A Workshop on:
Simulation and Case-Based Learning
- Differences and Similarities

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Abstract—This paper has its origin in the authors’ reflection on years of practical experiences combined with literature readings in our preparation for a workshop on learn-by-doing simulation and case-based learning to be held at the ICELW 2008 conference (the International Conference on E-Learning in the Workplace). The purpose of this paper is to describe the two online learning methodologies and to raise questions for future discussion. In the workshop, the organizers and participants work with and discuss differences and similarities within the two pedagogical methodologies, focusing on how they are applied in workplace related and e-learning contexts. In addition to the organizers, a small number of invited presenters will attend, giving demonstrations of their work within learn-by-doing simulation and cases-based learning, but still leaving ample of time for discussion among all participants.

Index Terms:—learn-by-doing simulation, case-based learning, e-learning design

I. INTRODUCTION

Learn-by-doing simulation and case-based learning are two approaches that are often used in workplace-related teaching and e-learning environments [1, 2, 3, 4, 5]. Though they represent two distinct pedagogical methods, they overlap to some extent in several areas: with respect to the kind of learning objectives associated with the methods; in the formats, content and learning processes used; and in the contexts in which they are applied. More specifically, the two methods share several abilities: to relay real-life situations; to allow users to immerse themselves in the online environment and through this perform, see and evaluate the results of various decisions; and to allow for collaborative as well as distributed processes. In our experience, these shared abilities make both approaches suitable for workplace-related learning situations. These similarities are interesting to explore; we find, however, that it is equally important to realize that there are also distinct differences between the methods and their uses — the methods are not necessarily equally appropriate for a given situation. We suggest here that designers would be best served (as would their end-users) if they make explicit, reasoned decisions as to which method to use in a particular situation. However, we have found that differences are seldom discussed, and thus designers often lack any basis upon which to decide between learn-by-doing simulation and case-based learning.

In order to further the discussion of the suitability of these two methods, we are holding a workshop in which we explore these differences and similarities and discuss their consequences for design, development, and use. In the following two sections, we reflect on some of these issues, which range from large-scale learning considerations to more practical issues of e-learning design.

Our primary objective in this paper is to point out differences and similarities, and through this, to open the minds of the audience to the wealth of possible pedagogies applied. It is not our objective to discuss in detail which method is best suited for which contexts. This is indeed an important question and we will provide examples of this in the workshop and in future more elaborate paper discussions. This paper therefore has a somewhat practical pedagogical focus rather than theorizing based on more abstract learning concepts, but does not provide deterministic solutions for doing one or the other and in what form.

II. LEARNING PARADIGM CONSIDERATIONS

In simulation based e-learning, real-life objects, environments, characters, and situations are represented in an online environment, and their interrelation with a user is simulated through the user’s interaction with the system. Though obtaining the feel of a realistic simulation is pivotal to the learning experience, the actual “events” in the simulated learning experience do not necessarily have to be real or have happened in real life, they just need to be plausible. The requirement for a simulation to be “realistic” often implies that the situation should look as much as possible as it would in the real world (flight simulators are probably the most used and well-known example of this form of simulation). From a learning perspective, however, the realism may as well mean that an adequate learn-by-doing frame is developed — the entire real-life world does not necessarily need to be simulated provided that the lines of reality are clear (either implicitly or explicitly) to the learner. Further, it is often not advisable, for the purposes of
efficient learning, to simulate a world in all of its detail, even if that is possible. One example of a simulation method that can be realistic but not a full simulation is a role-play simulation that uses written communication in a non-3D world (such as the customer service training for retail employees in [3,5], in which customers appear in video clips and the learner responds via on-screen text choices — despite the lack of a “complete” simulation, the situations are realistic and the learner experiences were very successful).

In case based e-learning, the realistic representation is often downplayed; the designer’s objective is to look at material which can give a rich picture of what has happened, but not to fully “submerge” the user into a realistic world. Cases usually describe a situation as it has already happened, where learners interact with the system by analyzing the event that has occurred and reflecting upon its consequences. In some case learning processes, a more actionable approach is chosen. Under this version of case-based learning, the case is presented only to a certain point in the case story, and the solution to the given problem that was chosen in real life is not revealed until later in the learning activity. In such situations, the learner’s goal is first to analyze the situation and reflect on viable solutions in the given context; only later is the actual chosen solution presented and reflected on. (Examples include the 18 e-commerce cases for information systems and IT project managers described in [6]. In one case, the ALKA case, material is presented using a visual-menu equivalent to a business process reengineering improvement cycle in which the learner can browse; whereas in another case (the LEGO case), the learner is motivated to look at the material as a consultant who has to make a decision, and the material is presented onscreen via an office layout — showing such items as folders of projects and balance sheets, whiteboards of memos, and a phone for interviews.

It is in these detailed design decisions regarding how to use case or a simulation that the boundaries between the two methods can become blurred and mixed. In a learn-by doing simulation, a case story — whether real and described as it took place or a realistic narrative of something that could happen — is often seen as the introductory item that sets the “stage” of a simulation. In other words, the case is used as the backdrop that initiates users to “act out the situation.” Similarly, a case-based reasoning application is sometimes developed using dynamic simulation learning processes, where the user can add case material of their own and thus alter the case format and storyline.

In practice, numerous contexts exist in which learning processes using simulations and cases are applied. Due to their focus on 1) practicing rather than studying [7], and 2) getting an understanding of theories-in-practice, corresponding to moving to competence and towards the proficiency level of learning [8] both methods are well-suited to workplace learning problems. For example, both methods are often used in the following areas, among others: continuing medical education courses (which use patient cases in diagnostic training and simulations for practicing new types of operational procedures — see http://cme.medscape.com/cme), skill development for businesspeople, which often use the Harvard teaching-case approach for management and related learning programs, but also use both macro- and microeconomic simulations (See the Harvard business school case method site at http://www.hbsp.harvard.edu/hbsp/case_method.jsp;jsessionid=AXZ4E3M05WXKGA9RWDR5VQBE0Y11SW and the European case clearing house and their newsletters at http://www.ecch.com/); military and rescue training programs that use cases and simulations for strategic practicing of various models of operations as well as hands-on training with equipment; and professional teacher development, where cases of classroom situations can provide teachers with new information in certain areas (such as cultural issues), and simulations can make teachers aware of the preferred behavior and its appropriateness in given situation (see, for example, the anti-bias training program in [10]).

In case-based learning within business education, the method is primarily placed within a social constructivist paradigm. Traditionally, this has meant that the learning process asked the learner to read or interact with the case material presented; analyze and interpret it individually or in a group; and then also in a group and/or the entire class, have a more comprehensive dialogue on the relevant themes [11]. As systems were developed which were able to facilitate dialogue online between learners in different physical locations, collaborative case learning was able to take place virtually as well. These transformations are also seen in the world of simulations, where some are planned and developed within a particular dialogue-oriented setting (such as the role play one can hold within a dedicated simulation engine), and some may rely on “virtual” online interactions between people—rather than the pre-programmed interactions of most simulations—or even within Second Life — see [12].

Under this more social constructivist approach, written interaction aims at not only learn-by-doing as seen as one individual acting and reflecting upon ones own actions, but to support the ability to perform reflection-in-action and reflection-over-action [13] through dialogue and mutual construction processes. This resembles many real work processes, which involves many actors and decision takers and not solely the action of one person.

The objective of getting to the “reflective practitioner” [13] not through actual work practice, but through explicit formal learning processes, can be seen as a general cornerstone for both learning methods — whether in the individual or collaborative form. Both cases and simulations are intended to best allow for transferability from the learning environment to real-life situations—that is, learners practice applying theories and experiences to realistic or real examples, acting upon them, and reflecting on them—and over time they become able to form the appropriate abstractions and bring their knowledge and skills to bear in real-life work situations. In Dreyfus typology for learning levels, this corresponds to a proficiency or expert level, depending on the learner’s prior knowledge and experience. [8].

http://www.uiowa.edu/~oprmar/webcase/ and [9]); skill development for businesspeople, which often use the Harvard teaching-case approach for management and related learning programs, but also use both macro- and microeconomic simulations (See the Harvard business school case method site at http://www.hbsp.harvard.edu/hbsp/case_method.jsp;jsessionid=AXZ4E3M05WXKGA9RWDR5VQBE0Y11SW and the European case clearing house and their newsletters at http://www.ecch.com/); military and rescue training programs that use cases and simulations for strategic practicing of various models of operations as well as hands-on training with equipment; and professional teacher development, where cases of classroom situations can provide teachers with new information in certain areas (such as cultural issues), and simulations can make teachers aware of the preferred behavior and its appropriateness in given situation (see, for example, the anti-bias training program in [10]).
Educational planners and teachers need to be aware of the learners’ current level of learning or actual development zone [14] when deciding which and how to use simulations in a learning process. One of the critiques that can be raised is that, if the learners do not understand the model of appropriate behavior or the rules of the subject matter being taught, from which the simulation is built on, then two major effects can result:

- If the learners do not understand why the engine reacts as it does to their input / actions – it can result in the learner consistently taking incorrect actions in the system and eventually taking a “random” rather than thoughtful approach to working with the application.
- In the more grave situations, learners may misinterpret the simulation’s reactions to the answers given, and based on this a learner may create an inaccurate mental model.

This critique thus deals with the learning method in itself and not the simulation per se. It can be addressed by facilitating the simulation process or at least making room for, in the specific learning process, some sought of meta-reflection on the models of behavior and knowledge representation implicit in the simulation. To do this the learners current and zone of proximal development is relevant to identify [14].

Another critical element of relevance here is oriented toward the design strategy (among others raised by [7]). Quite often simulation engines are based on a narrative element, which is too restricted or pre-defined in its path. So much so, that they tend to be a case-based reasoning scenario – that is, a storyline of some subject, which very much relates to real life as it typically happens, but in such a manner that the storyline is an abstraction, where the learner can choose among different paths. The critical part is in the situations, where the system in reality is designed so that there is no true open action, there is only “one right way through” the system. No real open choice of direction exists. In the instances, where this is so obvious that the learners see it immediately, no learning occurs and the motivation for learning through the interactive application drops significantly.

Similarly, this critique can be raised with respect to cases, and in particular case-based reasoning in the learning processes, where assessment is based on active participation in the case dialog facilitated by a teacher or instructor. Several studies point to that dialog ends up being a “guessing the right answers of the teacher”. So rather than taking part in open dialog among peers, the teachers comes (virtually or physical) prepared with what they think is an appropriate analysis and interpretation, and the students believe they have to say the same. This can turn out as a rather a fierce competitive environment that does not foster real learning. [15]

Though in order for the learner be able reflect on the case at all, the case material needs to provide an adequate amount of information, so the learner can get a real feel for what took place. For example, the decisions one must make in a particular real-life project are based on a complex array of information: knowledge of the organization culture, power structures, and more. It is not easy to get a gut feeling through secondhand information, and more than often companies, hospitals, and other organizations are not in a position to allow for or have the resources to convey such insights as part of a case. Many cases suffer on this point.

In conclusion, it is important to be aware of the pros and cons of the method and the choice of developing and using a learning process that incorporate collaborative learning environments vs. individual learning sessions. But these are just some of the major choices when doing simulation and case based learning. There are many others.

III. SPECIFIC DESIGN AND PEDAGOGICAL CONSIDERATIONS

On a more micro pedagogical level, there are specific design considerations within the design of simulation and case learning systems. These considerations can have a very significant impact on the overall effectiveness of a simulation or case-based learning program. Below we list four specific considerations that in our experience have been vital to address.

- The use of imaginary vs. fact-based material. If a “fact-based” approach is used, the case or simulation uses material taken from the real world. This may include publicly-available material from newspapers, web sites, or information collected for this specific application via interviews or other research. An “imaginary” approach allows the designer to base the system on events that occurred in real life, but with room for alternations and embellishment in the interests of creating the ideal situations for educational purposes without compromising the learner’s perception of realism.

- Narrative stories vs. a pool of information. Narratives have a beginning, middle and end, which can be the set-up for both cases and simulations. On the other hand, cases can be designed to use real-life news and media. This approach allows the learner to have access to pools of data—these pools can be structured into headings and sections by the designer, or the learner can simply be asked to synthesize the mass of information and to make heads and tails of what happened, when and why. A third approach to designing the representation of data is to present a montage for the learner to explore—this is a variation of the ‘structured pool of information’ approach in which the material is structured as a montage that conveys a certain mood or feeling is chosen—focusing around themes rather than time or content structure.

- Pre-defined problem based vs. project oriented. Both learning methods are rooted somehow in the problem based pedagogies, where typically not only the overall problem area is predefined, but also the content which the learners explore is predefined - as pre-determined case materials and pre-determined simulation story and structure. It is however important to emphasise that even the content is pre-determined, considering the learner perception of the situation is that of an ill-structured-problem. However, Cases in particular, but
also simulations can also be designed using a broader approach, of allowing the user to construct their own material and structures, which from a motivational point can be very stimulating for the learning process (similar to Seymour Papert and Harel’s discussion on instructionism vs. constructionism in [16] and Papert’s in [17]). Within this frame it moves the pedagogy into including a more project oriented thinking. That is, moving from applying case-teaching to developing case studies.

- Stand-alone applications vs. generic platforms. From a design perspective there is the possibility either to use pre-existing learning management systems and engines or to develop dedicated platforms to run a series of cases or simulations. So rather than each case and simulation having a unique design a generic platform is can be used to various extents. Using a platform means that supporting social constructivist, collaborative and project oriented environments may be easier and certainly they are much more cost-effective to develop. The major downside is that it is much more difficult to obtain a visual design and an adequate learner-system / human-computer interaction form in the specific learning process. (Both generic case and simulation platforms are touched upon in [18]).

Within the worlds of case-based e-learning systems and simulations, it is clear that there is a possibility for overlap between the two methods. In addition, within each methodology there are a wide number of variations in specific design possibilities, at a variety of levels within the design. Simply choosing “case-based e-learning” or “simulation” is not only difficult, but insufficient: in our view, designers need to thoughtfully consider possibilities at all levels of design in order to provide an optimal learning experience for a particular situation.

IV. THE WORKSHOP

The workshop at ICELW 2008 will facilitate a discussion on the types of learning outcomes that the various combinations of methods discussed here might produce. The discussion will be based on a number of demonstrations of case and simulation applications and their use. These applications stem from various contexts of work, and have been applied for in-house training sessions, for professional development as well as in university oriented learning processes. We argue that designers should make methodological and pedagogical choices explicitly based on knowledge of the learners’ needs and their context of use.

REFERENCES


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