Systemic Design as an Explanation for Powerful Learning Experience

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Abstract

Our past studies have pointed toward complexity science as a source of potential explanation for especially powerful learning experiences. Our most recent inquiry with the Sea Education Association took us further into complex systems and added design. We have found that systemic design, viewed as an epistemology, appears to better account for powerful learning than any explanation to date. We thus speculate that development and adaptation of concepts and tools of systemic design may offer means to making learning experiences more powerful.

Introduction and Background

For the past 15 years, my graduate assistants and I have conducted studies on the nature of what we call "powerful learning experiences." Recently our results have pointed toward explanations in theories of complexity, design, and systemic design. In the RSD5 session, I presented our most recent study with the Sea Education Association.

We define a powerful learning experience (PLE) as one that stands out in memory because of its high quality, impact on one's thoughts and actions over time, and transfer to a wide range of contexts and circumstances. In a series of studies (Rowland & DiVasto, 2001; Rowland, Hetherington, & Raasch, 2002; Rowland, Lederhouse, & Satterfield, 2004; Rivera & Rowland, 2008; Bolger, Codner, Reuning-Hummel, & Rowland, 2011; Reuning-Hummel & Rowland, 2015; Rowland & Meyer, 2016), we have explored the nature of PLEs, with an eye toward eventually offering guidance on how to create them. We have studied these experiences with adults in various contexts, and as general conclusions have proved elusive, we have done so with groups and circumstances that are increasingly similar. We have found a tendency for experiences to be authentic, to involve close relationships with others such as mentors/expert teachers, and to offer opportunities for reflection in and on action. More consistently, though, we have found experiences to be highly individual, and dependent on many factors coming together in unique ways and circumstances. Consequently, we have found more compelling explanations in the literature of complexity than the mainstream literature of education.

Our studies have gathered stories of hundreds of PLEs through a variety of methods (e.g., interviews, surveys). Since PLEs are uncommon, observing them as they occurred has been difficult, so previous studies involved gathering retrospective reports. That changed when we learned of a setting where PLEs were reputed to be frequent.

The Study

The Sea Education Association offers unique, interdisciplinary programs called SEA Semester on its Woods Hole, MA campus and aboard two tall ships. One program called Marine Biodiversity and Conservation (MBC) involves a full load of undergraduate coursework over a five week on-shore component, six weeks aboard ship in the Atlantic Ocean, and a second two-week on-shore component. Students conduct original scientific research, translate that research to policy recommendations, simultaneous to sailing the tall

ship. It's a very intense experience, and students frequently report that it changes their lives in significant ways.

I was able to study the 2013 MBC program as a context for PLEs. I interviewed faculty and students at the beginning and end of the program, crew members during a port stop of the voyage, and students again six months after the program had ended. I also reviewed a wide range of relevant documents and sailed as a participant observor (i.e., crew member) for the first leg of the vogage from St. Croix to Bermuda.

Independently analyzing the data, my graduate student Allison Kitchner Meyer and I found that for many students, MBC was, in fact, a powerful learning experience. We found that a number of themes contributed: uniqueness of the setting; authenticity of the expectations and activities; strength of the institutional culture; shared fascination and openness to learning; helping relationships among faculty, staff, and fellow students; a sustained focus on learning; intense engagement by all; and the individual nature of outcomes.

Interpretation

We examined these results through a variety of lenses. For example, we found consistency with social constructivist learning theories (e.g., Fosnet, 2005). However, while explanations from common learning theories were reasonable, they offered little more than typical heuristics. We could say, for example, that heuristics associated with constructivist learning environments (e.g., Wilson, 1996) were evident and may have contributed to deeper learning, but this did not tell us why the specific experiences our participants described stood out as especially powerful, even life changing.

Recognizing that many factors had come together in unique and special ways, we came to conclude that we were looking at emergent phenomena. We turned to the literature on complexity, and we found very strong connections between what we had observed and characteristics such as interdependence (Brown, 2002), non-linearity (Waldrop, 1992), agent interaction and adaptation (Holland, 2014), emergence (Morowitz, 2002), mutual causality (Morin, 2008), and sensitive dependence (Gleick, 1987).

This led us to literature that connected complexity and education (e.g., Davis & Sumara, 2006; Alhadeff-Jones, 2012; Jorg, 2009). However, being in the learning environment to observe, I saw things that this literature tends to miss. For example, faculty and students might be seen as agents interacting in an autopoietic system, without knowledge of the whole. However, they were intelligently and creatively guiding each others' experiences, with sophisticated judgments made in the moment with respect to goals at multiple levels.

This led us to connect with characteristics of design— for example, intentional action on behalf of others, design judgment in solving wicked problems, mutual shaping of container and contained, self imposition of productive constraints, and composition of the "expected unexpected" (Biskjaer & Halskov, 2014; Buchanan, 1992; Cross, 2011; Nelson & Stolterman, 2012). And as have others in the RSD community (e.g., Banathy, 1991, 1996; Nelson, 2014; Sevaldson, 2010), we have come to appreciate the two, complexity and design, as complementary and synergistic rather than competing. That is, we have found the combined holistic understanding of complex systems and the creative action of designing to offer a compelling explanation of what we observed in MBC.

Next Steps

The work is descriptive at this point, but we speculate that the conscious incorporation of systemic design concepts and tools in educational contexts could lead to especially powerful learning systems. Table 1 includes examples of concepts we believe might be combined in this effort, and questions such as the following are raised:

- What if we thought of interactions in learning systems as design actions of people acting as their own and each others' client?
- What if teachers were prepared to foster complexification by defining and imposing productive constraints?
- What if we sought Goldilocks conditions for learning informed by the law of requisite variety (Ashby, 1958) and the heuristic of overconceptualization and underspecification (Weick, 2004)?
- What if we thought of learning systems as means to consciously evolve (Banathy, 2000)?

Table 1. *Complementary concepts of constructivism, complexity, and design.*

Themes	Constructivism	Complexity	Design
Setting			
uniqueness	context dependence, problem- and case-based learning	edge of chaos, space for novelty	container and contained
authenticity	authentic learning environment, relevance, real-world problems	complexity of real settings and tasks	studio approach
strength of culture	learner cohort, learning community	interdependence, nested structure, continuity and transformation	design team, conspiracy
People			
shared fascination	self-motivated learners, embrace of individuality, instructor as co-learner	intelligent agents, diversity and redundancy	stakeholders, throwness
openness	openness to uncertainty and others' ideas, error as feedback, flexibility, multiple perspectives, eclectic approach	positive attitude toward error, unpredictability, requisite variety	divergence, what-if and over-the-edge thinking, imagination
helping relationships	social interaction and negotiation, sensitive guidance, peer instruction	local interactions of agents, interdependence, mutual causality, autopoiesis	mutual shaping of container and contained, mutual enhancement, co-design, homeopoiesis
Processes			
sustained focus on learning	knowledge construction, high-level and negotiated learning	complexification, surprise, adaptation, control parameter	composition, supersaturation and crystallization, the

	goals, collaboration, scaffolding	adjustment, complex responsive processes, growth, evolution, curation of emergence, requisite variety, enabling constraints	expected unexpected, design judgment, design dialogue, wicked problem setting/framing, generative dance, over-conceptualize and under-specify, productive constraints
intense engagement	reflection, self-regulation, learn through activity	presence, mindfulness, second-order cybernetics	intentionality, liminality, flow
Outcomes			
individual outcomes	a-ha moments, insights, seeing the big and little pictures	emergence, unpredictability, non-linearity, sensitive dependence on initial conditions	ultimate particular, the parti (seed)

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