Developing interactive scenarios: The value of good planning, whiteboards and table-based schemas

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Fictional or fact-based interactive scenarios (or cases), where students are able to explore a problem, event or issue, can assists with student problem-solving, decision making and interpretation of data or observations in a real-world context. Software exists to assist with authoring and delivery of these types of learning objects, but one of the hardest tasks is the planning and storyboarding of the scenario itself. Interactive scenarios are context-based, often include elements of drama, and may be required to follow a script of sorts. They must also link back to the learning objectives of the lesson. In goal-based scenarios in particular, where students are required to form hypotheses and test them in order to get to the root of a problem, the scope (and limits) of what they can do within the scenario must be carefully thought about. This paper reports on the initial questions which need to be answered before commencing work, and outlines simple techniques such a whiteboard brainstorming and table-based schemas for developing scenario structure and content. Along with their function as planning aids, these techniques can also be useful in communicating the structure and content to other team members during development. Thirdly, they allow archiving of scenarios in an easy-to-access format, so content can be used in different authoring tools than the one they were originally designed for, and for other modes of delivery, such as face-to-face tutorials and scenario walkthroughs.

Keywords: interactive scenarios, goal-based scenarios, scenario-based learning, lesson planning, schemas, whiteboards

Introduction

Interactive scenarios (or cases) are electronic exercises where learners are able to explore an event or a problem within a real–world context. Normally the student engages with these exercises using a combination of text, images and/or multimedia. The learner may click through the scenario to see different facets of a case, follow a timeline, and/or make choices about exactly what they want to do. At various times they may be asked to answer questions or comment by way of dialogue boxes, multichoice or check-box forms. Learning scenarios can have a gaming element which can aid engagement. Used properly, educational games can be beneficial for learning (Kiili, 2005; Quinn, 2005; Amory, 2007)

Scenario-based exercises come in a number of different flavours. Some may simply be a narrative, following an unfolding event, where students are asked for reflective input at various stages. For example, students could be passive observers to an unfolding crisis, and be asked questions at various points along the timeline, and at the conclusion. Progress through the scenario can be under the student's control simply by clicking a mouse. In essence it is a little like showing a film, and pausing from time to time to get student input.

A particular type of interactive scenario may outline an existing problem, which needs evaluating in order to solve it. The student must formulate hypotheses, make observations, run tests and come up with a diagnosis/analysis and then a recommendation. These are "goal-based" scenarios as defined by Schank 1997. In these scenarios, students must formulate hypotheses, and then make choices as to what actions they will take as they mount an investigation. These actions may carry a time and/or financial penalty and may be irreversible, so students may need to think carefully about what options to take. Once they decide on a course of action, they are shown the results of that choice. It may be up to the student then to interpret this data. Being non-linear and involving choices, this type of scenario generally requires more planning, and a more sophisticated authoring and delivery mechanism that simple click-through scenarios.

Interactive scenarios can be authored and delivered using a number of different packages. At the simplest level, linked webpages developed in a simple HTML editor can be used. However in most cases, scenarios require more functionality than the latter can offer such as the ability to set prerequisites on actions, add time and cost variables, track student progress and offer customised feedback. Figure 1 shows a screen shot an interactive scenario for crop diagnosis developed and delivered in a program called SBL-interactive (SBLi) which has much of this functionality built-in (Anon, 2008a).

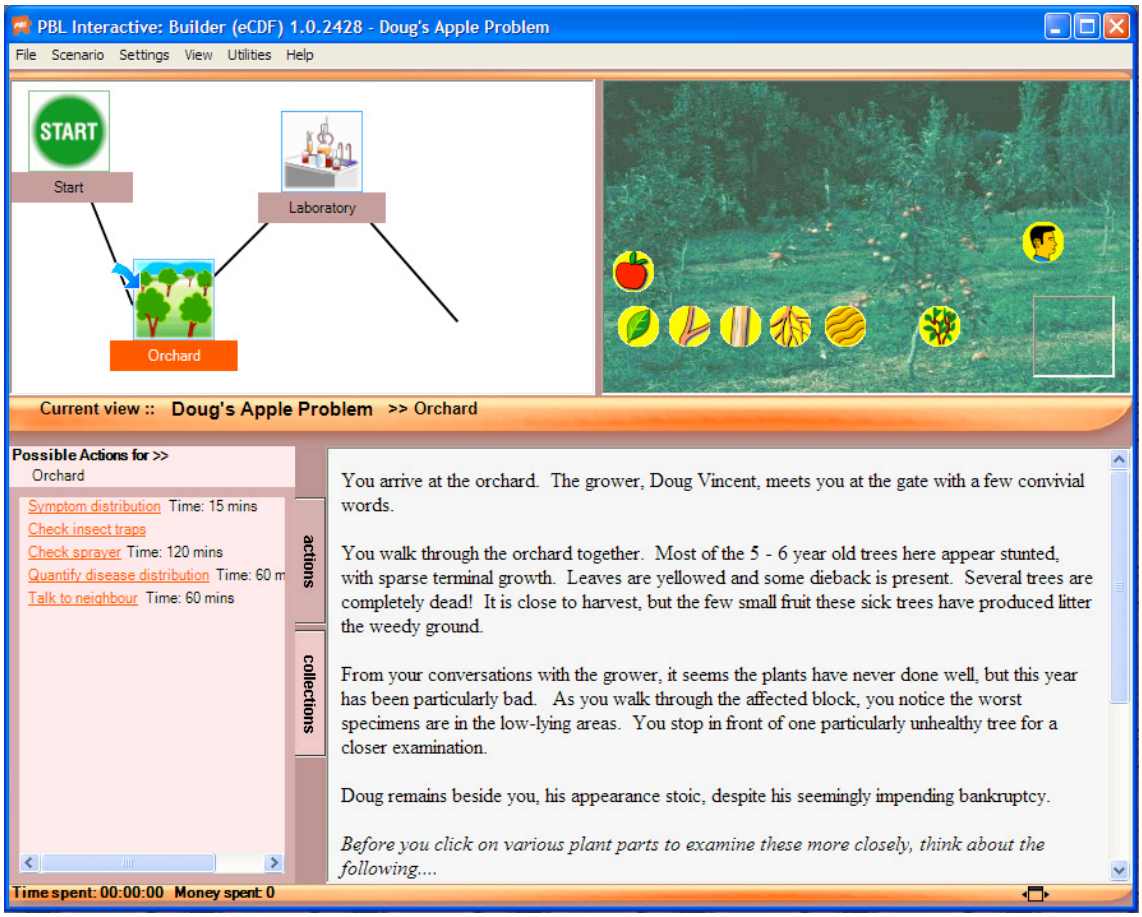

Figure 1: Student view of a SBLi interactive scenario, where the goal is to diagnose an orchard problem

The authors have been involved with creating many of these interactive scenarios for teaching in a number of disciplines using a number of different software packages including SBL-interactive (Stewart 1997, Stewart and Bartrum, 2002, Stewart 2007, 2008). "Emergo" (Nadolski, 2007) offers a similar toolkit and scenario-based lessons can also be created using templates in "Udutu" (Anon, 2008b). The purpose of this paper is not to describe these packages or discuss scenario-based learning generally. Rather it is to outline some useful tips and techniques in *planning* these kinds of lessons.

The design of e-learning lessons is important (Clark and Mayer, 2003) and developing a framework is an early stage of this process. While an authoring tool is useful and necessary, there is a real temptation to start using it straight away, before a clear idea of content and structure has been developed. Whilst useful for prototyping , this can be a mistake. Once the scenario is broken up into its separate components in the authoring tool, it is difficult to see the whole. If the scenario has not been planned well, the result can be an ill-structured mess which does not tie to the learning outcomes, and which students find difficult to navigate through. Without a clear framework, they can also have a tendency to become too complex and focus on the visual experience rather than the educational objectives (Westera *et al*, 2008).

Good planning and documentation, using whiteboards and simple table-based schemas prior to authoring, can avoid this situation. Aside from assisting with planning, whiteboard outputs and schemas are useful as communication devices for other stakeholders.

Based on the authors' experience, this paper provides some software-independent tips and techniques on the use of these tools to plan interactive scenarios.

Planning an interactive scenario

Step 1 – Initial decisions

To be of most value, interactive scenarios must be embedded as an integrated part of the course rather than an "add-on" (Gossman *et al*, 2007). Instructional context is important (Robertson and Howells, 2008) along with good scaffolding (Wall and Ahmed, 2008). Before creating any interactive scenario for course work, several things need to be decided on. The following considerations apply...

- Synopsis:. What role will students play and what will they be expected to do?
- Expected Learning Outcomes. What skills/knowledge should students develop/learn from going through this exercise?
- Placement and Course. What course and where in it is the scenario going to be placed?
  - Beginning – Good for motivation or to demonstrate a process or skill.,
  - Part-way through a course – Assess the learning process, invigorate students and provide in-depth examples of integrated theory and practice.
  - At the end of a course – Integrate knowledge, test what students have learned and be used as a tool for reflection.
- Assistance in Interpretation. How much (if any) assistance will students be given in interpretation?
- Reflection and Feedback. When and how will students be given feedback?
- Assessment: Will the scenario be assessed and if so how?
- Delivery. How will it be delivered?
- Frequency. Will students be expected or allowed to go through the scenario more than once?
- Team Play. Will this be a team exercise or will students go through these scenarios alone?

While the answers to these questions can be modified later in the process, their consideration is essential at the start in order to set a clear direction for scenario construction. The answers to these questions can be summed up in a simple table we call a *scenario descriptor*. Table 1 shows an example scenario descriptor, for the scenario illustrated in Figure 1. Note that this particular scenario was not designed for summative assessment but rather as an introduction to the subject, designed to show process and motivate students to learn.

Table 1: The scenario descriptor for the scenario shown in Figure 1

Name	Doug's apple problem
Synopsis	Students will play the role of a horticultural consultant. They will visit an orchard and assess a plant problem, discuss the problem with the grower and take back infected plant samples to analyse in the laboratory. They must determine the problem, justify their reasoning and recommend an action.
Expected Learning Outcomes	The scenario will be a walk-through or demonstration, showing how a diagnostic episode might proceed in real life. The main educational purpose is to demonstrate the process of diagnosis and to show students how knowledge is used in a real-life situation. Hopefully, seeing the relevance of the subject matter will motive them to learn it.
Placement and Course	This exercise will be embedded in 171.387, Controlling Plant Pests and Diseases. It will be given just before the series of lectures on plant diagnosis
Assistance in interpretation	No interpretation within the narrative text but this will be given as feedback to reflective questions.
Reflection and Feedback	Questions as to the significance of observations or tests will be posed during the scenario whenever a significant observation or result is presented, to give the students an opportunity for reflection. The correct interpretation will then be given to students through a hyperlink.
Assessment	There will be no formal assessment for this particular scenario.
Delivery	Students will access the exercise over the web.
Once or many	Students can go through the scenario as many times as they wish, but should do so before they commence the lecture course.
Model answer	This will be provided at the end of the exercise
Team Play	Students can work through the scenario with others if they wish

Step 2 – Determining the essentials

Storyline
An interactive scenario normally requires a script of sorts. At the very least this should involve an introduction which outlines the task at hand, some kind of overall environment to explore in order to complete this task, and some kind of endpoint and conclusion. To engage and capture interest, scenarios should have elements of drama. Humour can also be used where appropriate.

Objects
The scenario environment may be populated with *objects* such as conceptual or real locations, items, people, actions and exercises. Exploring these objects can provide information (useful or misleading), which the student needs to evaluate and perhaps make a decision on. The objects may have a pre-requisite property, which determines when they are available in the scenario. In other words, they may not be available until a particular task is done or conversely, they may become unavailable at some point. Exploring these objects may also accrue a time or monetary penalty.

Click-through narrative-type scenarios are fairly straightforward when it comes to determining the objects required, as the student pathway is clearly defined. However, when determining the components of a goal-based interactive scenario, much thought has to go into what is added. In these kinds of scenarios, students are required to diagnosis something that has gone wrong, or is going wrong. Providing *only* the locations, objects and tasks that are going to reveal the actual cause (or causes) of the problem does not mirror real life and is of limited value as far as a teaching exercise is concerned. When first confronted with an initial description of the problem, students will generate (or at least will be expected to generate) a number of possible causes (hypotheses) depending on their level of knowledge. They must therefore, be given the opportunity to explore these alternatives (and the incorrect) hypotheses so as to discount them. This is what happens in the real world. Hence (within limits), the locations, tasks and objects which enable students to explore (and hopefully discount) these *incorrect* hypotheses must also be included. For example, in our scenario described in Table 1, initial symptoms of the plant problem (i.e. plants stunted, leaves yellowed, dieback present) outlined to students in the first screen of the interactive scenario (Figure 1) could have been caused by any one of the following...

- *Armillaria* root rot fungus
- *Pratylenchus* root nematode
- *Phytophthora* crown rot fungus
- Too much water
- Poor nutrition
- Other root rotting pathogens

Students investigating this scenario would have a plant health background, and most would be expected to consider any of these causes as possibilities. Therefore they need to be given the ability in the scenario to extract nematodes, establish the nutrition status of the tree and soil, and isolate and examine fungi under the microscope so they can see the morphological characteristics. In other words, they need to be given the objects (actions, items, tests, locations etc.) to explore each one of these possible causes so they can discount the wrong ones and discover the right one.

Other, less essential components which may add interest or engagement can be added after these essential ones have be defined.

Using a whiteboard
Simple whiteboards lend themselves to mapping out these initial ideas, especially where a team is involved; for example the subject expert and an e-learning designer whose task it is to provide expertise in the paradigm. Once the exercise is complete, a framework, scaffold or skeleton exists for constructing the draft scenario. This framework can be saved as an image direct from the whiteboard, or sketched out using mapping software. Figure 2 shows one such framework initially developed on a whiteboard but then sketched out using Microsoft Visio software. In this particular scenario, students will play the part of a rural banker assessing the feasibility of a subdivision plan.

Step 3 – Developing a schema

After an initial framework has been developed using a whiteboard, simple table-based schemas, in say a Microsoft Word document, can be used to the hold the content.

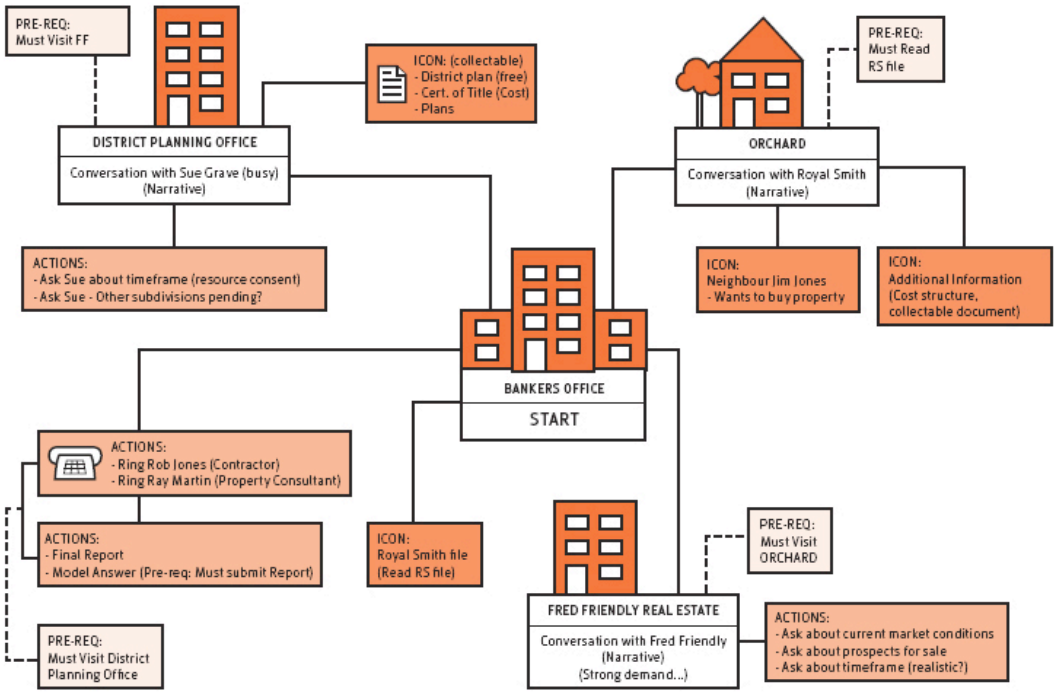

Figure 2: Framework for an banking interactive scenario, initially developed on a whiteboard

Table 2 shows a schema template used to construct any goal-based scenario in SBLi. Although designed for use with this particular software, it is generic enough to be used with other authoring tools with some amendment.

Within the schema, the scenario is presented as a number of tables. Each table is a "location". A location can represent a physical place, or it can be a conceptual location, like an introduction or summary page. Within a location, there may be objects (actions, items or further locations). Within an item, other actions can be made available pertaining to that item. Clicking on an item, action or a location reveals content, which may be a mixture of rich text, multimedia and fill-in-forms. This content can also contain hyperlinks to internal or external resources.

Duplicate sets of rows can be added to represent all objects within that particular location to whatever depth is required. The same template can then be used again for the next real or conceptual location. Eventually the content of the whole scenario can be fleshed out as a series of tables in a single document.

Table 2: Template for developing a goal-based scenario in SBLi

Location: *This can be a real location in the scenario, or a conceptual location, such as an introduction or summary page.* Environment Window image: *Graphic file (file name) used to represent the view at this location. Gives the student a feeling of "being there"*	
Initial Path	Where this object lies in the scenario tree? (e.g. Scenario→)
Object	The type of object in the scenario associated with this location. It could be a location root, an item or action.
Name	Name and type of object.
Icon	If used, the graphic icon (file name) used to represent this object.
Pre-requisite required	What needs to be done before this object appears (or what makes it unavailable)
Pre-requisite set	Any pre-requisites set by clicking on this object
Content	Textual content the student will see when they explore (click on) this object.
- Media	What media will be incorporated into the content
- Hyperlinks	What hyperlinks will be included in the content, either to external resources, or embedded internal ones.

Objects Revealed	What other objects will be revealed by clicking on this object
Collectable	Whether or not the object is collectable or not (applicable for items only)
Cost:	The cost in time or money?
Text to appear as part of the summary	Text to appear if this object is clicked:
	Text to appear if this object is not clicked:

Table 3 shows part of the scenario schema for the scenario shown in Figure 1. The schema was constructed using the template in Table 2. For the sake of brevity only the initial part of the content text in the Content and Hyperlink cells are shown, but normally the whole text would be included.

Table 3: Part of the schema used to design "Doug's apple problem" shown in Figure 1

Location: Orchard Environment image: sicktree.jpg	
Initial path	Doug's Apple Problem -→ Orchard -→
Object	Location (root)
Name	Orchard
Icon	Orchard.gif
Pre-requisite required	No pre requisite
Pre-requisite set	None
Content	You arrive at the orchard. The grower, Doug Vincent, meets you at the gate with a few convivial words...(etc.)
Media	None
Hyperlinks	Link from Content to embedded page. Text is as follows... Here's how an experienced diagnostician would interpret these clues... 1. Symptoms seem relatively non-specific At first glance trees seem to be showing non-specific "decline" symptoms characterised by yellowed leaves, poor growth, general malaise and death... (etc.)
Objects revealed	Items: Doug fruit, leaf, branches, trunk, roots, soil, weeds, Actions: Symptom distribution, Check insect traps, Check sprayer, Fertiliser applicator, Quantify disease distribution, Talk to neighbour
Cost	No cost
Text to appear as part of the summary	*if clicked: None* *if not clicked: None*
Initial Path	Doug's Apple Problem -→ Orchard -→ Doug
Object	Item: icon: man.gif
Name	Doug
Pre-requisite required	None
Pre-requisite set	None
Content	The grower is willing to answer any questions you want to pose, and he waits beside you expectantly. (etc...)
Media	Image of Doug (Doug.jpg)
Hyperlinks	None
Reveals	Actions: Ask about: past weather, disease management, weed management, insect management fertilizer, irrigation, variety, neighbour's crops, Doug's opinion, changes in management, history of the problem, drainage
Collectable	No
Cost	No cost

Text to appear as part of the summary	if clicked: None if not clicked: None
Initial Path	Doug's Apple Problem -→ Orchard -→ Doug –> Ask about Drainage
Object	Action
Name	Ask Doug about drainage
Pre-requisite required	None
Pre-requisite set	None
Content	At this question Doug appears a little embarrassed. He tells you that the drainage is poor, and that the low lying areas retain water for some time. (etc.)
Media	Video of Doug speaking (drainage.avi)
Hyperlinks	None
Reveals	None
Cost	No cost
Text to appear as part of summary	If clicked: It was useful to ask about this. The answer revealed poor drainage, which is conducive to Oomycota pathogens such as *Phytophthora cactorum*
	If not clicked: It would have paid to ask about this. The answer revealed poor drainage, which is conducive to Oomycota pathogens such as *Phytophthora cactorum*

It should be noted that, again for the sake of brevity, only one template and schema is illustrated. This template is used to develop the environment the students will explore. Other scenario templates and schemas are used by the authors for developing the reflective parts of the exercise. These contain the ingredients of the multichoice, check box and text entry forms.

Table-based schemas can be very flexible. Heading for the table rows and columns can vary depending on the nature for the scenario, and the intended authoring tool. For example, if the scenario being planned is simply a click-through one, with no items to collect and transport elsewhere, then the row heading "collectable?" is unnecessary and can be left out. If producing the scenario using simple hyperlinks in an HTML editor, the schema can be simplified and rows which deal with prerequisites etc, can be deleted. If the schema is produced in a modern word processor, the content also has the advantages of a spell-checker and thesaurus. The latter tools are not always available in authoring programs for interactive scenarios.

Once complete, the scenario schema can be "checked off" by the development team, ready for incorporating into the authoring tool of choice. Although minor amendments may (and usually are) made to the flow and content of the scenarios once constructed in the authoring software, the schema exists as an easy-access repository of the initial content. It shows the scenario in it's entirety within a single, searchable document. As such it is useful for both archiving purposes and communication between other members of the production team.

There is another advantage to using a schema. It means that both the structure and content of a scenario can be used for alternate forms of delivery. For example, a scenario initially designed for construction in SBL-interactive might be adapted for use as a problem-based learning exercise delivered orally as a question and answer session to a class during a tutorial. Being in a universal format (such as a Word document) pieces of the scenario can easily be used as reference for the teacher planning this kind of exercise.

Conclusion

It is always tempting to jump right into the authoring tool and start constructing scenarios, even without a clear plan of all the components. However the non-linear nature of most interactive scenarios, with their hidden content and pre-requisite triggers can make it difficult to see all the component parts and how they relate to one another once the scenario is fixed in the authoring tool. Tools such as SBLi are certainly useful to quickly prototype scenarios but, as with designing websites, good planning and storyboarding of the scenario is essential. The "Emergo" toolkit (Nadolski, 2007) incorporates planning tools. However simple techniques such as the use of a whiteboard and developing a table-based schema can also provide this framework, if not incorporated into the main authoring program. Furthermore, once scenarios (or cases) are captured in this format they can be used and delivered in a variety of different ways, perhaps not even involving computer technology at all!

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