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Beauty and Precision: Weaving Complex Educational Technology Projects with Visual Instructional Design Languages

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Instructional design and technology products result from many options and constraints. On the one hand, solutions should be creative, effective and flexible; on the other hand, developers and instructors need precise guidance and details on what to do during development and implementation. Communication of and about designs is supported by design languages, some of which are conceptual and textual, and others more formal and visual. In this article we analyze a case in which both a creative solution (beauty) and clear-cut details (precision) are sought. To contribute to the final beauty of the product we apply a narrative approach that outlines the general structure of the design solution. To provide the necessary precision, we employ a more formal visual design language to specify design details for development and implementation. We claim that a mix of design languages at different layers of abstraction and formalization can be used effectively as complementary tools for creating aesthetic and successful design solutions through progressive refinement.

Introduction

Imagine the moment a fashion designer gets an idea for a new evening dress – inspired by the beauty of the woman who will wear it, by the feeling of the event that makes that dress necessary, or by another similarly inciting detail. In the very next moment, the designer will turn to the astonishing number of detailed decisions that need to be made in order to transform that idea into the final, tangible product: questions of materials, measures, techniques, etc. Knowledge and mastery of development details is what distinguishes a pure theoretician, critic, or failed artist from a professional designer; the *compelling idea* that generates the *grand view* is what makes a designer more than a good technician (Hokanson, Miller & Hooper, 2008). Only together – a compelling idea made real with sufficient precision – can they deliver a high quality product (cf. Schön, 1983; McKee, 1997). While the dynamic remains the same, the tension between the two elements increases with the complexity of the final product.

The design of technology-based teaching and learning experiences – like instructional design in general – is a complex process that often lacks the proper consistency between the idea and the implementation (Boot, Nelson & De Faveri, 2008). The space in which the translation of an idea into implementation takes place is filled with competing needs, goals, and constraints (Nelson & Stolterman, 2003), which makes translation always more than simple representation. Indeed, instructional design, like most forms of contemporary design, is a strongly social practice, involving teams and often bringing together people with different backgrounds, languages and cultures. In this situation, communication is clearly a key issue.

Even before communication becomes an issue, the design process is filled with complicating factors that require representation systems to support thinking about them. Some of these factors are connected directly to the instructional content, some with the organizational or societal structures in which the learning environment is embedded, some with the practicalities of delivery, and some with the constraints and affordances of the available technologies. These can be considered the technical factors, that is, those that can be identified and analyzed to some extent as long as the necessary information is available. Other factors are more difficult to identify and resistant to rational analysis, like those relating to the desires and goals of learners, the creative powers of the design and development team to generate effective design ideas, and how these might interact with other factors and each other to determine how content and instructional activities will be expressed. For any design project, and for instructional design projects in particular, this complex design space requires abilities and tools for working comfortably within both the soft focus of desires and creativity and the sharp focus of technical detail. The tension created in shifting focus is one of the greatest challenges to instructional designers and one of the most significant sources of conflict within design teams.

The use of a shared design language is one method of dealing with design complexity and the requirements of communication in interdisciplinary design teams. Recently there has been much research into the use of *visual* design languages for this purpose (cf. Botturi & Stubbs, 2008). It reveals that there is a plethora of languages available to choose from, ranging from sketch-oriented languages that facilitate the creation and representation of the grand view of a design to more formal languages that enable detailed representations of specification and/or implementation details of a design. In this article we show that the use of visual languages for instructional design projects is not a matter of making an exclusive choice among available languages, but a matter of complementary choice that supports a smooth, consistent transition from the grand view to the details of a design.

The article is structured as follows. In the Visual Languages for Instructional Design section, we discuss the state-of-the-art in visual languages for instructional design. Based on the presentation of a concrete design case, section three demonstrates the use of two different visual languages to support the development of a grand view and the precise specification of details for the case. The final section presents a discussion of insights from the case study and a conclusion.

Visual Languages for Instructional Design

Designers must find effective means of communication about the varying needs, goals, constraints, desires and ideas among the many professionals involved in the design team (Botturi, 2006). They have to document not only the information that will guide sound design decisions, but must also create shared documents that describe resulting design decisions for other team members. Otherwise, it can be impossible to ensure that the final project demonstrates fidelity to critical analysis factors and to the synthesizing ideas that lead to the final design. Many design fields like Architecture, Fashion Design, Mechanical Design, Software Design, etc. have found more or less official and standardized ways to express the complexity of their designs and generate a shared view of the project (Stubbs & Gibbons, 2008). Such design languages usually accompany the design process at different stages: while sketching can be used for expressing and refining the first ideas for a new building, more formal drawings will be used later for details, and CAD generated plans will be necessary for communicating with the construction crew. Design languages usually blend text and diagrams, and allow designers to articulate different layers of expressions – ideas, movement, technologies. It is not uncommon in many fields to find a wide use of materials for rapid prototyping of ideas – from soap to wood to LEGO bricks.

Instructional designers also use a variety of verbal and visual design languages to capture the nature of designs in progress, yet there is no long tradition or common practice in making use of more formal languages and notations in educational design contexts (cf. Koper, 2005, p. 4). Visual design languages, in particular, due to their level of abstraction and ability to depict large amounts of information and relationships in a relatively concise space, offer much to meet an instructional designer's needs for communication. The review of visual languages for instructional design made by Botturi and Stubbs (2008) reveals languages suitable for different design phases (analysis, initial brainstorming and fast "sketching", development or finalization) and with different intentions. Some languages are focused on enhancing communication between designers, while others rely on a technological standard – such as IMS Learning Design (IMS Global Learning Consortium, 2003) – for allowing human-computer interaction. The classification proposed by Botturi, Derntl, Boot, and Figl (2006) provides a framework for understanding such differences and identifying potential applications.

While communication is central to design processes, it is not the only need driving design documentation. The creative process itself, even if carried out individually, benefits from some form of external, visual documentation of ideas as they are forming. Design happens as much on paper, on white boards, or in computer documents as it does in the minds of the instructional designers performing it (Nelson & Stolterman, 2003; Hokanson, 2008; Stubbs & Gibbons, 2008). All design languages in a way support creativity, providing concepts, words, patterns, and methods for organizing the design process. But for designs in-the-making, visual design languages hold particular strengths related to the way their rapid shorthand methods can keep up with the pace of forming ideas.

A universal language or documentation system that will suit all these needs is likely impossible, just as no language can be taken as *the* medium of humankind, be it English or Esperanto, for capturing all forms of cultural expression that exist. As instructional designers ponder their needs for visual design languages to support their work, they are more likely to find that a variety of means are necessary at different stages of the design and development process. To demonstrate the breadth of potential for design languages in this article, we use a case study to explore how a design team might employ two very distinct visual design languages in the process of creating a design for a complex instructional design goal. One of these languages employs the narrative diagram known as "Aristotle's Incline" to assist in meeting the goal of creating an engaging learning experience that will exhibit aesthetic qualities similar to those found in a well formed story (Parrish, 2008). This tool might be said to aid in developing the beauty of the design (Hokanson, Miller & Hooper, 2008). The second language is coUML (Derntl & Motschnig-Pitrik, 2008), a visual instructional design modeling language based on the Unified Modeling Language (Rumbaugh, Jacobson & Booch, 1999). coUML offers a more detailed and comprehensive way to describe an instructional design, including the learning activities, roles, and communication patterns. It can be said to aid in developing the precision necessary for the efficacy of the design. We are in no way suggesting that beauty and precision are in opposition to one another, nor even that they are mutually exclusive concerns. We make the distinction merely to further stress the competing demands on instructional designers for maintaining a grand view of the learning experience while also addressing the myriad details of an effective end product.

Case Study: Multimedia Learning Objects for Public Education Drop-Outs

Developing a grand view and being able to manage detail decisions are key to instructional design, but they are not sufficient. The deepest challenge in the functioning of a design team is making details *consistent* with a well formed grand view, that is, having a team that shares the vision and is able to make coherent decisions. As claimed above, this depends on effective communication, which can be supported by the use of visual languages. This article explores this issue further by demonstrating how two distinct design languages can be integrated within an e-learning design scenario. The case used for this demonstration is hypothetical, yet based on elements from real cases. We will use the case as an anchor for illustrating the need to facilitate the complex transition from a creative design idea to precise instructions for development and implementation.

The key elements of the case are the following:

- A non-profit organization has received funding to develop multimedia tools to support drop-out students from public education.
- The organization decides to produce a large set of up to 80 learning objects (LOs) aimed at developing basic skills and knowledge in reading, writing, math, history, and geography. Adaptable LOs are the planned instructional technology because it is assumed this will support adaptation and adoption by many schools and school districts.
- The target learners are 14-18 year-olds, many with difficult family situations and some with learning disabilities. For many in this audience, lack of and inability to form supportive relationships are known to be a factor in their learning difficulties.

Designing and Sketching for an Aesthetic Learning Experience

The primary concern in our initial response to this case is to create a learning experience that will encourage learners to respond positively to and interact deeply with the instructional materials. Our major observations regarding the needs for this experience are these:

- It will be difficult engage the 14-18 year-old at-risk students and additionally hard to maintain their focus.

- Drop-out students are likely to have relationship issues and few constructive role models for academic engagement. Interactions with people, not just technology, will be key.
- LOs provide flexibility for adaptation, but will provide little inherent context to stimulate the required engagement on their own. Students are likely to be unmotivated without a unifying structure to keep them on task. In fact, given the relationship issues in particular, LO approaches might be seen as an unlikely design decision. So this constraint calls for a creative solution.
- Adaptability and sharability are given as primary goals. We cannot create materials that have only one possible implementation plan or we risk cost ineffectiveness. However, there will be a fine balance between providing a quality learning experience that can maintain the good name of the non-profit group funding the project and one that is adaptable to multiple contexts.

From the stated goals and our understanding of constraints we develop a set of design goals:

1. **Engagement.** We want to develop an overarching structure with narrative qualities to enhance the experience of working with the set of LOs. The experience should both build engagement and create strong feelings of accomplishment at its completion.
2. **Incremental accomplishment.** The LOs should be thematically related and build upon one another toward a satisfying accomplishment. Objects engaged with early on should develop skills or knowledge necessary for later objects. (Ensuring highly interrelated content that crosses the variety of subject matters will be a significant curriculum design challenge.)
3. **Peer collaboration.** LOs should be used at least in part within social contexts, including collaboration with other students and with teachers.
4. **Flexible scenarios.** LOs must be able to be combined in a variety of ways, such that students or groups of students can have somewhat unique experiences, and such that a single student who has to make more than one pass through the set of objects to master the content will have a unique experience each time. Providing flexibility will be a challenge given goals 1 and 2.

Goal 1 may not strike the reader as an obvious conclusion to draw from the above observations about needs, because learning experiences are not frequently discussed in narrative terms. Looking closely, however, one will see that the pattern of any learning experience, shows a general storyline of establishing a need to know (through puzzlement, problems, or conflicting information), a sustained period of action, observation, and mental struggle to find and evaluate solutions or master understanding, and a culmination that closes the experience and indicates the degree of success in learning. Comparing this pattern to the storyline of any fictional narrative will reveal striking similarities. Viewing learning as a narrative in no way reduces instruction to a form of entertainment because narrative itself is a fundamental way of understanding the world – perhaps our primary way of making sense of experience (Bruner, 1990, 2002; Polkinghorne, 1988). Narrative is the story-logic we find in any meaningful experience. It possesses five necessary components – an Agent, an Action, a Goal, a Setting, and a Means (Burke, 1969). The fact that these components are also necessary elements in the processes of learning reveals the fundamental role narrative plays in our lives.

To help us instill narrative qualities in our design, a design sketch is created using a narrative diagram (Parrish, 2008) as shown in Figure 1. The narrative diagram depicts the experiential goals for the design, which include a desire to increase engagement throughout the instruction. At this stage the diagram is only a skeleton upon which to design the experience. It shows only the goal to present the LOs in three phases, and the approximate numbers to be used in each phase. The narrative diagram used here is only one way to visualize a design to reveal its narrative structure, but it is one with a tradition that goes back as far as Aristotle's Poetics (trans. 1984). Its three-act structure is also as fundamental as the beginning-middle-end pattern we perceive in any experience felt as complete and coherent. So while there is nothing to suggest that three, and only three, parts are required or desired in an instructional design, it will nearly always be easy to perceive these three basic acts in a coherent learning experience. In this case, the use of an object-oriented instructional design (Parrish, 2004) does more than intro-

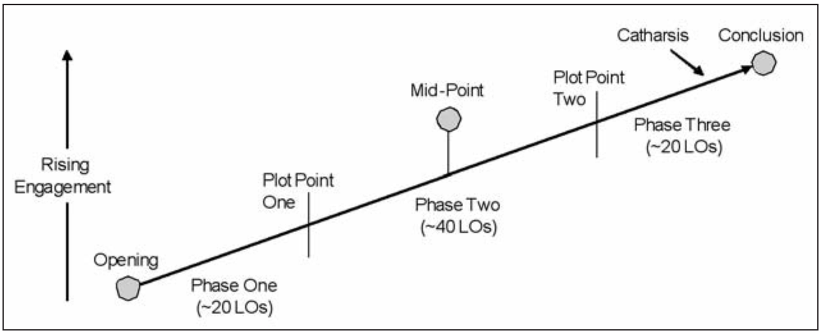

Figure 1. A sketch narrative diagram for the case.

duce constraints; it provides freedom to make the three-part structure an explicit aspect of the design. Using a skeleton narrative diagram as inspiration, the following design ideas come to us.

To meet the formidable challenge of engaging this student audience, the LOs will be learning activities that serve as challenges along the path of an adventure learning game. They are grouped into four sets for four stages in the adventure – approximately 20 are used each stage, of which the learner completes perhaps 6-10, which leaves at least half left over for repeat uses and for offering variety in the learning experiences between teams of students. Writing and math tasks are often combined with history and geography tasks to make the most of all topics. For example, math problems might have a historical context, or writing tasks might include providing geographic information.

Within the game's story, the learner will be an adventurer required to meet a series of challenges. Completion of one task permits movement to the next. In this way, the LOs are earned, not just assigned, which offers built-in motivation. Tasks are set by the instructor (in a role similar to *dungeon master* – well known to all D&D players). The instructional package will provide several game stories and guidance for the instructor's role in each.

Completing tasks in the adventure brings increased status for students and access to new tools and information (e.g., new LOs and knowledge required to solve a given problem). Students work in small teams to provide each other support by offering the unique set of tools and information to which they have earned access. Game stories are designed to increase complexity at two points, corresponding to the increased difficulty or levels of content/skills being taught at the starts of phase two and three (see Figure 1).

The **first phase** (using the first set of LOs) is an orientation to the adventure in which learners are sent on relatively straightforward tasks. In the initial adventure developed for the project, titled "Galactic Explorers," learners are academic researchers from a distant planet exploring Earth for the purpose of understanding its culture and technological milestones. They are to report facts about the planet and the people who live there to create a catalog of knowledge about the galaxy's inhabitants.

In the **second phase** (using the second and third set of LOs), learners begin to realize that their tasks are taking on a larger, not yet fully understood meaning, enhancing the complication of the story and learner engagement in the adventure. In Galactic Explorers, learners find that Earth is in the path of a large asteroid, through some recent change in its orbit, and collision is unavoidable. Learners are tasked to document what they can about the planet before it is destroyed. If they want to save Earth's inhabitants, they will have to learn as much as possible to develop effective plans to relocate the people and other life forms to a hospitable new planet. At the midpoint, in order to increase urgency, learners are asked to provide the mission leaders plans for relocation.

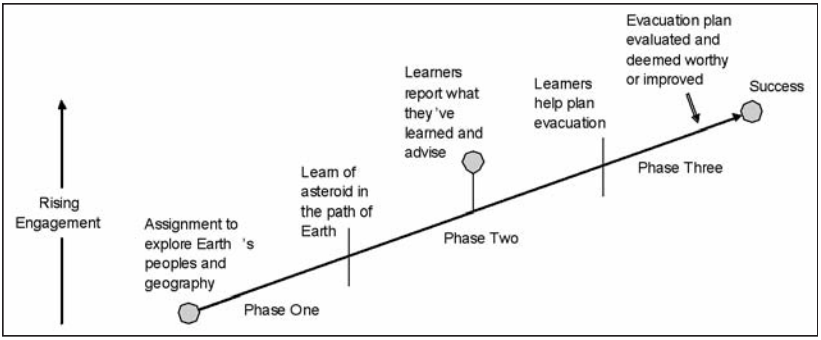

Figure 2. A narrative diagram for one sample learning scenario.

In the **final phase**, the larger meaning hinted at in phase two is fully revealed (and the final set of LOs is required). In our Galactic Explorers, because of their accumulated knowledge, learners are assigned to help with the planet's evacuation by solving the technological problems and planning associated with redistributing Earth's population in appropriate locations on the new planet and within appropriate community designs that allow them to carry on with their cultural backgrounds. The instantiated narrative diagram for our Galactic Explorers is shown in Figure 2.

Due to the archetypal plot structure, multiple stories can be created to provide game contexts with similar patterns of engagement and incrementally revealed meaning. The range of subject matters designated to be taught (reading, writing, math, history, geography), suggest that stories might use plot devices that include time travel or archeological research, since these allow the history topics to be logically connected to the tasks of the story. Several stories would be provided by the developers, but stories can be modified and new stories can be developed by creative instructors and shared across schools. This option for customization might increase motivation for some instructors to adopt the innovation.

In the terms presented in the introduction of this article, this section has offered the *compelling idea* and *grand view* of the design: the overarching idea that gives unity to the project or the sparkle that makes it unique. At this point, as any teacher or instructional software developer would tell you, it looks full of holes and too complex to actually implement. How can this idea be turned into a product? How can developers retain this idea without watering it down amid the plethora of technical details that will come up during development and implementation?

Designing and Documenting for Precision

The case includes the requirement to produce 80 LOs that are to be shared among multiple schools in the district. Starting with the learning adventure described in the previous section, the aim of this section is to introduce precision at crucial points to prepare the design for development and documentation. Thereby we aim to show that a combination of visual design languages – where precision complements beauty – can help produce both creative and unambiguous design solutions.

At some point the design needs to be communicated not only to other designers, but to developers and instructors as well. At that point, completed designs are most effectively communicated using a language based on a limited, well-defined, clear-cut set of concepts and perspectives on instances of those concepts. Of course, this requires a shared understanding of the concepts involved (e.g., LOs, learners, instructor, learning paths, roles, relationships, etc.) and of the symbols offered by the visual design language to represent the concepts and their relationships. The narrative diagram and resulting plot outline work mainly on the conceptual layer. To specify and document the design in more detail we need to employ a design language that focuses on the specification and implementation layers. One such language is coUML (Derntl & Motschnig-Pitrik, 2008), which can be used to create visual models of the structure and process of instruction. Note that instead of coUML we could use any other language that allows the visual representation of system structures and dynamics based on some formal notation, such as MOT+ (Paquette, Léonard, & Lundgren-Cayrol, 2008) or PoEML (Caeiro-Rodríguez, 2008). We chose coUML for illustration purposes here because its visual notation is comparatively simple to understand and because it is located on the right level of abstraction to support our arguments. It can be characterized as a semi-formal language to be used for specifying details of an instructional design solution. That is, it is too formal for efficient representation of ideas about the grand view of a design, and it is too informal to be efficiently used as machine-readable instructions during implementation.

Using a formal language for detailing an initial design sketch typically triggers a reflective, discursive process in which the original design itself needs to be altered to accommodate new insights and ideas. In this case, when the initial design solution for the case was ready for the detailed specifications provided through coUML, the authors identified several aspects in the sketch that needed to be refined and revised. A selection of these is presented in the following.

Learning Objects Structure

The design sketch states that the LOs can be consumed along various learning paths according to a given adventure storyline used for the instruction. However, to ensure *feasibility* of storylines the instructors, designers and developers need information about the constraints on logical arrangement of available LOs. So first, we need to define a set of LOs for the given subjects to test for constraints. The outcome of this activity has significant impact because we need to ensure that LOs are sharable and that they build upon one another to enable a variety of storylines that will include different levels of accomplishment and information availability. Hence, before defining the actual content of LOs, we define an LO structure that includes their dependencies.

An LO dependency means that a dependent LO requires that learners have mastered the skills or knowledge taught by another LO. As an initial design decision we simply divide all LOs into different LO packages: for each subject (reading, writing, math, history, and geography) we create packages for basic, core, and final LOs, corresponding to the three main phases of the narrative, respectively.

- The *basic LOs* used in the first phase of the plot should be mostly independent of each other to ensure flexibility in the opening stages of a storyline.
- The *core LO* package, which is used in the second phase, hosts the most important LOs. They are designed to depend more on each other to create engaging, more tightly-knit storylines with stepwise accomplishments.
- The *final LOs* used will mostly build on core LOs to fully reveal meanings and eventual solutions to problems raised and encountered along the learning path.

LOs for each subject are to be distributed among the packages in accordance with the rough distribution of LOs indicated in the narrative diagram. So we need an average of 4 basic LOs, 8 core LOs, and 4 final LOs for each subject. To enable extensibility of the LO repository we specify a *generic*, content-independent model of LO dependencies for each package. During development, the generic LO model is instantiated by adding actual content that satisfies the constraints and dependencies. While this decision creates an additional layer of abstraction and thus adds some extra complexity to the design solution at this stage, it will later facilitate the creation of alternative storylines by developers and instructors.

An example of the generic history LO package is given in Figure 3. According to the division described above there are 3 sub-packages. The history basics package consists of 4 LOs without any dependencies among each other, meaning that they can be consumed in any order during the first phase. Completion of at least two of these basic LOs is required for tackling the core LOs that involve the learner deeper within the storyline (this constraint is stated in the note box attached to the history core package in the diagram). This constraint enables varying paths for different students through left over LOs. The figure shows that some of the core LOs depend others, e.g., HC7 depends on HC4, which itself depends on HC1 (HC stands for History Core). Note how these dependencies allow different paths through objects while also describing the valid paths. HC3 for instance can be accessed at any point (e.g., before or after HC1) in the second phase of the storyline, as it neither depends on any LO, nor does any other LO depend on it. Still, a particular path might require HC3 to be discovered during the story to allow access to one of the final LOs. Another story might as well place HC3 as a dead end.

The initial design sketch also includes the idea that LOs from different subjects should be combined and integrated into more complex tasks. The most basic way to represent a multidisciplinary LO is by applying multiple identifiers to it: for instance, HB2 from history basics might be identical to MB2 from math basics, because the LO may include the task of having students calculate how many lives were lost per kilometer of travel during Alexander's attempt to conquer the Orient. Both LO identifiers act as placeholders for the same LO.

The complete LO dependency structure for a design enables the specification of a *reference process*, or depiction of possible paths through a given set of LOs. This is an important input to storyline design and content development, where the reference process is instantiated with concrete activities and tasks. The reference process corresponding to the dependencies in our generic history core package is given in Figure 4. The figure shows a coUML "activity model" (Derntl & Motschnig-Pitrik, 2008), which defines the logical arrangement of tasks and activities where particular LOs can be accessed. Note that each activity symbol carries the identifier of an LO, which means that a storyline would have to define a task or activity that is fulfilled by this LO. (Also note that in a particular storyline a single task may also involve multiple LOs.) The reference process is not to be confused with the actual series of LOs a student accesses at runtime. It is a design-time tool for visual alignment of the (minimal) paths through some set of LOs based

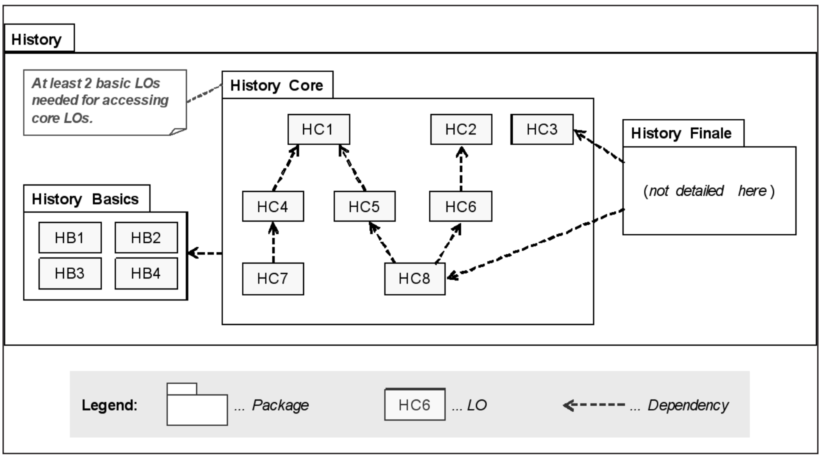

Figure 3. The history learning-objects package.

on their dependencies. Nevertheless, during runtime some student might find alternative paths. For instance, the LOs in the history finale package require H3 and H8 from history core to be completed; according to the reference process, the path to HC7 is not required to proceed to the history finale, but it can still be accessed by students in the second phase of the storyline, perhaps providing some knowledge or skill beneficial, but not essential, during the finale.

The previous discussion reveals several benefits of using a precise visual design language for depicting the overall structure of objects and tasks. The generic LO structure and the distribution of LOs among different phases of the curriculum is widely independent of actual content and storylines. At this point the designer may add any desired, reasonable dependency among LOs. As a next step, the designer derives a reference process for each package (and finally for all LOs) from the LO dependencies. The LO structure and the reference processes can be used by designers, developers, and even instructors as the basis for creating engaging storylines. Note that actual content (or at least ideas about content) can be added to LOs at any point

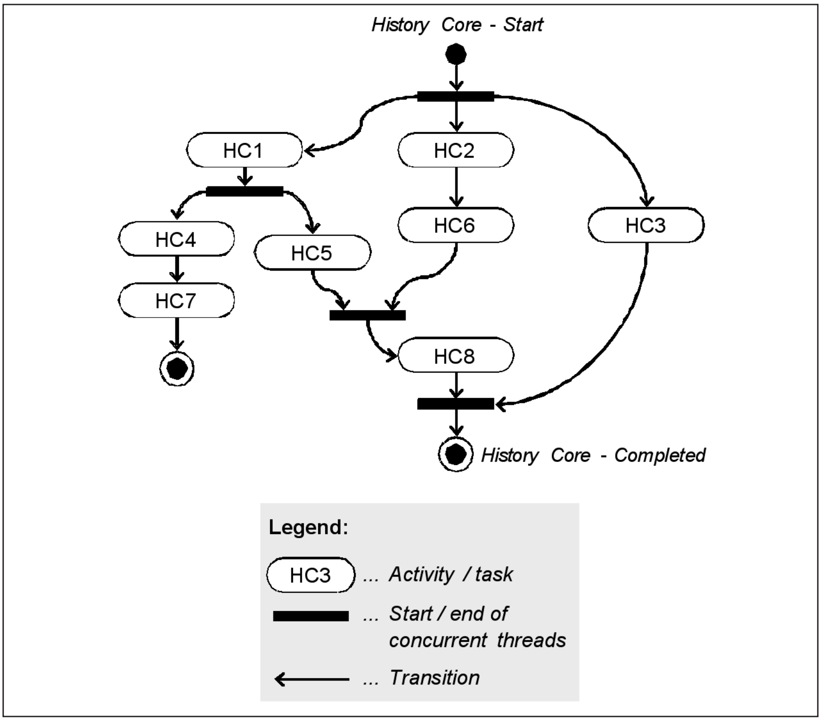

Figure 4. Reference process of history core LOs.

during the design and even later during development. This kind of separation of concerns enables the creation of any number of desired LO structures and offers virtually endless options for storyline design and LO development based on a shared, precise reference model.

Task and Activity Structure

The LO structure conceived for our narrative plot still lacks required detail. What tasks are assigned to learners? Who are the main actors in particular tasks during implementation and what are their roles? What documents/LOs must the instructor and LMS provide and what documents (worksheets, reports, etc.) are to be produced by learners? These are just a few of the questions that are of interest during development and implementation. Seeking answers to these questions, we first identify crucial points or events in the narrative plot and start adding details. Subsequently, we would be able to fill the remaining gaps in our storyline.

Visual conceptual models in general, and coUML in particular, allow modeling activities and structures at arbitrary levels of detail. For instance, in one diagram you can choose to model a whole phase of the plot at an aggregate level, while you can also refine each task in several more detailed activity diagrams. For illustration, we pick the first obvious crucial point in the plot. In the suggested storyline, learners are confronted at the end of the first phase with news that Earth is on a lethal collision path with an asteroid. One assignment that follows this plot point requires learners to build small groups, collect information, and research the history and geography of space impacts on Earth. They should first take individual notes on their research, gather in their small groups and collaborate on writing a report on their findings. Finally the reports are presented and discussed with other learners and the instructor. Note that this assignment specification is only hinted at in the initial design sketch; the details were elaborated and sketched out during a team discussion about this transition point.

The "Asteroid Impact" assignment is modeled using a coUML activity diagram in Figure 5. We identified three roles actively involved in the assignment:

1. The **instructor**, who is responsible for assigning tasks, selecting LOs, facilitating student work and evaluating outcomes;
2. The **students**, who follow the assignments and work their way through the LOs provided;
3. The **group**, which conceptually represents an aggregation of the student role.

Each role is represented as a separate area in the diagram. Note that the activity diagrams can be used to show the initial selection of LOs suggested for a given activity (e.g., HC1 and HC2 are input to the research activity on previous asteroid impacts).

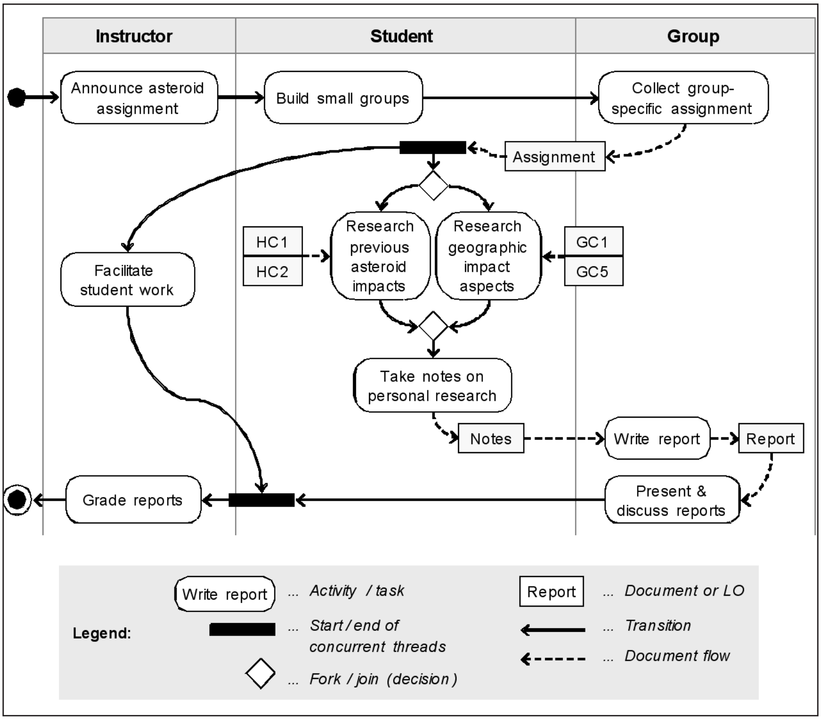

Figure 5. Activity plan for the asteroid assignment.

Creating diagrams for other important points in the storyline allows precise planning and documentation of any aspect relating to tasks, activities, and LO usage. Of course, the creation of detailed visual design artifacts for the entire design can be a resource-intensive endeavor, but we believe it pays off. Based on the overarching structure outlined in the narrative diagram, these more precise design artifacts can be exploited in many ways, such as for preparation of instructors, provision of required project documentation, selection and development of LOs, creation of alternative storylines, comprehensive documentation and design sharing, as well as for evaluation of implementations following these blueprints. Most design languages let users select the level of detail applied, allowing a fine-tuned trade-off between resources and quality of documentation.

Discussion and Conclusions

As this case study has shown, even widely disparate visual design languages can act in concert in addressing the needs of an instructional design project. As you read through the case, you may have found yourself identifying more with the use of one language than the other. This is natural and reflects your individual design orientation. However, to be a successful designer, one must be conversant in many potential languages and be comfortable working within both creative freedom and within constrained technical detail – this is indeed an important step in learning to manage an interdisciplinary group and have it work effectively. A desire to stick only to one's strengths can thwart a complex task like instructional design. Instead, we are better served by more pluralistic approaches, appropriating those design techniques and languages that serve our purposes in the various phases of a design.

Botturi, Boot, Figl and Derntl (2006) proposed a classification framework for design languages for the purpose of describing them and guiding their use. While we will not analyze the formal features of the two languages used in this article, the classification framework can provide insight about their functions. The narrative diagram would be described as a *generative* language, that is, an expressive tool suitable to shape new ideas, or elaborate them while they are still evolving. On the other hand, coUML would be described as a *finalist* language, that is, a language that freezes design decisions into the portrait of the to-be product as documentation to be passed on to instructors or instructional developers. This article claims that the two functions must somehow be reconciled. Passing along only detailed diagrams is insufficient to create an aligned team that shares the *grand view* and is able to make consistent decisions. The reverse is also true, sharing the *compelling idea* without controlling the details might lead to a less efficient process and poor and inconsistent outcomes.

The selection of the two languages used in the case study is mainly for the purpose of illustration and we do not claim that these are the only languages appropriate to develop a solution for the given case. Based on the design language classification framework (Botturi, Boot, Figl & Derntl, 2006) it is possible to select different languages for similar purposes. The choice will more or less be a matter of taste and estimating the utility of a particular language for a particular purpose. For example, E2ML (Botturi, 2006) could be useful as an intermediate step between the grand view and the detailed specification. Depending on the desired degree of computational support at runtime, languages such as PoEML (Caeiro-Rodríguez, 2008) or IMS Learning Design (IMS Global Learning Consortium, 2003; Tattersall, Sodhi, Burgos & Koper, 2008) might also be required to develop machine-readable and executable units of learning based on the coUML models.

Instructional design is about creating learning *experiences*, not just instruction, and so designers need tools that enhance their ability to create designs that encourage perceptions of *beauty* in the experiences of engaged learners. These tools might be learning theories, instructional strategies, guidelines for powerful learning activities, and stimuli for creative designs.

Narrative diagrams are just one way to consider the learning experience. But instructional design is also about clearly communicating design intentions to content developers, software programmers, instructors, and others who are critical stakeholders in the effort. It also requires techniques for maintaining the integrity of design plans. Without *precision* in design communication, original intentions might be lost in the complexity of instructional development and delivery.

In an attempt to stimulate self-reflection for instructional designers, this article performed an in-depth analysis of this relationship through a brief case study. It proposed visual instructional design languages as tools for supporting the design process and enhancing consistency, and for improving the generative process from idea, to design, to development, and to a powerful learning experience.

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