SIMULATIONS – BRIDGING FROM THwartED INNOVATION TO DISRUPTIVE TECHNOLOGY

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INTRODUCTION

Gartner Research dubbed simulation the new "killer application" in e-learning (Lundy et al., 2002) but even assuming the best estimates for the adoption of simulations, they represent a tiny proportion of the annual spend in training and education. Considerable research has been done to evaluate the effectiveness of simulations and, by and large, the results suggest that simulations are effective but there are doubts about even the most fundamental claims of the efficacy of simulations (Feinstein and Cannon, 2002) partly because there isn’t a clear, acceptable methodology, partly because there is no real agreement on definitions, and partly because there is little agreement on what should be evaluated. Burns et al. (1990) consider the multi-fold problem with evaluating experiential pedagogies stating that there is firstly a need to compare the efficacy to ‘traditional’ approaches, and there is a need to compare alternative experiential pedagogies competing to achieve the same learning. Not surprisingly, they note a paucity of solid empirical evidence regarding the relative effectiveness of experiential techniques. Other authors (e.g. Pierfy, 1977) note two particular problems with respect to evaluating simulations or experiential techniques: the first being the conceptual problems pertaining to definitions, domain boundaries and the theoretical basis which underpin and frame pedagogical research. The second fundamental problem is that there remain significant methodological difficulties including experimental design, constraints within the organisations and institutions, time considerations and ethical questions associated with any comparative study.

This paper does not intend to argue in favor of one approach, method or definition over another but to consider why simulations have not yet emerged as training and education’s “killer application” and how it may be possible to bridge from being a thwarted innovation (Zemsky & Massy, 2004) to a disruptive technology (Christensen, 1997).

It is important to clarify first, what the author means by simulations, as these come in many guises and the term is used ubiquitously in the field of education and management learning. Summers (Summers, 2004) suggests three basic types of business simulations currently in use – computer-based simulations, board games and behavioral simulations. MacDonald et al. (1977) define that within a simulation, the learner may only tinker within the parameters, not the central working of the system. Whilst board games and behavioral simulations as described by Summers, do simulate real situations, users are an integral part of the simulation and can change the central working of the system. Such ‘simulations’ are not the focus of this paper. The simulations considered here are computer-based virtual realities representing real situations and, drawing also on Barr and Tagg (1995), are classic examples of the Revelatory paradigm. To ensure clarity, the author uses the term “Vebeat” an acronym for ‘Virtual Environments for Business Education and Training’. Vebeats may be enhanced with [video] game-like characteristics, utilize agent-based behavioral elements and increasingly include implementations of artificial intelligence (AI). They may be stand-alone environments with a user interacting directly with the computer or in cooperation or competition with other human users.

Such Vebeats have become widely accepted pedagogical techniques, in part because participants are more actively involved in the learning process and receive immediate feedback on the results of their actions (Brenenstuhl & Catalanello, 1979). This supports Senge’s (1990) view that human beings learn best through first-hand experience, particularly when feedback from actions is rapid and unambiguous. Garris et al. (2002) support this view and propose that the game cycle is iterative, in that game play involves repeated judgment-behaviour-feedback loops and user reactions to this lead to greater persistence or intensity of effort because it is enjoyable, interesting and builds confidence. Support for simulations in greater learning in and of itself is one aspect, but Swanson and Holton (1999) also argue that learning activities that recreate work situations, such as simulation enhanced learning activities, foster better transfer of learning. A recent study by Kenworthy (Kenworthy, 2005) shows clear empirical evidence supporting the effectiveness of Vebeats over the use of case studies in a strategy management programme across all four levels of Kirkpatrick’s ubiquitous framework. Vebeats also bring a different value proposition to the market of business education and management training…they are more effective! The efficacy of simulations and games has been substantially questioned and tested for decades and proponents of simulations and games, Hoberman and Mallick (1992) and Greber (1994) suggest an impressive number of benefits of training using simulations including: 1) Improved transfer of learning to the work venue; 2) Well-suited for teaching participants how to respond to change; 3) Relatively risk-free environment in
which to try new behaviours; 4) Higher participant involvement and motivation; 5) Ability to manipulate several variables at once; and 6) Potential for immediate feedback.

Researchers have identified benefits that are unique to simulation techniques: improved ability to teach teamwork (Keys et al., 1994); unique contribution to long-term strategy making (Gopinath & Sawyer, 1999); demonstrate the complexities of dynamic business systems (Romme, 2003); and positive relationship between business game experiences and outcomes such as income and organizational position (J Wolfe & Roberts, 1993). It has also been proposed that simulations seem well suited to promoting what Argyris and Schon (1978) have termed ‘double-loop learning’, a learning climate that supports valid information, free and informed choice, and internal commitment: and strategic knowledge that requires applying learned principles to different contexts or deriving new principles from general or novel situations (Garris et al., 2002).

So, if Vebeats deliver more value in terms of greater enjoyment, learning, transfer and business impact than more traditional pedagogies, why are they, after nearly 50 years, still a niche product? Is this an example of thwarted innovation that lives up to a promise of a better future but fails to deliver to enough customers to be successful?

A recent article in The Wall Street Journal (Totty, 2005, Page R6), states that companies in the U.S. “spend about $60 billion a year on training their employees, but there's a good chance much of that is wasted”. Totty goes on to cite several examples of major US corporations using computer gaming in training employees effectively. According to Gartner Research, simulations may be the ‘killer application’ for e-learning (Lundy et al., 2002) and in 2005, annual spending for training worldwide is over $100 billion, and e-learning content accounts for only a few little of that and when it comes to potential growth in the e-learning content market, Lundy suggests that much of the expected growth for e-learning will be driven by simulations (Boehle, 2005). Brandon-Hall estimate that simulations accounted for 2.9% of the e-learning industry in 2002 and predicted that they would represent 7.3% of the e-learning market in 2006 (Adkins, 2002) and Summers (Summers, 2004) drawing from a number of sources, estimates the size of the worldwide market for business simulations between $623 and $712 million. Estimating the number of business simulations in use by companies and academia is particularly difficult as there is little consistency in definition of business simulations, though Faria and Wellington (Faria & Wellington, 2004) report a thorough analysis of the academic market showing more than 52% of respondents had used a business game with expectations that use would increase. The ASTD State of the Industry Report (Sugrue & Kim, 2004; Thompson et al., 2002) support the figures and show that these are all very positive trends, but realistically, the current use of business simulations represents a tiny proportion of overall spending on corporate training – perhaps 1% or 2%. By way of contrast, computer simulation games for entertainment have a market size of $7.3 billion (ESA, 2005) in the US alone – ten times greater than the estimated worldwide market for ‘serious games’. It is possible that the intended market is policed by gatekeepers who are preventing access to potential learners, Naish (2005), for example, suggests that serious games can overcome the poor motivation to participate in e-learning but that bringing these into the learning space remains difficult, particularly since the budget-holders may not have played any such games. Clearly, a dominant design has not yet emerged, and this may be holding back the greater adoption of the technology in ways that parallel the adoption of e-learning (Zemsky & Massy, 2004).

There are doubts about the efficacy of simulations and since the early days of simulation and gaming as a method to teach, there have been calls for hard evidence that support the teaching effectiveness of simulations (Hays & Singer, 1989). In spite of the extensive literature, many of the claims and counterclaims for the teaching power of business games and simulations rest on anecdotal evidence or inadequate or poorly implemented research. These research defects, according to Keys and Wolfe (1990), have clouded the business gaming literature and hampered the creation of a cumulative stream of research. Gredler (1996) notes, as did Pierfy (1977) that a major design weakness of most studies evaluating simulation based training is that they are compared to regular classroom instruction even when the instructional goals for each differ.

Vebeats are benefiting from new computing technologies increasingly readily available and the development of sophisticated decision trees, agent-enabled simulations, artificial intelligence, natural language processing, voice recognition and haptic devices are transforming Vebeats from roots in models made from formulae (Summers, 2004). Are Vebeats mired in arguments about efficacy or is it time for a new mindset? Rather than striving for incremental change, improving particular aspects of the technology or integrating straight-forwardly with existing technologies (like the Internet), we might consider business simulations to be a disruptive technology that is going to fundamentally change the way people learn about business and management.

**DYNAMICS OF INNOVATION**

The development of simulation based learning is a story of radical technological innovation in that as an invading technology it has the potential to deliver dramatically better performance or lower costs in what has been a stable industry. The important word is *potential*. When a new technology first emerges, it is often inferior and clumsy compared to its predecessor. In the early days, it is the new technology’s promise rather than its actual performance that attracts adherents. In *The Innovator’s Dilemma*, Christensen (Christensen, 1997) states that disruptive technologies bring
a very different value proposition to the market compared to sustaining technologies. The latter foster improved product performance and although disruptive technologies frequently are regarded as under-performing established products in mainstream markets, they have other features that certain (niche) customers value. Christensen notes that disruptive products are usually cheaper, simpler, smaller and easier to use. They move up-market when they have sufficient functionality to unseat incumbent, sustaining technologies – which often provide more features than customers need or want.

Incremental change is the most common way in which technology develops, either through improvement to particular aspects of a technology or to the integration of that technology with other technologies in a relatively straightforward manner. Incremental change is, in this sense, evolutionary, focusing on making the key technology drivers better. Are the changes and improvements in simulations and games for education and training only driven by the increasing ease of producing more sophisticated products because the underlying technology, personal computers and the Internet have changed? Or are the newer simulations, Vebeats as they have been termed here, an example of a disruptive technology that now possess the functionality necessary to unseat incumbent technologies such as lectures, case studies and the predominantly text-based and PowerPoint™ e-learning prevalent in companies, universities and colleges the world over (Zemsky & Massy, 2004).

**DISRUPTIVE ATTRIBUTES**

Disruptive technologies have certain attributes that distinguish them from new technologies brought about by incremental change, according to Christensen (Christensen, 1997). Vebeats currently share some of these attributes but not all. Disruptive technologies have attributes that:

<table>
<thead>
<tr>
<th>Disruptive Technology test question</th>
<th>Possible responses for Academia</th>
<th>Possible responses for Corporate</th>
</tr>
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<tbody>
<tr>
<td>“Where is the application that a simpler, more convenient technology would take root before it matures enough to become relevant to our current best customers?”</td>
<td>Replacing assignment writing or projects or even exams.</td>
<td>Enabling small businesses to have training for very small groups in specific task areas</td>
</tr>
<tr>
<td>“Who might be some unsophisticated customers that would be delighted to have a crappy product?”</td>
<td>Colleges in poor areas or countries, or have never experienced using simulations</td>
<td>Holders of very small training budgets wanting to fulfill compliance quotas.</td>
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<td>“Do we think that our best customers [existing] would want the product? If so, it’s probably not a disruption.”</td>
<td>Not all, it threatens the realm of experts.</td>
<td>Not all, it threatens HRD and their position as experts and organizers.</td>
</tr>
<tr>
<td>“Will it strengthen our existing business model? If so, it probably is not a disruption.”</td>
<td>The business model changes to reflect fewer resources in delivery, decentralization, less time in delivery and travel. Focuses attention on applying knowledge not simply gaining knowledge ‘just-in-case’.</td>
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result of work in computational science and the massive growth in information technology. Few Vebeats require new IT infrastructure (exceptions being high-end virtual reality) and few demand the computational power of the more ubiquitous video-games that work happily on home computers.

It targets a trajectory of improvement that has not yet overshot what customers can absorb.

Most of the education and training industry’s traditional products are generalist in nature combining a number of skills areas and/or knowledge acquisition, whereas many of the newer Vebeats teach specific knowledge addressing a particular task, such as reading financial statements or using a particular sales methodology. Such Vebeats provide customers with smaller chunks of knowledge and skills.

It builds an outcomes purpose or brand.

Outcomes from a Vebeat are likely to be clear because the purpose must be designed and programmed into the software. Artificial intelligence technologies may begin to cause this to change but it is unlikely that even the most sophisticated AI would be able to go off on the tangents that the human mind is capable of. However, are Vebeats, particularly commercial Vebeats, designed with outcomes first and foremost or are they designed to demonstrate the sophistication of the technology?

So do Vebeats have the potential to be a disruptive technology? Christensen (Christensen, 1997) presents a series of questions to help test the disruptive potential of an innovative idea shown in the table below together with possible example answers for the academic and corporate markets:

<table>
<thead>
<tr>
<th>DISRUPTIVE POTENTIAL OF VEBEATS</th>
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<td>We need a measure in internal and external validity, although there seems to be little motivation to make this happen (Gosen &amp; Washbush, 2004), or perhaps it is time to change mindset and consider other performance criteria that are intuitively more appealing and much easier to measure. We could, for example, borrow criteria from e-learning, accessibility and cost-saving, or borrow from the video-game industry and perform on fun and enjoyment, or from the mobile phone industry and perform on freedom from fixed locations and choice of what is accessed. Combine these and you have a powerful set of performance metrics such as – freedom to choose to enjoy learning what you need when you need it wherever you need it by yourself or together with other like-minded people.</td>
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Competing on different performance metrics, Vebeats fall at the first hurdle to date. There has been a great concentration on comparing simulations and evaluating the effectiveness against other incumbent technologies, case studies, lectures, outdoor games and so on. The evidence suggests that Vebeats are as good as, if not better than case studies across different levels of evaluation, learning, transfer and business impact. In addition, Vebeats gain much better scores from users in enjoyment – which may be one of the key intrinsic motivator’s for learning. As has been suggested, perhaps it is time for a new performance metric that establishes a common instrument to measure internal and external validity, though there seems to be little motivation to make this happen (Gosen & Washbush, 2004), or perhaps it is time to change mindset and consider other performance criteria that are intuitively more appealing and much easier to measure. We could, for example, borrow criteria from e-learning, accessibility and cost-saving, or borrow from the video-game industry and perform on fun and enjoyment, or from the mobile phone industry and perform on freedom from fixed locations and choice of what is accessed. Combine these and you have a powerful set of performance metrics such as – freedom to choose to enjoy learning what you need when you need it wherever you need it by yourself or together with other like-minded people.

Changing the business models of organizations. We have seen that Vebeats certainly have the potential to change the business model but more frequently many Vebeats require a seminar presentation either due to the fact that the Vebeat still requires an expert to run it, or the Vebeat package may not be a complete learning solution in

DISRUPTIVE PROCESS

The disruptive process can be characterized in four steps as follows:

1. The sustaining technology is mature and performing well and is being improved according to customer feedback and demands. For example, the fixed-line telephony service in the early 80’s
2. The disruptive technology is developed but doesn’t meet the performance requirements associated with the sustaining technology and its market. The early cell-phones with limited network availability and frequent dropped calls and low quality transmission.
3. Alternative markets are found or created where the price and performance metrics of the disruptive technology match the customer requirements. Short-Message-Service on mobile phones.
4. The disruptive technology is developed to the point where it can now enter the original markets, challenge and disrupt the incumbent, sustaining technology, based on new performance criteria. There are over 1.5 billion consumers with mobile phones (Economist.com, 2005) and the OECD outlook shows that there is almost one mobile phone for every inhabitant in the developed world and globally, there are more mobile phones than fixed line phones in 2005 (OECD, 2005).

The sustaining technology, as in this example the plain old telephone system or POTS, may not be totally replaced; however, mobile telephone technology has substantially affected the market, radically changing the original telco business model and consumer habits.
and of itself by design, or, more frequently, because the
sales process is necessarily consultative and the initial cost
of development is extremely high and is built into the
selling price. Fragmentation of the industry with decreasing
barriers to entry, high selling costs, high delivery costs and
little real product differentiation combine to cause most
players to adopt an existing (traditional) business model -
simulations are used as add-ons to existing development
programs to add-value, at a price.

**Incubating fringe markets** – in some ways, this is
where Vebeats do operate – it tends to be driven by a few
believers. Individuals within organizations and academia
who have an interest in simulations and either develop one
themselves or buy-in one that they have used for themselves
successfully in the past.

Are we, as suggested by Brown (2000) only in the
gradual development phase of this transformative medium
and yet to experience its explosive impact? Experiencing
technology enhanced learning in its early forms and have
much to learn about its inherent capabilities and the creation
of a new learning ecology? What are Vebeats relative
advantages and are they really compelling enough to force a
reconceptualisation of the teaching and learning transaction?
Perhaps, because of our inability to come to grips with this
learning ecology, business education and training is largely
unchanged by simulation and game technology that has
otherwise changed society through entertainment, video
games, the media and massive, multi-player simulations
across the Internet. Are the impediments to the diffusion of
this technology too great?

**OVERCOMING IMPEDIMENTS TO THE
DIFFUSION OF THE NEW TECHNOLOGY**

Summers (2004) suggests a number of impediments to the
diffusion of simulation technology including cultural
obstacles that simulations place more responsibility on the
learner, and that if learners are self-motivated, this threatens
human resource departments (and presumably academic
teachers). He further identifies that people learn differently
and the new technologies don’t address the necessary
diversity of learning styles. Development costs for
simulations can be very high and these costs are passed onto
a relatively small number of customers – keeping selling
prices high. Much of the time, those potential customers in
the market don’t know what they are buying, they are
unable to try simulations before buying and the current
business model for most corporate market simulation
developers includes expensive consultative selling. In the
academic market, the predominant business model uses
publishers as distribution and sales channels. This suggests
that the potential customer is not sure of the inherent
advantages associated with simulations and the
fragmentation of the industry means there are no formal
standards for what a simulation is, let alone that it should
deliver on the objectives claimed by the developer.

**So how could these impediments be overcome?**

If we consider how other technologies have overcome
the impediments of diffusion, there may be some good
indicators of what needs to happen in this Vebeat industry.
Typically, innovations adoption follows the classic S-curve.
Adoption processes of a new technology usually start slowly
because of the need for experimentation, accelerating once a
dominant design emerges. The actors at various stages of
adoption differ markedly and are usually referred to as
innovators, early adopters, early majority, late majority and
diehards. The mobile phone phenomenon has been used
above as an example and I shall continue with this
comparative disruptive technology.

In the early days of mobile telephony, there were
numerous problems. Readers of a certain age, may recall
that cell phones were rather large and cumbersome objects –
originally, many came attached to a motor vehicle as the
source of power, later a briefcase sized battery. Now they fit
in a small pocket, have the computational power of a laptop
computer, battery life extending to days and are capable of
video conferencing or replaying a movie. The same mobile
phone can access networks across the world with few
limitations. Part of the phenomenal success of mobile
telephony is the result of deregulation across the world
allowing new companies to compete in a market-driven but
regulated environment. The devices and networks that
support them would not be as useful without industry
standards and robust platforms. The Vebeat industry could
benefit from both establishing standards and providing
strong, adaptable platforms on which to build simulations. I
will consider these two aspects first and then discuss how
these might be achieved.

**Standards:** Feinstein and Cannon (Feinstein &
Cannon, 2003) suggest a hermeneutical approach to the
external validation of simulation models, this might be
extended to provide an expert judgment on the internal
validity as well as the external validity of a simulation
model and whether the fidelity and realism in the simulation
either is appropriate, or for whom it is appropriate. The
approach accepts that there is judgmental bias but with
transparency and good governance, such a body equates to
the ITU (International Telecoms Union) in the
telecommunications industry.

**Platform:** The high cost of developing simulations is
frequently cited as the reason for high prices and hence,
poor take-up. The industry is mostly made-up from
bootstrapping companies who provide their own funds with
few venture capitalists becoming involved. There are
currently a number of proprietary platforms developed and a
small number of developers license or sell their platforms to
others to develop simulations. Industry consolidation may
take place and may help this become a reality, though
without a recognized set of standards, which platform, or
few platforms that become the de-facto standard is pure
conjecture. In mobile telephony, the standards that moved
the industry from small, niche low quality to the mass
market today came with the change from analog to digital
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and were established essentially in geographic regions, the GSM standard in Europe, CDMA in the US and PCS in Japan. For 3G telephony, the ITU approved two standards – perhaps by the time of 4G, there will be one standard. Such platforms take time to develop and agree, though the benefits of reducing development costs and enabling cross-functionality could be immeasurable.

How could simulation technology diffuse and genuinely become the ‘killer application’ of both e-learning and management development? Again we can take lessons from the mobile telephony industry to help identify how these technologies have diffused and the importance of particular segments of the early adopter market to the future success of technological innovation.

Following Gilbert and Kendall (Gilbert & Kendall, 2002) the market segmentation model is used to help identify segments within the corporate and academic markets for simulations over the backdrop of a product life cycle S-curve. Relationships are proposed among the intention to use Vebeats, specific requirements and influencing variables resulting in the identification of four early user segments:

**Techno Toys:** Mostly innovators, filling needs for hands-on knowledge about technological developments, intend to stretch existing boundaries and establish if it works. Influenced by technical and/or academic reports. First in market and tend to develop and/or research simulation technologies.

**Training Professionals:** Early adopters of simulation products to create new value related to training work, including new revenue opportunities, differentiation, acceleration of training, higher selling prices. Influenced by employers and clients – particularly in competitive sales pitch or need to demonstrate ROI of training or find products that users will enjoy and actually use on previously installed learning management systems.

**Sophisticates:** use of simulations demonstrates sophistication and willingness to embrace new technology particularly when superior to known, close competitors. Influenced by mass media and trade journal reports.

**Socialites:** use simulation products because major competitors, friends and children are using them, wish to keep up with trend. Influenced by friends, peers, and family.

As the product matures, indications in the trade media suggest that it will become mainstream, and most likely, will be web-based – this makes up the early and late majority segment:

**Lifestylers:** Partly overlapping previous categories, simulations provide convenience related to learning and development, particularly on-demand specific knowledge chunks. Influenced by free trials.

The last two segments are unlikely to adopt:

**Misers:** Members of this segment are unwilling to pay for simulations (or any training).

**Laggards:** The last to know about and adopt new technologies.

The limited data we have on the actual use of simulations, games and the newer technologies including Vebeats gives us an indication that we are still, after 50+ years in the very low market penetration stage of the product lifecycle. Perhaps as much as 1% of the corporate training market and 2% of the academic market. It is predominantly the techno toys and some training professionals who are actively using, developing and promoting the use of Vebeats and a few trade journals and mass media are picking up on the potential of these technologies to change the way training and education are delivered. The October 2004 special report from Chief Learning Officer on simulations (Summerfield, 2004) suggests that the combination of high-cost, lack of organizational infrastructure, scarcity of quality products and services, and management-level comprehension deficiency have all contributed to the limited use of simulations and Vebeats. In other words, the techno toys and training professionals are not communicating the message to the right people. These are the very people who have the knowledge and experience and expertise to ensure that Vebeats are seriously considered for corporate learning.

![Diagram showing market segmentation model](image-url)
and development and business school education. They also have the professional and academic objectivism that could assess and insist on quality standards helping to organize a coherent framework for platform development to reduce development costs and reduce the fragmentation of the industry. Wolfe and Roge (1997) describe a variety of games suitable for different purposes allowing a potential user to select from the list, which goes some way to help overcome the difficulties above, that potential users don’t know what they are buying – and it must be possible to go further and provide quality and efficacy judgment on particular products. However, this is certainly not the first call for the establishment of standards in this field, Gosen and Washbush (2004) lament the failure of several initiatives to develop and validate a suitable and acceptable instrument to measure learning effectiveness in business simulations and games.

BUILDING A STANDARD EVALUATION FRAMEWORK

It is well recognized that establishing robust measures for learning effectiveness is difficult, and assessing the external validity of a business simulation, its fidelity, realism and appropriateness is perhaps, asking too much. Pragmatically, is it possible to create a framework that assesses whether or not a particular product, or method, appears to be efficacious in the environment for which it is designed (Gosen & Washbush, 2004) and what might such a standards framework include?

Reeves (1997) provides a useful framework for conceptualizing the important factors for measurement in computer-based education. Adapting this to computer-based simulations and games and with a particular intention to focus on newer technologies, called Vebeats here, may provide a basis for discussion. Reeves considers fourteen dimensions to provide improved criteria for understanding, describing, and evaluating Computer-Based Education (CBE) that may be used to compare one form of CBE with another to overcome the noted difficulties in empirical evaluation to measure effectiveness of one method over another. The figure below, shows a summary of the pedagogical dimensions Reeves identifies:

In light of more recent research in the field of Vebeats, we might consider adding or substituting other dimensions:

Such dichotomous scales could include an empirical scale and be useful for an overall understanding of how a particular Vebeat is designed; it’s validity both internal and external. However, it still reflects traditional foundationalist views that force a dichotomy between each factor, though
inevitably must recognize that judgmental bias exists.

Such a framework may be helpful in the research community or for reviewers to be able to compare one product with another or against a benchmark. It is deliberate that the framework is not suggesting what is good and what is bad, nor does it intend to suggest that one a product with a profile towards the right is in any way superior to one with a left profile. It may help researchers gain a clearer understanding of what attributes of a particular simulation or game are causing learning of a particular aspect of knowledge or developing a particular skill set. The following figure is an example of how this framework might be used comparing two very different simulations, a commercial airlines flight simulator used for training airline pilots, and Imparta’s Strategy CoPilot™ - a business simulation or Vebeat used to develop strategic management knowledge and skills. The choice of position on each scale is the author’s own, though influenced by discussions with colleagues and users of the simulations, and the purpose is to illustrate the concept. Clearly the two simulations have very different learning purposes, but to serve their respective purposes well, they share some similarities and some marked differences. Realism, for example, in a commercial airlines flight simulator is as close to real as it is possible to be on the basis that trainee pilots need to practice in a completely realistic way but that doesn’t place lives at risk. Interestingly, the US Air Force has been reported to be using video game simulations that are less realistic and much less expensive in training pilots in the early stages of training. To take the other example, Strategy CoPilot™, the simulation has a certain amount of realism within it, utilizing realistic situations with video-based characters that the user interacts with – however, time is accelerated within the simulation and users benefit from an improbably useful personal digital assistant that neatly keeps and provides access to critical information and the appropriate business models. Too much realism in such soft-skill training or education and users might get lost in the plethora of other events and not focus on what is being learnt. Teacher role in the above examples are also different, the didactic role with a CAS flight simulator is to tell trainee pilots how to fly the aircraft, the precision of pressing the right button at the right moment and applying just the right amount of throttle, flaps etc is critical, and it must be right – otherwise the aircraft falls from the virtual sky and crashes – and as someone who has crash-landed a 747 simulator, I can assure you that these beasts can be broken and you’ll be relieved to know that I won’t be at the front of your next flight.

Such a framework may be useful in clarifying the key attributes of any simulation product and be beneficial for comparable research in learning effectiveness and in
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By describing the attributes of a simulation learning product to potential buyers. From this, the research community may be able to establish appropriate standards for particular learning objectives and be able to suggest how a particular simulation can be improved to achieve particular learning objectives.

Using such a framework may also clarify the attributes where simulations outperform alternative methods and enable the simulation community to change the performance metric. It is possible that simulations provide a more concrete learning from experience that is intrinsically motivating. This would compare favorably in comparison with classroom learning, which is usually more abstract, and more intrinsically motivating than non-simulation based e-learning.

If the simulation community can establish a framework to assess diverse simulation products, it may then be able to communicate with the mass media and potential customers with useful, judgmental opinions about the quality of the product – perhaps in a way that has been successful for video-games and may be catching on in the e-learning community (see tmreview.com or eqcheck.com for examples). According to the CLO article cited above, potential simulation users want to know, the cost and quality of products and what they achieve. Beyond a description of the product, from agreed standards and means of assessment, it may be possible to provide simple answers to these questions with a scoring system such as the example below:

<table>
<thead>
<tr>
<th>Ease of installation</th>
<th>9/10</th>
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</thead>
<tbody>
<tr>
<td>Ease of Navigation</td>
<td>7/10</td>
</tr>
<tr>
<td>Production quality</td>
<td>5/10</td>
</tr>
<tr>
<td>Instructional Value of content</td>
<td>5/10</td>
</tr>
<tr>
<td>Value for Money</td>
<td>6/10</td>
</tr>
<tr>
<td>Overall Value</td>
<td>5/10</td>
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(numbers shown are completely arbitrary and bear no relation to any product living or dead)

By doing this, we can begin to address part of the issue for the lack of real growth in the use of simulations in education and training, and only by understanding what it is about simulations, the attributes they have over other methods, can we establish a performance metric that is sufficiently different, knowing that there are benefits to the education and training community, its students, users and paymasters. If we know what attributes are important, we can then guide development or emergence of the platform(s) that most easily, effectively and usefully provide the benefits.

CONCLUDING THOUGHTS

This paper began in an attempt to answer why simulations are not yet the “killer application” for education and training that some have been suggesting it will be (by now) and why the market in terms of dollars and users is still such a small amount compared to the whole education and training industry. Estimates of actual usage are particularly difficult to know with any real certainty, but it is safe to suggest that there is more classroom-based training and education than simulation-based. It may be that there are gatekeepers preventing simulation accessing the training and education market because they threaten HRD and teachers or it may be that the innovators and early adopters of the technologies are not communicating the right messages to the potential market.

The industry is very fragmented and we are yet to see a dominant platform or player emerge and perhaps this is because the simulation advocate community has been reluctant to abandon performance metrics and evaluation that compare it with more traditional pedagogies, replete with semantic debate and a desire to make absolutely sure that simulations really are effective.

I have gone on to suggest that we can learn from other disruptive technologies and consider a mindset shift, develop a framework to aid research, communicate with the potential market, compete on new performance metrics, change the business model and guide the development of a platform on which simulations can be built. It is likely that without the establishment of standards that the industry will continue to fragment until a small group gets together and defines standards through success, will it be a Microsoft or a Linux?

REFERENCES


