

Reflections on eLearning Storyboard for Interaction Design

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Abstract. The purpose of this paper is to highlight several fundamental questions surrounding eLearning storyboards: (1) What exactly is a storyboard? (2) What significance does a storyboard can bring in different industries? (3) How does the design process take place in eLearning storyboard? Finally, (4) What is the role that eLearning storyboard plays for its user(s)? Issues pertaining to the community of practice i.e. social and collaborative task support and agility of the design process that can facilitate task performance and effective communication between designers are discussed and recommended for future works.

Keywords: eLearning storyboard · Multimedia design tool

1 Introduction

In Human-Computer Interaction (HCI), designer draws or sketches a storyboard to see what the interface does and how it is used to accomplish the tasks in real usage scenarios. It is also regarded as low fidelity prototyping in designing system interfaces, that looks like, or very close to the actual product or design solution. This is because it uses materials that are different from the intended final version such as papers and cardboard. Nevertheless, the use and application of storyboard has been extended to other industries including in the design and development for eLearning courseware, hence the name eLearning storyboard. Users of eLearning storyboard have been diversified from a storyboard designer to the eLearning manager, information manager, and head department of eLearning unit and subject-matter experts in different fields. In delivering high quality user experience (UX) to these users, eLearning storyboard communities would depend on how well does the interaction designers understand the intended product that need to be designed and developed. As we look across a number of theoretical and empirical studies, it had been identified that the essential ideas about what an eLearning storyboard has not been addressed and discussed in a manner that can be used by the interface designers, UX practitioners, information architects, software engineers, human factors experts, information systems analysts and/or social scientists to introduce or improve the existing system designs.

The goal of this paper is to highlight several essential ideas regarding eLearning storyboard. This paper begins with defining storyboard in general. It continues by providing some significance use of storyboard in different industries. The design process and roles that an eLearning storyboard plays will be discussed. Finally, a discussion about designing interactions and human factors for eLearning storyboard will be presented along with some recommendations for future research.

2 Defining Storyboard

In general, a storyboard can be defined in many ways, such as:

- “A series of sketches that are used as a planning tool to visually show how the action of a story unfolds” [22, p. 11]
- “An illustrated view, like a comic book, of how the producer or director envisions the final version of a production will look” [20]
- “An outline or a draft line of a production made up of consequential pictures” [5]
- “Script is a verbal plan for a story, while storyboard is a plan for visualisation of that story” [8]
- “Storyboards are series of sketches that indicate how sequences of events should take place. They are similar to cartoon panels because they have pictures with captions explaining the scenes and any possible dialogue” [19, p. 3]

In summary, a storyboard is explained as a technique for illustrating and outlining an interaction between a person (people) and a product(s) in narrative format, which includes a series of drawings, sketches, or pictures and words that tell a story. Another name for storyboard is “narration”. Narration board is described as a “valuable design tool to the design team as it provides a common visual-based medium to share the common understanding of future design developments” [24, p. 276]. The visual-based elements are important to the designers because it assists them in visualising and developing ideations for future design solutions.

3 Significant of Storyboard in Different Industries

Storyboards are used in a range of industries. Some significant uses of storyboards across different industries include [22, p. 13]:

- Advertising campaigns: storyboards are used to sell campaign strategies to clients or for use in focus group. These storyboards reflect campaign ideas that are highly detailed and include only key frames.
- Video games: storyboards are used to create each scene of the game, including cinematic and full-motion video sequences that introduce a story and act as the user’s reward for excelling in game play.
- Multimedia: storyboards are used to sketch each of the screens along with notes about the content of particular images, the functions of specific button and how the video and sound is to be presented. These storyboards assist in developing CD-ROMs for education or training.

- Web design: storyboards are used for the web design development in defining and grouping elements such as graphics, animations, videos and illustrations. These storyboards assist the web development team to understand the structure of a site and how that information is presented.
- Industrial and governmental videos: storyboards are used to present ideas to clients when creating industrial and/or governmental videos. These storyboards promote effective decision making, help to set strategies and solve problems.

4 Design Process in eLearning Storyboard

To date, there are few researches on storyboarding design process have been found specifically for eLearning storyboard. While most researches in storyboard have been focusing on the design process for designing products [23] and system interface designs [21], this section reviews such works that are related, including Marie and Klein's and Donahue's reports on eLearning storyboard. Van der Lelie described the five phases of the product design process of a storyboard. Each design process is accompanied with its own design activities, purpose, visualisation style and the forms it will produce [23]. Van der Lelie's product design process of storyboard focuses on different visualisation style for each design cycle. As shown in Fig. 1, Van der Lelie's storyboarding design process practices agility in the five phases of storyboarding, which are analysis, synthesis, simulation, evaluation and decision. Throughout the design process, design teams interactions are reported in the synthesis and simulation phases (refer Fig. 1).

Ideas and concepts are generated from the design team to evoke comments, judgment or acceptance in the processing phase. Interestingly, Van der Lelie's storyboarding design process was influenced by the visualisation style used in relation to the design phase and the intended goal. Truong et al. provided five significant attributes of storyboards for demonstrating system interfaces in HCI [21]. These attributes can be significant in designing interfaces within the processing of an eLearning storyboard. The attributes are as follows [21, p. 15]:

- Level of detail: This refers to how many objects and actors might be presented in a particular frame, level of photorealism and display of the entire scene or only details of the interface.
- Inclusion of text: It refers to the texts, either through the tagline narrations for each pane or within individual frames as speech, thought bubbles, or labels and signs which represents in the real life environment. The designers can also choose to depict the story entirely using visual elements without text.
- Inclusion of people and emotions: This refers to the renditions of human characters to build empathy for potential users, display motivation, or convey other intangible elements.
- Number of frames: It refers to the number of panels presented in a single storyboard, which can consist between 1 and more than 20 frames. Truong et al. said 3 and 6 frames are regarded as minimum size to show single activity. However, multiple features and activities are usually shown in multiple storyboards.

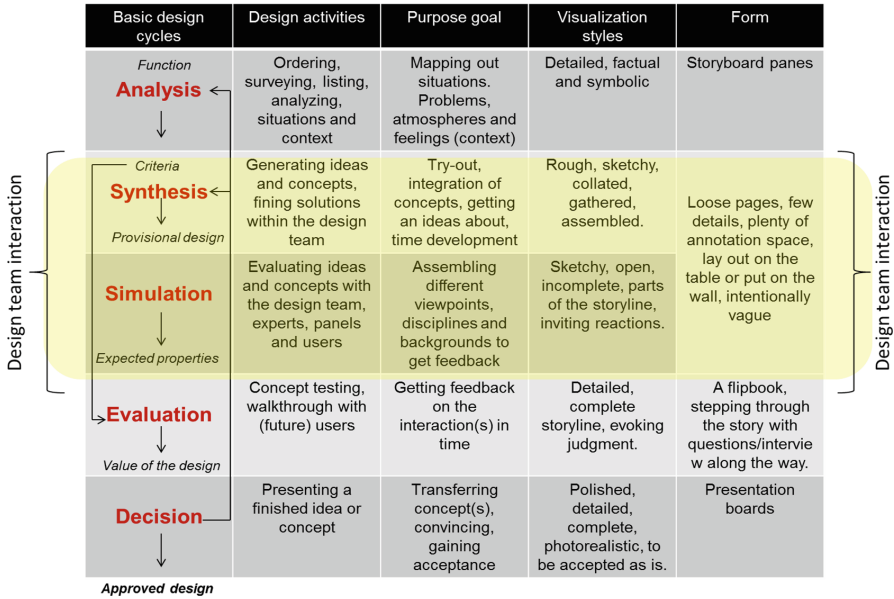


Fig. 1. Five phases of design process in storyboard for product design (Source: Van der Lelie [23])

- Portrayal of time: It refers to the explicit time indication passing within a storyboard or use transitions that convey changes over time.

Marie and Klein reported a detailed design guideline for developing storyboards that can lead to faster client approval and fewer editing during the design and development process [13]. The detailed design was categorised into three design processing activities. First the design activity that refers to the analysis of five requirements of eLearning development, which are content gathering and analysis, high level design, detailed design, storyboarding and web-based training modules i.e. alpha, beta and final phases. Second is the design activity that refers to the detailed design development which includes the following steps: identifying learners, gathering and analysing contents, developing instructional objectives, identifying instructional strategies and identifying the flow of the content. This document on detailed design needs to be approved before continuing to the next step. Apparently, this document had become a guideline for the storyboarding process. Finally, the design activity that refers to the storyboard template which are reviewed and compared in terms of its alignment with the detailed design in storyboard development. Hence, Marie and Klein’s guidelines can be significant for structuring design process activities in the development of an eLearning storyboard framework. Since design documents are the core and most extensive activity in developing eLearning storyboards, six strategies to assist the designer’s task are offered, as follows [6, p. 4]:

- Graphic themes must be consistent and clear with the interface before the early phase in design process.

- Combination of instructional methods can be used to provide information in the eLearning course, such audio, graphical illustrations and case studies
- Interactivity for course development should be agreed.
- Testing or evaluations of the course should be included
- Constraints in course development such as scaling or deemphasising of extraneous or non-critical information from subject-matter experts need to be emphasised.
- A preliminary course plan to structure the format, sequence and presentation of a specific content need to be developed. This high-level outline may include the breakdown of the course's objectives and content into modules, recommended interactivity to support the contents and length estimation for each module, as well as a flow chart to visualise the complex interaction or branching.

From the review of these literatures, four important findings had been identified. Firstly, Van der Lelie has shown agility practices and visualisation strategies in the storyboarding design process as well as the element of design team interaction in the synthesis and simulation phases of the storyboarding design process. Secondly, Truong et al. provided three attributes which can be significant for designing interfaces within the processing of eLearning storyboard. Thirdly, Marie and Klein's reported on the detailed design guidelines for developing storyboards that can be used to structure design process activities in the development of an eLearning storyboard framework. Finally, Donahue's strategies for design document activities can be used to assist design team in documenting contents for the eLearning storyboard.

5 Roles of eLearning Storyboard

A storyboard in the context of eLearning course development is used to document the eLearning design. It provides the content in a visual format which will be customized based on the needs of the eLearning team members, similar to the practise in the instructional design field, for example; the instructional designers needs to provide the detail in the storyboard that is needed by the subject-matter experts in order to produce an effective eLearning [18]. Hence, in this section, there are two roles of eLearning storyboard identified in the literature. Firstly it acts as an instructional design tool and secondly, as a communication tool.

5.1 An Instructional Design Tool

A storyboard can assist in the instructional design process. This is because the storyboard that is used for developing eLearning courseware contains scenarios and their processes, which describe elements, purposes about the assignment, in addition to its components. These components can be animations, sounds, pictures, texts, graphics and interactive interaction. Each component describes the kind of interaction it should behave like during the actual implementation, as well as where the amount and positions of these components are being planned in storyboarding. When the scenarios and descriptive components have been completed, the storyboard will be passed to the multimedia developers to translate the requirements into a form of multimedia

courseware [18]. Brandon provides several steps that lead to the creation of eLearning storyboard. As shown in Fig. 2, the production storyboard is created in the instructional design process before it ends and being handover to the multimedia development team. Each of these steps is meant to reduce the possibility of mistakes and to preserve the integrity and value in the eLearning design process. Briefly, the steps are described as follows [1]:

- The priority of business needs is identified.
- The job objectives (in terms of outcomes and accomplishments) are outlined to fulfil the needs.
- The tasks of a learner are being analysed to accomplish each outcome.
- Available methods and tools to accomplish each outcome are listed out.
- The approximations are identified to help the learners develop the needed skills in a learning setting.
- Formal learning objectives can be defined
- Formal learning objectives are organised into learning progressions
- A flowchart is created to set up the sequence of learning activities
- Draft storyboards are created to provide a basis for reviewing the course plan with subject-matter experts.
- Draft storyboards are transformed into production storyboards that will guide the developers. These production storyboards can also serve as a checklist for the final summative evaluation before its release.

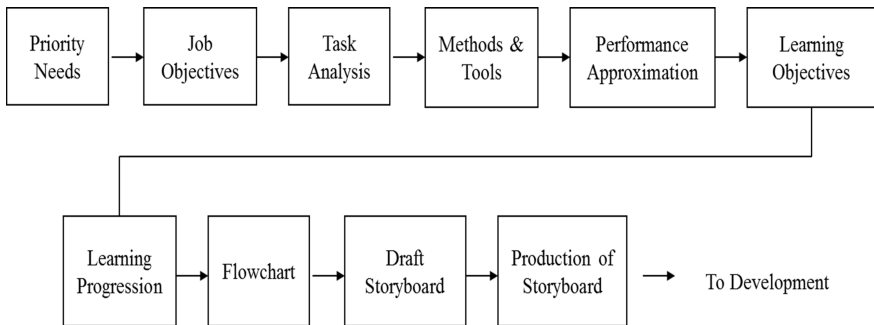


Fig. 2. Steps in eLearning storyboard creation (Source: Brandon [1])

5.2 A Communication Tool

In general, the eLearning storyboard is used to communicate eLearning design which “provides the details from the designers that are needed by the developers in order to produce an eLearning application on time and within budget” [1]. Brandon stated that the eLearning storyboard provides a communication channel between at least three disciplines contributing to the final product; instructional design, graphic design and technology. There are three significances of a storyboard in producing effective eLearning through the support of communication [1]:

- Storyboard completely documents eLearning design
- The brainstorming which accompanies work on the storyboard may assist the creative process and result in a better design
- Storyboard provides an important basis for project management, control and communication.

In achieving communication using storyboards, some works have been demonstrated by Haesen et al. and Malizia et al. Haesen et al. demonstrated principles and techniques which were derived from comics that can facilitate and support communication in the process of storyboarding [9]. The approach is called ‘Collaborative Multidisciplinary user-centred Software engineering (COMuICSer)’. This approach formalises the way storyboards are created and at the same time preserving the creative aspects of storyboarding to provide greater involvement for all team members and end-users in an engineering processes. Malizia et al. demonstrated the principle of back-channel communications in emergency management in their emergency storyboard system (eStoryS) where it provides combinations of tools including storyboards in mash up application [12].

6 Discussion and Recommendations

Based on the information to the fundamental questions raised about eLearning storyboard, we identified two important supports in eLearning storyboard. Firstly, social support is needed to shift the paradigm of storyboarding away from the individual user practices to social practices. Better tools should be designed to encourage participatory and collaborative modes of designing among designers [10]. Secondly, agility support is needed to move away from linear process. It is suggested that computer-based instructional design tools such as the eLearning storyboard should move towards an agile design process in order to be more effective in adapting to the designers’ activities [7]. Current practices in instructional design were interpreted by Häkkinen as nonlinear, cyclical and iterative process [10, p. 466], therefore, the need for agility is important as it enables the change in requirements and allows flexibility in reaching common understanding among the design team. In order to meet this need, one of the techniques that can be used to reach common understand among the designers is to apply the shared visualisation in eLearning storyboard design [15]. Among the techniques includes collaborative concept mapping, collaborative discussion board and collaborative annotation where shared visualisation can help eLearning storyboard designers to pre-plan the eLearning structure or discuss virtually in an e-discussion room. Besides, shared visualisation that works for distributed eLearning team should allow participatory design in both web-based and mobile-based applications.

In addition, the design process in eLearning storyboard should be more adaptive and agile, where instructional design team can carry out their work in a flexible and interactive manner [10]. Software designers should find initiatives and effort to design and develop eLearning storyboard applications that can provide agility, tightly linked design-analysis-redesign cycles, and able to move toward artefacts improvement [2, 11]. Interestingly, Douglas said that any instructional system can be more effective

if its components have well defined functions to perform under adaptive or people-oriented, rather than predictive and process-oriented. It explains how such feature that allows the adaptive design and agility is needed in eLearning storyboard.

Apart from these two roles, there is another important role in the component of an eLearning storyboard that worth investigating is the shared cognitive aspects that are needed to support interactions between eLearning storyboard designers. This is because the cognitive task activities are commonly shared between the designers. Designers share cognitive tasks activities which includes; deciding on the storyboard content, organising the structure for storyboard design, recalling the analysis requirements before storyboarding, and evaluating the storyboard design production.

According to Cannon-Bowers and Salas [3], as these cognitive activities were being shared, designers will develop shared mental model, resulting in better task performance and more effective communication. This notion had been discussed by Nor'ain and Salim [14, p. 281] in the team's cognitive research in human-computer interaction. In their work, they presented a schematic model of social-based vs. shared situation awareness-based approaches. The two perspectives on the shared cognition shown in the model can be used by HCI researchers who aim to solve a particular problem in team cognition by selecting the appropriate shared cognitive models for specific types of systems and applications. For example, if the researcher is investigating shared situation awareness in an emergency response system, he/she can use distributed the situation awareness model to analyse the process of decision making of that system. Similarly, the collaborative design in eLearning storyboard can be investigated using the shared mental model theory to analyse the practise of agility process.

In addition, more attempts to understand storyboard in terms of the tools, concepts and frameworks, similar to one written by Nor'ain and Salim [17] are needed. In this paper, the storyboard has been reviewed and analysed with regard to the three aspects of eLearning design requirements; collaborative design environment, iterative process methodology and designer-centeredness support. In understanding the problem in eLearning storyboard, another work has been done by Nor'ain and Salim to investigate problem aspects of the cognitive task and the storyboarding skills required of subject-matter experts using the cognitive task analysis technique in HCI [16].

With respect to our discussion earlier, we can see the important issues here is to warrant the needs that support the interaction design for eLearning storyboard, which include collaborative work, agile storyboarding design process methodology and achieving shared mental model. As suggested by Häkkinen [10], Douglas [7], Jonassen [11] and Bratt [2], future needs of softwares that applied the agile design process to assist designers' roles is essential and recommended. In all, in addition to the social and agility elements, this study sheds light on the importance of shared mental model, which is needed to support eLearning storyboard users' interactions. It suggests how these insights can contribute to improving humanness for the community of practices of eLearning storyboards, which can be offered by interface designers, UX practitioners, information architects, software engineers, human factors experts, information systems analysts and social scientists.

7 Conclusion

This paper discusses the fundamental questions with regards to the meaning, significance, design process and the roles of storyboards. From the discussion, some information that has been synthesised and concluded, are as follow:

- E-Learning storyboarding design process consists of three main design activities: analysis, design document and design template. It is found that design document is the core and most extensive design activity that requires strategies to assist the task of design team.
- E-Learning storyboard performs roles in assisting instructional design process and communication among team designers.
- Storyboard tools, concepts and framework use different approaches and need different kinds of support.
- Storyboard system that can assist collaborative tasks for the design team should be able to function as a communication tool as well as performing the design instructions. However, what is more needed in supporting designers' interaction is the functionality to adapt changes in the design process. Therefore, interface designers or software engineers can look forward a new paradigm of agile storyboarding process.
- E-Learning storyboard needs social and agility support for designers' interaction. In addition to these needs, the notion of shared mental model is important to support the shared cognitive aspects between them.

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