DESIGNING THE TRAINING CHALLENGE

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ABSTRACT

This paper explores the detail design of a business simulation, the issues that arose during the design and the reasoning behind the design actions. The Training Challenge is a simulation that was likely to present particular design challenges because of its industry setting, short duration, ambiguity, uncertainty and dynamic behaviour. Unusually, perhaps uniquely, the Training Challenge replicates a training company addressing the issues facing a small service-based knowledge transfer business. Unlike other total enterprise simulations with similar learning purposes that last a day or longer, this simulation needed to be run in half a day as it was to be used as part of a one-day workshop and this very short duration would be a problem. Reflecting the decisions facing such a company, many are ambiguous and so it would be difficult for learners to predict the impact of their decisions. Because of nature of client demand the simulation needed to be stochastic and this could cloud the analysis of results. The need for learners to position their company in terms of portfolios of customers and services, manage the short-term, tactical development and the long-term, strategic development of the business would mean that dynamic calibration would be crucial. Finally, as the simulation was to be part of a Business Acumen Workshop, the simulation needed to link with and support the rest of the workshop. Overall this paper attempts to capture the issues and "reasoning" throughout the design of a new business simulation.

INTRODUCTION

The simulation was designed to allow training providers and training consultants (individual trainers) to hone and develop their business acumen and financial understanding experientially. It was to be half of a one-day business acumen workshop where the simulation ran in the morning with the afternoon discussion exploring and expanding on the issues raised in the morning. The workshop's purpose was to help the training consultants be more successful and through this build a relationship with them. Also, it was hoped that their exposure to a business simulation would encourage them to use simulations.

Table 1
Workshop Schedule

Activity	Time	Duration
Introduction	8:30 am	30 minutes
Simulation	9:00 am	4 hours
Lunch	1:00 pm	1 hour
Discussion	2:00 pm	3 hours
Close	5:00 pm	

DESIGN ISSUES

There were several issues impacting the design:
> Replicating a training business
> Short Duration
> Stochastic Model
> Novelty

TRAINING BUSINESS REPLICATION

As the simulation designer had over forty years' experience of the training industry and had run his own training firm for some thirty-five years, he had reasonable knowledge of the challenges facing a training business and felt these were:

- time management
- balancing the short with the long-term
- course and client portfolio management
- uncertainty and ambiguity
- selling and marketing
- cash flow & profitability

However, reflecting adult learning needs (Knowles et al, 1998) the afternoon discussion would need to allow the learners to add to and prioritise these.

Time Management: In common to most service businesses, allocating and managing effort (time resource) is a key driver of business success and the decisions should reflect this. The afternoon would discuss what was a reasonable mix of time between activities and the financial

impact.

Short vs. Long-Term: An ongoing problem associated with a small, training business is balancing short-term success with long-term survival. This means that it is necessary to balance effort directed towards short-term fee-earning work (consultancy and running courses) with long-term business continuity and expansion (through increasing the client base, course development and improvement, marketing, business improvement and personal development). This needed to be reflected in decisions and outcomes. The afternoon would discuss how one might balance the short and the long-term.

Portfolio Management: There is a need to manage portfolios of clients and services. This requires balancing the range of client groups and services with the amount of time required to manage them and the financial return. The range of client and services needed to be sufficiently wide and different to allow the learners to position themselves strategically based on each client group's strengths, weaknesses, opportunities and threats. The afternoon would discuss ways of segmenting clients and the risk/rewards for each segment.

Uncertainty and Ambiguity: A characteristic of a small training business is fluctuating and uncertain levels of demand. Fluctuation is a particular problem in terms of variations in client demand; client numbers and consultancy projects and this meant that the simulation had to be stochastic. Understanding the impact of marketing, selling effort, business skills etc. meant that there would be ambiguity.

Selling and Marketing: Here the learners would need to balance selling to existing clients (short-term) with gaining clients (long-term) where relationship, professionalism and service range are crucial for existing clients and, where trust, pricing, business image and professionalism are crucial for new clients. This meant that the decisions needed to cover allocating time to selling, prospecting, course development, etc. The afternoon would discuss and share tips on selling and marketing.

Cash Flow & Profitability: As with any business, the crucial financial aspects are cash flow and profitability. With cash flow there are the issues of a small business selling to large businesses and to other training providers (who might have cash flow problems) and profitability impacted by different fees and payment times. A further impact on cash flow and profitability is demand variation. The afternoon would involve a discussion of costing and client profitability.

SHORT DURATION

A mismatch would be likely to exist between the half-day duration and the scope of the Training Challenge simulation. Other business simulations with a similar purpose and scope (business acumen and financial understanding simulations) all had durations of a full day or more. Thus it was necessary to minimise the risk of cognitive overload when running the Training Challenge in half a day by having the learners make direct use of the simulation and decision limitations.

Direct Use means that the learners would enter their own decisions asynchronously. As a result interactions between teams in common marketplaces would not be possible but this would be acceptable as the learners would come from small organisations or be sole traders where an oligopolistic marketplace would be inappropriate. Asynchronous decision entry means that the decision-making cycle is not constrained by the slowest learners. Rather, teams enter decisions and simulate as soon as they are ready. As the simulation progresses, if one or more teams lag behind, they are pressured to increase the pace of their decision-making. The downside is that it is advisable to have a computer and printer for each team. Having access to computers is not an issue (as most learners would have a laptop with them) but the same would not be true for printers. As the learners enter their own decision the trainer is outside the decision-making loop and will make it more difficult to identify learning problems. To ease tutoring, the simulation would be run with the teams spread around a large room with charts to allow teams to share results, learn from each other and to encourage competition.

Decision Limitations: As shown by Hall and Cox (1994) duration is highly correlated with the number of decisions and this limits the number of decisions that can be incorporated, But, the number of decisions needed to cover the issues facing a training provider or training consultant adequately were likely to be more than the four or five suggested by the Hall and Cox model. This would be dealt with by reducing decision *granularity* (Hall, 2008) and by having several decisions made once only rather than every period. To maintain workload and hence maximise learning in the time available, decisions and issues would be introduced as the simulation progressed.

STOCHASTIC MODEL

In the main, a training company's demand is driven by the clients and varies quarter-to-quarter. This means that the simulation model needed to be stochastic and this would be a problem. If the random variation was too large it would be difficult for learners to link cause (decisions) with effect (results) as the results would be swamped by random variation, and learners would use this as an excuse for poor performance in the simulated world *and* for not learning. If the random variation was too small then it would be unrealistic and insufficiently challenging. Finally, testing and calibrating the simulation would be difficult if the randomness disguised whether abnormal outcomes were random or caused by design errors.

NOVELTY

Although a wide range of business simulations exist to develop business acumen, as far as the author is aware

there is no simulation that replicates a training company, its financial, marketing and operational structures and the issues facing it. This novelty was mitigated to some extent by the background of the designer but limited by the number of pre-existing models that could be used with little or no change and this would lengthen design time (Hall, 2007)

DESIGN PROBLEMS

It was felt that design problems and challenges would be ambiguity, granularity, stylisation and simplification (Hall, 2008).

Ambiguity: The combined effect of randomness and the nature of the decisions meant that ambiguity would be high and this would make it difficult for the learners to determine the way decisions impacted results (identify cause and effect). This meant that managing ambiguity was identified as a major design challenge.

Granularity: The Hall & Cox (1994) formula suggests that a simulation with a four-hour duration could have four or five decisions. However, the Hall & Cox investigation was of simulations where the decisions were very granular (where there were a wide range of possible values for each decision). As this simulation would have significantly more than five decisions, there was a need to reduce granularity (Hall, 2008) by limiting the range of possible values allowed for a decision.

Stylisation will be needed to ensure that learners can identify the causal links between decisions and results and ensure that they find the simulation an engaging, fun activity. Thus it would be necessary to amplify and speed the impact of decisions and, perhaps, make it easier to be profitable.

Simplification: As for granularity, simplification is necessary because of the short duration and meant that aspects of a learning business were not included. But this provided an opportunity to set the scene for subsequent discussion in the afternoon where the wider issues could be explored.

THE SCENARIO

The design of the scenario involved deciding the market situation (client groups), the services offered (courses and consultancy), time scale (the period simulated and how one steps through this) and the key resource (time) to replicate the key elements of a training consultancy,

CLIENT GROUPS

The simulated business would serve four client groups – large, frequent users; large, infrequent users; prestigious (reference) clients and training providers. These groups were chosen to raise several strategic issues and allow learners to position their business so as to maximize short-term profit and long-term survival and growth – balancing risk and reward.

Large, frequent users provide a stable flow of business but could become **a disproportionately large part of** the business with high impact if a client is lost.

Large, infrequent users require a reasonable amount of selling effort but on a client-by-client basis their use of services is infrequent and this means that the loss of an individual client would have minimal impact.

Prestigious (reference) clients provide a way of enhancing the image of the training business and the trust in it. Thus they help with winning new clients but with limited income and profit generation.

Training providers provide a flow of work requiring little selling and marketing but where profitability is low.

Having just four client groups is a simplification and, in actuality, a training business would have more groups and perhaps treat large individual clients as separate market sectors (a matter to be explored in the afternoon).

SERVICE OFFERING

Initially the training business would offer consultancy and three courses (A, B and C). But later new courses (D, E, F and G) could be developed and offered. Although, the range of courses could be increased, as course design would require considerable effort, it would not be necessary. Instead of growing the business by extending the course range, sales could be grown by increasing the number of clients and/or increasing the number of courses run for individual clients. Beyond adding to the product range, it would be necessary to update existing courses continuously to protect existing business. During the afternoon's discussion, the offering would be discussed in the context of differentiation and meeting market (client) needs.

TIME SCALES

The simulated business would be run on a quarter-by-quarter basis for eight simulated quarters. The choice of this time frame was to balance the exploration of strategic and tactical issues - the strategic issues associated with long-term business development and portfolio management and the tactical issues associated with time management and fulfilling client needs in the short-term. The eight quarterly decision-periods meant that the business could be run for two full years – with the first year providing a familiarisation and exploration of basic issues and with second year a more challenging environment, the introduction of further issues and the consolidation of learning.

RESOURCE MANAGEMENT

A (perhaps the) key training business resource is time and an appropriate, but limited, mix of tasks are:

- Fee Earning Work
- Servicing & Supporting Existing Clients
- Selling to Existing Clients and Prospecting for New Clients
- Business Development
- Administrative Work

Fee Earning Work involves doing consultancy and running courses. The amount of work derived on a client group and course basis is determined based on client need, client numbers, fees, selling effort and course quality. To reduce uncertainty to a manageable level seventy to ninety percent of work is pre-booked in one quarter for delivery in the following quarter.

Servicing and Supporting involves necessary pre and post course work that is unpaid. It includes advice, course preparation (printing documentation, etc.), travel to and from the course etc. Serving and supporting time is established based on client group, client numbers, course numbers etc.

Selling and Prospecting involves increasing business with existing clients (selling) and increasing the number of clients (prospecting). Selling and prospecting time is decided by the learners and provides a way to refocus the business portfolio.

Business Development is a range of tasks that have a long-term impact. Learners decide the time to spend on Course Updating, New Course Development, Business Improvement and Professional Skills Development

Administrative Work is work that is necessary to the operation of the business (filing, accountancy, etc.) Thus it is neither fee earning nor does it contribute the future of the business but, unfortunately, is necessary.

DECISION DESIGN

As shown below decisions were introduced progressively to maintain cognitive load and focus on specific issues at different stages in the simulation. Work effort and restriction were ongoing decisions. To limit cognitive load, capital investment, fee changes, and the marketing initiatives decisions were made once only. But capital investment and marketing initiatives could be made any quarter after introduction.

WORK EFFORT DECISIONS

Work Effort decisions involved deciding the amount of time (in whole days) to be spent selling to and prospecting for individual client groups, updating courses, developing new courses, business improvement and for professional development (Figure 1).

Selling Effort has an impact on sales to existing clients but reflecting that clients also initiate course demand, some courses are required by clients even if there is no sales effort. The client groups have different selling effort needs, with, for example, for Client Group 4 practically *all* the work being initiated by the client. Also, there is a limit to the number of courses required by clients and so at some point selling effort has no further effect. In the afternoon Selling Effort would be discussed together with the need for and ways of growing and maintaining the relationship with clients.

Prospecting Effort has a longer-term impact and allows learners to make major structural changes to their client portfolio. Getting a new client is a combination of potential clients, fees, prospecting effort, market image and professional skills. This allows a discussion in the afternoon on marketing push and pull and the promotional mix.

Course Updating involves deciding how much time to devote to updating the least up-to-date course. As time passes the quality of a course declines and impacts learning, leading to client dissatisfaction, a drop in demand and, possibly, client loss. To limit cognitive load, the course to update was selected automatically rather than decided by the learners and only one course is updated each quarter. This is a simplification and in actuality, training providers would decide which course to update based on its up-to-datedness and factors such as strategic importance – a topic to discuss during the afternoon. Also, they might update multiple courses in parallel (with, perhaps, reduced productivity).

New Course Development involves deciding how much time to devote to developing a new, one-day course.

Table 2
Decision Groups

Decision Group	Introduction
Work Effort	Throughout
Restrict Work	Quarter 3 onward
Capital Investment	Quarter 4 onward
Change Fees	Quarter 5 only
Marketing Initiatives	Quarter 6 onward

Figure 1
Initial Decision Screen

Decisions	Y1 Q1 TEST			
	Group 1	Group 2	Group 3	Group 4
Selling (days)	1	1	1	1
Prospecting (days)	1	1	1	0
Updating Courses (days)			2	
Creating New Courses (days)			2	
Business Improvement (days)			1	
Professional Development (days)			1	

The effectiveness and speed of new course development (and course updating) depends on professional skills and business efficiency. To limit cognitive load, learners did not have the option to decide the course subject matter or it's duration and this would be an afternoon discussion topic.

Business Improvement involves deciding how much time to devote to improving business efficiency and marketing effectiveness *and* (from quarter 6 onward) deciding marketing initiatives. This decision was to provoke discussion (during the simulation and during the afternoon) about investment in business improvement and how one might assess the impact pre and post hoc.

Professional Development involves updating and increasing personal skills. Arguably, for any businessperson, continuing professional development is crucial (Megginson and Whitaker, 2004) and 30 hours a year (one day a quarter) is a common requirement. In the simulation, one day a quarter maintained skills at the starting level (average) but to build skills and maintain them at a higher level more time needed to be spent. Besides emphasising the need for CPD, this decision provided a discussion topic for the afternoon both in terms of the amount of time to spend and the form of CPD.

In the afternoon workshop, these decisions would be used to discuss how one should spend time on fee earning and non-fee earning work and balancing the short and the long-term.

INVESTMENT DECISIONS

It was desired that the learners should learn about the financial aspects of capital investment (such as ROI and payback) as well as introduce a hierarchy of capital and learning investment. To cover differing investment situations three investments were included – a new printer, a new computer and replacing software. These decisions were introduced from period 4 onwards to allow the learners to become familiar with the Work Effort Decisions and reduce workload in the first three quarters.

New Printer Decision involves the use of a laser printer in place of an existing ink jet printer. Because of printing cost per page and printing speed, up to this point course documentation had been printed at a copy shop with the cost charged back to the client. With the laser printer, documentation printing would be brought in-house with the clients being charged the copy shop price, providing a new revenue stream (Figure 2). But bringing printing in-house will involve time (Figure 3) and this has an opportunity cost.

Financially both the non-duplex and the duplex printers are very, very attractive with payback being respectively four and six weeks. But, besides financial considerations there are operational considerations and the outcome of the new printer decision was chosen to necessitate learners considering the impact on workload (Figure 3).

Consequentially, on a purely financial payback basis, the non-duplex printer is most attractive (payback in 4 weeks rather than 6 weeks). But, where time is a limiting resource, the opportunity cost of the printing time means that the non-duplex printer is not attractive if it limits fee-earning work. The duplex printer is only attractive where it displaces consultancy work and with daily fees less than 115 AUs.

The model was calibrated so that pulling manual printing in-house using the duplex printer added just over a day to the quarterly workload. This amount was chosen so as to be large enough to impact workload and, possibly, restrict fee-earning work but not so large that it would really hurt profits. The decision allowed a discussion of ROI, payback and opportunity cost during the afternoon.

New Software Decision involved replacing existing word processing with the latest edition. When deciding to replace there is the need to determine whether the latest edition provides additional, useful functionality (that will improve efficiency and capability) and the extent to which time needs to be spent learning about the new software. Unlike the printer decisions where it was possible to assess ROI before making the decision, for the software it was impossible to assess efficiency improvements before use and capability improvements before long-term use.

Figure 2
Financial Impact of New Printers

Option	Non-duplex	Duplex
Capital Investment	40 AUs	60 AUs
Documentation Pages	10,000	10,000
Copy Shop Cost	160 AUs	160 AUs
Material Cost	40 AUs	40 AUs
Net Documentation Income	120 AUs	120 AUs
Payback Weeks	4 weeks	6 weeks

Because of this, it was decided that a decision option would be a free evaluation version of the simulation. Although *free*, the evaluation would involve half-a-day administrative work. The new software would require a day to become familiar and the opportunity cost of this coupled with the purchase price, the efficiency improvements were calibrated to that that payback would be around five years and ROI unattractively low (around 12%). However, although in purely financial terms, the new software is unattractive, it does improve capability (email, newsletter, *flashier* course documentation) and through this more effective selling to existing and new clients.

New Computer Decision involved purchasing a new computer that could replace the existing computer or be used in parallel with the current computer. Again it is not possible to forecast ROI or payback pre-purchase and difficult to assess post purchase. But there was another issue associated with this decision – the necessity of having a computer. To emphasise that some investments are necessary to mitigate risk rather than discretionary, both the old computer and the new computer would break down and these breakdowns would waste a day unless a new computer is bought and the old computer kept.

Investment Hierarchy depends on whether the investment is required to improve operational efficiency (in the short-term); tactical effectiveness and risk mitigation (in the medium-term) and strategic investment to improve business effectiveness (in the long-term). In the afternoon the hierarchy would be explored and initiate a discussion about the ROI assessment of learning and whether ROI assessment is appropriate for all types of learning.

FEE DECISIONS

At the start of the second simulated year, learners can change the fees they charge on a client-by-client and service-by-service basis for the whole of the second year. The decision to delay the decision was to reduce cognitive load in the early stages of the simulation. Allowing only one change in fees (Quarter 5 provided time to explore other issues in the second year and, giving learners only one chance to change fees would force them to think carefully and deeply about the decision.

But, giving the learners just one opportunity to adjust fees (a highly ambiguous decision) presented a problem. This was overcome by providing comments about client perceptions about fees when checking the decisions before simulation and this allowed the learners to refine their price decisions at the decision-entry point.

In afternoon, pricing strategy and client profitability would be explored further.

WORK RESTRICTION DECISION

Besides shifting work between the client groups using selling, prospecting effort and pricing, the amount of work done for a client group can be restricted. From Quarter 3, the maximum number of day's fee earning work can be set for individual client groups. The timing of this decision was to reduce initial cognitive load and because, by the third quarter, fee earning work might need to be restricted. It was felt that the decision should cause reflection and discussion on customer segmentation and maximising profitability. (Originally, it was envisaged that the work restriction decision would be from period 6 onwards. But, during calibration it was realised that work effort was too great earlier and so this decision was introduced earlier.)

DECISIONS DESIGN PRACTICALITIES

Decision Structures: The introduction of new decisions as the simulation progressed coupled with the ability to develop and launch up to four new products meant that there was a need for twenty-six different decision entry structures that would be selected "intelligently" before decisions entry. This was to ensure that only the possible decisions were displayed meaning that learners were not faced with irrelevant, perhaps confusing decisions and this simplified and shortened decision entry.

Decision Checking: Because the simulation was to be used directly by the learners, rigorous decision checking was vital. Specifically *illegal* decisions (such as multiple purchases of software, printers and computers) and *unusual*

Figure 3
Time Impact of New Printers

Option	Non-duplex	Duplex
Net Documentation Income	120 AUs	120 AUs
Printing Time (days)	2.08 days	1.04 days
Documentation Earnings/Day	58 AUs	115 AUs
Lowest Fee/Day	80 AUs	80 AUs
Net Income/Day	-22 AUs	+35 AUs
Total Net Income	-46 AUs	+36 AUs

decisions (such as completely withdrawing from a market sector) were identified and learners informed. Because of links between decisions are complex and the timing of their introduction varied the decision checking logic was complex.

Granularity: To reduce granularity (Hall, 2008) and hence shorten duration, it was decided that all the time allocation decisions would be in whole days (rather than fractions of days or hours) and the investment and marketing initiative decisions multiple choice. The granularity of the time allocation decisions was reduced further by limiting the total number of days to work each period to 60 where only about half could be decided by learners. To reduce the granularity of results and fee decisions a mythical currency (the Account Unit or AU) was used to allow the numbers to be small (a fifth to an eighth of the size they would be if the dollar, euro or pound were used).

Ambiguity: As these decisions are highly ambiguous (i.e. difficult to quantify their cause-effect relationship) this had to dealt with by the results and by providing comments before and after the decision was introduced.

MODEL DESIGN

The financial elements of the simulation were clear-cut but demand generation; work effort; client relationship; client loss & acquisition; learning quality models and business improvement models were not.

DEMAND GENERATION MODEL

These factors impacted the demand for a service - typical demand/client, demand variation, selling time, impact of relationship, course quality, fee charged and whether the work was to be done in the current or future quarter.

Typical Demand/Client varied by client group and service type. But, to reduce uncertainty and limit cognitive load, the level did not vary over time and was not seasonal.

Demand Variation was stochastic that determined whether a course was run or not.

Selling Time (as described earlier) even if no time is spent selling there was some demand and, eventually, the impact reached a limit (and at this point a comment suggested that the clients were *really cherished*).

Relationship was the extent to which the client was close to the business (as described later)

Work Timing meant that some work was done immediately (in the quarter that it was booked) and some work booked to be done in the following quarter. Because of the impact on uncertainty and the ability to plan, the mix between immediate and future work was crucial and it was felt that a reasonable balance was that the majority (70% to 90%) of the worked being booked for the next quarter. However, as clients do not always run courses, some of the future work is cancelled in the following quarter. But to limit uncertainty, this would only be an issue for Client Group 4. This is a simplification as, in actuality, courses might be booked much further ahead and this would be explored in the afternoon.

WORK EFFORT MODELS

These models calculated whether the effort was too great and, if appropriate, reduce it, involving a process (Figure 4).

Pre-booked work is work booked the previous quarter to be performed in the current quarter. If this is too great courses would be cancelled randomly until the overload is eliminated and these cancellations would have a major impact on client relationships.

Work booked this quarter is the work booked in the quarter to be performed in the quarter. If there is insufficient time or the work exceeds the amount set for a client group work will be refused randomly. These refusals will have an affect on client relationship but less than where pre-booked work is cancelled.

Administration and Servicing Work is unavoidable and, if there is insufficient time to do it during the normal working quarter then more days will be worked. In actuality long hours would reduce productivity, but this was not be modelled as it would produce a dynamically unstable situation – where lower productivity would reduce the amount of work performed leading to working longer

Figure 4
Effort Calculations Sequence

Work Effort	If too much work
Perform work booked previous quarter	Cancel pre-booked courses & consultancy
Perform worked booked this quarter	Refuse courses and consultancy
Administration & Servicing Work	Work longer than desired days
Selling, prospecting and development	Reduce equally the time spent on these tasks
Future work	Refuse if too great to be handled in next quarter

than desirable and this would reduce productivity – a vicious circle. Instead of impacting productivity, comments (such as *"partner threatens divorce over time worked"*) are made.

Selling, prospecting and development time is seen as avoidable and if there is insufficient time will be reduced proportionately. This is a stylisation and simplification as in actuality, when time is short, work would be prioritised.

Future work is the work booked for delivery the next period. Here, where the work is greater than the total time available (or where, for an individual client group, it exceeds the time set for that group), work will be refused randomly (with some impact on the relationship).

CLIENT RELATIONSHIP MODELS

Managing and developing the relationship with clients is recognised as key (Godson, 2009) and these models would provide a discussion framework (as illustrated by the slide from the afternoon's workshop (Figure 5)). The factors improving the relationship are the length of the relationship, selling days, course success and professionalism. In contrast, the relationship is impacted negatively by lack of contact (selling days), outdated courses and having to cancel or refuse work. In the afternoon, this is discussed and extended to *"What other things improve and destroy [client relationship]?"*

Figure 5
Discussion Slide

Client Relationship

What improves it?
– Regular Contact
– Good Courses
– Professional Support

What destroys it?
– Neglect
– Bad Courses
– Unreliability (cancellations & refusals)

What other things improve and destroy?
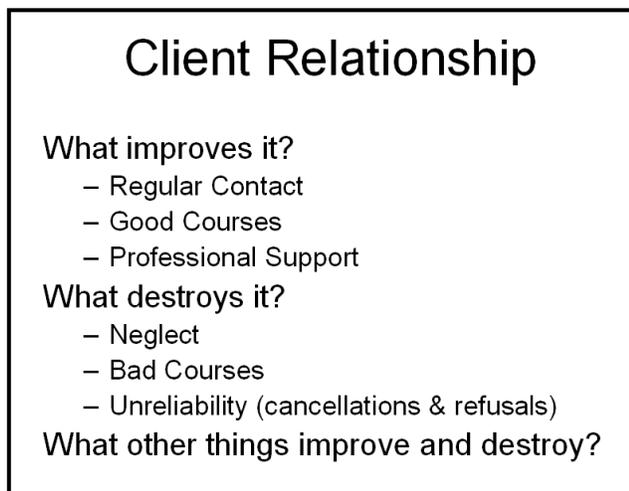
LEARNING QUALITY MODEL

Ultimate success is delivered by the quality of learning delivered and although in actuality many factors influence this, in the simulation there were just two factors – course age and professional skills. Where, the course age aspect is impacted by updating and the professional skills impacted by the time spent on developing and refreshing professional skills. Further, learning quality impacted both course demand and client loss (Figure 6).

CLIENT LOSS AND ACQUISITION MODELS

Client Loss was a combination of clients naturally changing suppliers and losses due to poor service, poor quality and inadequate relationships. Originally, it was decided that just the total client loss would be shown but it was then decided that this was too ambiguous and, so, losses were shown separately for natural (client initiated), service, quality and relationship.

There were two sources of new clients, those based on prospecting time and those based on the clients searching for new suppliers. Initially, it was decided just to show the total new clients gained but then (to reduce ambiguity) it was decided to also show whether these were initiated by the client or gained by prospecting.

Both client loss and acquisition had a stochastic element.

MODEL DESIGN PRACTICALITIES

Ambiguity: Because a significant number of decisions were ambiguous, a sizeable part of the model was concerned with providing *comments* for the learners and unravelling the ambiguity for the tutor and the designer. Throughout testing, the question was asked *"will learners be able to link cause and effect?"* and where this might be difficult comments for the learners and reports for the tutor/ designer were added.

Size: Initially, it was hoped that the simulation model would be similar in size to other business acumen simulations but the simulation's complexity and novelty (Hall, 2007) might mean that it was much larger. In actuality it was more that double the size of other business acumen simulations designed by the author.

Figure 6
Learning Quality Interactions
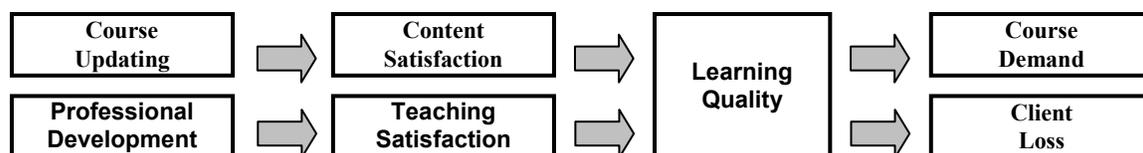
RESULTS DESIGN

There were several groups of results:
- Team Reports
- Review Reports
- Reconciliations & Design Validation Reports
- Design Calibration Reports

TEAM REPORTS

These were the results provided to the learners each quarter. These were printed and the learners could display individual reports on the screen. Like decisions, the results provided to the learners were introduced progressively so as to maintain cognitive load (Hall & Cox, 1993) and focus on specific issues at different stages. Initially seventeen different reports were produced (three pages of results). These included client initiated cancellations, actual time spent, future work, course and client information, financial results and comments on the results and issues. During the design, the reports were repeatedly assessed and detail reduced to reduce cognitive load or detail added to reduce ambiguity.

REVIEW REPORTS

These summarised the *whole* simulation and provided an analysis of business performance at the end of the simulation to allow the teams of learners to compare and discuss their results. To an extent, these overlapped with the Design Calibration Results (described later). The design of the review results was done in two stages. During simulation design they were based on perceived needs and results. But after running the simulation several times, additional reports were created that took into account actual learner behaviour.

RECONCILIATIONS & DESIGN VALIDATION REPORTS

Reconciliations reports detailed, explained and expanded on *white-box* (accounting, investment and operational (time allocation) calculations. They were available to the trainer but not to the learners but not because these reports would provide inappropriate information, rather it was because providing them would increase cognitive load significantly. Some reconciliation reports were produced as the simulation models were designed; other reports were created during testing and others following piloting. The reports added when testing were added when clarification was needed. During the pilot, questions raised by the learners indicated a need for further reconciliation reports. Beyond the results for the trainer, were the ones used during the design of the simulation to help validate the correctness of the *black-box* models (demand generation, relationship, course quality, etc.). The reports produced by the simulation were validated further using small spreadsheet models.

DESIGN CALIBRATION REPORTS

These results were used to help adjust the *calibration* of the simulation. They included reports that analysed the business and revealed how decisions impacted the results. This is illustrated in Figure 7 that reveals the raw data behind the prospecting model showing the current penetration of the client group, the days need to get the next client, etc.

RESULT DESIGN PRACTICALITIES

The key issues were cognitive load, ambiguity, result structures challenge and engagement.

Cognitive Load was also a problem with three pages of results produced each quarter. Because of this there was a need to reduce detail and this was done by only displaying relevant information, using a mythical currency,

Figure 7
Calibration Report

Prospecting Model Year 1 Quarter 1	
Group 1	Y1 Q1
Penetration %	43
Days Needed	7
Fee Response (new)	1.00
Accumulated Prospecting Impact	0.9
New Clients	0

Figure 8
Development Impact

Development Summary Year 3 Quarter 1	
Course Updating (days)	2.0
Course Updated	D
Updated Quality	v.poor
Course Development (days)	2.0
Course being developed	E
New Course Completion %	21
Days to Completion	34
Business Improvement (days)	1.5
Work Efficiency	Poor
Market Image	V.Poor
Professional Development (days)	0.5
Professional Skills	average
Development Days	5.9

restricting time detail and using comments. For example, in terms of relevance, only the courses cancelled by clients were displayed. Also, using a mythical currency mean that financial results could have fewer significant figures. Time results were displayed to one decimal place (Figure 8) and Professional Skills could be v.good, good, average, poor or v.poor (Figure 8).

Ambiguity: A problem with the simulation was the *ambiguity* of the links between decisions and results. An example is the Development Summary (Figure 8) (that shows the outcomes of the Development Decisions. Course Updating was straight forward as all that was needed was to show the course updated and the quality after updating. New Course Development was more ambiguous. Originally, just the completion % was reported but then a forecast of days to completion was added. The impact of Business Improvement and Professional Development were highly ambiguous and this was overcome by low granularity comments about Work Efficiency, Market Image and Professional Skills.

Ambiguity was reduced further by providing *comments* that included remarks from learners about course quality and from clients about fees.

Result Structures; Just as the decision structures were complex, so too were the result structures as the simulator had to decide intelligently which reports to print and display.

Challenge & Engagement: Here, beyond the design of the simulation's dynamic response (with increasing challenge, the introduction of new decisions etc.) it was decided that the learners would *share* information about progress. To help speed-up the decision-making of stragglers, each team had a sign that showed their current quarter. But to encourage reflection, key decisions and results were written on large charts to boost inter-team competition and to increase the information available for decision-making. Also *Success Awards* were made for course quality, website etc. When won, the simulation informed of the award and a placard was provided for the winning team to display.

EXPERIENCE DESIGN (CALIBRATION)

Here the concern is the dynamic behaviour of the simulation as the learners run their business. Beyond ramping the decisions and results during the simulation, the challenge and engagement must evolve (Hall & Cox, 1993)

LEARNER DOCUMENTATION

The Learners' Documentations comprised the Learners' Manual, Briefing Slides, New Decision Briefs, Awards, Posters and Online Help.

The Learners' Manual is the first part of the learner's experience and needed to be sufficient to describe the activity; the business to be run; the decisions to be made; the results and (as the simulation would be used by the learners) how to use the software. The description of the activity and how to use the software were unambiguous but to stimulate thought and discussion, the description of the business was ambiguous. The design of the learners' manual involved balancing brevity with ensuring adequate information and the necessary *clues!* For example, results could have be provided for a whole year (four quarters) or just the last quarter. To shorten familiarisation time, it was decided that just a single quarter's results would be sufficient. The sufficiency of the learning manual was checked to see if it was adequate for the learners to do a rudimentary SWOT analysis. The Learners' Manual is short (consisting of ten pages).

The Briefing Slides were designed to provide a quick overview of the simulation, the task, decisions, results, using the software and learning through simulation. To minimise duration there were only eleven briefing slides.

New Decision Briefs were necessary to detail the decisions that were introduced as the simulation progressed. The quarter before a new decision was introduce the simulation warned the learners of the impending decision and asked them to get the brief from the trainer (that provided detailed information about the decision).

Awards were made for course quality, the website etc. and were printed on card and laminated so that they could be used for several workshops.

Posters were spread around the room providing key business knowledge. These provided for discussion on arrival, during breaks and lunch and sensitised learners to issues and make best use of *dead* time.

Online Help consisted of several hundred pages of context sensitive help that explained the current task, report or result.

The design of the learners' manual, briefing slides and online help pages were started at the beginning of the design process and evolved as the design progressed. This helped focus the design and communicate with the sponsors (clients) paying for the simulation. The posters were developed from the afternoon workshop slides. The awards and new decision briefs were developed as these were built into the simulation.

STARTING SITUATION

In financial terms, the starting point for the simulation was low profitability but reasonable liquidity. But, it was envisaged that sales growth would increase profitability (at the expense of liquidity). Initially there was little *surplus* time (capacity). But this surplus would evaporate, leading to a lack of capacity that would force learners to discuss and determine priorities. All courses would be reasonably

up-to-date. Market Image and Business Efficiency would be low, providing an opportunity for improvement, but expending time to do this might be at the expense of short-term sales. Professional Skills would be average and would remain at this level unless more time was devoted to Professional Development. This starting position was chosen to build engagement as the learners improved profitability and drive challenge as the learners handled the lack of capacity and prioritised how they allocated time between the short and long-term.

FIRST YEAR

Here the learners will be familiarising themselves with the task, their fellow learners and beginning to understand the business. The focus would be on growing profits by increasing sales to existing clients and (perhaps) increasing the client base. However, by the middle of the year, the time resource would be fully utilised and learners would need to focus on capacity utilisation – perhaps by eliminating selling days for the low profitability Group 4 clients, limiting Group 4 work and stopping new course development. These changes that would release capacity for additional fee earning work, selling to the higher profitability Groups 1 and 2 clients, business improvement and professional skills development. By the end of the first simulated year, the learners should have a rudimentary resource utilization (capacity) strategy that they could then hone in the second year as they built income, profit and capability. *Traps* built into the first year were the introduction of a new course and the printer decision. If new course development time is maintained for the first three quarters, a new course will launch in Quarter 3 adding significantly to workload. Likewise, if a new printer is purchased in Quarter 4 it too will add workload. If these are not planned for, then there would be insufficient time for selling, prospecting and development.

SECOND YEAR

In the first quarter, learners have the opportunity to change client fees for the year. Doing this should force them to review the previous year and especially capacity use and client group profitability. From quarter 2 onwards they can improve their market image through Marketing Initiatives, but only if there was sufficient time. Further, the second year is when *"the chickens come home to roost"* (Chaucer, 1390) and ad-hoc events (Hall, 2008) were pre-planned for this year. These were computer breakdowns and the possible loss of a group 1 client.

Computer breakdowns as both the new and the old computer would breakdown and, unless a new computer was purchased and the old computer kept one day would be lost while the computer is repaired.

Loss of Group 1 client will occur in Quarter 6 if the number of the group's clients exceeds 4 and penalises for having *"too many eggs in one basket"* (Murphy, 1763).

The simulation calibration was such that it would be attractive to increase the number of clients in the group and through this profitability.

Capacity: Also, during the second year, time allocation becomes a major issue, that can be addressed by fee increases and restricting client work.

ENDING SITUATION

Here the concern is that the business is a continuing entity that is profitable (and liquid). Income growth over the simulation can be some 70% and, because of the fixed cost nature of the business coupled with low initial levels of profits means that growth in profits can be extremely high.

The Performance Summary report (Figure 9) summarises performance by assessing key measures against norms to indicate where a company is strong and weak. The measures include long-term measures of the past of profitability, daily income and client growth, together with indications of where the company is now and the future (time management, quality, relationship etc. and an overall rating (the Performance Summary line).

Figure 9
Comparative Summary

Performance Summary Year 2 Quarter 4	
Profitability Performance	v.good
Daily Income Performance	adequate
Time Management Performance	v.poor
Client Growth Performance	v.good
Quality Performance	good
Relationship Performance	adequate
Professional Skills Performance	good
Market Image Performance	v.poor
Performance Summary	adequate

REVIEW

Key to ensuring learning from a business simulation is the review session (Thiagarajan, 1995) where learners and the trainer discuss and compare results and ensure transfer to the real world. Normally, the review will be a stand-alone session at the end of the simulation. However, to save time, the review was embedded in the afternoon's discussions. As the design progressed, individual slides and the associated notes were developed for the afternoon. Because learner interaction was required, these slides were designed to facilitate "Socratic Questioning" (Whitely, 2006) and this meant that many slides included a discussion question (illustrated in Figure 5) with the notes including possible topics. Because the slides were added in an ad hoc way there was a need to reorganise and group them. This was done in a low tech way - the slides were printed six to

a page, cut out and the *pack* shuffled into the desired sequence! To check duration, a spreadsheet listed the slides, time estimates and discussion activities.

EXPERIENCE DESIGN PRACTICALITIES

Interactive Process: Having determined how the simulation experience should evolve the next step was to set the parameters and if necessary modify the models. This was an iterative process where the dynamic responses were tested to see if the simulation evolved as required and that the links between decisions and results could be identified. But, as decisions and results interacted, this process was not clear-cut as illustrated by the learning quality interactions (Figure 6). Initially the simulation was run simulating Year 0 (the prior year) and Year 1 (the first year simulated) with a base-line set of decisions that would be used to set the starting position (Year 0 Quarter 4). Then a second base-line position was created where the simulation was run for Year 1 and 2 without changing the initial decisions. Next the Year 1 and Year 2 were rerun with both foolish and sensible decisions to see the extent to which the company could loose money or be profit making.

Cash Flow: Reflecting the importance of managing cash flow it was planned that this would be a growing concern as sales and hence accounts receivable grew. But, the calibration runs showed a major problem as the profit generated before depreciation was more than sufficient to fund increases in accounts receivable and investments in new equipment. Reflection, suggested another solution.

Instead of owning the automobile (as a depreciating asset), the automobile would be leased (involving quarterly cash expenditure). This improved the situation but not enough. Then the investment on office equipment was halved but even this did not dealt with the cash flow problem. As the asset base was now much smaller, return on investment was too high and this was resolved by increasing the office operating costs. But despite these stylisations it was not possible to build in liquidity problems, meaning that cash flow would not be an issue but discussed in the afternoon.

Cognitive Load and Duration: To check that short duration was viable, the time taken to make each decision was estimated as shown in the workload pattern (Figure 10).

Stylisation: Beyond the cash flow stylisation, it was decided that unlike the real world there would be no inflation, seasonal and cyclic demand patterns. This reduced cognitive load and focused on key, strategic, issues rather than tactical, control issues. Another stylisation was the use of a universal currency (the Account Unit (AU)) that allowed the numbers to be smaller than if $, £, € or ¥ were used (reducing granularity and cognitive load). Also, it meant that the simulation could be used around the world without changing the currency and adjusting the parameters (as would be necessary to take into account differences in exchange rates, costs and fees).

Learning: It was felt that a major factor impacting the simulated training business was workload (time resource) relative to capacity and there were two possible situations. One where work levels were below capacity and one where

Figure 10
Decision-making time forecasts

Cognitive Workload Estimates
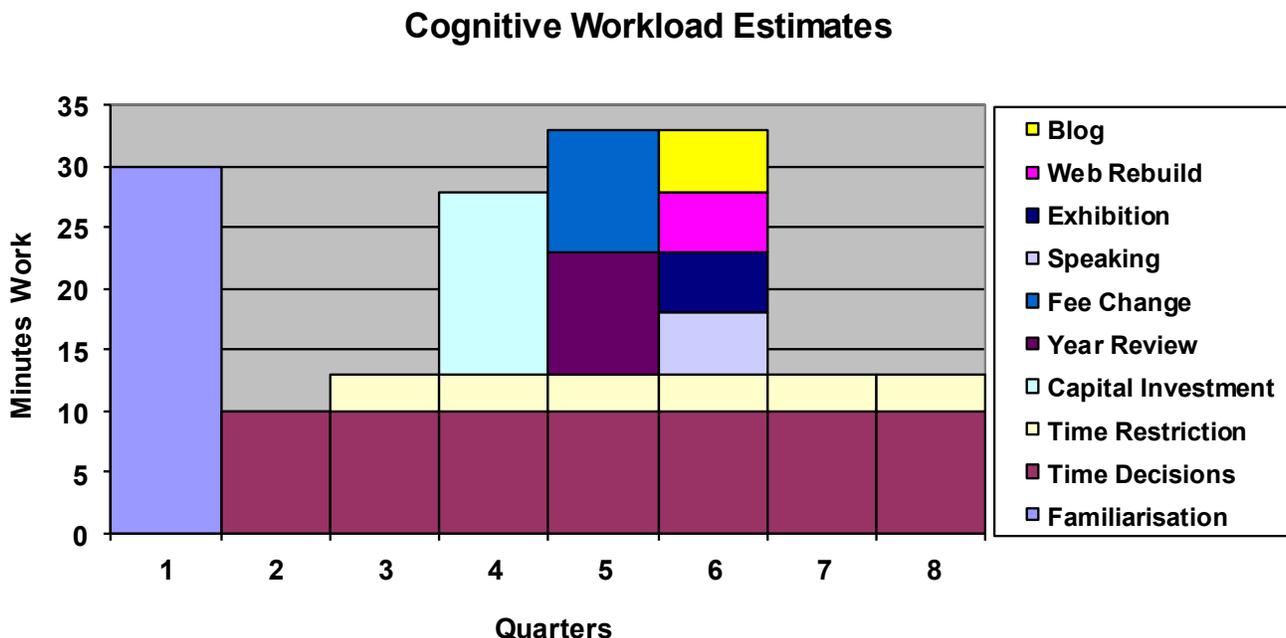
the work levels were initially near full capacity and then rose leading to under capacity. It was decided that the full and later under capacity situation would be used as this would force learners to prioritise how they directed effort and this would stimulate discussion about the short and long-term and especially tradeoffs between growing sales and business development. In contrast, if the over capacity position was used then an obvious solution would be to grow sales and there would be no need to curtail business development and this would involve little discussion and differing viewpoints. Unfortunately, as described, full/ under capacity meant that cash flow was not an issue. In the afternoon, learners would have the opportunity to discuss the issues and strategies associated with an over capacity situation.

Links to the Workshop: As previously mentioned throughout the design, links were built to the afternoon discussions. Simplification meant that the simulation did not cover everything but this facilitated discussion in the afternoon where the trainer and the learners explored and expanded on issues raised by the simulation.

DESIGN FOR QUALITY

Design for quality involved design documentation, testing and piloting the simulation and checking links to the workshop.

DESIGN DOCUMENTATION

This consists of the tutor's manual, in model documentation and online help pages all of which were created as the design progressed. The online help was further checked and where necessary modified when the simulation was piloted. Additionally, because of the relationship to the workshop a series of slides were created as the design progressed for the afternoon

The Tutor's Manual documented the simulation models. This was created as algorithms were added to simulation models. However, this meant that the document was unstructured and so as part of the finalisation stage of the design was editing and restructuring the Tutor's Manual.

The In-model Documentation succinctly described each model line to help during logic testing and facilitate future modification and customisation.

The Online Help Pages described each variable, report and comment to provide explanations as required by the learners. Whenever a variable or report was added to the design, a help page was created for it. Even where only the tutor-designer would see the variables and reports these pages explained them as there is the risk that the tutor-designer might *forget* what a report or variable meant!

Afternoon Discussion Slides were also created as the design progressed. Not only did this ensure that there was a link between the simulation and the afternoon but served to check the relevance and completeness of the issues explored by the simulation.

DESIGN TESTING

Throughout the design the validity and quality of the model was checked and tested but, beyond this, the final stages of the design involved checking the logic, sensitivities, stability, understandability, cognitive load, engagement and learning.

Logic Checking was particularly important because of the complexity of the model. It involved developing special reports to test the models, small spreadsheet models (see later) and stepping through the model checking to see how variables changed. Although this was done as the design progressed, it is useful to revisit this and check that the help screens adequately explain the logic.

Sensitivity Testing ensured that decisions had a noticeable impact on results. This involved running the simulation with a range of decisions across the spectrum. Besides the team results, the design calibration results were used during this testing

Stability Checking ensured that it was impossible for learners to get into an untenable and unrecoverable situation. It was a particular issue because of interactions between decisions (Figure 6) and because individual decisions impacted several results.

Understandability Checking ensured that the briefing, the learners' manual and online help were clear and the decisions and results were suitably ambiguous. This involved revisiting the on-line help and creating new reports to clarify.

Cognitive Load was a prime concern and was considered throughout the design. But, the ultimate test was in use and so checking it was a key aspect of the simulation pilot.

Engagement is always a concern and is impacted by cognitive load, relevance, perceived success and learning. As with the cognitive load the ultimate test was the pilot.

Checking Learning was simplified because the simulation was used as part of a workshop with discussions subsequent to the simulation. Ultimately, as the workshops are run. checking learning continues based on the feedback from the learners. This is particularly relevant as these were experienced business people with a vested interest in learning how to improve their business..

Spreadsheet Models: Throughout the design, small spreadsheet models were developed to help with logic design, calibration and to check calculations. Thirty-one spreadsheets were developed. Of these, 6 (19%) helped with logic design; 12 (39%) helped with calibrating the simulation and 13 (42%) helped to check calculations

THE PILOT

The final stage was to *pilot* the simulation. This was done with a single small team of learners. (To save time the

whole workshop was not piloted – just the simulation). During the pilot, the designed observed the learners and made notes of issues that needed to be addressed (a to do list (Hall, 2011)). Following the use of the simulation, it was discussed with the pilot group and their suggestions reflected on and incorporated.

QUALITY ASSURANCE PRACTICALITIES

Creating the design documentation as the design evolved ensured that it was done and done in the most efficient way. Logic checking, sensitivity testing and stability checking were done in parallel to design and calibration. Checking understandability, cognitive load, engagement and learning were done during the pilot.

A second issue with quality assurance is how it impacts design time. As design time is correlated with model size (Hall, 2007) a way of forecasting the impact of quality assurance is to determine the size of the models dedicated to testing and calibration and comparing this to the total model size. But, this would be difficult because of the time involved and the difficulty in identifying the algorithms associated with testing and calibration. This meant that a second approach was necessary. As the simulation was developed the size of the model, number of variables, number of reports and number of help screens were recorded regularly. It was apparent from this data that the model size was highly correlated with the number of reports (R^2 =0.985). As it was possible to separate out the reports necessary for learning from those required by design (for testing and calibration), the relative numbers would allow one to estimate the time related to quality assurance. Of the 195 reports, 71 (36%) were to provide learning (during use) and 122 (64%) were to support design. As the Training Challenge was a complex, ambiguous and novel simulation where the simulation model was more that twice the size of other business acumen simulations it is possible that the proportion of the simulation model and design time associated with testing and calibration is larger, perhaps, much larger than usual.

CONCLUSIONS

Although this paper addressed the issues specific to the design of a particular simulation there are several aspects that may have wider implications.

SIMPLIFICATION AND STYLISATION

Duration and cost constraints mean that a business simulation is a simplified and stylised abstraction of the real world (Merkuryeva G., 2000). But simplification and stylisation must be done purposefully, so the impact on learning can be gauged, implications established and, as necessary, dealt with by other learning. Here, simplification and stylisation were used to prime learners for the later

discussions and allow the learners to reflected on the issues before they were revisited in the afternoon of the workshop.

AMBIGUITY

As the Training Challenge involved highly ambiguous decisions, handling this was a major design challenge. There are several issues associated with ambiguity that must to be considered. First, many real-world situations are ambiguous. Second, although, arguably, ambiguity involves deep cognitive processing, ambiguous decisions lengthen decision-making and make it difficult for the learners to identify how their decisions impact results (link cause and effect). During design it is necessary to identify the degree of ambiguity for both decisions and results and take action to adjust or mitigate it..

INTEGRATING WITH OTHER LEARNING

Here the concern is how the simulation relates to the other learning. Here the simulation was an initial and integral part of a one-day workshop and as such it needed to integrate with and support the following part of the workshop. It would introduce issues that, later, would be discussed and expanded on. Using the simulation before the content session was predicated on the shortness of the workshop and the fact that the learners would be experienced training professionals. Thus the simulation acted as an *ice-breaker* and primed the learners to proactively discuss and interact in the afternoon.

If the simulation had been used *after* rather than before the other learning, there would be a different need - a need to ensure that the knowledge from the prior learning was adequate and related to the issues explored by the simulation. Likewise, the issues explored by the simulation needed to relate to and were covered by the prior learning (as otherwise some of the learning provided by the simulation would be irrelevant).

If the simulation was to be used as a course theme, the timing of the introduction of new issues in the simulation would need to link to the timing of content. By and large, the business simulation must relate to and support the other learning activities *and* the other learning activities must relate to and support the simulation. For example, if the Training Challenge was used as a course theme, a session on capital investment would immediately precede the decisions to invest in a new printer, computer and software.

This means that the design of other learning activities and the simulation should not be done in isolation and depend on how the simulation relates to the other learning.

Although the design of the workshop involved both the simulation and discussion aspects, it was felt likely that the workshop would not cover all learning needs and the learners would reflect on the day and identify further needs and clarification. To accommodate this, the learners were encouraged to make use of a *blog* where they could pose

questions and continue to share knowledge and experience.

REFERENCES

Chaucer, Geoffrey (1390) The Parson's Tale *The Canterbury Tales,* Wordsworth Editions Limited, Ware, Hertfordshire

Godson, Mark (2009) *Relationship Marketing* Oxford University Press Inc, New York

Hall, Jeremy and Benita Cox (1993) Computerised Management Games: the feedback process and servo-mechanism analogy, *Simulation & Gaming Yearbook 1993* eds Fred Percival and Danny Saunders, Kogan Page London

Hall, Jeremy J. S. B. and Benita M Cox (1994) Complexity is it really that simple, Systems *Developments in Business Simulations and Experiential Exercises* Volume 21 Reprinted in the *Bernie Keys Library*, 11th Edition

Hall, Jeremy J. S. B. (2005) Computer business simulation design: the rock pool method, *Developments in Business Simulation and Experiential Learning,* Volume 32, 2005 Reprinted in the *Bernie Keys Library*, 11th Edition

Hall, Jeremy J. S. B. (2007) Computer Business Simulation Design: Novelty and Complexity Issues *Developments in Business Simulation and Experiential Learning,* Volume 34, 2007 Reprinted in the *Bernie Keys Library*, 11th Edition

Hall, Jeremy J. S. B. (2008) Corporate Cartooning: The Art of Computerized Business Simulation Design *Developments in Business Simulation & Experiential Exercises,* Volume 35, 2009, Reprinted in the *Bernie Keys Library*, 11th Edition

Hall, Jeremy J. S. B. (2011) *Corporate Cartooning: The Art, Science and Craft of Computer Business Simulation Design* Hall Marketing. London [Available from http://www.simulations.co.uk]

Knowles, M. S., Holton III, Elwood F. and Swanson, Richard A. (1998), *The Adult Learner* Butterworth-Heinemann, Woburn, MA

Megginson, David and Vivien Whitaker (2004) *Continuing Professional Development* The Chartered Institute of Personnel and Development, London

Merkuryeva G., 2000. "Computer Simulation in Industrial Management Games" *Proceedings of IFAC Symposium*. Rio, Greece, July 12-14,

Murphy, Arthur (1763) *The citizen, a farce* Library of Congress

Thiagarjan, Sivasailam (1995) Guidelines for conducting a debriefing session and for developing a debriefing guide *Games and Simulations for Business* Kogan Page, London

Whitely, T. Rick (2006) Using the Socratic Method and Bloom's Taxonomy of the Cognitive Domain to Enhance Online Discussion, Critical Thinking, and Student Learning *Developments in Business Simulation & Experiential Exercises,* Volume 33, 2006, Reprinted in the *Bernie Keys Library*, 11th Edition [Available from http://www.absel.org]