

Chapter 2

Why Design Alchemy?

Abstract In 2001, I had the opportunity to present at the EdMedia Conference in Finland, where I argued that the conversion of face-to-face courses to an online medium can result in worse, rather than better, learning and teaching experiences. In describing this transformation, I suggested it was in effect the opposite of the popular view of alchemy, with face-to-face ‘gold’ being transformed into online ‘lead’. Twelve years on this original concept has been developed into a comprehensive framework called Design Alchemy, which retains the original ideas of transforming ‘leaden’ educational resources into ‘golden’ learning moments. This chapter builds on the introduction in Chap. 1 to provide a synthesis of personal and career events which inform the Design Alchemy framework. The chapter commences by reinforcing the magic that computer technology can bring to learning and teaching and continues by exploring the persistence and latency of design knowledge, the separation of design practice from technology and the librettos (texts) that inform design practice. The analysis of these four factors provides a response to the primary question posed by the chapter: *why Design Alchemy?*

Finding Magic

The delight on a student’s face as concepts become clear and understanding dawns is the greatest reward for a teacher, and this delight reminds me of the awe and wonder experienced when watching magicians perform. In the same way that a handkerchief magically transforms into a dove, so the designs created to support learning and teaching can, almost magically, transform both the learner’s and the teacher’s experience.

Magic with Computer Code

In 1971, the first year of undergraduate studies, I met my first computer, an IBM 1480 that processed program instructions on punchcards. One of my subjects was computer programming, with the major assignment to write, using the FORTRAN IV language, a Computerised Crook-Catching program. As data we were given records of both witness descriptions and known criminals, and our task was to write a computer program that would produce a list of likely suspects based on matching witness data with the characteristics of the criminals (e.g. eye colour). I was confident I had completed the task correctly, having produced a list of the three most likely suspects, and showed it to one of the other students in the noisy room where we punched the program cards. My peer examined the printout and observed that the solution was not complete; there were actually three suspects who had scored as third most likely. Consequently, I re-examined the code, thought through the logic, rewrote the program taking account of equal suspect scores and completed the assignment.

This collaborative encounter is addressed further in Chap. 7, but this experience with computer programming was life changing with respect to the conditions that can make learning a magical experience. In the case of the assignment, the use of an authentic, problem-based task etched into my psyche that learning can be engaging, motivational and effective because the activity focused on the application of the knowledge and skills covered in the course. Learning can therefore be demonstrated more effectively through well-crafted learning activities, such as the Computerised Crook-Catching task, which required the application of knowledge rather than a formal examination of that same knowledge base.

Through these events, I also learned much about both the power and beauty of the technology: computers and the programs they processed were not just an abstract set of concepts relating to files, data and commands, but in unison a tool to support organisational demands, a tool that could transform data into information that had specific and authentic use. In the same way that a person could, according to their cultural traditions, magically transform into a bird (see Chap. 1), this encounter with computer programming was the genesis of understanding the computer as a transformational tool for learning and teaching. As an aside, the same process of data analysis used over 40 years ago to catch criminals is now being used in data analytics, the ‘discovery and communication of meaningful patterns in data’¹. In the educational sector specifically, data extracted from university records is being analysed to determine the ‘most likely suspects’ in terms of students who are likely to fail or become a statistic of attrition (Yasmin, 2013).

¹ Source from <http://en.wikipedia.org/wiki/Analytics>.

Magic at the Tip of a Finger

Some years later, having gained a qualification as a primary school teacher, I changed careers to become a computer programmer and began working for a large computer company. It was there, in 1977, I watched a video of Dr Donald Bitzer (the designer of PLATO: Programmed Learning for Automated Teaching Operations) speaking at the 1976 Australian Computer Society conference in Perth, Australia. During that presentation, I experienced for the first time the true magic and power that computers could bring to learning and teaching. This is how I expressed it my doctoral dissertation (Sims, [2000](#), p. 2):

Of particular fascination was the moment when Dr Bitzer, by touching the display, was moving bees from one screen location to another. During this demonstration he paused to make observations to the audience but was interrupted by the computer saying “Dr Bitzer—you still have a bee on your finger”!

This was a defining moment for me, an epiphany. From one brief interaction, I perceived the potential for communication and interaction between computer and human that would engage, humour and educate. The universe of possibilities for designing learning experiences opened instantly, the connections between computer, programs, interaction and learning coalescing into a meaningful whole. In 1979 Control Data introduced PLATO to Australia, and since then, the effective application of computer technology to education has been my passion. I strive to transform learning and teaching experiences through design practices that maximise the magical potential of computer-based learning environments. Based on this vision, I contend that designers must view themselves as magicians or alchemists, creating and/or transforming courses to achieve intentional learning outcomes through ‘golden’ engaging and motivational experiences.

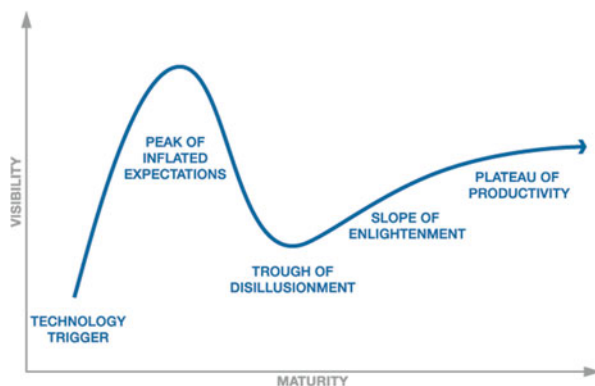
Finding or Losing Design?

Despite these aspirations, over the past 40 years, the quality of computer-based learning and teaching resources has taken a roller-coaster ride, with magical peaks and disastrous lows. In this section the focus is on design and technology innovation, and the extent to which the knowledge needed to effectively cater for technological change, even though established and accessible, is not always utilised by those responsible for the design effort.

Cycles of Forgetfulness

The Hype Cycle (Gartner, [2013](#)) is one representation of technological innovation, and how it is adopted within a user community, that provides a useful model to

Fig. 2.1 The Gartner Hype Cycle (Gartner, 2013; Used with permission)



assess educational technology, its associated pedagogy and related design practices. As illustrated in Fig. 2.1, following a trigger of technological innovation, once that technology is released, it is first received with high expectations, followed by periods of disillusionment, enlightenment and ultimately ongoing acceptance and productivity.

As an example, the ability to use the CD-ROM for multimedia applications emerged in the 1990s, the innovation triggering high expectations that the integration of high-quality images, audio and video would provide teachers and learners with new educational experiences and cater for a range of learning styles and preferences (Alessi & Trollip, 2000; Clark & Mayer, 2002). This was followed by a period of disillusionment when the costs for media, production and computer programming became too exorbitant for small projects; however, as production processes became more economical and the design of interface and learning activities matured, organisations began to see the value of multimedia (enlightenment), and applications became widely used across educational sectors (productivity).

While the Hype Cycle (Fig. 2.1) neatly mirrors the application of multimedia in education, there is more to the impact of technology in education. The sophistication of multimedia products reached its zenith about the same time as network technologies reached a trigger state, and the potential for collaborative education through online courses (which stand-alone computers and CD-ROMs could not provide) soon replaced the established benefits of multimedia resources. Rather than maintaining a plateau of productivity, multimedia applications began to disappear on a *slope of forgetfulness* (Fig. 2.2).

Based on involvement in educational technology and design since the early 1980s, it appears that this slope of forgetfulness of educational technology innovation occurs every 10 years (Fig. 2.3). Beginning in the 1960s with teaching machines that delivered programmed instruction (based on Skinner, 1968), the next trigger came in the 1970s with computer-assisted instruction, such as the

Fig. 2.2 Slope of forgetfulness



Basic Skills curricula marketed by Control Data,² and continued into the 1980s and 1990s with hypermedia and multimedia, respectively. As networked communications matured, this was followed by the emergence of e-learning or online learning in the 2000s. Currently, we are in a phase of personalised learning that, based on the growth of Massive Open Online Courses (MOOCs³) and Open Educational Resources (OERs⁴), is likely to evolve into more open and individual learning opportunities by the end of the decade.

In parallel with the cyclical nature of innovations in educational technology, the design practices that coincided with those cycles appear to have attached themselves to that technology as it disappeared from view down the *slope of forgetfulness*. Consequently, as a new generation of early adopters embraced the next innovation with inflated expectations, rather than building on established design theory and practice, it was common for design practice to be relearned and linked to the new technology, but in a diluted form, creating in effect a *half-life* of design knowledge.

On reflection, as technology plays more and more a significant role in educational delivery, it appears not enough emphasis is placed on design for pedagogy and far too much on design for technology. This is typified by scheduled 6-monthly upgrades to learning management systems; while they provide a livelihood for network and technical specialists, the teaching programs these systems are designed to support experience regular, and often frustrating, interruptions to their practice. Despite the accompanying rhetoric on the advantage such upgrades bring, the reality is that while this practice may enhance the technological and administrative components of education, the benefits to learning and teaching are questionable.

The design alchemist must therefore practice with a focus on the learner and learning; the technology will inform this practice, but not determine it.

² [http://en.wikipedia.org/wiki/PLATO_\(computer_system\)](http://en.wikipedia.org/wiki/PLATO_(computer_system)).

³ http://en.wikipedia.org/wiki/Massive_open_online_course.

⁴ http://en.wikipedia.org/wiki/Open_educational_resources.

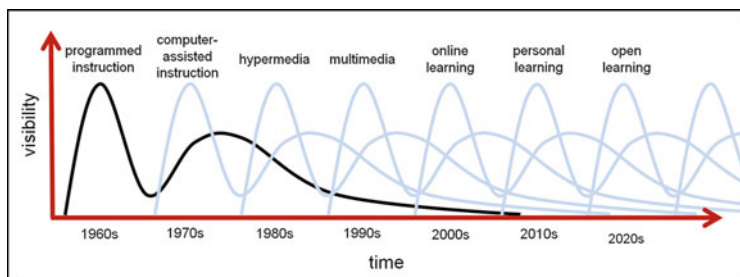


Fig. 2.3 Cycles of educational technology innovation

Technology or Pedagogy?

To examine the links between technology innovation and design, I will use as an example the award-winning multimedia application *Stage Struck* (Wright, Hedberg, & Harper, 1998), which allows users to ‘explore backstage, try scriptwriting, design sets, rehearse actors, meet performing artists’ (NIDA, 1998). From a pedagogical perspective, *Stage Struck* uses a combination of presentational (watching reading listening), discovery (exploring, testing) and creative (designing, rehearsing) strategies. From the technology perspective, the application not only integrates audio, video, animation, text and graphics (multimedia) within the user interface (graphic design) but also provides a set of tools (stage, sound tracks, sets, actors) that can be used to design and create a performance (interactive design). A sample of a unique design users can create is shown in Fig. 2.4.

It's the Pedagogy

While this application represents a very sophisticated integration of computer programming and multimedia, combining alternative delivery options into a single resource, the pedagogy is not unique to the multimedia CD-ROM and could have been applied:

- If students planned to tour a theatrical company and interact with the performers
- To a computer-based learning course developed in the 1980s, even though the fidelity of the graphics and animations would have been low, and there would have been no audio or video
- To an online or virtual reality environment

The point to emphasise is that the same pedagogy and learning outcomes can be achieved through a design that focuses on those elements; technology does not and should not determine the pedagogy. Design must be considered as independent



Fig. 2.4 User-generated scenario

from technology because a strong pedagogy can embrace any technological innovation.

Can Technology Compromise Quality?

Is it possible therefore that, from a design perspective, pedagogy and technology have been linked too closely and that this association might be partly responsible for the variations observed in the quality of educational resources? In contemplating this question, a comparison with motor vehicle manufacturing rose. Over the past decades, the visual appearance of cars has changed, and the controls and options available for driver and passengers have changed; yet the primary design of body, wheels and engine has remained constant. Cars consistently take their passengers to the destination. Based on my experience and encounters with many teachers, learners, applications, technologies and resources, if educational design had been applied to cars, we would see more broken down and dysfunctional vehicles than those on the road!

So why is it that design practices are not more consistently conceptualising and creating learning and teaching resources that achieve their goals efficiently and transparently?

- Is technology innovation being privileged over the importance of a strong design ethos and pedagogy?
- Are programs that teach educational design focused more on technology than pedagogy?

- Are graduate students ignoring the research foundations that inform the field?
- Is design for learning considered less important than design for media?
- Do development projects emphasise project management and compliance over learning outcomes?

Design Librettos

Whether one or more of these possibilities is accurate, there is a further option to consider: that the texts (librettos) we use to support design (the established theories, models and practices) do not yet provide a complete design framework to both achieve learning outcomes and integrate appropriate learning technologies. Novelist Tom Robbins (1994) wrote a perfect analogy for challenging existing paradigms (librettos) of design:

Sarah Bernhardt was such a powerfully popular, awe-inspiring actress that when she toured in North America her performances invariably sold out, even though she spoke hardly a word of English. Whatever play she did, Shakespeare, Moliere, Marlowe, or whatever, she did in French, a language few nineteenth-century Americans could comprehend. Theatergoers were provided with librettos so that they might follow the action in English. Well, on at least a couple of occasions, ushers passed out the wrong libretto, a text for an entirely different drama than the one that was being staged. Yet from all reports, not once did a single soul [...] ever comment or complain. [...] We modern human beings are looking at life, trying to make some sense of it; observing a 'reality' that often seems to be unfolding in a foreign tongue—only we've all been issued the wrong librettos. For a text, we're given the Bible. Or the Talmud or the Koran. We're given Time Magazine and Reader's Digest, daily papers, and the six-o'clock news; we're given schoolbooks, sitcoms, and revisionist histories; we're given psychological counseling, cults, workshops, advertisements, sales pitches, and authoritative pronouncements by pundits, sold-out scientists, political activists, and heads of state. Unfortunately, none of these translations bears more than a faint resemblance to what is transpiring in the true theater of existence, and most of them are dangerously misleading. We're attempting to comprehend the spiraling intricacies of a magnificently complex tragicomedy with librettos that describe barroom melodramas or kindergarten skits.

Informing Texts

To explore the idea of whether the librettos we have are appropriate, the text that informed my early practice as an educational analyst was based on the model shown in Fig. 2.5. At the time, the perceived value of this cyclical approach was that the process of analysis-design-development-implementation would itself result in the creation of effective learning resources, and over the years, this general instructional design approach has become well established, although with different representations of the process (e.g. Dick & Carey, 1996; Morrison, Ross, & Kemp, 2006). So while we have access to librettos addressing topics such as design for

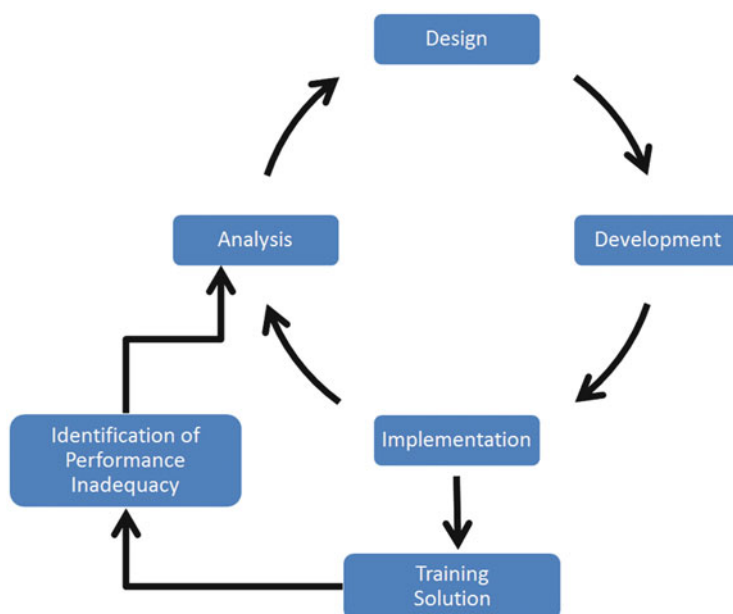


Fig. 2.5 Instructional design process (Adapted from Control Data Australia, 1984)

successful learning (Allen, 2007), design for how people learn (Dirksen, 2011), instructional design (Smith & Regan, 2004) or rapid instructional design (Piskurich, 2006), the question remains as to whether they are complete enough to enable the desired learning and teaching experiences in a world that is more and more social, more and more complex and more and more open.

There are many thousands of online educational resources and courses to support design, and there are hundreds of documented design approaches, and yet educators and educational administration still fail to focus on the potential of learners by developing educational experiences that lack interaction, engagement, collaboration, personalisation or relevance (Robinson, 2013).

This leaves the question hanging: are the texts we have the right ones to achieve the design goals for an effective educational experience?

Design Quality

While the librettos for educational design should ensure quality in the resources developed, the growth of agencies devoted to quality assurance and accreditation (e.g. Quality Matters, 2013; The Tertiary Education Quality Standards Agency, 2013; The Higher Learning Commission, 2013) suggests otherwise. Why are external quality agencies required when design practice should ensure quality?

One possible reason is that despite the foundations of theory and practice, when the range of learning and teaching resource are considered, their characteristics reflect design practices that range from the inspired (capturing a combination of creativity, innovation and art) to the structured (reflecting strict adherence to a specific design model), to the informal (where the resources are more ad hoc and just in time) and to the uninformed (resources reflect none of the accepted theory and practice). The inspired designs are rare but generate what I believe Csikszentmihalyi (1998) refers to as flow, where ‘a person performing an activity is fully immersed in a feeling of energised focus, full involvement, and enjoyment in the process of the activity⁵’, and which were observed to some extent in the findings of Sims (2000) and are further elaborated in Chap. 7. The structured designs are those that follow a prescribed, predefined pattern, such as ADDIE (analysis, design, development, implementation, evaluation), and which in practice often focus on the sequencing and presentation of subject matter. The informal designs reflect those created by the self-motivated learner who decides on a certain learning outcome and, being motivated, works to achieve that goal through trial and error and interaction with people and resources as required.⁶ The uninspired designs represent those where education and training are presented as ‘digital paper’ or where the complexity of the resource and technology used shows little understanding of learning, teaching and design.

For the design alchemist, therefore, the aim is to implement inspired levels of design, using a combination of science (the structured approach) and art (the creative, innovative approach) to transform educational environments into quality learning experiences.

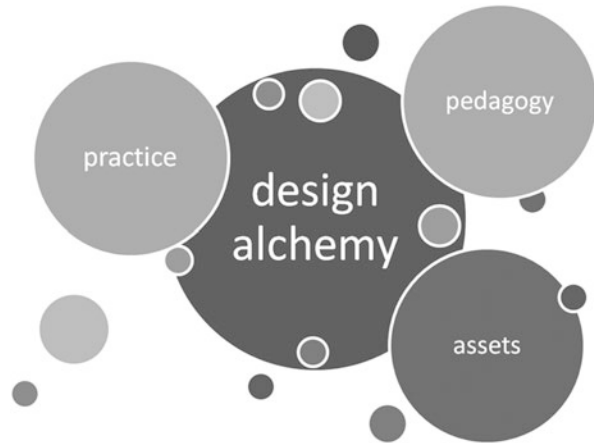
Have We Got Design Right?

As we move into a period where, with the right infrastructure, we can learn anywhere and anytime, it becomes critical that we embrace design architectures or frameworks that ensure the focus is on learning, and not on content access to, which underpins Design Alchemy. It is my contention that the ideas and approaches that many use in our field are predicated on misconceptions of teaching and learning through technology, and it is therefore timely to reassess design and rethink the meaning of learning and teaching.

⁵ [http://en.wikipedia.org/wiki/Flow_\(psychology\)](http://en.wikipedia.org/wiki/Flow_(psychology)).

⁶ I evidenced this process many years ago when my son, interested in astronomy, wanted to take night photographs of the sky by having a camera that could track the movement of the stars. He researched the process and, on the Internet, found plans for a manual tracking system and proceeded to build the device and take successful photographs. While I am sure we all have similar anecdotes, this struck a chord with me—if we have a learning goal and basic literacy skills, the ‘web’ can provide all the guidance we need to achieve a learning goal.

Fig. 2.6 Elements of Design Alchemy



Design Alchemy is proposed as a framework that extends current approaches, providing a complete and comprehensive approach to design practice.

Why Design Alchemy?

The basic architecture of Design Alchemy, consisting of three major components, is represented in Fig. 2.6. The additional but unnamed elements emphasise that the framework must be viewed as dynamic; research and practice will continue to inform our field, and therefore, the models and practices must be open to modification and revision. In brief, these three components focus on:

1. **Pedagogy**, the underpinning learning theories and strategies that inform the practice of the design alchemist and the structure of learning activities (see Chap. 8)
2. **Practice**, the essential steps that provide a practical and effective way to design and implement new or revised programs and courses (see Chap. 9)
3. **Assets**, the different factors that influence and inform the overall design process (see Chap. 10)

Chapter 1 argued that the artistic and spiritual attributes associated with alchemy, when combined with the more formal scientific elements of learning and instructional theory, provide a valuable metaphor for the practice of design which has been further elaborated in this chapter. Computers have the potential to be magical in their ability to process instructions and respond to learner interaction, and yet technological innovation appears to have diminished rather than enhanced this potential. In parallel the design practices used to create learning and teaching environments have not always achieved designs that achieve ‘flow’ for the individual learner.

In response to this conundrum, Design Alchemy provides a framework where design alchemists create environments in which all participants interact to achieve learning outcomes relevant to their own needs and context and which harness the power of the technology to support those interactions.

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