

# A Review, Timeline, and Categorization of Learning Design Tools

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**Abstract.** Enabling teachers to define or portray efficient teaching ideas for sharing, reuse or adaptation has attracted the interest of Learning Design researchers and has led to the development of a variety of learning design tools. In this paper, we introduce a multi-dimensional framework for the analysis of learning design tools and use it to review twenty-nine tools currently available to researchers and practitioners. Lastly, we categorise these tools according to the main functionality that they offer.

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**Keywords:** Learning Design · Learning design tools · Learning design practice · Learning analytics

## 1 Introduction

Learning Design (LD) is a research field that is concerned with the educational processes of planning, sequencing and managing learning activities, supporting teachers in delivering and sharing teaching ideas to improve learning of students [1]. In LD, the emphasis is on the pedagogical intent, following high-level design principles positioned in the framework of socio-cultural educational research. In practice this has led researchers to develop various representations to define and document learning design ideas [2], such as the Educational Modelling Language, the IMS Learning Design, Learning Activity Management Systems (LAMS), digital representations, and patterns.

Moreover, our literature search identified twenty-nine digital learning design tools: the Integrated Learning Design Environment (ILDE) [1], The Learning Designer [3], CADMOS [4], Reload [5], LD Tool [2], HKU Learning Design Studio [6], LAMS [7], GLUE!PS [8], LdShake [9], ScenEdit [10], CeLS [11], DialogPLUS [12], WebCollage [13], MOT+ [14], exeLearning [15], coppercore [15], GLOMaker [16], Pedagogic Pattern Collector [17], ReCourse [5], CompendiumLD [18], Pedagogical Plan Manager [19], PHOEBE [20], OpenGLM [21], LAMS Activity Planner [22], OpenScenario [23], HEART [24], Cloudworks [25], Map My Programme [26], and LAMS v2 [7].

Even though there have been many attempts to model learning design and develop tools for practitioners, the issue of representation of the learning design remains one of the central concerns of the field [27]. According to Mor et al. [28], representing teaching practice in meaningful ways for teachers to understand, discuss, share ideas remains problematic and requires further investigation. Another relevant concern is the lack of an agreed common language used among the tools developed so far [28].

Although this is understandable due to the complexity of the LD process, creating a common language is an area that needs to be further explored. Additionally, in spite of the richness of the representation tools, practitioners' adoption of these tools falls behind expectations.

The aim of this paper is to provide an updated view of the area of LD tools to facilitate further work. To this end, we review available LD tools using a new evaluation framework, create a timeline of LD tools, and organise LD tools according to their functionality. The rest of the paper is organised as follows. Section 2 introduces a multi-dimensional framework while Sect. 3 presents an analysis of the tools. Finally, Sect. 4 provides conclusions and considers future prospects for LD tools.

## 2 A Multi-dimensional Framework

In the field of LD, there have been studies about specific LD tools illustrating their functionalities and innovative characteristics, compared to the relevant state-of-the-art. There has been a small number of attempts to review the literature, however, as Britain points out, there is a wide range of LD tools, so it is difficult to present a comprehensive evaluation of them [15]. Later in [29] Britain proposed an evaluation framework and reviewed a limited number of LD tools. In another study, Conole [30] reviewed seven learning design tools, whilst later Dalziel et al. [26] presented a wide range of LD tools but was not able to cover all of them.

In terms of organising tools in different categories, Britain [29] categorised tools as authoring environments, run-time environments, and integrated environments. Conole [30] distinguished LD tools into visualisation tools, pedagogical planners, generic tools, and learning design resources. With respect to the learning design representation used in the tools, within the same study, Conole [30] organised the tools in two groups: textual representation and visual representation. More recently, Persico and Pozzi [31] categorised LD tools based on their functionality into reflection tools and pedagogical planners, authoring and sharing tools, repositories, and delivery tools.

In this paper, we adopt an approach that is based on a reconceptualization of the framework proposed by Britain [29]. One of the distinct differences of our framework from Britain's is that our framework evaluates the tools in terms of their facilities that consider learning analytics. Another dimensions introduced compared to Britain's approach is that our framework considers the tools with regards to their ability to deploy learning designs into VLEs, export and import learning designs into different file formats. Like Britain's framework, our framework also consists of three main sections: general properties, learning design properties, and technical properties. The main sections and their subsections associated with their corresponding meanings are presented in Table 1. The general properties section comprises of five subsections, the learning design properties section have four subsections, and there are three subsections in technical properties section.

**Table 1.** 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 illustrate activities?                                                         |
|                    | Workflow model pl  | What is the model used in the representation of the LD flow?                                |
|                    | Learning analytics | Does the tool have any functionality regarding learning analytics?                          |
| Technical          | Form of software   | What is the form of the software of the tool?                                               |
|                    | User interface     | What does the tool present in terms of user interface?                                      |
|                    | Technical needs    | Does the tool have any technical requirement or additional software to run the application? |

### 3 An Analysis of the Tools

Our analysis adopts the key categories suggested in [31], namely authoring and sharing tools, reflection tools and pedagogical planners, repositories, and delivery tools, with the addition of assessment planners and learning analytics. The analysis covers 29 tools- the number of the tools in each category is graphically presented in Fig. 1.

A timeline of the learning design tools is presented in Fig. 2. In this timeline, we present approximate dates that the 29 tools were released, and use colours to indicate the category that each belongs. Authoring and sharing tools include LAMS, Coppercore, Reload, MOT+ , GLOMaker, exeLearning, CompendiumLD, WebCollege, LAMS v2, OpenGLM, DialogPlus, Recourse, CeLS, Learning Designer, CADMOS, ScenEdit, HKU Learning Design Studio, and ILDE. LAMS Activity Manager, PHOEBE, OpenScenario, PPM, LdShake, and PPC go into the category of reflection tools and pedagogical planners. Repositories include HEART, LDTTool, and Cloudworks. There is only GLUE!PS tool in the category of delivery tools. Lastly, the category of assessment planners & learning analytics includes Map My Programme.

#### 3.1 Authoring and Sharing Tools

According to Persico and Pozzi [31], the group of authoring and sharing tools includes tools which “allow the representation of activities and are rooted in specific

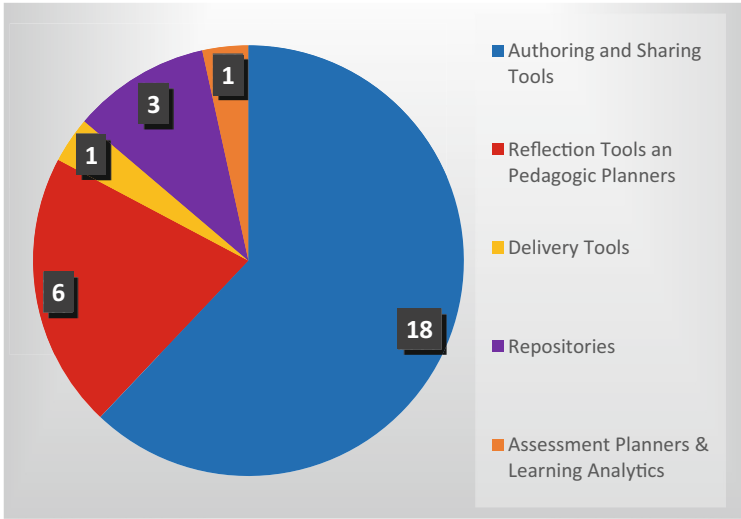


Fig. 1. The distribution of the tools according to the categorisation

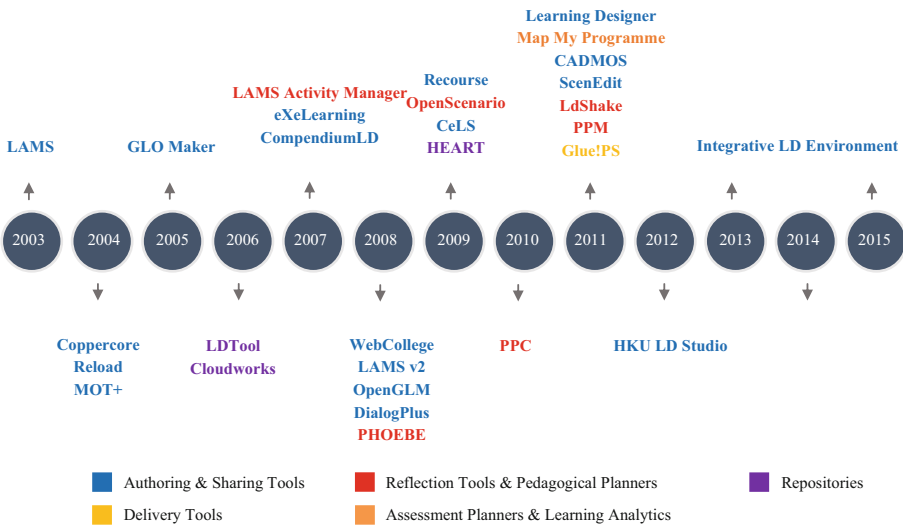


Fig. 2. The timeline and categorisation of learning design tools

pedagogical models”. As presented in the timeline, eighteen authoring and sharing tools are placed in this category. We present their characteristics in line with the dimensions of the evaluation framework in Tables 2 and 3-only tools that are still functioning are included.

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

|                           | ILDE                       | HKU LD Studio                            | Learning Designer                        | GLO Maker                                 | CeLS                 | Web Collage                              | Dialog PLUS                          | MOT+                     |                       |
|---------------------------|----------------------------|------------------------------------------|------------------------------------------|-------------------------------------------|----------------------|------------------------------------------|--------------------------------------|--------------------------|-----------------------|
| <b>GENERAL PROPERTIES</b> | <b>Scope</b>               | Authoring, sharing, editing, exploring   | Authoring (For self-directed activities) | Authoring (create, share, edit and reuse) | Authoring            | Create and reuse activity                | Authoring tool (pattern-based)       | Authoring tool           | Authoring tool        |
|                           | <b>Release date</b>        | 2012– still running                      | 2013 – still running                     | 2011 – still running                      | 2006 – Not available | 2009 – still running                     | 2006 – still running                 | 2006 – Not available     | 2008 – Not available  |
|                           | <b>Target users</b>        | Teachers                                 | Teachers                                 | Teachers,                                 | Teacher-designers    | Teachers and researchers                 | K-12 teachers                        | Teachers                 | Teachers              |
|                           | <b>Export &amp; Import</b> |                                          | JSON file.                               | MS Word, shared as an URL                 | N/A                  | XML-based model                          | IMS LD (A level)                     | IMS LD                   | IMS LD                |
|                           | <b>Deploy into VLEs</b>    | Moodle, SCORM, metisVLE, MediaWiki       | N/A                                      | N/A                                       | N/A                  | N/A                                      | LAMS, Moodle                         | N/A                      | LAMS, Moodle          |
| <b>LEARNING DESIGN</b>    | <b>Design language</b>     | Integration of LD tools                  | Text-based (Similar to IMS-LD)           | Formal learning concepts                  | Text-based           | N/A                                      | Graphical and pattern based          | Nugget taxonomy language | Graphic-based, formal |
|                           | <b>Activity model</b>      | OpenGLM, WebCollege, exeLearning, CADMOS | It follows the sequence of learning.     | In sequence, similar to lesson plan       | Sequential           | Presentation, input, interaction, dialog | Collaborative activity patterns      | Nugget Model             | IMS LD                |
|                           | <b>Workflow model</b>      | OpenGLM, WebCollege, exeLearning, CADMOS | It follows the sequence of learning.     | Main properties of a learning design      | Sequential           | XML-based model                          | Collaborative learning flow patterns | Nugget Model             | IMS LD                |
|                           | <b>Learning analytics</b>  | Peer-review evaluation of LDs            | N/A                                      | Graphical show of activities              | N/A                  | N/A                                      | Provides assessment patterns.        | N/A                      | N/A                   |
| <b>TECHNICAL</b>          | <b>Form of software</b>    | Web-based                                | Web-based                                | Web and desktop based, Mobile App         | Web-based            | Web-based                                | Desktop-based, web-based             | Web-based                | Web-based             |
|                           | <b>User interface</b>      | Easy-to-use                              | Comprised of two steps.                  | Interactive                               | N/A                  | Interrelated stages                      | Flexible                             | N/A                      | N/A                   |
|                           | <b>Technical needs</b>     | Java Run-Time                            | N/A                                      | Windows, Mac, Linux                       | N/A                  | Internet Explorer 5                      | N/A                                  | N/A                      | N/A                   |

### 3.2 Assessment Planners and Learning Analytics

Tools that mainly focus on informing learning in terms of learning analytics are listed in this category, as shown in Table 4.

**Table 3.** An analysis of authoring and sharing tools.

|                           | LAMS                       | eXe Learning                                                           | Copper Core          | CADMOS                  | Recourse               | Open GLM                          | Compendium LD                            | Reload                                            |                                 |
|---------------------------|----------------------------|------------------------------------------------------------------------|----------------------|-------------------------|------------------------|-----------------------------------|------------------------------------------|---------------------------------------------------|---------------------------------|
| <b>GENERAL PROPERTIES</b> | <b>Scope</b>               | Authoring, Community, and Run-time Environment                         | Authoring tool       | Authoring tool          | Authoring tool         | Authoring tool (IMS LD compliant) | Authoring tool (create, share and reuse) | Authoring and runtime learning environment        |                                 |
|                           | <b>Release date</b>        | 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 |                                 |
|                           | <b>Target users</b>        | Teachers                                                               | Teachers, academics  | Teachers                | Novice teachers        | Teachers (IMS LD)                 | Non-professional user                    | Lecturers, teachers                               | Teachers (familiar to IMS LD)   |
|                           | <b>Export &amp; Import</b> | 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    |
|                           | <b>Deploy into VLEs</b>    | Moodle, Blackboard, Sakai, LRSN, WebCT, SharePoint, OLAT, Desire2Learn | SCORM, Moodle        | N/A                     | Moodle.                | LAMS, Moodle                      | Moodle                                   | LAMS, Moodle                                      | N/A                             |
| <b>LEARNING DESIGN</b>    | <b>Design language</b>     | 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 |
|                           | <b>Activity model</b>      | LAMS educational workflow system                                       | IMS LD, SCORM        | IMS LD                  | Conceptual/flow model  | IMS LD                            | Visual modelling metaphor                | Mind mapping, or concept mapping                  | IMS LD                          |
|                           | <b>Workflow model</b>      | LAMS educational workflow system                                       | IMS LD, SCORM        | IMS LD                  | Conceptual/flow model  | IMS LD                            | Visual modelling metaphor                | Mind mapping, or concept mapping                  | IMS LD                          |
|                           | <b>Learning analytics</b>  | Monitors progress of a student                                         | N/A                  | N/A                     | N/A                    | N/A                               | N/A                                      | Allows users to think on assessments              | N/A                             |
| <b>TECHNICAL</b>          | <b>Form of software</b>    | Desktop-based                                                          | Desktop-based        | Desktop-based           | Desktop-based          | Desktop-based                     | Web-based                                | Web-based                                         | Desktop-based                   |
|                           | <b>User interface</b>      | Drag and drop user interface                                           | N/A                  | N/A                     | User-friendly          | Visual based                      | Comprised of panes                       | Flexible, simple                                  | Tabs and editing fields         |
|                           | <b>Technical needs</b>     | Written in Java and operated in cross platforms                        | N/A                  | N/A                     | N/A                    | Java Run-Time                     | Java Run-Time                            | N/A                                               | Java Run-Time                   |

### 3.3 Reflection Tools and 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” [31]. These are shown in Table 5.

**Table 4.** An analysis of assessment planners and learning analytics

|                    |                    | Map My Programme                                                         |
|--------------------|--------------------|--------------------------------------------------------------------------|
| General properties | Scope              | Mapping and planning assessments                                         |
|                    | Release date       | 2011 – still running                                                     |
|                    | Target users       | Teachers                                                                 |
|                    | Export & Import    | N/A                                                                      |
|                    | Deploy into VLEs   | N/A                                                                      |
| Learning design    | Design language    | Visual-based                                                             |
|                    | Activity model     | N/A                                                                      |
|                    | Workflow model     | N/A                                                                      |
|                    | Learning analytics | The tool provides summative and formative evaluation of the assessments. |
| Technical          | Form of software   | Web-based                                                                |
|                    | User interface     | N/A                                                                      |
|                    | Technical needs    | Google Account                                                           |

**Table 5.** An analysis of reflection tools and pedagogical planners

|                    | PPC                | PHOEBE                        | LdShake                         | OpenScenario                   | Lams AP                                         | PPM                        |                                            |
|--------------------|--------------------|-------------------------------|---------------------------------|--------------------------------|-------------------------------------------------|----------------------------|--------------------------------------------|
| GENERAL PROPERTIES | Scope              | Pedagogical Pattern Collector | Pedagogic planner               | Social network oriented tool   | Scenario-based tool                             | Create learning activities | Pedagogic planning of LDs                  |
|                    | Release date       | 2011 – still running          | 2006 – Not available            | 2011 – still running           | 2009 – Not available                            | 2007 – still running       | 2010 – still running                       |
|                    | Target users       | Teachers                      | Teachers                        | Teachers                       | Teachers                                        | Teachers                   | Teachers                                   |
|                    | Export & Import    | N/A                           | N/A                             | N/A                            | N/A                                             | N/A                        | N/A                                        |
|                    | Deploy into VLEs   | N/A                           | N/A                             | N/A                            | N/A                                             | Moodle                     | N/A                                        |
| LEARNING DESIGN    | Design language    | Pattern-based                 | Wiki-based, and set of resource | Various pedagogical approaches | Scenario-based design                           | Sequential                 | Hierarchical entities                      |
|                    | Activity model     | Cognitive model               | Sequence structures             | 4SPPIces Model                 | Scenario-based model                            | Sequential                 | Pedagogical Hierarchy                      |
|                    | Workflow model     | Cognitive model               | Sequence structures             | 4SPPIces Model                 | Organization, learning, observation, evaluation | Sequential                 | Pedagogical Hierarchy                      |
|                    | Learning analytics | N/A                           | Assessment and activities       | N/A                            | N/A                                             | N/A                        | N/A                                        |
| TECHNICAL          | Form of software   | Web-based                     | Web-based                       | Web and desktop based          | Web-based                                       | Web-based                  | Web-based                                  |
|                    | User interface     | Browser, designer, abstractor | N/A                             | N/A                            | Flexible                                        | N/A                        | Hierarchy Manager, Field Sector, Data Area |
|                    | Technical needs    | N/A                           | N/A                             | N/A                            | N/A                                             | Flash Player               | N/A                                        |

### 3.4 Delivery Tools

Delivery tools are specifically designed to support the delivery of the activities and learning design into learning environment. A tool in this category is evaluated in Table 6.

**Table 6.** An analysis of delivery tools

|                    |                    | GLUE!PS                                                                                                                                                             |
|--------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General properties | Scope              | It allows integration of existing external tools including Google Docs, Google Spreadsheets, Google Presentations, Dabbleboard, Noteflight, Doodle, Wookie Widgets. |
|                    | 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                                                                                                                                                                 |

### 3.5 Repositories

This category defines the tools that provide teachers learning design ideas, sample of practices, and experiences' reports. Tools analysed across the dimensions identified in the framework are presented in Table 7.



**Table 7.** An analysis of repositories

|                           | <b>Cloudworks</b>          | <b>HEART</b>                  | <b>LDTTool</b>                                        |                                                                                                                       |
|---------------------------|----------------------------|-------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>GENERAL PROPERTIES</b> | <b>Scope</b>               | Social networking environment | Learning design support strategy                      | Authoring, sharing, and browsing among existing LDs                                                                   |
|                           | <b>Release date</b>        | 2008 – still running          | 2009 – Not available anymore                          | 2008 – still running                                                                                                  |
|                           | <b>Target users</b>        | Teachers                      | Teachers                                              | Teachers (Primary, secondary, and higher education teachers)                                                          |
|                           | <b>Export &amp; Import</b> | N/A                           | N/A                                                   | N/A                                                                                                                   |
|                           | <b>Deploy into VLEs</b>    | N/A                           | N/A                                                   | N/A                                                                                                                   |
| <b>LEARNING DESIGN</b>    | <b>Design language</b>     | N/A                           | Visual and text based                                 | Text-based                                                                                                            |
|                           | <b>Activity model</b>      | N/A                           | Pedagogical dimension                                 | Sequence of learning tasks                                                                                            |
|                           | <b>Workflow model</b>      | N/A                           | Pedagogical dimension                                 | Description, intended learning outcomes, resources, tasks, supports                                                   |
|                           | <b>Learning analytics</b>  | Peer feedback                 | N/A                                                   | N/A                                                                                                                   |
| <b>TECHNICAL</b>          | <b>Form of software</b>    | Web-based                     | Web-based                                             | Web-based                                                                                                             |
|                           | <b>User interface</b>      | 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 |
|                           | <b>Technical needs</b>     | N/A                           | N/A                                                   | N/A                                                                                                                   |

## 4 Conclusion and Future Works

The purpose of this paper was to present all LD tools in one place and analyse them along the same dimensions. In the paper, we distinguished the tools based on their functionality, and provided a timeline for LD tools. Twenty-nine learning design tools from the literature of the LD field were identified as still functioning. These were categorised according to their functionality, and a timeline of these tools associated with their categorisation was created.

It is worth to highlight that ILDE is the most recent tool developed within the field. According to Maina et al. [27], “a promising step in this direction is the ILDE” as it focuses on integration of the various tools available rather than creating a new one.

The findings of this paper have a number of implications for future practice. First, further research could be conducted to compare teachers’ learning design practices of using these tools on the same topic. Second, an analysis of the pedagogical underpinning behind these tools would be also useful. Finally, usability and user interface characteristics of the LD tools would worth further investigation.

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## References

1. Hernández-Leo, D., Chacón, J., Prieto, L.P., Asensio-Pérez, J.I., Derntl, M.: Towards an integrated learning design environment. In: Hernández-Leo, D., Ley, T., Klamma, R., Harer, A. (eds.) EC-TEL 2013. LNCS, vol. 8095, pp. 448–453. Springer, Heidelberg (2013)
2. Agostinho, S.: The use of a visual learning design representation to support the design process of teaching in higher education. *Australas. J. Educ. Technol.* **27**, 961–978 (2011)

3. Laurillard, D., Charlton, P., Craft, B., Dimakopoulos, D., Ljubojevic, D., Magoulas, G., Masterman, E., Pujadas, R., Whitley, E.A., Whittlestone, K.: A constructionist learning environment for teachers to model learning designs. *J. Comput. Assist. Learn.* **29**, 15–30 (2013)
4. Boloudakis, M., Katsamani, M., Retalis, S., Georgiakakis, P.: CADMOS: a learning design tool for Moodle courses CADMOS by example. In: *Proceedings of the 1st Moodle Research Conference*, pp. 14–15 (2012)
5. Griffiths, D., Beauvoir, P., Liber, O., Barrett-Baxendale, M.: From reload to recourse: learning from IMS learning design implementations. *Distance Educ.* **30**, 201–222 (2009)
6. Mor, Y., Mogilevsky, O.: The learning design studio: collaborative design inquiry as teachers' professional development. *Res. Learn. Technol.* **21**, 1–15 (2013)
7. Dalziel, J.R.: Lessons from LAMS for IMS learning design. In: *Sixth International Conference on Advanced Learning Technologies*, pp. 1101–1102. IEEE Computer Society, Los Alamitos (2006)
8. Prieto, L.P., Asensio-Pérez, J.I., Dimitriadis, Y., Gómez-Sánchez, E., Muñoz-Cristóbal, J.A.: GLUE!-PS: a multi-language architecture and data model to deploy TEL designs to multiple learning environments. In: *European Conference on Technology Enhanced Learning*, pp. 285–298 (2011)
9. Hernandez-Leo, D., Romeo, L., Carralero, M.A., Chacon, J., Carrio, M., Moreno, P., Blat, J.: LdShake: learning design solutions sharing and co-edition. *Comput. Educ.* **57**, 2249–2260 (2011)
10. Emin, V., Pernin, J.-P., Aguirre, J.L.: ScenEdit: an intention-oriented authoring environment to design learning scenarios. In: Wolpers, M., Kirschner, P.A., Scheffel, M., Lindstaedt, S., Dimitrova, V. (eds.) *EC-TEL 2010. LNCS*, vol. 6383, pp. 626–631. Springer, Heidelberg (2010)
11. Ronen, M., Kohen-vacs, D., Raz-fogel, N.: Adopt & adapt: structuring, sharing and reusing asynchronous collaborative pedagogy. In: *International Conference on Learning Sciences (ICLS)*, Bloomington, IL, pp. 599–605 (2006)
12. Conole, G., Fill, K.: A learning design toolkit to create pedagogically effective learning activities. *J. Interact. Media Educ.* **8**, 1–16 (2005)
13. Villasclaras-Fernández, E., Hernández-Leo, D., Asensio-Pérez, J.I., Dimitriadis, Y.: Web collage: an implementation of support for assessment design in CSCL macro-scripts. *Comput. Educ.* **67**, 79–97 (2013)
14. Paquette, G., Lundgren-Cayrol, K., Léonard, M.: The MOT+ visual language for knowledge based instructional design. *Instr. Des. Concepts Methodol. Tools Appl.*, 697–717 (2008)
15. Britain, S.: A Review of Learning Design: Concept, Specifications and Tools. A report for the JISC E-learning Pedagogy Programme. Retrieved from [http://www.jisc.ac.uk/uploaded\\_documents/ACF83C.doc](http://www.jisc.ac.uk/uploaded_documents/ACF83C.doc) (2004)
16. Khademi, M., Haghshenas, M., Kabir, H.: A review on authoring tools. In: *Proceedings of the 5th International Conference on Distance Learning and Education, IPCSIT*, pp. 40–44. IACSIT Press, Singapore (2011)
17. Prieto, L.P., Muñoz-Cristóbal, J.A., Asensio-Pérez, J.I., Dimitriadis, Y.: Making learning designs happen in distributed learning environments with GLUE!-PS. In: Ravenscroft, A., Lindstaedt, S., Kloos, C.D., Hernández-Leo, D. (eds.) *EC-TEL 2012. LNCS*, vol. 7563, pp. 489–494. Springer, Heidelberg (2012)
18. Brasher, A., Conole, G., Cross, S., Weller, M., Clark, P., White, J.: CompendiumLD – a tool for effective, efficient and creative learning design. In: *Proceedings of the 2008 European LAMS Conference: Practical Benefits of Learning Design*, Cadiz, Spain (2008)
19. Olimpo, G., Bottino, R.M., Earp, J., Ott, M., Pozzi, F., Tavella, M.: Pedagogical plans as communication oriented objects. *Comput. Educ.* **55**, 476–488 (2010)

20. Masterman, L.: Phoebe Pedagogy Planner Project Project: Evaluation Report. Retrieved from [https://www.academia.edu/1856696/JISC\\_Design\\_for\\_Learning\\_Programme\\_Phoebe\\_Pedagogy\\_Planner\\_Project\\_Evaluation\\_Report](https://www.academia.edu/1856696/JISC_Design_for_Learning_Programme_Phoebe_Pedagogy_Planner_Project_Evaluation_Report). University of Oxford, Oxford (2008)
21. Derntl, M.: OpenGLM : integrating open educational resources in IMS learning design authoring. In: *The Art & Science of Learning Design*, pp. 157–168. Sense Publishers, Rotterdam (2015)
22. Cameron, L.: Planner tools-sharing and reusing good practice. *Teach. Engl. Technol.* **1**, 40–49 (2009)
23. Jullien, J.M., Martel, C., Vignollet, L., Wentland, M.: OpenScenario : a flexible integrated environment to develop educational activities based on pedagogical scenarios. In: *Proceedings of 9th IEEE International Conference on Advanced Learning Technologies, ICALT 2009, Riga, Latvia*, pp. 509–513 (2009)
24. Donald, C., Blake, A.: Reviewing learning designs with HEART: a learning design support strategy. In: *ASCILITE 2009 - Australasian Society for Computers in Learning in Tertiary Education*, pp. 1211–1213 (2009)
25. Conole, G., Culver, J.: Cloudworks: social networking for learning design. *Australas. J. Educ. Technol.* **25**, 763–782 (2009)
26. Dalziel, J., Conole, G., Wills, S., Walker, S., Bennett, S., Dobozy, E., Cameron, L., Badilescuhbuga, E., Bower, M.: The larnaca declaration on learning design. *J. Interact. Media Educ.* **1**, 7 (2016)
27. Maina, M., Craft, B., Mor, Y.: *The Art and Science of Learning Design*. Sense Publishers, Rotterdam (2015)
28. Mor, Y., Craft, B.: Learning design: reflections upon the current landscape. *Res. Learn. Technol.* **20**, 85–94 (2012)
29. Britain, S.: Learning design systems: current and future developments. In: *Rethinking Pedagogy for a Digital Age: Designing and Delivering E-Learning*, pp. 103–104. Routledge, Oxford (2007)
30. Conole, G.: Tools and resources to guide practice. In: *Rethinking Pedagogy for a Digital Age: Designing for 21st Century Learning*, pp. 78–101. Routledge (2008)
31. Persico, D., Pozzi, F.: Informing learning design with learning analytics to improve teacher inquiry. *Br. J. Educ. Technol.* **46**, 230–248 (2015)