The Learning Designer could provide a function to enable video integration into LDs. However, it is possible to attach “resources” (actor) (see Figure 9.3) in the learning design, so, videos can be inserted as “resources”. PPC also allows users to attach resources.
Principle 28	The real transfer of LDs among “LD tools” (actor) is required to take advantages of them. Both the Learning Designer and the PPC do not accommodate this feature.
Principle 29	HE lecturers do “online search” (actor) for relevant information and LDs using search engines. The tool could incorporate a search functionality to discover relevant LDs across available LD repositories. PPC allows users to make a keyword search (see Figure 9.6). However, this feature is not available on the Learning Designer’s browser page as presented in Figure 9.5.
Principle 30	The tool could have a functionality that will suggest and guide about “learning technologies” (actor) and how to integrate them into the module design. Both Learning Designer and PPC do not support this function.
Principle 31	“Delivery method” is another actor allowing HE lecturers to deliver their LDs in various “VLEs” (actor). The tool could allow easy transfer of LDs into “VLEs”. The Learning Designer allows to transfer LDs to “VLEs” (Laurillard et al., 2018), but more “VLEs” needs to be supported. According to (Diana Laurillard, 2012b), PPC also allows users to deploy LDs into “Moodle” (actor).

Principle 32	The tool could offer feedback or self-reflection mechanisms that will support designers in noting ideas (“taking notes” actor) on each LD. Both Learning Designer and PPC do not accommodate this feature.
Principle 33	The tool could have functionalities to exploit “student feedback” (through tests, forms or indirectly). Both Learning Designer and PPC do not accommodate “student feedback” actor.
Principle 34	The tool could support designers to add “informal students’ feedback” (actor) as notes (gathered through informal “discussions with students” (actor) and “word of mouth” (actor)). Both Learning Designer and PPC d not accommodate these actors related to informal student feedback gathering.
Principle 35	“Learning analytics” actor is about getting feedback through analytical results about each students’ performance and learning experience. The tools could support the design of LDs with the use of “Learning analytics”. Both Learning Designer and PPC do not accommodate this actor.

9.4 Summary and Contribution of the Chapter

Building on previous analysis of the LD-P and the unified sociomaterial design framework, this chapter considered the actors involved in LD-P and presented areas of overlap and misalignment between the LD-P of experts and HE lecturers and the actors considered in LD approaches and LD tools. Describing and articulating these areas helped to derive sociomaterial design principles to inform the design of LD tools.

The above consist of a key contribution of the thesis. The sociomaterial design framework and the design principles challenge existing perceptions on the alignment of LD approaches and tools with LD-P in HE, which have been considered human actors and focused on pedagogical aspects. Pedagogical considerations and the role of designers are vital elements of the LD-P and are indeed captured by the sociomaterial analysis and the associated design framework and principles. However, the sociomaterial perspective offers additional insights on the LD-P, revealing the existence of several other actors that impact on LD tools adoption in HE. This requires a new approach in the design of LD tools that will accommodate user needs and support better the LD-P. This chapter was the final step in answering the research questions and accomplishing the research objectives of this thesis.

Chapter 10

Conclusions and Directions for Future Research

This Chapter provides a summary of the research of this thesis and its findings in Section 10.1. It outlines the contributions of the thesis and acknowledges its limitations in Section 10.2. Thesis contribution is given in Section 10.3. Directions for future work are suggested in Section 10.4 Finally, Section 10.5 presents concluding remarks.

10.1 Summary of Research and Findings

LD or design for learning is an essential activity in HE and there is a clear need for digital tools to assist HE lecturers to create LDs, share LDs with others, and reuse LDs from others. Developing a digital environment to allow HE lecturers to perform LD and share effective teaching ideas with other teachers is, however, a very challenging task, as pointed out in Chapter 1 and Chapter 2. Several attempts have been presented in Chapter 2. However, most of them did not represent adequately the actual LD-P of HE lecturers. This lack of attention to the practice and the partial understanding of issues that affect it have led to poor adoption of LD tools in HE. Unlike previous research, the work presented in this thesis focused on understanding LD-P of the HE lecturers from sociomaterial perspective.

Chapter 1 presented the introduction of the research of this thesis including where it fits in the broad picture of the LD field, research questions, research objectives, the structure of the thesis, the summary of the contribution of the research of this thesis, and thesis structure. The issues of the LD field were triangulated with three sources of data: literature analysis (Chapter 2), LD experts' interviews (Chapter 4), and HE lecturers survey (Chapter 5).

Chapter 2 gave a literature review on the existing research of LD approaches and LD tools and their theoretical stances, HE lecturers' perspectives on LD tools, the issues and challenges with these frameworks and the tools. Various challenges of LD field were identified in the literature review.

In Chapter 3, methodological considerations of the research of this thesis were presented. Chapter 3 included a detailed explanation of methodological underpinnings and the DBR methodology, justifications for employing DBR method for this research and using various research methods such as literature review, semi-structured interview, online survey, Creswell's data analysis method, and sociomateriality as a theoretical lens. The implications of DBR for the research of this thesis, the explanation of the rigour in DBR, and ethical considerations were also presented in Chapter 3.

Chapter 4 presented the results of the interviews conducted with LD experts to understand the challenges and issues of the LD field from the experts' perspectives. It explained the procedure for conducting interviews protocol including details about the participants, data analysis method and data presentation. In Chapter 4, various challenges of the LD field were considered. Among them, a key point was the misalignment between LD tools, LD approaches and actual LD-P. This was the main contribution of this chapter to this study as well as to the LD field. Therefore, Chapter 4 helped us to the triangulation of the LD fields' problems as a second source of knowledge.

In Chapter 5, we presented the findings of the online survey that aimed to gather data for a need analysis of the LD field from HE lecturers' perspectives. Chapter 5 presented the implications of an online survey in this study with details, the demographics of the participants, data analysis procedure, and the findings according to the themes that emerged during the data analysis process. The most appealing finding and contribution of this chapter were that existing LD tools do not reflect the LD-P of HE lecturers. This issue is aligned with the challenge mentioned in the literature (Chapter 2) and the perceptions of the LD experts (Chapter 4). Therefore, the misalignment between the actual LD-P of HE lecturers, and LD tools and LD approaches was verified with three sources of data.

Chapter 6 presented the interviews' results contributing to our understanding of the LD-P of the experts through the lens of sociomateriality. As the methodology for conducting interviews was presented in Chapter 4, we explained in detail how sociomateriality is used as an analytical lens in this chapter. The results of the analysis and the discussion of the results were also presented in this chapter. Additionally, we developed a sociomaterial design framework (model 1) to examine LD approaches and LD tools based on the findings of this chapter. Various valuable insights were sought in the findings.

Chapter 7 presented the results of the HE lecturers' survey data from the sociomaterial perspective contributing to our understanding of the actual LD-P of HE lecturers from the sociomaterial perspective. As the survey methodology and its implications were presented in Chapter 5 and the sociomaterial analysis procedure was presented in Chapter 6, we focused on the findings and the discussion of the results in this chapter. Furthermore, we developed a sociomaterial design framework (model 2) to examine LD approaches and LD tools based on the findings of this chapter.

In Chapter 8, we compared the LD-P of experts (Chapter 6) and LD-P of HE lecturers (Chapter 7). Then, we introduced unified sociomaterial design frameworks, building on the models developed in the previous two chapters, to examine LD approaches and LD tools. The findings were significant. It was found that there is no full alignment between the LD-P understanding of the experts and lecturers' actual LD-P. More technological artefacts are get involved in the LD-P of the lecturers, unlike experts LD-P. It was also found that HE lecturers value getting feedback more than experts. Another interesting finding was that existing LD tools and frameworks barely cover the actors mentioned by experts and lecturers. Again, there is a misalignment in between the existing LD tools and frameworks, and LD-P of experts and lecturers.

Chapter 9 presented the points of overlap and misalignment between experts' LD-P, HE lecturers' LD-P, LD approaches and LD tools. It also introduced a new set of design principles derived from sociomaterial perspective to inform future developments in LD tools.

10.2 Outcomes and limitations

A misalignment was identified between LD tools and LD approaches and the actual LD-P of HE lecturers, and that was verified by three sources of data: literature review, LD experts interviews, and HE lecturers survey. First, we looked at the LD-P of HE lecturers. In the literature, Charlton, Magoulas, & Laurillard (2009)'s analysis showed that there exists a gap between the requirements of teachers and the LD tools that have been developed. This gap is considered as a reason for the low adoption of LD tools among teachers by (Charlton, Magoulas, & Laurillard, 2009). Supporting this argument, Bennett et al. (2015) said that LD tools are developed based on supposition about LD-P of teachers rather than empirical evidence on LD-P. Also, in the literature, it was highlighted that limited attention has been given to understanding what teachers actually need and what they do in their LD-P - an issue that should be actually explored before even starting the design of an LD tool (Dalziel et al., 2016; Mor & Craft, 2012; Bennett et al., 2014).

When we further explored the existing empirical studies on LD-P of the HE lecturers, such as (Prieto et al., 2014; Stark, 2000; Norton et al., 2005; Bennett et al., 2008; Bennett et al., 2011; Bennett et al., 2014; Nguyen & Bower, 2018), we realised that these studies had a different focus and did not consider the complex sociomaterial environment and all the actors.

Unlike existing empirical studies on LD-P of HE lecturers, one outcome of this thesis (Chapter 6 and Chapter 7) is an analysis of the LD-P of HE lecturers from sociomaterial perspective. Sociomateriality as an analytical lens provided us with a new perspective in discovering LD-P of HE lecturers.

Based on sociomaterial analysis of HE lecturers' LD-P, we developed gradually a Sociomaterial Design Framework, starting from model 1 in Chapter 6, model 2 in Chapter 7, and then the unified model in Chapter 8. This sociomaterial design framework for LD tools can be used as an instrument to examine existing LD approaches and LD tools in terms of how they accommodate the requirements of the LD-P in HE and also as a tool to inform the design of LD tools that support closely the LD-P in HE. This is an important outcome of this work as the literature of LD lacks systematic techniques to examine LD tools and LD approaches. Britain (2007)' framework for analysing and distinguishing LD tools in terms of their facilities, which is entirely different from this work, is to the best of our knowledge the only previous attempt.

Although there have been studies on understanding LD-P such as Prieto et al. (2014), Bennett et al. (2011), and Charlton et al. (2009) in LD literature, albeit not from sociomaterial perspective, there has been no attempt to provide general design principles for LD tools. An exception is a study by Albó & Hernández-Leo (2018) that derived design principles for a specific LD tool that targeted high school teachers. Therefore, the sociomaterial design principles presented in Chapter 9 is an outcome of this work that possesses unique characteristics in the LD domain.

As with every research study conducted, the outcomes of this work are subject to some limitations.

- **Methodological limitations**

It is essential to bear in mind the possible bias in the responses. To avoid bias, increase objectivity, explore the credibility and therefore to improve transferability of the results of the study, the number of the participants to the survey is kept high. The sample size of this study was sufficiently large compared to the existing studies in the LD - 32 was the one of the largest sample size identified in the most recent LD literature (Bennett et al., 2011).

The data analysis process is conducted by one researcher therefore there is a possibility of bias in the analysis. To avoid bias, the data analysis process comprised of various iterations to make sure about the results. The analysis process continued until we reached a saturation point in the results of the analysis.

- **Limitations of the Sociomaterial Framework**

The data is viewed through the lens of sociomateriality. Questions used in the interviews and survey were created based on the key characteristics of sociomateriality. The use of sociomateriality in this work is limited in the sense that we have not observed the actual LD-P in HE but we rather asked HE lecturers and LD experts about their LD-P and analysed the data from sociomateriality inspired questions.

Sociomaterial theory highlights that all the actors (human and non-human) have equal value in the practice and it has been criticized from this perspective. It has been said that sociomaterial studies have '…a tendency to grant relatively equal footing to all actors' contributions...' (Leonardi and Barley 2010, 24). Therefore, the actors that affect LD-P are considered equally irrespective of their nature- human or non-human.

Another limitation is with the use of ANT in this work. ANT has been criticized because it assumes that nothing exists before the enactment of human and non-human actors. The thesis presented and analysed multitudinous practices and has already acknowledged in previous chapters that deriving a complete set of networks may not be possible. However, our view is that despite the temporal nature of the process examining instances of the LD-P in HE can still provide useful lessons about the actor-networks that emerge when these actors are enacted in LD-P.

- **Limitations on the Examinations of LD tools and Approaches**

In this thesis, we examined 10 LD tools and 7 LD approaches using the new sociomaterial evaluation framework. The number of tools and approaches could be increased.

In the examination, the specific versions of LD tools and LD approaches presented in the cited papers in Chapter 8.3 and Chapter 8.4 were considered. Although theoretical models and tools may evolve in time, the analysis does not capture this evolution but it is based on a specific version of the tool or framework, as explicitly stated in the relevant sections.

- **Limitations of Sociomaterial Design Principles**

The design principles developed in this thesis were validated on seven LD approaches and ten LD tools and identified points of alignment and misalignment between then and the actual LD-P of HE lecturers. A more extensive validation using other LD tools and LD approaches, from the wide range of methods and tools available, would be necessary to fully assess the value of the proposed framework and design principle and generalise the findings of the research. The thesis provided an example application of the design principles to show how a prototype LD tool could be further enhanced. However, it should be acknowledged that in practice, it may not be possible to adopt all design principles when developing a new LD tool due to technical and organisational constraints governing a software design, or due to available resources limitations. In HE, many of these issues are not always as well known as for some other organisational contexts but since all LD projects so far were led by educational organisations these issues are relevant and have clear implications on the development and deployment of LD tools.

10.3 Thesis Contributions

This section presents an overview of the thesis contributions. For each chapter describing research work, the contribution is outlined together with the research areas to which it has contributed.

The main contribution of this thesis is the development of sociomaterial design framework (presented in Chapter 8) allowed us to examine LD tools and LD approaches and finally derive design principles (described in Chapter 9) to inform the development of future LD tools. Our proposed design principles consider the LD-P of HE lecturers from the sociomaterial perspective and inform the development of LD software tools. Thus, this work contributes to the field of LD, which is a sub-field of Technology-enhanced Learning. It is distinguished from existing studies of LD as it employs sociomateriality and therefore considers all the human and non-human actors in LD-P, unlike previous LD studies that were mainly human-centric.

Our methodology is based on triangulating the problems of LD field with three sources of data, namely literature, LD experts and HE lecturers, which is an approach that has not been used before in LD to the best of our knowledge. The contribution of Chapter 4 to the LD field is to understand the LD process and LD-P and its challenges from the experts' perspective using the interview method. Moreover, the contribution of Chapter 5 to the LD field is to understand the LD-P of the HE lecturers and the issues encountered when using LD tools in HE. Therefore, Chapter 4 and Chapter 5 contribute to the development of the basement for our proposed sociomaterial design framework and design principles for the LD field.

Once the main challenge was identified with three sources of data, then the LD-P of the LD experts and HE lecturers were analysed from a sociomaterial perspective. Thus, the contribution of Chapter 6 is to explore for the first time the LD-P of the experts from the sociomaterial perspective and develop a sociomaterial design framework based on the findings (model 1).

The main contribution of Chapter 7 is to extend this analysis to explore the LD-P of the HE lecturers and create a sociomaterial design framework based on the chapter's findings (model 2).

The main contributions of Chapter 8 are to compare LD-P of experts with LD-P of lecturers and align them with existing LD tools and LD approaches, present a unified sociomaterial design frameworks building on the models of Chapters 6 and 7, and examine well-known LD approaches and LD tools using the combined framework.

The main contribution of Chapter 9, a key contribution of the thesis as well, is defining the points of overlap and misalignments between LD-P and LD tools and LD approaches and propose a novel set of sociomaterial design principles for LD tools.

10.4 Directions for Future Research

In this section, we present several directions for future work, grouped into three main topics, each of which is described below. The topics are: (i) further exploring LD-P in HE setting, (ii) alignment of the LD-P of lecturers with existing LD tools and approaches, (iii) stabilizing some of the future for LD tools.

Further Exploring LD-P in HE Setting. In Chapter 6, we presented the result of the interviews conducted with ten experts to understand their LD-P and their perception of existing LD tools from the sociomaterial perspective. In Chapter 7, we presented the results of the survey that is made with one hundred HE lecturers from diverse countries and disciples to explore their actual LD-P from the sociomaterial perspective. Further research might explore LD-P of HE lecturers by country and also discipline. Employing other data collection method might also be helpful to get a deep insight into LD-P. Furthermore, as this study's theoretical basement was sociomaterial theory, future research on LD-P of HE lecturers would employ different theories to get insight from different theoretical perspectives.

Alignment of the LD-P of HE lecturers with existing LD tools and LD approaches. In the alignment process, we examined the alignment of six LD approaches and ten LD tools with the sociomaterial design framework developed in this study. Future research might examine other LD tools as well. Additionally, seeing this study as a starting point and research model, future research might develop a new design framework for LD tools building upon other theories and examine the alignment of LD-P with existing LD tools and LD approaches.

Stabilising some of the features for LD tools. The design principles derived in this study is a step towards the definition of a standard set of LD tools' functions. It would be useful to conduct further studies to explore how standardisation could work and define specific sets of functionalities for LD tools.

10.5 Concluding Remarks

This thesis has investigated the LD-P of the HE lecturers and experts from a sociomaterial perspective to develop a sociomaterial design framework. It proposed sociomaterial design principles to advance the development of LD software tools. Our study indicates that despite the challenges and complexity of the LD field, modelling design principles for better design and development of LD tools is possible. The solution presented in this thesis is one way of creating a set of design principles as its theoretical basement is sociomaterial theory. The results of the research of this thesis can be extended with a higher number of participants to the interviews and survey, and also through the use of other theoretical tools.

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Appendix A: Interview Questions

INTRODUCTION

This interview has been made available as part of the PhD Project, which is carried out by Dilek Celik under the principal supervision of Prof George Magoulas at Birkbeck College, University of London.

The information that will be collected will be treated in confidence and will only be used for the PhD Project. The research team will be free to publish the outcomes of the data analysis, but at no time will you or your institution be identified.
During the interview, the topics that will be discussed are Learning Design (LD), Learning Design Practice (LDP), LD Tools, Issues in LD, and Future of LD.
Throughout the interview, the following terms will be used:

Learning Design (capitalised): Learning Design field
A learning design (uncapitalised): An individual example of a sequence of teaching and learning activities.
Learning design tool: A tool that enables teachers to define or portray efficient teaching ideas in order that these ideas can be shared with, and adapted by, other teachers.
Learning Design Practice (LD-P): The action of applying Learning Design concepts to the creation and implementation of effective teaching and learning activities, also called "designing for learning".

QUESTIONS

1. What is the meaning of "Learning Design" to you?

2. Thinking an example of a lesson plan which you have created recently, could you tell me how did you design the learning (from the starting point to the end)?

3. When you create a new lesson plan, do you ever make use of an existing plan? If you ever adopt or look at plans written by other people, how do you locate those plans (e.g. ask those people, look on the Web)?

4. What are the actors – material and virtual, human and nonhuman – influencing the process of learning design? How do they influence the process of learning design?

5. Turning back to the lesson plan which you have created recently, what tools did you use? (e.g. Paper-based tools, Word, Presentation tool, Mind-mapping tool, Moodle) Can you briefly describe how you used these tools, and in what order?

6. When, typically, do you get feedback on how well the lesson went in relation to the plan?

7. Have you ever used Learning Design tools in your learning design?
If so, what are they? What did you like about the tools?
What challenges do you face when you design learning using these tools?
How Learning Design should be presented in online learning design environments? Visually, textually, or formally?

8. What challenges do you see in the Learning Design field?
How could these problems be solved?
What could be the future direction of the Learning Design field?

Appendix B: Survey Questions

TEACHERS' LEARNING DESIGN PRACTICES AND NEEDS ANALYSIS ON LEARNING DESIGN TOOLS

1. About this questionnaire

This questionnaire is one of the instruments used in a PhD project, carried out by Dilek Celik under the principal supervision of Prof George Magoulas at Birkbeck College, University of London. The PhD research is funded by the Turkish Ministry of Education, and the Department of Computer Science and Information Systems, Birkbeck College, University of London.

The aim of this research is to elicit university teachers' requirements of lesson planning and learning design, and analyse their current practices and perceptions of learning design and of learning design tools. The research employs several methods such as surveys, interviews, analysis of lesson plans, and literature search.

The research adheres to the College Ethics Framework and Code of Practice on Research Integrity- details are available online at http://www.bbk.ac.uk/committees/research-integrity - and has received institutional ethics clearance.

The information you provide will be treated in confidence and will only be used for research purposes. The research team aims to disseminate the outcomes of the data analysis in articles and presentations, but at no time you or your institution will be identified.

SurveyMonkey requires that participants complete this questionnaire in one sitting, and we estimate it will take 20-30 minutes to fill it in. So before starting, please make sure you have this time available because it won't be possible to save any answers and return later to complete it. (If you do not have the time right now, then please exit without answering any questions and come back later.)

* 1. What is your gender?

- ◯ Female
- ◯ Male

* 2. In what country do you live?

* 3. What level do you teach? (Please, select all that apply.)

- ☐ Bachelor's
- ☐ Master's
- ☐ Doctorates

Other (please specify)

* 4. What subjects do you teach?

* 5. How many years of teaching experience do you have?

- 1-5 years
- 6-10 years
- 11-15 years
- 15+ years

The following questions (6, 7, 8, 9, and 10) will be about learning design tools. In these questions we use the following terms:
Lesson = Individual tutorial, seminar, practical class, laboratory work or lecture
Learning design tool = A tool that enables a teacher to define or portray their teaching ideas so as they can be shared with, or adopted by, other teachers.

* 6. Which Learning Design Tools have you heard of? (Please, select all that apply.)

N/A (Not Applicable)	ScenEdit	CompendiumLD
ILDE	CeLS	Pedagogical Plan Manager
The Learning Designer	DialogPLUS	PHOEBE
CADMOS	WebCollage	OpenGLM
Reload	MOT+	LAMS Activity Planner
LD Tool	exeLearning	OpenScenario
HKU Learning Design Studio	coppercore	HEART
LAMS	GLO Maker	Cloudworks
GLUE!PS	Pedagogic Pattern Collector	Map My Programme
LdShake	ReCourse	LAMS v2

- If you know any other tools that are not listed here (please specify)

If you selected N/A in Question 6, you can skip Questions 7, 7a, 7b, 7c, 7d, 7e, 7.2, 7.2a, 7.2b, 7.2c, 7.2d, 7.2e, 7.3, 7.3a, 7.3b, 7.3c, 7.3d, 7.3e and go directly to Question 8.

7. Choose from the list a learning design tool you have used before. (If you have used more than one tool, please pick the one you liked more)

7a What was your main motivation for using the tool?

7b Please describe all the benefits you get from the tool.

7c What challenges did you face when using this tool?

7d How likely would you be to use the tool?

- Extremely likely
- Very likely
- Moderately likely
- Slightly likely
- Not at all likely

7.e What changes would you like to see within the tool and why do you think they would help?

If you would like to review more tools, use Questions 7.2, 7.2a, 7.2b, 7.2c, 7.2d, 7.2e, and 7.3, 7.3a, 7.3b, 7.3c, 7.3d, 7.3e. Otherwise, go to Question 8.

7.2. Choose from the list a learning design tool you have used before. (If you have used more than one tool, please pick the one you liked more)

7.2a What was your main motivation for using the tool?

7.2b Please describe all the benefits you get from the tool.

7.2c What challenges did you face when using this tool?

7.2d How likely would you be to use the tool?

- Extremely likely
- Very likely
- Moderately likely
- Slightly likely
- Not at all likely

7.2 e What changes would you like to see within the tool and why do you think they would help?

7.3. Choose from the list a learning design tool you have used before. (If you have used more than one tool, please pick the one you liked more)

7.3 a What was your main motivation for using the tool?

7.3b Please describe all the benefits you get from the tool.

7.3c What challenges did you face when using this tool?

7.3d How likely would you be to use the tool?

- ◯ Extremely likely
- ◯ Very likely
- ◯ Moderately likely
- ◯ Slightly likely
- ◯ Not at all likely

7.3e What changes would you like to see within the tool and why do you think they would help?

Now, we would like to focus on how you design an individual lesson.

* 8. Thinking an example of a lesson plan which you have created recently, could you tell us what you used as a starting point? For example:
- Did you start with the desired learning outcome(s)?
- Did you start with assessment criteria stipulated in the curriculum?
- Did you start with an activity(ies) that you want students to do?

* 9. When you create a new lesson plan, do you ever make use of an existing plan? (Please, select all that apply.)

- ☐ I adapt an existing lesson plan of my own.
- ☐ I look at one of my old plans for ideas.
- ☐ I adapt an existing lesson plan written by someone else.
- ☐ I look at someone else's plan for ideas.
- ☐ Other (please specify)

* 10. If you ever adapt or look at plans written by other people, how do you locate those plans? (Please, select all that apply.)

- ☐ Ask those people.
- ☐ Look on the web.
- ☐ Other (please specify)

* 11. What approach do you follow when you design a lesson plan? (Please, select all that apply.)

- [ ] Holistic/top-down approach: start by developing the big picture and then refining it with the small details
- [ ] Serialist/bottom-up approach: work step-by-step through the plan
- [ ] If you use any other models (please specify)

* 12. Do you use paper-based tools or digital software to create a lesson plan? Please, indicate into the boxes below what tools you use and how you use them.

Paper-based tools (e.g. paper, pen)	
Word processor (e.g. LaTeX, Word)	
Presentation tool (e.g. Microsoft Power Point)	
Mind-mapping or other diagramming tool (e.g. MindManager)	
VLE (e.g. Moodle)	
Web page design tools (e.g. Wordpress)	
Other (please specify)	

* 13. Turning back to the lesson plan which you have created recently, could you tell us how you used these tools and in what order?
For example:
"I used a plain-text editor to put in writing the ideas I had in my mind. For those ideas that were not clear, I do some writing on a whiteboard because it is easier to think around a whiteboard than it is with a text editor. "

* 14. In the learning design process, there are several factors that need to be considered. Please, rate how important each of the following factors is to you when you are creating a learning design.

	Very important	Important	Not very important	Not at all important	No opinion
Curriculum	○	○	○	○	○
Target Audience	○	○	○	○	○
Location	○	○	○	○	○
Students' access to resources	○	○	○	○	○
Availability of technology in the classroom	○	○	○	○	○
Students' accessibility to the technology outside of the classroom	○	○	○	○	○
Time constraints	○	○	○	○	○

Other (please specify)

* 15. At what point(s) of the learning design process do you create supporting materials for students? (e.g. handouts, reading lists)?

- ☐ As I plan each activity
- ☐ After I have finished the lesson plan
- ☐ Other (please specify)

* 16. When, typically, do you get feedback on how well the lesson went in relation to the plan? (Please, select all that apply.)

- ☐ On the same day as the lesson
- ☐ A few days or weeks later
- ☐ Just before the next time that I run the lesson

Other (please specify)

* 17. How do you get feedback on how well the lesson went in relation to the plan?

18. If there are any other considerations of learning design process that are not listed in this survey, please write them to the box below.

Appendix C: Two Samples of Interview Data

A CLEAR VERBATIM TRANSCRIPT I

Interviewer (I) **: Dilek Celik**

Respondent (R) **: E4**

Date **: 1th December at 18.00 (CET)**

Type **: Skype**

Q1. What is the meaning of "Learning Design" to you?

E4: The meaning of learning design to me is a systematic process where educators take to define the task for students to do, the task you get all their aspects relates to the resources and tools that support this task and all the details that combine that the definition of the activity that will be finally performed by the student.

Q2. Thinking of an example of a lesson plan which you have created recently, could you tell me how did you design the learning (from starting point to the end)?

E4: OK. I am a bit bias. Because, you know, I am researching in this domain. I use my tools. So, I don't know my answer will be very sound. For example, one of the research that we are doing is how to scale after the learning methods and in my teaching and the pyramid, collaborative learning flow pattern, the pyramid pattern. And then, I am doing these many times pyramid-based learning actually these days. And you see a tool that we reproduced that is an authoring tool learning design tool where I create an activity and I run the activity directly there. Then I also put the final link to that design into the Moodle. But I use authoring tools, design tools that we are producing in my team.

Q3. When you create a new lesson plan, do you ever make use of an existing plan? If you ever adopt or look at plans written by other people, how do you locate those plans (e.g. ask those people, look on the Web)?

E4: I typically create my lesson plans, but this is probably because there are not many high-quality lesson plans shared. I mean really to use etc. There are no many I do use mine owns from previous years. And there are no many options to reuse complete lesson plans.

Q4. What are the actors – material and virtual, human and nonhuman – influencing the process of learning design? How do they influence the process of learning design?

E4: OK. Um. In my case, it depends on the university which is face to face university is essentially in me as a main professor in the courses I am involved in and the coordinator and assistants. We have half support if we request from the university service in terms of managing the learning management system, the Moodle. But, this is for only technical issues. It is not about supporting institutional design or something like that. So, essentially, in terms of designing for learning, designing the activity, it essentially needs to get it with the teaching assistant.

Q5. Turning back to the lesson plan which you have created recently, what tools did you use? (e.g. Paper-based tools, Word, Presentation tool, Mind-mapping tool, Moodle) Can you briefly describe how you used these tools, and in what order?

E4: It is, there are several, the Integrative Learning Design Environment is the main infrastructure. And, within it, we have several tools integrated. These days, essentially, I use Pyramid Editor that we just built. But they are all tools integrated. We also use such as WebCollage. This is very specific for assigning collaborative learning activities and patterns so, it is not generic, you cannot do everything. And then we come and implement it in Moodle. I also to document an idea in there. All those things I have done directly into Moodle, you know, more WebCollage oriented theme.

Q6. When, typically, do you get feedback on how well the lesson went in relation to the plan?

E4: This is a good question this is what we are having a couple of projects in that. This is where we are currently researching how we can analyse the learning design. And this aligns with the main aspect of the learning design. In the past, when we were collecting data which essentially to understand for research purposes not really to support our work with teaching practice. Now we want to see how these can be down into our teaching practice of use of our tools. And, we are currently trying to see to what extent this, if it is feasible or how to implement it. But we don't have a definitive answer yet. So, we are currently trying to do that. *How are you planning to get feedback on the lesson plan?* E4: And now there is a PhD student who has been working on that. So, he is thinking of several options on combining this is a piece of work my own on a framework that includes different types of data from the satisfaction of the different agents to embed on learning, engagement, enjoyment and so all these aspects. So, we are in these processes right now. There are two workshops papers on this. But I cannot share it with you. So, there you see our initial idea, early day ideas.

Q7. What did you like about these tools? What challenges do you face when you design learning using these tools?

E4: The ones that I use are those integrated into the ILDE. Since I am for conceptualisation or sketching, another authoring, I mainly use WebCollage and then the Pyramid and then the one is DELL. And then for conceptualisation, I use Learning Design Tool by colleagues in the university that comes from the JISC project in the past. So, those are the ones that I mainly use. In the past, I used openGLM but just play, not properly used it in myself. The main challenge that I see is that in general is the time because we are professors, we have time-limited. And that for everyday practice is tricky to do that. For some cases, more emphasis when we want to document some of the activities because you want to stand there, and plan, you want to share with all there, because you have documented them to give it for yourself that you will use in the future. So, the challenge I see is essentially the timing of teachers in that. In many cases, the knowledge that is implemented in the tools is also limited. The tools are limited in terms of features. Because you can only design specific things. But, if you are using a tool that is more generic than you can design whatever, then, you are not seen by in terms of inspiration that they provide. So, there is a tension there and they are not perfect by launch because it will be complicated maybe we need a lot of resources to do that. So, it is the challenges that I see. *What do you think that how Learning Design should be presented in an online learning design environment?* Visually, textually, or formally. E4: There is a lot of research on these representations. And there is a lot of options. I think there is no perfect option. I think that it depends on the particular kind of design in terms of pedagogy, or terms of the formality of the design. And I think that it also depends on the person. So, for example, some people like a more visual representation, so some people prefer more textual representation. So, it depends on the disciplines. So, engineering or science-oriented discipline, they lie down around more humanist oriented. And there is also my experience when we were working with teachers that they prefer more demonstrations. So, I think the need is also no representation is better for all the problems and all the contexts.

Q8. What challenges do you see in the Learning Design field? How could these problems be solved?

I think the challenges have many levels. There are challenges for adoption that have to do with the ecological constraints of the teachers and their time, their cultural practices. So, there are these challenges. And other challenges had to do with the resources that we have to be a high-quality tool in. Because we build a research prototype even though they are very flush or are mature. There are not resources, you know, we have limited resources. But, we will have more resources and it will be more useful or they will have more knowledge integrated in terms of templates, inspiring.

Then, the market has not seemed to value these tools. It still is not seen as the key to the method of the active learning methods that are not seeing as a way to really by the industry. And, there are also technical challenges that have to do with interpretability. There are some solutions, but the solutions we have are also limited. The mapping between the formals - it works, but there is design detail and means when you use the mapping so. There are also standing cultural things. And also because all industries in terms of building up major systems, I think the industry is more interested in, especially the editorial the publishing industry in creating their materials, so they put more effort into that and they are not supporting teachers in building their materials. So, there are these cultural aspects as well. But, there is also a nice initial coin going on in this but they are proprietary and there are difficult to be used for research purposes. *What could be the future direction of the Learning Design field?* E4: The future directions. I think that there need to be more works with teachers to try to understand the needs of teachers and how this can be integrated into their current practices. They already do learning design in their way so we need to see how we are doing and allowing them to continue what they do. So, this one is one thing. We need to work more work with the practitioners on a long-term basis. This is another thing. And we need to do tools that are easier to use, richer in terms of the pedagogical knowledge that is provided in there for inspiration. And I think that we probably also need to more work on having more high-quality examples that are sharable and understand how teachers will be willing to share, they will be willing to use this and may or their somewhat which are the challenges there. I think there is a hot topic now the change, you, know, closing the whole cycle of the designing, implement in and evaluate in and using the evaluation for redesigning I think that many of us have a project on that. I think that it is important. But, more things need to be done not only this one. This is also having many challenges. The evaluation of design coming from a valid context that not only for that context we know that many factors are involving in learning in education. Not just the learning design but also contextual factors. So, there are many issues there. We need to be very careful when we look at that problem.

A CLEAR VERBATIM TRANSCRIPT II

Interviewer (I)	**: Dilek Celik**
Respondent (R)	**: E2**
Date	**: 12th December 10am**
Type	**: Skype**

I: I'm going to ask you eight questions. And I will start with the first one. *What is the meaning of Learning Design to you?*

R: So, learning design, I think recently some people have started using the term learning experience design. The idea about learning design is the kind of conceptualisation and planning and shaping the experience that would achieve certain educational goals. So, it's really, for me not about producing or a sequence in content but about thinking about the learners' experience in view of learners' background on the context of learning and the educational objective that you want to achieve as an educator.

I: OK. My second question is "*Thinking of an example of a lesson plan which you have created recently, could you tell me how you designed the learning (from starting point to the end)?*".

R: So, you know, I have developed a methodology for learning design. So, I usually start with getting some view of the learners' using the tool called Personas and then defining the objectives and design intentions. And then doing a quick storyboard of the learning experience. So, the first step is getting a good understanding of who is a learner and what is the context in which they're learning. And then I might use Personas or other representations of the context of learning. And then marking my intentions in terms of what I want them to achieve in terms of the learning experience and then doing the storyboard. I don't always do the full cycle, sometimes I just jump straight into the storyboard if I have a good idea of my mind of the target audience and the objectives then I might just start to jump straight into the storyboard. But I think storyboarding is a very important phase in the process. There is at the moment a few methodologies around that that you storyboard like you know the Carpe Diem methodology. And there is I think the ABC methodology that used at UCL I think they also use storyboards I'm not sure. But for the actual storyboarding I either use paper and pen or a template they have created in an action in Google Draw. So, the fact is although you know, I have seen quite a few learning design tools and I use quite a few learning design tools. Another way of two of that really starts with the representation of the learners, and their context and then the storyboard. So, that's why I do things kind of intuitively. I mean there is a tool that you know I was involved in its development called ILDE and that tool does have representations for learner Personas and storyboards and so on. So, that is one tool that I sometimes use which does cover, you know, the different representations there are in use. The problem is that there isn't kind of a clear streamlining from one representation to another. You know the different representations that you have to actually move between them on your own.

I: My next question is *"When you create a new lesson plan, do you ever make use of an existing plan? If you ever adopt or look at plans written by other people, how do you locate those plans (e.g. ask those people, look on the Web)?*".

R: Well. I don't usually because I might make reuse of my plans and you know sometimes, I might look for documented plans that others made. But, usually, no to the topics I teach, I don't think I can find detailed lesson plans designed by other people. So, that's why I don't usually do that. I mean there are two dimensions in the ILDE has actually you know it's designed for sharing and we use design artefacts, not just lesson plans but also other design artefacts. And I know the tools like you know Diana's Learning Designer is also a theoretical built for sharing and reuse of lesson plans. But I think that what I find more effective is not necessarily sharing a specific lesson plan but sharing kind of higher-order representations like design patterns. So, I do definitely reuse Design Patterns from other people. But then you know the actual sequencing of a lesson is something that I would do on my own. Because usually, that would be kind of quite unique to the course that I'm teaching.

I: My fourth question is *"What are the actors – material and virtual, human and nonhuman – influencing the process of learning design? How do they influence the process of learning design?"*.

R: That is a very interesting question. I mean obviously, I think it's very it's highly dependent on the institutional context. So, for instance, when I was at the Open University, each course had a team of three or four academics. And then some learning technologists and usability experts and editors and so on. So, there was a huge team that was involved in one way or another in the learning design process. Open University has specialists in learning design which would also support a course. In most universities, what happens in the lesson is pretty much between the lecture and the students. And most lectures will not involve students as partners in the learning design. And so, you know learning design is very much up to the lecturer. In some places like work with universities where especially Open University where there was a kind of separation between the lecturer that provides the academic content and then the learning designer and instructional designer that actually set up the online environment and actually produce the content online. And so, you know its interaction between these two but there was a very kind of clear and strict separation of roles. A lot of times, a lot of the education products I am involved in involved a team. So, if I'm running a course or a workshop or you know designing some education innovation, there will be a team of people who might be from different institutions. And they will collaborate on the learning design. And ideally, I would like to have my students involved in the learning design and subject a specialist and so on but that usually doesn't happen.

I: I see. Another question is "*Turning back to the lesson plan which you have created recently, what tools did you use? (e.g. Paper-based tools, Word, Presentation tool, Mind-mapping tool, Moodle) Can you briefly describe how you used these tools, and in what order?*".

R: So, I use. Once I use the ILDE. And there is something else I'm happy to get in touch with the people developing that tool. I use paper-based tools a lot. I use Google Docs a lot. So, a lot of times when I'm doing a quick design with people who aren't familiar with various learn design tools, I just do stuff in Google Docs. And yes, and paper. I think a lot of times you know it's kind of hard to replace paper and pencil I think I also do that. In terms of the full cycle of learning design from the initial concept and the characterisation of the target audience to do the actual implementation in a VLE or in some sort of blended or hybrid environment, I don't see any tool that's really kind of streamlines this whole process. So usually there's some paper involved and, in the end, sometimes at some point, you jump into the VLE and the craft things there.

I: OK. I see. Another question is "*When, typically, do you get feedback on how well the lesson went in relation to the plan?*".

R: [Laughs] The one thing I try to do is to set up a feedback form. So, I do a lot of workshops. I haven't done and actually, I haven't taught courses for the last two or three years. So, I don't get feedback on courses but the workshops. And then I usually set up a feedback form in Google and ask the students for feedback at the end of the lesson. When I was working in the design team, or you know in learning innovation teams then you get feedback on the design before it was actually implemented. And that is for instance the way that is here at the Open University that you know that you do an initial draft of the course design and then it's sent out to reviewers, and you get feedback on that and then you proceed to the next draft. And I think that is a quite unique environment.

I: OK. My seventh question is on LD tools. *Have you ever used Learning Design tools in your learning design?* You said yes, you do use them. *What tools did you use? What did you like about these tools?*

R: Yes. So, I've used The Learning Designer tool. I liked the sort of the visual clarity, and you know and also they have the kind of the dashboard that gives you a kind of review of the sort of the pedagogical mix. But I thought it was a bit too constraining. And I thought it was good where you already have a very good idea of what you want to do but it wasn't good for the kind of earlier conceptual phases. And there was not an option to export the design to any other tool. So, if I want to then say OK this is my design, now, I want to implement it in Moodle or IXL Learning or Canvas or whatever. There wasn't that integration. So, that for me you know on one hand I could not use it in the sort of the early phases. And then on the other hand I could not export it into an actual learning environment. Those are the reasons why I did not use it. I decided not to work with this tool so often. I use ILDE quite a lot. ILDE is not a single tool it's actually a kind of a suite of different tools. And I was also partnering in developing it. So, I like to set of representations it gives me. I like the fact that it does follow through the cycle from the initial conceptualization to the actual deployment to the VLEs. But I thought that some of the phases could be improved in terms of the transition from one set of representations to another. I have used CADMOS a bit. I thought the general design was interesting, but I thought it is kind of reflected. A very particular learning design process and you know which is good if you follow that process well. I didn't feel that I have the flexibility to do other work in different ways. At the end of the day, you know as I said I haven't yet seen the tool that I can actually say OK you know this is it, you know I can do all my learning design with this tool. I'm also in the position at the moment where you know I'm in the kind of senior position in a teachers' college.

So, I would like to actually introduce learning design tools. We have about four hundred lectures in the college and seven thousand students. So, I'd like to introduce learning design as a paradigm and the tools to all of these. So, I still don't have you know a tool that I think OK, this is something I can show people and they will start using it.

I: As part of the seventh question, *what do you think that how learning design should be presented in an online learning environment? I mean visually, textually, or formally.*

R: Yeah. I think it is very important to have multiple representations. The things you need to have. Well, first of all, different phases in the learning design process require different representations. So, in the conceptualization phase, you need kind of very open and fluid representations. And also, I think very graphical representation, so you know various concept maps, sketching things like that which is important in the conceptualization phase when you start going into more, what we call, authoring then you know you need kind of shift to slightly more formal representations. So, but at the same time, you need to be able to toggle between the kind of graphic or visual representation and textual representation. I also think that most people if we think of teachers as learning designers then you need to be careful not to become too formalistic because then people just freak out. I mean you know there's I don't know if you're familiar with this one, you know there is a whole LMS LD work which was popular for a few years and then kind of quietly died off. And I think LMS LD was sort of building on your earlier work in terms of the EML educational modelling language which was kind of a version of UML but for a learning design. And these things simply did not catch because they were over formalistic. And educators simply just refused to work with those representations and then find them useless and they found them hard to understand. And there was a paper that you know, I think it was in a special issue that might be on the book that was about why LMS fail. I think if it becomes too formalistic, people see it as just another chore. On the other hand, if you want to be able to apply a kind of formal verification method or if you want to be able to tie learning design to learning analytics, then you do need some structure. So, I think that the big challenge in learning design representations is that you need to be able to release the switch between very intuitive and very formal representations. And also, that, some people find it easier to communicate in a visual representation some people find it easier to communicate in a textual presentation. Also, in terms of the different actors involved I mean if I'm just doing a quick sketch of a lesson plan and I want to discuss it with you then I think a kind of graphical representation like a storyboard is very powerful. But then you know if I want to actually get that course approved by the kind of by the academic institutions, then I need to write it up in the text. So, for different purposes, you need different representations.

I: Yeah. [Laughs] My last question is that *What challenges do you see in the Learning Design field? How could these problems be solved? And finally, what could be the future direction of the Learning Design field?*

R: [Laughs] Yeah. I mean. You know. I think. Given that I've written a few papers to try to answer those questions. I think it is better to read my papers but.

I: I think I have read all of your papers on learning design.

R: Yeah. OK. But now, I will try to answer less formally. So, again can you repeat a question so that I might answer?

I: *What challenges do you see in the Learning Design field? How could these challenges be solved?*

R: So one challenge is in terms of creating a kind of common discourse and kind of enlarging the circle enlarging the community of learning designers so moving more and more educator is in education practitioners into scenes themselves as learning designers and getting also institutional and societal recognition that a teacher is not someone who delivers content because the content is available redundantly in high quality on the internet with the teacher is someone who designs a learning experience. So, that is kind of a huge cultural shift that for me it is one of the biggest challenges. The other challenge is really to come up with tools and representations that support these processes. In the same kind of effect of this is as you know if you want to write a paper then you just open a Word Processor and write a paper, right. If you need to do some accounting, you open the spreadsheet and do some accounting. If you want to do a survey then you can open you know Google Forms and in five minutes, you create a survey. And I would like to see tools that make the process of learning design as easy as that. And I think again I have seen a lot of tools and I haven't seen any tool that really makes it as easy as that. The last challenge I would say is connecting learning design to learning analytics. Because in a VLE, when we had the workshop which then led to the special issue and in the book, that we took the title of the art in the science of learning design. And I think that a lot of the work in learning design is turning to the level of art or craft so that people say well I have done this, and I think it works. And so, they share it with other people and people say oh yeah that's cool, I will do it also. But we don't have a scientific method. You know that to have a scientific method, we need to be able to attach data to design. So, there is work that you know others are doing at the Open University at the moment about trying to correlate between learning design and learning analytics. And I think that is really very interesting work what they are doing. And Davinia in UPF is doing similar work as well. I think we need to kind of scale that up. So, I think we need to be able to when we design a learning activity, we need to say well if this activity works, this is what I expect to see in terms of the data coming in and then to validate that. Or if we express kind of elements of the design say there in the design patterns or design principles, we should be able to say well if you use design patterns, this is the kind of data you should be seeing. And then, actual collected data validate that. So, those are I think for me the kind of the exciting challenges in it at the moment.

Appendix D: A Sample of Questionnaire Data

TEACHERS' LEARNING DESIGN PRACTICES AND NEEDS ANALYSIS ON LEARNING DESIGN TOOLS

SurveyMonkey

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TAMAMLANMIŞ

Toplayıcı: Web Link 2 (Web Bağlantısı)
Başlangıç: 10 Ocak 2017 Salı 10:04:33
Son Değiştirme: 10 Ocak 2017 Salı 10:51:40
Geçen Süre: 00:47:07
IP Adresi: 129.194.31.183

SAYFA 1: About this questionnaire

S1: **1. What is your gender?**	Female
S2: **2. In what country do you live?**	Switzerland
S3: **3. What level do you teach? (Please, select all that apply.)**	Bachelor's, Master's, Other (please specify) continuing education

S4: **4. What subjects do you teach?**

instructional design, web-design and development, HCI, technology-enhanced learning design

S5: **5. How many years of teaching experience do you have?**	6-10 years
S6: **6. Which Learning Design Tools have you heard of? (Please, select all that apply.)**	Reload, LD Tool, LAMS, ScenEdit, CeLS, DialogPLUS, MOT+, LAMS v2, LAMS Activity Planner, CompendiumLD, ReCourse, GLO Maker, exeLearning
S7: **7. Choose from the list a learning design tool you have used before. (If you have used more than one tool, please pick the one you liked more)**	LAMS v2

S8: **7a What was your main motivation for using the tool?**

Showing future teachers how a tool can integrate design and execution, show what good learning analytics tools can look like, LAMS can integrate collaborative and interactive activities (wiki, forums, etc.) and feedback into scenarios within one environment for creating distance learning scenarios.

S9: **7b Please describe all the benefits you get from the tool.**

Not needing to leave the environment for all activities that require peer or tutor interactions. Sequencing activities clearly while maintaining flexibility (branching, groupwork, etc).

S10: **7c What challenges did you face when using this tool?**

Convincing future teachers to use it as it requires that IT support it on top of traditional LMS (moodle or whatever)

S11: **7d How likely would you be to use the tool?**	Extremely likely

S12: **7.e What changes would you like to see within the tool and why do you think they would help?**

A more appealing and ergonomic interface. It is important in getting future teachers to explore and use it.

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TEACHERS' LEARNING DESIGN PRACTICES AND NEEDS ANALYSIS ON LEARNING DESIGN TOOLS | SurveyMonkey

S13: **7.2. Choose from the list a learning design tool you have used before. (If you have used more than one tool, please pick the one you liked more)** CompendiumLD

S14: **7.2a What was your main motivation for using the tool?**

To create and communicate learning designs in the conceptual phase. To teach instructional design to future teachers

S15: **7.2b Please describe all the benefits you get from the tool.**

Relative ease of first use. The learning design stencils structure the design process.

S16: **7.2c What challenges did you face when using this tool?**

Little adaptability in graphic displays for outputs (font and node sizes). No possibility to collaborate on designs without manipulations usually beyond the effort most stakeholders are willing to make.

S17: **7.2d How likely would you be to use the tool?** Extremely likely

S18: **7.2e What changes would you like to see within the tool and why do you think they would help?**

Allow for the possibility to collaborate on designs. Compendium can be used for macro-level (curriculum, modules, courses), designs, meso-level (courses, lessons, scenarios) all the way to micro-level (activity) designs. An instructional designer is rarely alone in the design process.

S19: **7.3. Choose from the list a learning design tool you have used before. (If you have used more than one tool, please pick the one you liked more)** exeLearning

S20: **7.3a What was your main motivation for using the tool?**

Creating standalone learning objects

S21: **7.3b Please describe all the benefits you get from the tool.**

Ease of use. Some interesting devices for easy interaction.

S22: **7.3c What challenges did you face when using this tool?**

All 'active pedagogical' interactions must be done outside of the environment (content package).

S23: **7.3d How likely would you be to use the tool?** Extremely likely

S24: **7.3e What changes would you like to see within the tool and why do you think they would help?**

None. It does what it says. Recent versions are more stable too.

S25: **8. Thinking an example of a lesson plan which you have created recently, could you tell us what you used as a starting point? For example:- Did you start with the desired learning outcome(s)?- Did you start with assessment criteria stipulated in the curriculum?- Did you start with an activity(ies) that you want students to do?**

The last design began with specific desired learning outcomes linked to assessment criteria I knew to have been poorly met in the past and quickly to the activities that could help to develop skills needed to attain the outcomes. It's really an iterative process, regardless of which thread I start with.

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TEACHERS' LEARNING DESIGN PRACTICES AND NEEDS ANALYSIS ON LEARNING DESIGN TOOLS SurveyMonkey

S26: **9. When you create a new lesson plan, do you ever make use of an existing plan? (Please, select all that apply.)**	I look at someone else's plan for ideas. , I adapt an existing lesson plan written by someone else. , I look at one of my old plans for ideas. , I adapt an existing lesson plan of my own. , Other (please specify) start from scratch
S27: **10. If you ever adapt or look at plans written by other people, how do you locate those plans? (Please, select all that apply.)**	Look on the web., Other (please specify) ask colleagues
S28: **11. What approach do you follow when you design a lesson plan? (Please, select all that apply.)**	Serialist/bottom-up approach: work step-by-step through the plan , Holistic/top-down approach: start by developing the big picture and then refining it with the small details , If you use any other models (please specify) again, each step introduced is checked against the big picture, which sometimes is also adapted as a result.

S29: **12. Do you use paper-based tools or digital software to create a lesson plan? Please, indicate into the boxes below what tools you use and how you use them.**

Mind-mapping or other diagramming tool (e.g. MindManager)	freemind, compendiumLD, cmap tools, cacoo, LAMS

S30: **13. Turning back to the lesson plan which you have created recently, could you tell us how you used these tools and in what order?For example:"I used a plain-text editor to put in writing the ideas I had in my mind. For those ideas that were not clear, I do some writing on a whiteboard because it is easier to think around a whiteboard than it is with a text editor. "**

I used compendiumLD to set objectives, outputs and outcomes and then filled the steps in between (scénarios). I then added the required resources and tools. I then checked to make sure I could tick off most of the content-based objectives stipulated in the syllabus. I added a resource or two and adapted one activity. Then I built the course in a VLE (Concourse Canvas). It should be mentioned that I find course and lesson design or planning to be greatly hindered by LMS. Sequencing is always a hassle especially if a course is not a traditional weekly course. Blended learning and project-based learning are particularly difficult.

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TEACHERS' LEARNING DESIGN PRACTICES AND NEEDS ANALYSIS ON LEARNING DESIGN TOOLS — SurveyMonkey

S31: 14. In the learning design process, there are several factors that need to be considered. Please, rate how important each of the following factors is to you when you are creating a learning design.

Curriculum	Important
Target Audience	Very important
Students' access to resources	Very important
Availability of technology in the classroom	Very important
Students' accessibility to the technology outside of the classroom	Very important
Time constraints	Important

Other (please specify)
course modality - distance/blended, course schedule and duration

S32: 15. At what point(s) of the learning design process do you create supporting materials for students? (e.g. handouts, reading lists)?

As I plan each activity,

Other (please specify)
these are sometimes the content around which a course or lesson has to be built to aid their integration

S33: 16. When, typically, do you get feedback on how well the lesson went in relation to the plan? (Please, select all that apply.)

On the same day as the lesson,

A few days or weeks later,

Other (please specify)
when I see student productions or responses (how they work during or after class)

S34: 17. How do you get feedback on how well the lesson went in relation to the plan?

from questions that arise and the work produced, student interactions when working in class.

S35: 18. If there are any other considerations of learning design process that are not listed in this survey, please write them to the box below.

Yanıtlayan bu soruyu atladı

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Appendix E: Publications

The research presented in this thesis was partly published prior to thesis submission.

1. *(Under Review)* Celik, D.; Magoulas, G. D. (2019). Sociomaterial perspective on learning design: insights from sociomaterial analysis of experts' views on learning design tools, approaches and practice. Computers & Education, United Kingdom

2. *(Accepted but not published because of funding issues)* Celik, D.; Magoulas, G. D. (2019). Creating Learning Experiences with Learning Design Tools: Higher Education Lecturers' Perceptions of Use and Adoption**.** In International Conference on Web-Based Learning (ICWL). Magdeburg, Germany.

3. Celik, D., & Magoulas, G. D. (2019). Challenging the Alignment of Learning Design Tools with HE Lecturers' Learning Design Practice. The 14th European Conference on Technology Enhanced Learning (EC-TEL), Delft, Netherland.

4. Celik, D., & Magoulas, G. D. (2016). Approaches to Design for Learning. In International Conference on Web-Based Learning. Rome, Italy. Available at https://www.researchgate.net/publication/308760600_Approaches_to_Design_for_Learning

5. Celik, D., & Magoulas, G. D. (2016). A Review, Timeline, and Categorization of Learning Design Tools. In International Conference on Web-Based Learning. Rome, Italy. Available at https://www.researchgate.net/publication/308759808_A_Review_Timeline_and_Categorization_of_Learning_Design_Tools

6. Celik, D., & Magoulas, G. D. (2016). Teachers' Perspectives on Design for Learning Using Computer-Based Information Systems: A Systematic Literature Review. In 21st UKAIS Conference. University of Oxford, United Kingdom. Available at https://www.researchgate.net/publication/301685917_TEACHERS%27_PERSPECTIVES_ON_DESIGN_FOR_LEARNING_USING_COMPUTER_BASED_INFORMATION_SYSTEMS_A_Systematic_Literature_Review