Reinventing and reinvigorating instructional design: A theory for emergent learning

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This paper explores emergence theory as a means to interpret and redefine current approaches to and models of instructional design. Based on their extensive practical and research experience and through examples from multi-disciplinary perspectives, the authors discuss key factors from the discourse of science and architecture that are missing from contemporary instructional design approaches. Using this analysis, the authors elaborate a theory of emergent learning that transcends many existing approaches to the design and implementation of educational programs and resources. By applying this theory, it is proposed that learning can be understood from more complex and 'chaotic' perspectives, and consequently more amenable with and aligned to emergent social, recreational and educational networks.

Keywords: emergence theory, instructional design

Introduction

In the field of education, instructional design has traditionally been applied using established models, typically using a top-down approach, that focus on explicit definitions of audience, environment, strategies, activities and outcomes. However, when different traditions of design are considered, more creative and organic elements are emphasised, which also embrace a 'bottom-up' strategy. In this paper the authors present a case that advocates using alternative concepts of design, integrated within emergence theory, to redefine the way we conceptualise and implement online teaching and learning environments.

On the nature of design and problem solving

For several decades, architectural design theorists and methodologists have analysed and developed approaches to creative problem solving activities that have aided the designer in continually improving design methods and process models (Kays, 2003). Design methodology has since developed through cross-disciplinary efforts between architecture, engineering design, industrial design, interior design, and more recently, software and interface design. However, this considerable body of knowledge has not yet been sufficiently recognized in the field of instructional design.

One important area to consider relates to problem solving. Architects and other three-dimensional designers deal with highly complex, multi-dimensional, and interactive design problems, as well as an ever-increasing body of information and technological change. Alexander (1964) noted in his design treatise, *Notes on the Synthesis of Form,* that to turn a problem into form, "we need to make explicit maps for the problem's structure, and therefore need first to invent a conceptual framework for such maps" (p. 132). Such proponents of design methodology suggest that following a design process allows for a greater understanding and organization of highly complex problems by defining patterns and pieces of the overall form, deconstructing a multifaceted design problem into manageable component parts. However, when comparing these problem-solving strategies with today's instructional design practices, we find that while many forms of design deal with systemic and chaotic thinking, this is not characteristic of instructional design practice. This leads to a range of questions about how designers think, such as: How do they go about solving complex problems? Is there a method that maps their process? How does creativity influence their problem solving methods? (Kays, 2003; Kays & Francis, 2004). For instructional designers, addressing these questions can shift the way teaching and learning environments are conceptualised and implemented.

From another perspective Rowe (1987) suggests such design problems can be thought of in terms of *well-defined* (clear problem, clear solution)*, ill-defined* (neither problem nor solution have clarity) or *wicked* (as for ill-defined problems but with no shared agreement on solution options). Rowe (1987, p. 41) also presented four key characteristics of wicked problems: (a) without a definitive formulation, (b) with no explicit basis for termination – they can be developed still further, (c) the differing formulation of the problem implies different solutions and vice versa, and (d) the problem's proposed solutions are not necessarily correct or incorrect – plausible alternative solutions can always be provided.

With respect to instructional design for online learning this has particular relevance. First, we argue that problems inherent in designing effective online learning environments are often ill-defined, requiring alternative approaches to implementation and the ways learners interact. Second, given the variety of individual learning styles that must be accommodated and the variations the Internet makes possible, we argue that instructional design must be reassessed within a broader context (Kays & Francis, 2004; Sims, 2006). Third, the complexity of interactions between participants and stakeholders within the online learning dynamic can make instructional design problems *wicked*. To allow for more flexible problem-solving and to extend the learning environment, we believe the application of emergence theory is important for the field of instructional design to meet changing needs in student learning (e.g. Ulmer, 2003) and the emerging technologies such as social networks and communications.

Emergence theory

As discussed in Irlbeck, Kays, Jones & Sims (2006), the origins of emergence theory can be traced to a seminal paper by Weaver (1948), where life sciences were considered to deal with real human problems, addressing neither the simple problems of classical physics nor the disorganized complexity of quantum mechanics. Subsequent studies of widely dissimilar organized phenomena such as slime moulds, ant colonies, and human cities were drawn together by Johnson (2001) into a new scientific perspective called "emergence." The key to understanding this new perspective, according to Johnson, lay in appreciating that simple interactions of the elements in a system – without any central top-down control – can lead to the emergence of highly complex, intelligent behaviours, which also aligns with a *wicked* problem solving context. Applied to the instructional design context, this approach implies a radical shift in the role of designers and the expectations for participants in the environments created.

In these emergent systems there is no controlling agent or pacemaker, and systems operate from the bottom-up, organizing themselves by creating feedback loops that encourage other agents to join the group. For a system to be considered emergent, the interaction must create a macro behaviour, while high-level patterns arise from the complex interaction between the agents. Emergent behaviour also has the quality of adapting, growing smarter over time and responding to changing needs of the environment (Johnson, 2001), and this concept of emergence is now being seen in online gameplay communities (Webb & Sims, 2006). Importantly, the study of emergent behaviour has moved from the laboratory into the mainstream of our everyday lives, and we argue that it is not merely a case of implementing an revised instructional design model, but rather using behaviours and activities within the broader instructional design system as a means to allow complex and intelligent behaviours, and higher level learning, to occur spontaneously. The application of emergence theory to the design of online distance education derives from viewing the e-learning environment and the learning process itself as a problem in organized complexity. The elements in it – students, instructor, resource materials, environment – interact spontaneously, even randomly, and are shaped by social processes of a natural alignment of the concepts for learning and dynamic group behaviour (Kays, 2003).

Conceptualizing instructional design from the perspective of different design methodologies, wicked problem-solving techniques and emergence theory is a radical extension to learner centered design, supporting explicitly on spontaneity and creative learning outcomes. More importantly it aligns with other speculations on the nature of online learning and roles of the various participants (Sims & Jones, 2003; Sims & Hedberg, in press). While the principles of emergence may well be more suited to the generation of experienced, sophisticated learners with more technological experience and the ability to create their own dynamic learning environments, emergence theory contains the essence to fully realize the potential of online distance education and the affordances of networked communities. We are at the threshold of seeing the traditional instructional design ethos shift to one that is emergent rather than systems or process oriented.

Given this context, we therefore present a theory of emergent learning to counter existing paradigms of instructional design and provide a forum for debate on effective practices of online teaching and learning.

A theory of emergent learning

Our theory of emergent learning proposes that to realize the true benefits of online learning, such as community, collaboration and personalised learning, it is necessary to relinquish the control that we see being imposed by enterprise learning management systems, complex institutional administrative environments and antiquated teacher-centred instructional environments. By removing these controls learners will become the central focus of the pedagogy and, from many perspectives, the role of the teacher and trainer will shift and diminish significantly (Siemens, 2004).

The underlying principle of a Theory of Emergent Learning (TEL) is that it is essential to understand educational empowerment and emancipation from the learners' perspective (cf. Ulmer, 2003; Prensky, 2005). More importantly, the extent to which learners engage with and generate meaning from the various interactions and encounters that exist within online systems can only benefit if within an emergent context. We argue that we have the challenge to totally rethink what it means to 'design' a learning system and to re-consider the way we address and attempt to (re)solve the various problems that such environments afford. Rather than focus on the predictable, the 'designer' must extend existing and develop new pedagogies where the learning and the outcomes are both unpredictable and emergent – and yet remain significant in terms of their relevance and application to the individual. To achieve this means allowing a learning system to 'be' and to 'grow' and to 'emerge'.

In proposing this theory we identify some critical tenets:

- the learner has the potential to advance and define their own essential knowledge base
- the very uncertainty and lack of predictability of learning outcomes will be the key factor that adds value to a learning community
- emergent systems will provide the necessary triggers to enhance knowledge and understanding
- emergent learning will be one of the critical triggers to unleash individual creativity.

While we are not advocating an open environment without framework or rules, we are reinforcing the importance of a bottom-up approach, where the complexity, creativity and flexibility of the human is given opportunity to flourish and for knowledge and learning to consequently emerge.

The key for implementing emergence theory is to establish an environment with a set of simple rules and in which students are able to establish complexity in terms of their individual interactions. For example, in the same way that trained musicians can get together and jam and create a new composition, so can it be with learning. A group of learners with shared understanding of a content base could get together and allow their combined knowledge to generate new thoughts and ideas emerging from their environment. A second example would be an online discussion thread where there are no explicit outcomes and students, through their deliberations, establish concepts or outcomes that can have a limited 'life' in terms of whether the group develops the ideas or not.

Conclusion

We have articulated this theory based on our individual experiences as academics, researchers and online educators. Those experiences have led us to see anomalies in the current ways of design for online education, and (as Laszlo, 2004, p.19 reminds us) "investigating the anomalies that crop up in observation and experimentation and coming up with fables that account for them make up the nuts and bolts of fundamental research in science". This is our 'fable' and presenting our theory of emergent learning is designed to articulate a resolution for those anomalies. By challenging the current and dominant paradigm of instructional design means that we can more effectively test our assertions and come, within the academy, to better understand the true dynamic of online, networked learning.

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