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Design-Artifacts in Learning: The Mediation of Emotions and Ideas for Innovation

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Philip Wong

The purpose of this article is to articulate a dimension of technologies for learning which we regard as having immense potentials. Learning technologies can have the potential for being embedded in everyday design artifacts and serve to mediate between learners in seamless integration. Design is a field traditionally dominant in the arts and aesthetics, not thought to be related to technology and the sciences. In the emerging field of design-artifacts, we visualize products evolving through a merger of the arts and the sciences (Kemp, 2000). In this article, we articulate principles underpinning how design-artifacts can be adapted as technologies for learning. We highlight three major tenets: (1) design-artifacts mediate between persons for the expression of thought and emotions; (2) innovation as manifested through design-artifacts, which in the past has usually been an individualistic activity, can now be distributed meaningfully in teams or groups whereby appropriate depths of understanding and design skills are coordinated; and (3) that educators can possibly facilitate learners-in-teams towards such innovation.

The assumptions underpinning this article include first the notion that artifacts, as in the Vygotskian perspective (Vygotsky, 1978, 1981; Wertsch, 1998), contain a historical trace of knowledge, and represent meanings that are socially constructed. Second, innovation requires both depth of domain or disciplinary understanding (e.g., in the sciences) and design abilities (e.g., as in the arts), including the tenacity to achieve meaningful products and processes. In this sense, innovation could include new methods, customs, devices, etc., where a change from old ways and methods are evident (adapted from Webster's New World Dictionary, 1982). Rogers (1983) expressed innovation as an idea, practice, or object that is perceived as new or novel by an individual or a group. As such, we connote the emphasis in this article that when the ‘sciences’ meet the ‘arts,’ innovative (new methods, customs, and devices) ideas are formed and evolved into design-artifacts. Innovative ideas often arise when we integrate the sciences with the arts and by creating a setting where researchers of an interdisciplinary nature can meet and develop new services and products.

Many fields of the applied sciences, such as engineering and technology, have been grappling with the core nature of their purpose in human activity (Gibbons, 2003). Design in technology often depends on science for inspiration, and technological advances require the convergence between concepts and specific forms (materials). We emphasize the role of the convergence of science, technology, and the arts. Gibbons (2003) describes Herbert Simon’s notion that “technology is the work of synthesis because it is associated with the design and creation of some kind of structure and artifact. Technology is synthesis toward a goal (Gibbons, 2003). Science, on the other hand, is analytic—building “conceptual models from one set of constructs in order to explain observed effects” (Gibbons, 2003, p. 12). Technology “builds different causal models using a different set of constructs to describe how artifacts can be created” (p. 12), which in essence is synthetic.

A Study Trip to Sweden’s Interactive Institute

This article arose from a study trip to Sweden by the authors. Many thoughts arose from the trip, such as the possibility of future experimental schools set up in radically different structures compared with the traditional schooling systems with which we are familiar. The visit occurred with the intent to transfer possible ideas of learning and instruction into Singapore schools. In this article, we particularly focus on one dimension of our study tour, which arose from a visit to the Interactive Institute in Sweden and which turned out to be a fruitful experience. In essence, the visit to these particular projects of the Institute showed the innovative dimensions of how technology is integrated with design in artifacts for both learning and industrial purposes. SMART and SHARE (they are not acronyms) are research companies arising from the Institute, funded by the government with researchers...
from both the university and industry. The SMART project is industry-oriented, whereas SHARE is educationally oriented. Doctoral students from the university are usually assigned to the Institute on a project basis, working on ideas and evolving them into design prototypes. An interdisciplinary focus charts the work at the interactive institute:

...today the need for a closer coupling between natural sciences, social sciences, humanities and “pure” art becomes more and more apparent. A closer coupling will make methods, tools, and ways of expression that today are used only within one field of knowledge available within other fields to mutual benefit. Information technology (IT) can help lessen the division of knowledge. The reason for this is that IT fundamentally changes how we communicate and exchange knowledge. In Sweden the Interactive Institute will try to explore these new possibilities to see how they affect society in general and, not least, the educational sector. (Groth, 1999; http://www.eun.org/cn/hs/history/papers/johan1.html)

The institute envisages changes which digital technology has made feasible. Some of these trends are:

1. Digital information has made it easier to transform and reinterpret data, to look for new structures or patterns. This makes it possible, e.g., for engineers to present new findings in the formats currently used by artists.
2. IT can exploit the connection to networks and thus expand the possibilities of connections to resources and persons.
3. Today anyone with a computer can become an information producer. This means that we will all go in and out of different roles, being producers within our fields of work or interest and being consumers otherwise.
4. The primacy of text is gradually reduced and multi-modal formats are becoming equally easy to handle.

IT has in the past decade been popularized by advantages such as for simulation, visualization, and modeling. Learners can benefit from simulations in order to understand complex phenomena. Cognitive tools could also facilitate the construction of knowledge using epistemic structures. Technologies such as authoring tools and collaborative environments enable learners to express meanings through creating projects and artifacts electronically. Many of these tools focus on the cognitive and social dimensions of meaning-making. These electronic artifacts are able to represent the state of evolving understandings of learners. The distinction between what we have observed in SMART and SHARE compared with other IT tools is the expression of emotions, such as musical meanings embedded in everyday, real-world objects and appliances. As design-artifacts, technology is able to merge with design in order to express evolving emotions and knowledge, mediating interactions between persons.

The methodology for facilitating design-artifact creation adopted in these research companies is one of an evolving nature, where only constraints and some parameters are defined, of which the end product(s) cannot be predicted. A facilitator or project leader leads the team in the generation of ideas, and these ideas are experimented with and prototyped. The creative facilitation process begins with a group of interdisciplinary members identifying areas of possible interests, where formulations can be based on emotional expressions and other forms of feeling and realities. This phase is followed by a generative stage, where participants use brainstorming and other provocative thought methods to create new ideas for finding design expressions. A filtering process of the ideas generated proceeds, and this is followed by an attempt toward consensus with regard to definitions and perspectives held by members.

Once an idea-design is agreed upon, the group undergoes another detailed iteration of how to proceed with the design product. For example, the SMART team has worked together for the past three to four years, and the members have built up confidence and mutual trust with each other. Such a process is unlike the traditional model of problem solving but rather like a compositional process where the goal is not prescriptively defined. Nelson and Stolterman (2003) describe this ‘composition’ skill as central to design activity, leaving sufficient room for explorations. Nelson and Stolterman (2003) make the case for design as an approach to creative human inquiry and innovative action, particularly useful in facilitating intentional change in an unpredictable, complex, and dynamic world. Design is an intrinsic process that people are continually engaged in through reflective inquiry and practical action.

Design is also treated as a means of creating both the material and immaterial world—an integration of imagination, systemic reasoning, and pragmatic action. This process is similar to the process of learning, where learners commonly begin with naïve, romantic conceptions (beliefs) of the world and move through the deconstruction and disciplining of their minds and arrive subsequently at more accurate and mature worldviews through an ongoing, dialectic cycle; knowing that principles and theories are the product of human construction, imagination, insight, and experience. Our intellectual constructions are based on interactions, not on our isolated subjectivity or opinions.

In the next section, we attempt to concretize our descriptions of our study trip by articulating principles for learning.
Learning as a Social-Innovative Process for Expression of Emotions and Ideas

Instead of focusing on learning as knowledge transmission or mastery, SMART and SHARE assume that knowledge does not necessarily reside in the head but is shared in artifacts and between persons. Learning is measured to have taken place when artifacts are designed by learners and the evolving nature of the artifacts captures the learning processes. Each learning project team is composed of members from interdisciplinary subjects, and the integration or fusion of different disciplines brings innovation and enterprise into the design-artifacts. Figure 1 shows how groups of individuals can discover music by interacting with sensors within mediational artifacts through constructions of musical meanings among peers. Many more of these design-artifacts can be found at the Interactive Institute: http://w3.tii.se/. Figure 2 illustrates an "intelligent wall," which has embedded technologies to interact with individuals.

Design-artifacts are used to express knowledge in multi-modal representations. Through these design-artifacts, concepts are brought to expression through substance or artifact-representations. These artifacts mediate conversations, dialogues, and questions, and in these ways capture evolving states of understanding. Technology is used in this manner to shape or capture in situ emotions-knowledge in the form of design-artifacts. In many regards, such a philosophy is grounded in the work of Vygotsky, where artifacts mediate cognition and activity. In this sense, technology is used to mediate cognition, and these artifacts create opportunities for questioning and dialogue. But more than that, design-artifacts evoke emotions which are very important to the educative process because they drive attention, which subsequently affect learning and memory (Sylwester, 1995). Design-artifacts link emotions to the important activities of everyday appliances and life.

Thus, design-artifacts are able to mediate between individuals in teams where the expression of emotions, ideas, and innovation can be manifested. Innovation and creativity in the past have largely been perceived as an individualistic activity (see Howard Gardner's book (1993) on creative people), whereas we draw the conjecture that innovation can be expressed socially and emotionally in the form of design-artifacts. However, not all teams or groups will create or innovate, but appropriate combinations of persons with technological expertise with aesthetics (in emotional expressions) can manifest this phenomenon. We were able to notice in our observations within SMART and SHARE that innovation is a team effort. Not every member in the project teams possessed all the inherent traits of an innovative or creative individual. We noticed that innovation required individuals with sufficient depths of understanding in a particular discipline or domain. However, such an understanding is complemented by the work of other individuals within the team who possessed the emotional expressions of design and aesthetics.

A good facilitation process is necessary for guiding teams of learners towards innovative design. As mentioned earlier, innovation is commonly an individualistic affair, but we stress that such a conjoining of the sciences and arts within a team can
be a distributed activity facilitated by skillful facilitators; and the artifact is a mediational support for the further expression of innovative design. However, future research is needed on how to balance the entire process. What are the processes which facilitators or educators need to bring learners through in teams in order to innovate? What kinds of design-artifacts (past and future) are needed to mediate the expressions of thoughts and emotions? What degrees of domain and disciplinary understanding conjoined with design knowledge (although distributed in different learners) are needed in order to manifest innovation? And, finally, how do educators know how to harness in individuals which particular dimensions of the sciences and arts?

Perhaps we have asked more questions than produced answers. The issue is in empowering learners towards a skillful balance of both the logical and the emotional. Learning is a life-long learning process which requires also the affective dimensions of tenacity and hard work (or discipline) in order to achieve products of deep societal significance.

Conclusion

We conclude this article by reiterating the main points of this paper, namely:

1. Design artifacts mediate between persons for the expression of emotions and ideas.
2. Innovation can be a team effort whereby combinations of sciences and arts are manifested—a distributed enterprise.
3. Depths of understanding in both disciplinary knowledge (both sciences and arts) are needed to create innovative design in artifacts.
4. Innovation can be guided and facilitated; however, we need to understand the processes that lead to the goals.

The Swedish people are able to combine their strengths in design and the arts with the inevitable influx of technology into their society and economy. The integration of technology and the arts into the design process has enabled opportunities for Swedish students to express their social knowledge and emotional selves.

Suggested Readings


This interesting book describes as its main theme that creativity is not a solitary introspection but an intense exchange of ideas emerging in interactions among people. The author draws out descriptive stories and accounts of how creative minds meet. Congruent with our conjecture that innovation can be a distributed enterprise, we find this book explicating the dynamics of mutuality, which are not just restricted to artists and scientists, but to virtually anyone.


This book reveals how art and science can co-influence each other. The author emphasizes the structural intuitions shared by both artists and scientists. The author argues that if we observe the processes rather than the end products of arts and science, both share many commonalities—observation, structured speculations, visualizations, exploitation of analogy and metaphor, experimental testing, and the presentation of a re-construction of a particular experience in particular style or media forms. The visual plays a very important role.


The field of creativity is increasingly witnessing a convergence of the arts, sciences, education, and other areas, such as business. Knowledge and research about creativity cut across many disciplines, including cognitive science, psychology, biology, and education. The role of emotions and other forms of aesthetics is now an integral part of creativity. This encyclopedia provides information for readers interested in how creative ideas and inspirations are borne and harnessed.