

BP4ED: Best Practices Online for eLearning Content Development Development Based on Learning Objects

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Abstract: The development of *effective* eLearning content is complex. In addition to subject matter experts (SMEs), it involves instructional design (ID) experts, technical design (TD) experts, and production personnel (PP). In small projects, a single person with experience may take all of those roles on. Large projects usually involve different people in each role, and a few eLearning officers to help other participants' interaction. This paper presents the design of a web system that will facilitate the role and interaction of SMEs, ID experts, TD experts and PPs through the use of best practices online. Our system is organised around a set of templates of learning objects, designed after best practices regarding ID and TD in the literature, that will guide both *development* and *presentation* of eLearning content. For some eLearning our system *may* prove less flexible than the software tools currently used for developing eLearning content. However, we argue that our system will significantly increase the chances of developing effective eLearning content in less time. Our system is being developed as a cloud-based web system. The paper presents some implementation results on the functioning of our system.

1 INTRODUCTION

eLearning continues to be adopted for educational and training purposes in many ways: from simply sharing files in a web server to serious games online, or from a single course to academic programmes with official value. Simple ways to organise eLearning are easy to develop and deploy, and practically risk-free, but complex organisations may become a rather difficult and costly project, and even unsuccessful.

Asynchronous eLearning, wherein learners (students/trainees) can take a course anytime on their own, is particularly complex to develop because eLearning content must be organised following instructional design principles in order for such content to be *effective* on its own, i.e.: content must facilitate learning and engage learners — and it should be possible to determine whether learners do, or do not, learn from such content. In contrast, content for synchronous, teacher-led eLearning is complementary to the central role of the teacher. The teacher is in charge of making the class engaging, etc.; hence content for this kind of eLearning does not need to be that effective on its own.

The focus of the paper is the development of *effec-*

tive eLearning content. Developing this kind of content is complex and costly because a team of specialists is required, typically:

1. SMEs specify and write adequate content for the target learning unit such as a topic, lesson, etc.
2. ID experts (IDEs) design the *best* instructional experiences: sequence of activities learners should carry out for them to learn that content.
3. TD experts (TDEs; also known as technopedagogues) design those activities into/around digital resources such as graphs, plots, sound, videos, games, etc.
4. PPs (graphics designers, programmers) develop those digital resources, using software tools such as Flash, Photoshop, Powerpoint, etc. They also organise all eLearning content into web (HTML) pages within a learning management system (LMS) such as Moodle and talenLMS.

Note that those software tools used by PPs are rather good and flexible. They can develop practically whatever they can imagine regarding visual display.

However, those software tools do not cater for *effective* eLearning content development as a whole.

They do not manage courses, lessons, topics or similar concepts. They are just too flexible and, overall, can only be used both to develop *individual elements* of content (e.g. a graph, video, etc.) and to collocate such elements within web pages. Editors within LMSs and other authoring tools, such as eXeLearning (eXe Project, 2014), are also too flexible despite having been developed for authoring eLearning content. Hence the need for a team of specialists to guide development of eLearning content. Unfortunately, assembling and running a team of specialists is also complex and costly, and team joint operation tends to be slow because participants' expertise is usually in different areas. Thus many companies and institutions outsource eLearning content development.

This paper presents BP4ED (from *Best Practices for eLearning content Development*), a cloud-based web system designed to facilitate the role and interaction of SMEs, IDEs, TDEs and PPs through providing them with online best practices on ID and TD. BP4ED embodies some of the best practices suggested by (Horton, 2012) *to organise* eLearning content and by (Clark and Mayer, 2011) *to present* (display) such content.

Horton and Clark are well known for their work on those issues; their books are now considered classics. The book by (Pitman, 2011) is based on his "experience as an eLearning designer and developer applying the wisdom from masters including William Horton, Michael Allen and Ruth Clark, and many other." (Pitman, 2011, p. i). We obviously agree with Pitman.

Horton has described in good detail a general methodology to organise eLearning content applying instructional design (Horton, 2012), which involves: "selecting, organising, and specifying the learning experiences necessary to teach somebody something". Figure 1 shows the general organisation of eLearning content to be derived from Horton's methodology: *Curricula* are academic programmes composed of related courses that lead to a degree or certificate in a subject area; a curriculum is composed of *courses*, a *course* is composed of *lessons*, and a *lesson* is composed of *topics*. Topics are designed to accomplish a single low-level learning objective using *learning activities* that provoke, each, a specific learning experience. Learning activities are designed using multimedia: text, pictures, voice, video, etc.

Effective eLearning content is usually organised into a similar hierarchy — perhaps using different names for each eLearning unit in the hierarchy. Such hierarchy is designed by SMEs, ID experts and TD experts, and is implemented by PPs, and determines the design of navigation through, and interactivity with, eLearning content (web pages) by learners.

BP4ED consists of a set of templates designed to correspond to the units of eLearning in Figure 1. When eLearning content is designed with BP4ED, selecting the desired units of eLearning entails to automatically assemble the corresponding templates into the corresponding hierarchy — SMEs will then write or insert relevant content (text or multimedia resources) in the fields of the templates selected. From the resulting structure of a course thus designed, BP4ED determines both navigation and interactivity by the user, thus eliminating the corresponding design and implementation work. The paper presents results regarding the use of templates corresponding to topics and activities within topics — other templates are being developed.

Note in Figure 1 that topics (designed to accomplish a single low-level learning objective) are to be organised as *learning objects* composed of learning activities that provoke, each, a specific learning experience. Other units of eLearning (lessons, etc.) are organised as LOs of LOs. We will discuss in Section 2 our decision to organise BP4ED around LOs.

(Clark and Mayer, 2011) have minutely analysed various issues involved in presenting multimedia content, and have synthesised a few principles for doing it effectively so that learners feel more comfortable and less overloaded. Some of those principles include:

- "Place printing words near corresponding graphics" (idem). Both should appear in the same screen (idem.) – it should not be necessary to scroll the screen to read the text relevant to a graphic.
- "Present words as audio narration rather than on-screen text." (idem). Thus incoming information is "split across two separate cognitive channels — words in the auditory channel and pictures in the visual channel rather than concentrating both in the visual channel." (idem)
- "Explain Visuals with Words in Audio OR Text: Not Both ... learners may try to compare and reconcile on-screen text and the narration, which requires cognitive processing extraneous to learning the content" (idem).

BP4ED includes screen templates to organise eLearning content around Clark and Mayer's principles that facilitate formatting of content for adequate display by browsers. This will reduce web page design and implementation work by TDEs and PPs. The paper presents the use of some of our screen templates. Note that BP4ED does *not* help at all in the development of individual elements of content such as graphics, videos, sound, etc. This is work by PPs.

For some eLearning content, BP4ED may be less flexible than the software currently used. However,

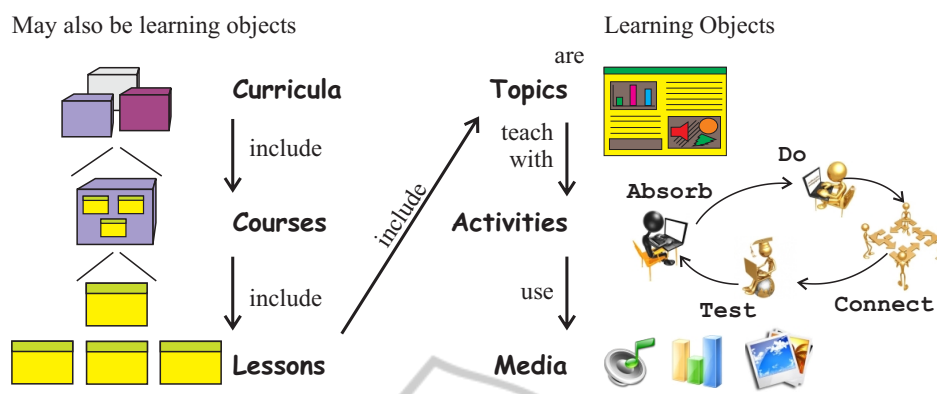


Figure 1: Horton's general organisation to develop eLearning content.

BP4ED can be improved, and we believe it can significantly increase the chances of developing effective eLearning content in less time with online help as discussed in Sections 2.3 and 4.4.

The paper continues thus: Section 2 presents related work; Section 3 presents some functionality of BP4ED as seen by users; Section 4 outlines the design of BP4ED. Section 5 presents our conclusions and work in progress.

2 RELATED WORK

The development of effective eLearning content involves both software tools and methodologies. In this section we contrast BP4ED with other software tools and methodologies currently in use.

2.1 Software Tools

eLearning content is mostly developed with the software tools that are used to develop web content: web page editors, paint editors, animation editors, content editors. As mentioned earlier, these software tools are powerful and flexible but do not cater for eLearning development as a whole. Work on designing and implementing the overall layout of, for example, content for a course is the responsibility of SMEs, IDEs, TDEs and PPs. This work includes the specification both of navigation through and interactivity with web pages by the user. BP4ED reduces this work.

eLearning content is also developed with editors within LMSs such as Moodle, TalentLMS, Blackboard, etc. These editors are also rather flexible. In addition to text editing, these editors have functionality to manage multimedia resources and to create and organise a hierarchy of learning units such as courses, lessons, topics, etc. However, it is up to SMEs, IDEs,

TDEs and PPs to design and implement a hierarchical organisation of content along with navigation and interactivity by the user. As BP4ED manages upfront a typical content organisation (Figure 1), that design and implementation work is reduced.

There are many authoring tools available: eXe-Learning, Adobe Presenter, Camtasia, Lectora, are just a few, see (eLearning Atlas, 2014) and (C4LPT, 2014). They are good and flexible, but focused in perfecting a particular aspect of content such as stories, videos, etc. Hence, as above, there is no support for a hierarchical organisation of content based on learning objects (LOs), activities, and LOs composed of LOs as proposed for BP4ED.

2.2 Off-line Best Practices

By off-line best practices we mean books and other bibliography on eLearning design. We have somewhat introduced the best practices by Horton and Clark. There are many other books on this subject. The books by (Pitman, 2011) and (Vai and Sosulski, 2011) are good.

The purpose of BP4ED is to embody best practices for eLearning development so as to make them ready to hand. We believe this approach will prove successful because both such development involves many issues and relevant helpful information is scattered in many books. Anyone would have to read various sources in order just to make sense. In contrast, BP4ED or a similar system serves as a guiding path and can also provide relevant help when needed.

We chose mostly Horton's approach to design BP4ED for two reasons. It is the clearest methodology that provides a comprehensive and coherent view of the problem, and presented with plenty of examples and comments on relevant issues not to be overlooked. So far, other books just complement it. In addition, Horton makes eLearning to spin around the

concept of learning objects; learning objects are the building blocks of e-learning. This is a powerful concept which he defines as

“... a chunk of electronic content that can be accessed individually and that completely accomplishes a single learning objective and can prove it.” (Horton, 2012, p. 47)

Recall that a topic is to be organised as a (base) learning object (LO) composed of learning activities that provoke, each, a specific learning experience (other units of eLearning are to be organised atop the base LOs). Base LOs, being composed of learning activities and tests, show complex navigation and interactivity by learners. They are like computer programs whose behaviour depends on users input, the output being the results of tests. This analogy led us to think of somewhat automating Horton’s approach as a set of programs/templates corresponding to LOs.

2.3 Horton’s Approach in Brief

We close this section outlining other concepts of Horton’s approach which are relevant to the design of BP4ED. Figure 1 shows Horton’s general organisation of content; below is a specification of a topic, based on such organisation, taken from (Horton, 2012, p. 7):

Curriculum:	Master’s of Business Administration Programme.
Course:	Accounting 101.
Lesson:	Assets and Liabilities.
Topic:	Evaluating Assets.
Activity:	Using a spreadsheet to calculate the values of assets.
Media:	Voice-over animation explaining the concept.

To arrive to the specification of this topic and related topics, Horton’s methodology comprise the steps below — which he describes with loads of guidance, some examples and relevant issues not to overlook (Horton, 2012, p. 1-66):

- identify underlying goal of eLearning.
- analyse learner’s needs.
- identify what to teach.
- set learning objectives.
- write these objectives.
- identify prerequisites.
- choose an approach to meet each objective.
- decide the teaching sequence of objectives.
- create a learning object (LO) to accomplish each objective: for a high-level LO specify a structured sequence of LOs for more specific objectives; for a

low-level LO specify activities that will directly accomplish the objective of the LO.

- create tests to verify accomplishment.
- select learning activities for each objective.
- choose media for each learning activity,
- then redesign again and again.

BP4ED embodies step i) above as a set of templates of LOs and LOs of LOs, including navigation through, and interactivity with, those templates by learners. BP4ED also provides templates to specify tests and learning activities, step j) and k). The other steps must be specified by SMEs, IDEs and TDEs. However, we plan to extend BP4ED with online help regarding Horton’s best practices and examples in order to assist those experts in the other steps.

3 BRIEF TOUR THROUGH BP4ED FUNCTIONS

BP4ED is being developed as a cloud-based web system. eLearning developers (SMEs, IDEs, TDEs and PPEs) will have an account at BP4ED web site where they will develop and keep eLearning content. Once some eLearning content is ready for use by learners, a copy of it will either be accessed directly within BP4ED web site or be exported to another web site. We are currently designing these options.

We have already implemented some of the templates for developing base LOs. The functioning of some of these templates is shown below.

3.1 Developing a Base LO

Figure 2 shows the options that are offered by BP4ED to develop a base LO. The figure shows the options to choose learning activities for the topic called *Interrogative* — see top of figure. On getting to the screen shown, it is assumed that a containing lesson (*Simple Present*), a containing course (*English Level III*) and a curriculum (not shown) have already been created. (BP4ED will also support development of *individual* e-learning content not belonging to a full hierarchy of LOs (Curriculum-Topics), such as an individual course or topic.)

A base LO can be configured with 4 different types of learning activities: Absorb, Do, Connect, and Test. These types of activities and their subactivities shown in that figure are suggested by Horton. Briefly, in Absorb activities learners absorb knowledge; in Do activities they apply that knowledge; in Connect activities they connect what they are learning with knowledge in their lives, work, etc; and Tests are used to verify learners have learned.



Figure 2: Options to configure base learning objects.

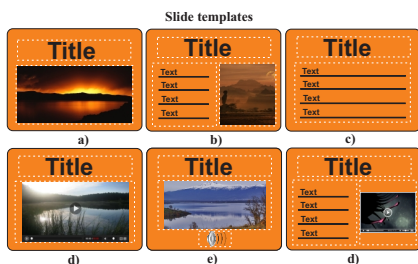


Figure 3: Slide types for Presentation subactivity.

We have finished the implementation of the first two subactivities of each type of activity. We will describe the workings of BP4ED for the case where a Presentation (Absorb) subactivity is configured.

3.2 Creating a Presentation Activity

On selecting the subactivity Presentation, eLearning developers (EDs) enter editing mode wherein they can create a presentation composed of various types of slides. BP4ED allows EDs to include in a presentation any of the types of slides shown in Figure 3.

On selecting a type of slide, EDs are presented with an editor screen wherein they will insert the content (text, picture, video, etc.) for that type of slide. For instance, if the type of slide chosen is the one shown in Figure 3.b, EDs will then be shown the editor screen shown in Figure 4, which consists of a field

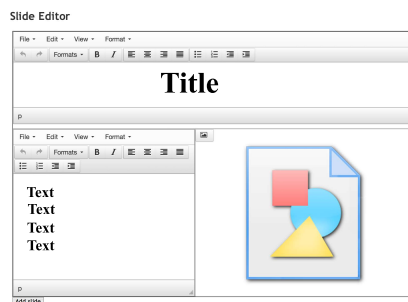


Figure 4: Editor screen to configure a slide with a title at the top and two fields below to insert text and a picture.



Figure 5: A sample slide generated with Presentation subactivity.

for the title at the top, two fields below (at same horizontal level), one for text (left) and one for a picture.

The types of slides that BP4ED manages are designed according to (Clark and Mayer, 2011) principles for presenting multimedia content, so that learners feel more comfortable and less overloaded. The principle underlying the design of slide type in Figure 3.b is “Place printing words near corresponding graphics”. Reading the text relevant to a graphic should not involve scrolling the screen. Figure 5 shows a sample slide of the slide type in Figure 3.b.

Why develop a presentation editor+software if there are so many available, and more robust? Power Point, Soffice, Google Drive, for instance.

One reason is that, for learners’ sake, it is convenient to organise content after Clark’s best principles. As other presentation editors do not support these principles, EDs may hence organise content into inadequate layouts. Another reason is that our Presentation activity can manage questions and answers along a presentation in order to support learners evaluation (i.e., EDs can specify questions to be answered by learners) – recall that a basic LO should prove that learners did or did not accomplish its learning objective. Hence we need to control navigation within a presentation, which cannot be done with those presentation editors. For instance, eXeLearning cannot return evaluation results.

4 BP4ED ARCHITECTURE

4.1 Cloud-based Web Design

BP4ED is being designed as a cloud-based web system. The main advantage of this design is flexibility:

Users only need a web browser to use BP4ED remotely from anywhere and from any machine; no need to install BP4ED nor other complementary software. This is important for general acceptance of BP4ED, as some SMEs and IDEs may lack enough technical knowledge to properly install and configure software on their machines. BP4ED is being implemented with Apache server, MySQL, PHP, JavaScript, CSS3 and HTML5. We considered using Java instead of PHP for security reasons. However, Java is much heavier to run than PHP and is not supported by providers of low-cost shared hosting, e.g., GoDaddy or Hostmonster. Our configuration allows testing BP4ED in more cloud settings.

A web organisation also facilitates software updates, as only the web server needs updating, and monitoring user activity (mouse clicks, etc.) within BP4ED in order to improve it. And it makes possible access to BP4ED from, and eLearning content delivery to, mobile devices.

Further, as mentioned in Section 3, once units of eLearning content are ready for use by learners, a copy of them will either be accessed directly within BP4ED web site or be exported to another web site. That is, such units of eLearning will be made accessible through web links to the relevant resources within BP4ED — see Section 4.2. These links can then be followed from other resources such as a Moodle course. However, we plan to add the facility to export BP4ED content through standards such as SCORM.

4.2 Templates of LOs

Internally, BP4ED is organised around the management of templates of learning objects (LOs). The templates of both base LOs (topics) and composed LOs are organised through mixing database and web (HTML) pages functionality. There is a MySQL database with a table for users, and for each user various tables, one table for each of the following: curricula, courses, lessons, topics (base LOs), (learning) activities and media (resources). The tables are organised such that they support the hierarchy shown in Figure 1. Such organisation provides the means for navigation between the corresponding objects. For each LO level (curricula, ... resources), web pages were designed both to display LOs information and

to enter information to update LOs. Entered information onto web pages also determines navigation and two operating modes as described next.

4.3 Operating Modes

The database and web pages organisation just described determines two operating modes: *editing mode* for eLearning developers (EDs) and *learning mode* for learners, see Figure 6.

In editing mode (left and bottom parts in that figure), EDs can carry out three functions: i) they can create/edit the structure of eLearning content as a curriculum, courses, lessons and topics, adding and/or deleting any of such elements; ii) they can edit the content (text, hyperlinks, pictures, etc.) within any of those elements; and iii) generating the learning mode version of some content, either to check it, use it in learning mode, or export it.

In learning mode (top right in that figure), students *consume* eLearning content developed in editing mode. This mode behaves as any other interactive web content developed with other software tools. It may feel somewhat restrictive, but its design is based on pedagogical principles; and can be improved.

4.4 Online Help

BP4ED will also include online help. *General help*, as a video, will show what BP4ED is, its motivation, its organisation around Horton's best practices, and examples of how to use it. Using BP4ED, we will also develop a course on how to use BP4ED.

Contextual help will show content about best practices and examples to fill in the templates depending on where, within BP4ED, help is invoked. In Figure 6, the bold arrows going down show the interaction between the editing mode and the help module. There is no help in learning mode.

It should be noted that such online help is a key factor for BP4ED to accomplish its goal of facilitating the role and interaction of SMEs, IDEs, TDEs and PPs. Ideally, SMEs using BP4ED should produce content that requires little editing by IDEs. However, BP4ED only supports (frames) a hierarchical organisation of content as shown in Figure 1. Yet content itself must be adequate and this mostly depends on SMEs following good practices in identifying and writing learning objectives, learning activities, content and tests, see Section 2.3 and (Horton, 2012) and (Mager, 1962). There are many good books on this subject. However, we believe that both online help and online examples of these issues will help SMEs to do a good job by themselves.

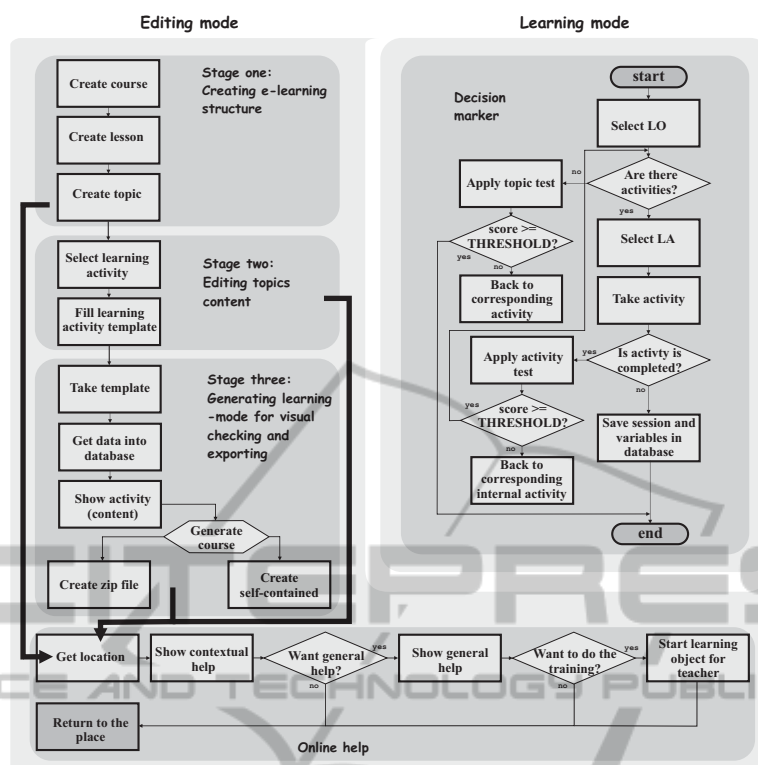


Figure 6: BP4ED engine operating modes.

5 CONCLUSIONS

This paper has presented BP4ED, a Cloud-based Web system that embodies best practises for developing eLearning content. It consists of templates to organise units of eLearning, screen templates for adequate display of content, and the logic to manage those templates in editing mode for developers and learning mode for learners. BP4ED does *not* help at all the development of individual elements of content such as graphics, videos, sound, etc. This is work by PPs.

BP4ED may feel somewhat restrictive in developing some complex eLearning content. However, it can be improved; or may be complemented with other software tools. We are currently finishing its implementation and adding online help.

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