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Transmergent Learning and the Creation of Extraordinary Educational Experiences

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Transmergent learning is a macro instructional strategy that increases the likelihood of exceptional educational experiences, where creativity and innovation reign. By blending the principles of transformational experiences with evolutionary and emergent properties of complexity theory, instructional designers are able to craft an educational experience weaving ten instructional tactics that together simulate a neural network. The result is an environment in which students can create new knowledge and tangible results that are more than the sum of the parts, that is, extraordinary learning.

Wow! That's what I say when my students, whether they be undergraduates or working professionals, do something in class that is truly extraordinary and inspiring. It may be a project they complete, a question they ask, or a statement of perspective they make. Whatever it iss, I (and most likely the other students in the class) sit in silence for a moment while the full impact of what we've just witnessed is absorbed. It is brilliant, enlightening, and provocative. I say to myself, "That's much better than I could have done."

Imagine, the instructor, a recognized expert in the field, being outperformed by his or her own students! Some people might resent such an event. I find it to be Wow! Extraordinary!

In this article, I share my research from the past five years into something 1 call transmergent learning. Transmergent learning is an instructional strategy that blends the transformational qualities of learning experiences and the evolutionary and emergent characteristics of complex systems. I'll explore the foundations of this instructional strategy and the tactics that might- be used in instruction by teachers, designers, and facilitators to trigger transmergent learning.

Transmergent Learning

One of the first things new instructional designers learn about instructional strategies is the concepts of expository learning and discovery learning (Romiszowski, 1981). Expository learning is generally described as a strategy in which an instructor presents content, concepts, rules, principles, examples, and so on, which a learner receives and internalizes. The classic lecture, where a professor waxes philosophically about a particular topic while the student diligently listens, takes notes, and asks questions, is an example of expository learning. So is an instructor demonstrating how to perform a task with a software application, or a basketball coach demonstrating the proper way to shoot a free-throw.

Discovery learning, on the other hand, reverses things. Rather than passively receiving content, learners are given a task or a problem to solve. Learners take actions to complete the task, and under the guidance and facilitation of an instructor, learn from their actions. An example of discovery learning is a role-play simulation in which one student plays the role of customer and another plays the role of salesperson, where they must negotiate a price for a product. The debriefing that follows the role-play elicits the key learning principles.

While discovery learning's efficacy as an instructional strategy has strong critics (Kirschner, Sweller, & Clark, 2006; Mayer, 2004), this criticism focuses on "unguided" or "minimally guided" implementations of discovery learning, in situations where learners do not have prior knowledge in a domain. If one views discovery learning through a Vygotskian lens tied to the "zone of proximal development" and then integrates it with cognitive apprenticeship's prescriptions for coaching and scaffolding (Collins, Brown, & Newman 1989; Vygotsky, 1978), it is clear that one should provide learners whatever guidance those learners need to achieve the desired outcomes of a learning experience, whether the desired outcomes are fluency, creativity, excitement, or even failure.

As shown in Figure 1, expository and discovery learning form a continuum, illustrating that a learning experience can have varying degrees of expository and discovery qualities. Transmergent learning stretches this continuum, suggesting that there is a region beyond discovery which is focused on creativity, invention, and innovation. A discovery learning experience, by its very nature, allows for exploration of a domain to discover facts, relationships, and truths. A transmergent learning experience, on the other hand, enables new knowledge to emerge and evolve through a learner's explorations, resulting in valuable transformations. In other words, transmergent learning is an instructional strategy that generates new constructions of knowledge and skill that are more than the sum of the parts.

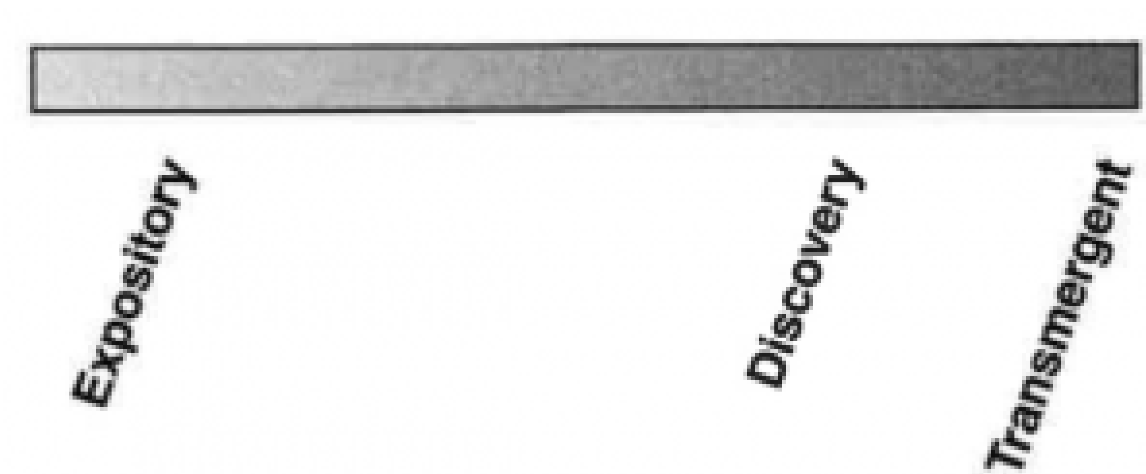

Figure 1. Expository-Discovery-Transmergent Continuum.

Let us clarify the two principles described in the previous paragraph. First, "new constructions of knowledge" reflects incremental improvements to things that are known. Thus, "new knowledge" applies to the creative application of "known knowledge" to create improvements in specific contexts. For example, one might design an activity to teach qualitative research methods in which students will contribute the "known" methods—video, photographs, tracking, and so on. But these same students might also invent something new by mashing together these known components in a unique way. That's where authentic activities come in, because they offer the freedom to explore, invent, and create. The theory that drives this is Csikszentmihalyi's principles of creativity, specifically, "…creativity generally involves crossing the boundaries of domains" (Csikszentmihalyi, 1997, p. 9). Thus, the creation of new knowledge is defined as when known knowledge from one domain is grafted into another domain to create a new approach or idea.

Second, the principle of "more than the sum of the parts" reflects how elements of a learning experience are leveraged. Typical learning experiences are often hierarchical. Figure 2 depicts the structure of a learning experience on the expository side of the continuum. Each node represents a person in an instructional experience. The dark node at the top is the instructor, and the lighter-colored nodes below are the learners. The instructor interacts with each learner linearly, such as through a lecture. If we added together what each node learns, we get the sum of the parts.

As we move toward the discovery learning side of the continuum, the arrows in Figure 2 might reverse, the learners might form small groups, and there would be some interactions between the groups and the instructor—with the instructor supporting the learners' thinking. However, the relationship between the different nodes is still linear.

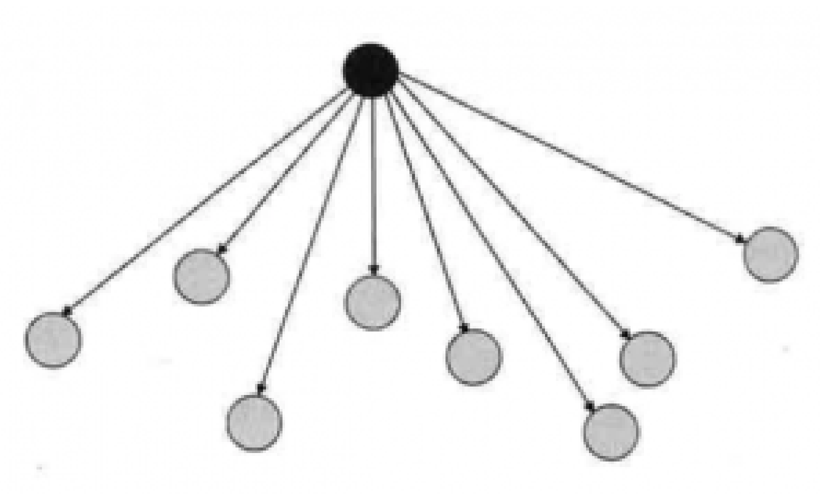

Figure 2. A typical expository structure.

Now, a transmergent learning experience is much different. Instead of creating a linear experience, what we do is create a dynamic experience. We design the experience to simulate a neural network, as shown in Figure 3. In a neural network, a task is handed off to a group of nodes, in this case, the students (light circles) and the instructor (dark circle). The nodes interact in a dynamic fashion, taking the task and processing it. Each node adds or subtracts information, insights, opinions, decisions, knowledge, skill, and so on, until a result is achieved. Furthermore, any node can have a role in guidance, coaching, and scaffolding. This can involve lecture by any member, group work by any group, private conversations between pairs, and individual reflection. If the conditions are right, the expectation is that the outcome will be Wow!—evolutionary and emergent results that are more than the sum of the parts, that is, extraordinary learning experiences.

Transmergent learning offers the possibility of some amazing breakthroughs when it comes to the creation of new knowledge. Given the right conditions, strong models of exceptional performance can emerge. These models define exemplary performance, which can then be further analyzed and examined by students and instructors alike to derive critical attributes and heuristics. Even the weak models offer learning opportunities, in the form of what one should avoid. After all, if you want to be a great photographer like Ansel Adams, you just don't look at his work that hangs on the walls of museums. You also take a look at what sits in his trash can. J. K. Rowling, author of the bestselling "Harry Potter" books, writes that, "Failure gave me an inner security that I had never attained by passing examinations. Failure taught me things about myself that I could have learned no other way" (Rowling, 2008).

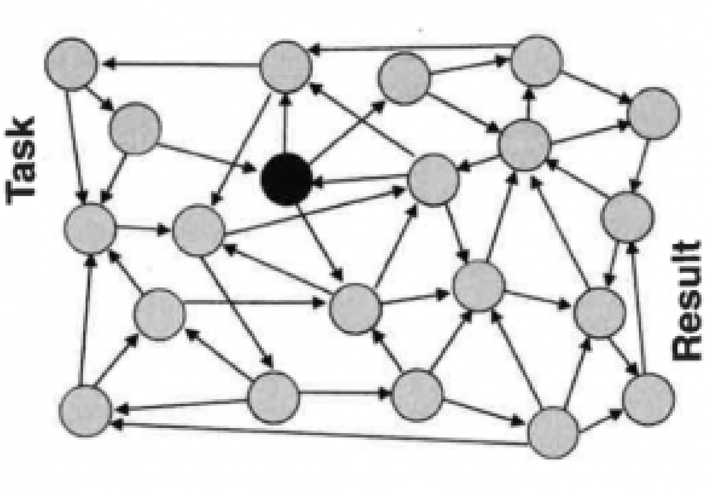

Figure 3. A Transmergent Learning Neural Network.

The most important quality of transmergent learning is that it increases the likelihood that learners can experience *transformation*. Transformation is an experience that significantly changes an individual in a positive way, resulting in a high level of economic value not only for the individual, but for the sponsor of the learning experience as well (Pine & Gilmore, 1999).

Complex Foundations

Transmergent learning owes its emergence to a branch of scientific inquiry called Complexity Theory (Lewin, 2000). Perhaps the reader is familiar with Chaos Theory, which describes nonlinear systems that are mechanistic, unpredictable, and without memory (for example, weather). Complexity Theory was developed to explain phenomena that Chaos Theory couldn't, such as systems that embrace the element of life. Ecosystems, living things, the brain, social structures, language, organizations, companies, and economies are often quoted as exemplars of complex systems, in that they develop over time in nonlinear ways, maintain a history of their development, and are somewhat stable.

Complex systems are emergent systems, in that they are shaped and developed over time through an evolutionary process. Thus, a learning experience, if it embodies the qualities of a complex system, has the capacity for emergence and transformation. It can enable learners to generate new constructions of knowledge and skill that are more than the sum of the parts. But the trick is creating a learning experience in which emergence and transformation can flourish. To do this, the literature suggests that the evolution of complex systems is influenced by two primary variables, a social variable called *framing* and a physical variable called *structure* (Cilliers, 1998).

Framing

Because complex systems become complex in the eye of the beholder, *framing* describes whether a system is perceived as being *simple*, *complicated*, or *complex* by a human observer. Each concept is relative, governed by the *frame*, the level or distance from which one perceives a system. For example, a small room aquarium may acquire the definition of *simple* when seen from afar, being nothing more than a home decoration. As one changes frame and sees a large number of components associated with the aquarium (heater, filter, chemicals, and organisms), it becomes *complicated*, but in a way in which the system can still be accurately analyzed and interpreted. However, as one changes frame yet again, looking even closer at an aquarium, one can see an ecosystem, and its *complexity* becomes evident.

In a learning experience, framing reflects the lens an instructor helps learners develop through many common instructional strategies (lecture, readings, practice, and so on) in terms of “seeing” the nature of a task. That is, if a learner can view a system at a complex level, then the learner has more degrees of freedom in manipulating the variables associated with that system.

Structure

Structure reflects the physical or conceptual nature of the system. While complex systems are by no means simple to identify, analyze, and interpret, Cilliers (1998) provides a useful model that suggests a set of qualitative attributes that define complex systems. A system is thought to be complex (and more likely to evolve) if it embodies the following structure:

- **A large number of elements.** This is the quantitative count of the number of elements that comprise the system.
- **Interaction between the elements.** This describes to what degree the elements interact or communicate with one another.
- **Interactions are rich.** This describes the amount of information shared between elements when they interact.
- **Interactions are non-linear.** This describes the expected outcomes of interactions as being predictable (linear) or not predictable (nonlinear).
- **Interactions have a short range.** This describes the relative physical distance between elements that are communicating.
- **Interactions have loops.** This describes the effect occurring when an element communicates with another element; the receiving element can provide feedback to the communicating element, and vice versa.
- **The system is open.** This means that the system can interact with other systems and can be directly modified and enhanced.
- **Disequilibrium rules the system.** Disequilibrium means that the system is in a constant state of change, where new forms may appear at any time.
- **The system has a history.** This means that the system keeps track of time, actions, events, and other data, and uses that data to manage interactions.
- **Each element is ignorant of the behavior of the system as a whole.** This means that no single element holds the key to the purpose, behavior, or structure of the whole system.

In transmergent learning, structure reflects the instructional strategy that forms the backbone of that experience. For example, if there is more potential for emergence with a large number of elements, then perhaps the designer should increase the number of learners in a class, rather than decreasing them. The next section describes the instructional tactics that correlate with these structural principles.

Instructional Strategies and Tactics for Embracing Transmergent Learning

The first thing one needs in the quest of Wow! is a task and a tangible outcome associated with that task. This should be an authentic task, something that is related to the work done by learners on the job (Honebein, Duffy, & Fishman, 1993). For example, in a university marketing course that I teach, the authentic task is the creation of a marketing plan. This document (and subsequent presentation) encapsulates all the performance goals and objectives associated with the course. In a corporate sales training course that I designed, the task for sales people is to develop a PowerPoint presentation for a simulated client meeting. This presentation is a work product that reflects customer analysis and product knowledge. Note that for Wow! to happen, the learners must create a tangible outcome.

Once the authentic task and outcome are defined, instructional designers who desire to make learning experiences more transmergent do so by integrating specific instructional tactics into those experiences. These tactics are applicable for both instructor-led training and e-learning, but as can be seen, the most ideal context is a blended learning experience. Table 1 introduces some of the example or generic instructional tactics that link with the instructional strategies associated with transmergent learning.

Application of Transmergent Learning in the Field

For the past five years, I have been experimenting with transmergent learning in two contexts. The first involves the university courses I teach at the University of Nevada, Reno and at Indiana University. The second context involves the instructional design work I do for corporate and government clients. This section discusses how I have integrated transmergent learning into various course designs.

Table 1. Instructional Tactics for Transmergent Learning.

Instructional Strategy	Example Instructional Tactics
1. Large number of elements.	• As many learners as possible. • As many books as possible. • As many information resources (literature databases) as possible. • Variety of guest speakers.
2. Significant interaction between the elements.	• Organize learners into reasonably-sized groups. • Enable groups to collaborate. • Allow classroom time for face-to-face interactions. • Provide technology (e-mail, threaded discussion, chat) for remote asynchronous and synchronous communication.
3. Interactions are rich.	• Focus communication on verbal, visual, and kinesthetic representations. • Reinforce synthesis and extension of ideas. • Encourage alternative representations (such as drawings, photographs, and multimedia).
4. Interactions are non-linear.	• Avoid communication templates. • Keep communication open-ended.
5. Interactions have a short range.	• Keep communication at the individual or group level. • Facilitate and coach at the individual or group level.
6. Interactions have loops.	• Facilitate and guide discussions so that they build and improve. • Engage learners to critique each other's work. • Allow iterative designs of learner work products.

7. The learning environment is open.	• Everyone sees each other's work. • Guests move freely in and out of the learning environment. • Work products of the learning environment are migrate and shared outside the structure of the class.
8. Disequilibrium rules the learning environment.	• Introduce new data or content at strategic times. • Disrupt groups by adding or removing members. • Change the nature of tasks to fit the context or situation. • Add new constraints or remove existing constraints.
9. The learning environment has history.	• Learners maintain logs of their actions • Learners maintain journals of their thoughts and ideas. • Discussions are conducted in online threaded discussion groups. • Learners maintain portfolios of their work. • Work from previous classes is accessible.
10. Elements are ignorant of the whole	• Learner's task must be clear, but ill-defined. • No one learner should dominate a group's work. • Instructor must facilitate, not dominate.

Transmergent Learning in a University Course

MKT 210 is an undergraduate marketing principles course at the University of Nevada, Reno. Upon first glance, the course is perceived as a large lecture course accommodating up to 200 students. It is taught in an auditorium-style lecture hall that features two big-screen projection systems and a media console that can present media from computer, DVD, video, document camera, and other devices.

The structure of the course, however, is much different from other large courses at the university. On day one, learners immediately assume the role of a marketing manager. Their task is clear: take a product from idea to marketing plan. This authentic activity forms the backbone for the learning experience. To accomplish this task and provide a bit of escapism to the student's roles, the class divides randomly into two competing companies (A and B), with each company having 16 teams of four to seven students (32 groups total). Over 3000 new-product ideas are elicited from students, from which eight are selected from a student-driven synthesis process. Two groups from each company work on the same product idea. Thus, four different marketing plans are generated for each product. Through a series of competitions, only one plan for each product will reign superior, and the winning teams are rewarded with extra credit. This attempts to simulate the vetting process companies use to develop and fund new product ideas (and the natural-selection process organisms and social systems use to gain strength).

During class sessions (which are once weekly for three hours), students experience a variety of instructional tactics that blend framing and structure. There is a bit of lecture involving core content, a couple of interactive learning activities, fluency practice, and sometimes a guest speaker or face-time for students to work with their groups. Outside of class, students use a WebCT discussion thread to collaboratively work on their projects. Each week, students post research and ideas to a blog, in the form of a private folder that only members of a team may access. For example, the Market Analysis Blog requires students to find and post research that supports the market need for their product. These postings are coached and scaffolded by my graduate assistant and myself. Toward the end of the semester, each student uses the data collected in their group's blog to write a five-page marketing plan. Plans then go through three rounds of peer-review competition that let the eight best plans emerge, one for each product idea.

The MKT 210 learning experience incorporates the principles of transmergent learning in many ways. Table 2 explores the linkages between the instructional strategies and their corresponding tactics:

One of the goals of the course is that students will be able to recognize a good marketing plan, and distinguish it from one that is not so good. In the final round of the competition, the top 16 plans in the class go head-to-head in a formal competition, two for each product idea (one from each "company"). Winners are determined by a best out of three vote: my vote, the students' collective vote, and, in case of a tie, my graduate assistant's vote. The agreement between my vote and the students' vote has been .86. And, in the cases where we didn't agree, the quality of the plans being presented was relatively equal.

Transmergent Learning in the Corporation

There is no doubt that the freedom a university environment offers an instructional designer allows for significant exploration and experimentation of transmergent learning principles. Applying transmergent learning is more challenging in corporate and government environments, due to numerous constraints. For example, resources are limited, especially in terms of instructor engagement and the time allowed for train-ing. However, my colleagues and I have had opportu-nities to apply the principles of transmergent learning in both e-learning and instructor-led projects in corporate settings, with favorable results.

Table 2. Linkages between instructional strategies and tactics.

Instructional Strategy	Instructional Tactics
1. Large number of elements	• 200 students. • Access to books in the UNR library. • Access to library databases. • Multiple guest speakers (experts and members of the business community).
2. Significant interaction between the elements.	• Students organized into cohorts of 4 to 7. • WebCT Learning Management System to manage discussions, e-mail, assignment postings, and so on. • Product brainstorming activity that yields 3000 new product ideas.
3. Interactions are rich.	• Content presentations incorporate verbal, visual, and kinesthetic encoding strategies. • All significant interactions between students are written in threaded discussion groups called Product Blogs. • In-class activities (such as distribution channel design) are documented on paper. • Groups are in competition with other groups, motivating deeper interactions and contributions. High-performing groups are rewarded with bonus points at the end of the semester.

4. Interactions are non-linear.	• Discussion postings do not have a rigid form or structure. • When worksheets or job aids are used, they are open-ended.
5. Interactions have a short range.	• WebCT discussions are between facilitator-students, student-student, and student-group.
6. Interactions have loops.	• Threaded discussions are visible to group members. • Facilitator monitors discussions and provides process/depth feedback as required. • Students must read and critique each other's plans. • Facilitator conducts marketing plan review sessions where groups exchange draft plans and discuss the strong and weak points of the various pans.
7. The learning environment is open.	• Posting to discussion boards are visible to all members of a group. • Book reports are posted to discussion boards and to the Amazon.com site.
8. Disequilibrium rules the learning environment.	• Course facilitator provides market data (such as previously unknown competitive products) to groups throughout the semester. • Group members can be fired; groups can be disbanded.
9. The learning environment has history.	• All discussion posting and e-mail are maintained in the WebCT system. • All assignments are maintained in the WebCT system. • Students maintain project folders for har-copy artifacts.
10. Elements are ignorant of the whole.	• Project involves inventing a product or service that doesn't yet exist. • Facilitator does not coach students in the form or design of their product or plan. The facilitator coaches process, depth, and generally-accepted practices.

No corporate project we have completed has seen a wholesale application of transmergent learning. i don't see this as prudent, since any course that relies on one kind of strategy, whether it is expository, discovery, or transmergent, in the corporate setting, will likely not achieve its intended goals. Instead, what a designer looks for in these contexts is niches or islands of opportunity, whereby transmergent learning may be integrated in certain strategic places that stimulate a Wow! factor from time to time.

As I mentioned above, the first thing that enables a learning experience to be transmergent is a task and a tangible outcome associated with that task. For example, in a sales training course we developed, as noted above, the task for sales people was to develop a PowerPoint presentation for a client meeting. This presentation was a work product that reflected customer analysis and product knowledge. In a systems analysis course, the task was to prepare a user requirements document for a simulated product. Again, this was a work product that represented the acquisition of knowledge and skill related to systems analysis.

Once one has the task, the next step is to find ways to create neural networks in the course, however small or large, persistent or fleeting. The sales training course is a self-paced e-learning program. Resource constraints prohibited us from including peer-to-peer discussion groups or other forms of direct asynchronous communication between learners. However, we convinced the client to allow learners to submit their finished presentations to the subject-matter expert for review. The presentations the SME found particularly good were recycled back into the course in the form of authentic examples. These examples became the inspiration for learners to adapt and improve, and the cycle became self-feeding.

In the systems analysis course, transmergent learning is a recurring theme in the activities learners complete to accomplish their task: creation of a user requirements document. One especially transmergent task is a requirements-writing activity. In the context of a multi-day simulation, we give learners the task of writing individual requirements for several user needs. Each learner writes a requirement for each need on an index card. A group of three to five learners then collates their cards by need, resulting in multiple stacks of cards—one stack for each need. The learners then pass the stacks, reading and ranking the cards in each stack. The result is what the group thinks is the “best” requirement for each need, which is then presented and compared with the work produced by other groups.

Conclusion

The selection of macro and micro instructional strategies is dependent upon the conditions the designer faces and the outcomes the designer desires (Reigeluth, 1983). With regard to conditions, my research suggests that transmergent learning is appropriate for:

- high-level cognitive skills;
- ill-defined or ill-structured domains;
- goals or problems “owned” by the learner;
- learning objectives related to creativity and invention;
- learner tasks that accommodate authentic activities, active learning, and more subjective forms of performance evaluation; and
- environments that incorporate learning management systems or similar collaboration tools.

As far as desired outcomes for transmergent learning are concerned, the answer is an extraordinary Wow!

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