

## **Interactivity and learning styles: an assumption challenged**

by

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## Abstract

One of the great advantages of online access is its anonymity. Where students in class are identifiable because they respond, or because they don't, the online student has time to think, to consult and to prepare the required response. Presuming they have the stamina, students can consider and, where they need to, adapt the demands of materials to their own needs.

This paper explores an intersection between the promised potential of an ever-increasing range of interactive design opportunities and our increasing understanding of the complex demands of various student learning styles. User testing results from the recently completed Generic Trade Training Skills project are used to suggest that meeting student needs may be more complicated than just addressing learning style differences.

## Introduction

There is a commonly held association in education between teaching and learning that reflects a traditional or formal approach within which *students*, usually children, are imagined in a classroom being taught by *teachers*. In this context, formal instruction holds two principal objectives for the cognitive development of the individual: (a) the long term acquisition and retention of stable, organised and extensive bodies of meaningful, generalisable knowledge and (b), growth in the ability to use this knowledge in the solution of particular problems, including those problems which, when solved, augment the learner's original store of knowledge (Notar *et al* 2002).

In formal learning, learners basically learn what is being taught to them and the teacher decides on how best to impart this learning. Focusing on adult, independent learning, Jarvis (1987) differentiates formal learning from non-formal or informal learning by the degree of control that learners have over what is to be learnt and how they learn. In non-formal and informal learning, learners have control over the objectives but not the means, or over the means but not the objectives.

Experienced *users* and *developers* within the e-learning forum readily recognise that completion rates, engagement and interactivity levels and appropriateness have provided the basis for increasing concern among *e-learning educators* over the past decade. More disconcertingly, maybe, it seems that technological capacity and educational demand are, largely, failing to draw together to create more powerful learning opportunities for e-learning students. At the same time, potential learners, and their potential employers, are far more clearly identified with Jarvis's (1987) independent adult learners. Regardless of these observations, an ever-increasing and ever-more-expensive range of proprietary commercial, and occasionally educational, solutions has provided little evident increase in e-learning effectiveness to match escalating development costs.

Notwithstanding this relatively depressing e-learning climate, there is still little research to challenge the assumptions underpinning either the business model for developing e-learning materials or their effectiveness in application (Chomley, 2005). More importantly, the division between educators who would develop learning materials and instructional designers who would put teaching materials online remains intact. Indeed, divergent research streams have emerged. On one hand, instructional design is a well theorised research field generously supported by the megalithic multinational icons of the IT industry (eg Merrill, 2002). On the other, educational researchers projecting from substantial data across generations of

emerging learning theory have become increasingly disenchanted with the misrepresentation and even aberrant application of their findings (Laurillard 1993, Karl 2004).

This paper briefly reports user response data from the recently completed TEC funded collaboration between Wellington and Waikato Institutes of Technology (WelTec and WinTec) to create engaging, interactive and educationally sound pre-trade learning modules for cross-platform delivery in distance mode with minimal tutor support. The paper uses this data to identify formal response findings with informal response patterns from the same data source to argue a disjunction between our intention and our achievement as e-learning developers. In brief, it challenges the assumption that increased interactivity and engagement necessarily address diverse learning styles

## **The GeTTS Project**

The Generic Trade Training Skills programme [GeTTS] was designed to meet the specific needs of

High school students seeking to undertake trade training  
Early school leavers and unemployed seeking entry to trade training  
Workers from other occupations seeking to establish basic entry levels for trade training

The GeTTS programme was developed through collaboration between

New Zealand Industry Training Organisations [ITOs],  
Wellington Institute of Technology [WelTec]  
Waikato Institute of Technology [WinTec], and the e-learning development company Learning Design Group [LDG] in Wellington.

Collaborative development of the GeTTS programme was funded by the Tertiary Education Commission [TEC].

The GeTTS programme provided a suite of 8 modules written and developed to meet New Zealand trade training entry requirements. The 8 modules include:

|                                |          |
|--------------------------------|----------|
| Basic Calculation              | [WelTec] |
| Self Management                | [WelTec] |
| Problem Solving                | [WelTec] |
| Customer Service               | [WelTec] |
| Workplace Health and Safety    | [LDG]    |
| Communication in the workplace | [WinTec] |
| Writing for workplace purposes | [WinTec] |
| Teamwork                       | [WinTec] |

The 8 modules, developed independently by WelTec, WinTec and LDG, were tested for cross-systems compatibility on both Janison and WebCT by WelTec and WinTec, and quality assured by LDG.

The modules were designed to meet New Zealand level 1 and 2 unit standards and to be delivered online with high levels of interactivity, low levels of tutor support and assessment provided through hosting institutions.

## **Two war stories**

The GeTTS project taught us a huge amount about the range of ways we could develop content, the ways we could design it and the ways we could ultimately present it. Put simply at this level, the project told us what we should have already known:

1. A learning project cannot succeed without initial agreement on the pedagogical imperatives underpinning the project.  
and
2. Module identification needs to be made on the basis of its evident suitability to e-learning mode development and delivery.

What the user testing of the GeTTS project taught us, however, was rather different. Two simple stories serve to illustrate this.

Story 1: A highly engaging basic calculation game featured a meercat in a fireworks factory. The meercat's job was to select appropriately sized boxes to package bundles of fireworks coming off two conveyor belts at the same time. Basically, this was a game confirming that students could double numbers and halve them. If the correctly sized box was selected, the meercat loaded its box of crackers into a third hopper and they were taken away. If the wrong box was selected, the fireworks fell to the ground and exploded in all directions, the meercat ducked and hid under the hopper. The groups of year 12 students testing this part of the basic calculation module loved the game. The game rules and maths theory we had laboured over, they never accessed. As the game got faster they got faster. Motivation was not a problem, engagement was not a problem. Success was its own feedback.

Then the game was changed to bring in the notion of near doubles – if  $2 \times 8 = 16$  then it is easy to see that  $8 + 9$  is the same as  $2 \times 8 + 1$ . Easy. Not so! Suddenly there was a rapid increase in explosions and for each failure, as before, a side screen explained how to get the right answer. But hardly anyone read the screen. Instead, faced with failure, they lost interest – and turned to look at the next element in the module.

Recall, these boys and girls were in year 12. Many were looking to come into trade training courses next year. Some were already in pre-trade courses. When we analysed their written assessments, they expressed high levels of interest, they 'loved' the games. But they were not willing to analyse their mistakes and read how to correct them. The game, it appears, offered them sufficient satisfaction that its learning elements were neglected. We must surely ask ourselves what we were missing here; what assumptions we had made that just didn't stack up in the reality of the real audience market-place. Why were our target audiences so apparently superficial in their learning behaviour? And why did our observers comment on the loss of interest when the users did not?

Story 2: Our high school user testing groups engaged with a fully flash-developed unit on Anger Management as part of a three-part module on Self Management. The screen opens with a title and a warning that the unit may upset some people as it deals with potentially personal and upsetting situations. The screen presentation throughout contains a mainscreen on which multimedia cartoon strips illustrate the points and a side screen or 'clipboard' carries the narrative content and key points.

Our year 12 user groups from two local high schools – girls and boys – opened the Anger unit, read the warning and began reading the clipboard. They progressed as we would hope until they realized that it was possible to skip by continually pressing the next button to get to the next multimedia section. This continued, for the boys

more commonly, until they reached a frame showing sexual harassment in the workplace. The response was graphic. Stopping to read the clipboard and the turning to the next user to tell them about the image. At this point, generally, the boys excitedly discussed what they had seen while the girls tended to take in what was happening and return to their own work.

This reaction, on its own, is probably fairly unsurprising. These are 16-17 year old boys. The girls are more mature and, probably aware of the reality of the scene anyway. What was more interesting was the boys following behaviour. Some continued their skipping until they arrived at a scene depicting a violent confrontation, others returned to the beginning of the unit and began to work through it in detail.

The violent confrontation showed two faces close to each other and obviously shouting. One face was red, the other blue. There were no identifiers for gender, race or age. The users coming to this image began an animated discussion about the identity of the pair – they were” brother and sister – see the colours”. “No, they’re two gangs”. “No, they’re not, they’re mother and father”. The discussion led to a hunt back and forwards around the area to identify the couple. Without success in identification, the users generally continued reading the clipboards closely from this point. Again, as we would have hoped they would do from the beginning.

User reporting on this unit maintained that the students felt the unit contained material they could use later, that it was highly engaging and that the difficulty level of the materials was appropriate to their needs and ability. As developers, we might feel smugly satisfied at the reportedly high levels of engagement with, and perceived appropriateness of the materials. Observing the user testing groups as students in charge of and engaged with their own learning we have mixed feelings. The obvious interest sparked by the two images suggests we were on the right wavelength with our intended audience – of male teenagers at least. The discussion the materials generated, however, suggests that we may have developed materials that would be better used in small group presentation modes. As we have previously observed, *we need a basis for the evident suitability of materials for e-learning mode development and delivery.*

User testing stories from the meercat and anger management units confirm, for us, the difficulty of developing the kind of process-line approach to theorizing e-learning characterized by much of the instructional design research currently in vogue but seriously questioned from differing perspectives by researchers such as Bechervaise and Chomley (1993), Laurillard (1993) and Mayes (1995). Instead, it is argued, a clearer representation of the pedagogy underpinning e-learning development is long overdue. Apparently convergent paths still fail to meet in our integration of independent, adult learning principles with fundamental teaching principles. Do we teach so they may learn? Is failure to learn a clear quantification of failure to teach? Is learning even related to teaching? And if, as seems increasingly likely, it is not, then perhaps – as Jarvis (1987) implied almost 20 years ago, we should be focusing on how to create learning materials than teaching materials.

## **Learning styles and learning needs**

e-learning strategies are necessarily grounded in assumptions of:

- high motivation level
- facility with computers


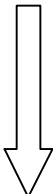

familiarity with online game-playing and internet instructional design conventions , and engagement with the materials presented.

From an instructional design viewpoint, learning access engaged in the development of e-learning materials includes visual, auditory and, to a necessarily limited extent, kinaesthetic styles. The learning style tends to be individual while the most frequently engaged pedagogy tends to be instructional.

Meanwhile, the capacity to engage interactively with learning materials, to apply them directly and in context is restricted, and the potential to receive tutor-mediated real-time response is unusual.

In this context, the breadth of the target audience for the GeTTS program has provided an extensive range of pedagogical challenges.

To access the range of learning styles anticipated across the GeTTS target student audience, modules have been developed with a range of emphases from highly interactive with low text density and literacy demand through reduced interactivity with average-level text and literacy demand to low interactivity level with higher-level text but controlled literacy demands (see fig 1 below).

| Read level  | Module               | Author/Designer | Tutor support level  |
|---|----------------------|-----------------|--|
| Low reading demand<br> | Basic Calculation    | WelTec          | Low<br><br>High |
|   | Problem Solving      | WelTec          |  |
| Mid-read demand<br>    | Self Management      | WelTec          |  |
|   | Occ. Health & Safety | LDG             |  |
| High read demand  | Report Writing       | WinTec          |  |
|   | Communication        | WinTec          |  |
|   | Teamwork             | WinTec          |  |
|   | Customer Service     | WelTec          |  |

**Figure 1: Designing for literacy**

Applying a largely constructivist learning approach (Bruner, 1966), the modules address a range of emphases based on Mayes Conceptualisation Cycle (1995) where blended learning [mixed mode] approaches offer a mix of on-line and face-to-face interaction. As previously indicated [see fig 1], the anticipated level of face-to-face tutor support has been established in recognition of the varying demands of the content to be presented and the level of complexity of the concepts to be engaged within a single module.

Most people become familiar with numbers, addition, subtraction and multiplication as part of their normal growing through childhood. Their learning is formalized through primary school levels so that by High school, they have a strong grasp of most basic mathematical concepts. Unfortunately, this is not true for all people. Failure to grasp basic concepts before their abstract manipulation becomes a necessity is a common characteristic among high school drop-outs and unemployed. As has been frequently observed by ITO representatives, trade tutors and employers of pre-trade workers, the assumption of basic calculation and measurement skills cannot be assumed.

Piaget (1957) established that cognitive development proceeds from pre-concrete through concrete stages towards conceptual abstraction. His work informed the later theories of Bruner (1960, 1966) and Gagne (1967) that underpin mathematics syllabus development in New Zealand (Hunter, 1998).

Mathematical development, as a special case of cognitive development, has been the focus of a wide range of initiatives since the 1960s (eg Dienes 1963, 1967) in Canada and UK, Clements (1972) in Australia and Roe (1962), Adler (1972) and Niedermeyer (1968, 1969) in America). In particular, these are reflected in the theoretical basis for the new maths syllabus that is currently being introduced into New Zealand primary schools.

The GeTTS Basic Calculation module (Unit Standard 8489) has been developed on the basis of research evidence and on strong advice from secondary maths specialist, Michael Drake at Victoria University, to align with those features of the new New Zealand maths syllabus which focus on basic concept development for addition and subtraction, multiplication and division.

The approach, at first glance, appears to be over-simplified. Consistent research findings, however, have confirmed that a failure to establish fundamental concepts make it almost impossible to develop the later, more complex, concepts which are built on them if they are missing. In essence, every ladder needs a first rung.

## **The modules**

### ***Basic Calculation***

Basic Calculation has been identified as the most conceptually demanding module. In response to this identification, levels of text density and reading demand have been maintained at the simplest levels, concepts have been identified and developed at fundamental levels and engagement has been maintained as a priority. The resulting development is focused on providing an integrated learning experience for an engaged adult learner (Knowles, 1997) whose identified needs have been established in a diagnostic pre-test and for whom an individual path through the module is established by the staged programme of formative testing that is integrated into the module as specific basic calculation strategies are mastered.

### ***Self Management & Problem Solving***

User testing with the target audience has established that, conceptually, these modules have considerable potential to engage the learner at a personal level. In consequence, a more distanced, less necessarily engaged approach has been employed to reduce their potential for generating stress and/or motivating disengagement from difficult and unpleasant memories or lived experiences. The modules introduce generic cartoon characters in familiar domestic and work situations, a glossary of technical, medical and potentially unfamiliar terms is presented onscreen as the module develops and this glossary is repeated as a static and continuous reference site from the navigation bar.

Language demands and text density are increased as the modules develop and as familiarity with terminology and concepts is established.

The two modules are considered together because they were scripted and developed by the same team. Each applies extensive multi-media solutions to engage learners and each provides a series of external reference points for students

who wish to extend their learning or identify support beyond the scope of the unit or module.

### ***Occupational Health and Safety***

The module has been developed according to traditional e-learning principals with a range of mainly drag and drop interactivity at the end of each of a number of subsections. The module contains considerable text, direct reference to extracts from government legislation, and a variety of descriptive sections and still images from available OSH publications.

### ***Communication***

The module offers a range of exemplars and activities describing and demonstrating common communication tasks including questioning, offering information and engaging in semi-formal discussion. The module is developed with audio clips and regular sub-headings to support the denser text presentation created by a scrolling screen presentation while maintaining the reduced literacy levels identified as appropriate to the GeTTS target audience.

### ***Workplace writing***

The module addresses the demands for precise, concise and accurate writing, the need for correctness, a basic range of common workplace and community report writing forms and the structural principals of report writing. Scrolling across a range of downloadable report forms, examples of completed forms and interactive cartoon examples supports interactivity with an offsite tutor and regular section headings and subheadings assist navigation through the module.

### ***Teamwork***

The module provides a wide range of interactive learning opportunities promoting student involvement, encouraging responsibility for, and rewarding student choice. The module requires tutor engagement in the learning process and presents opportunities for online engagement with tutors and fellow students through chat-room interaction. To the extent that learning about teamwork without becoming involved in a team at a physical level can be overcome in an e-learning environment, the module provides a substantial learning resource.

### ***Customer Service***

The module presents a wide range of information from basic meeting and greeting of a customer to the consideration of legislation underlying all customer service transactions. As a result, the approaches developed within the module range from simply illustrated, low text density, low reading demand engagements through to essentially text-on-screen, low interactivity content presentation. The resulting form of the module is similarly varied to meet the varying demands of the module.

### ***Teaching or Learning***

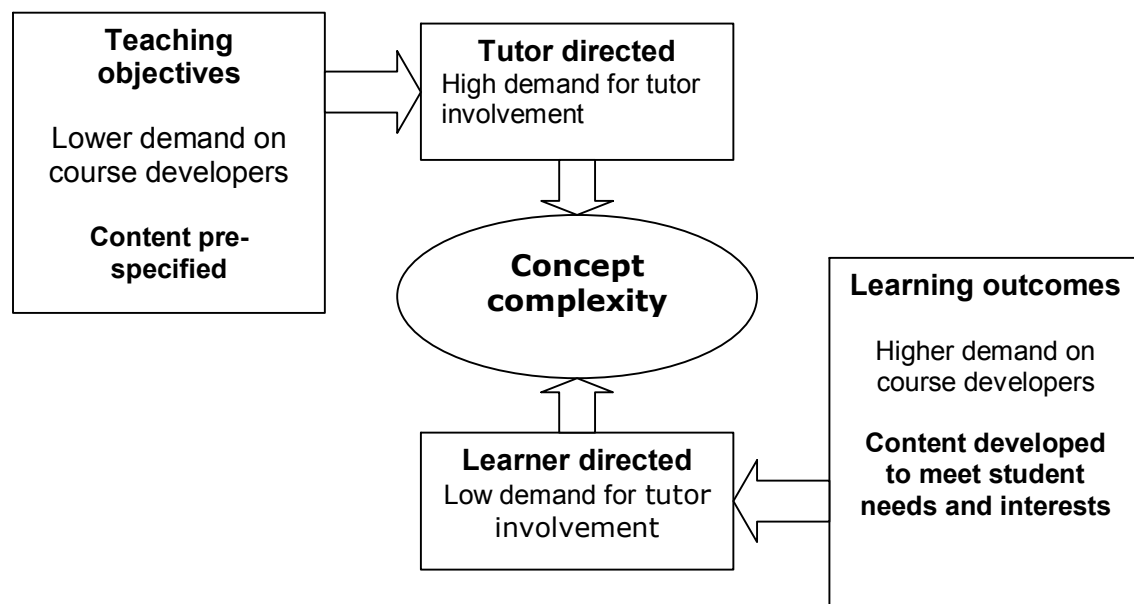
Considerable effort has been applied across the GeTTS project to developing a constructivist learning experience (Brown, 2004) where student-centred activities support student experience and commonly identified pre-trade student needs. User testing of representative groups from within the target audience suggests that these have been more successful in engaging the younger groups (school student and

early school leavers) than those already experienced in employment. Even so, the motivators have not necessarily been intended and the levels of engagement have not necessarily come from predicted and consciously designed materials.

The range of tutor [or peer] support demand represented in module development (see fig 2), however, reflects early recognition of both the range of potential presentation opportunities and, more importantly, the range of learning demands placed upon students seeking to undertake these modules in distance learning mode.

Where teaching objectives have been considered as the primary focus [the instructivist model] because content has been prioritized (eg Legal responsibilities in Customer service and OSH regulations), the demand for tutor involvement has been seen as central to the effective maintenance of student engagement. Where meaningful development from student experience [the constructivist model] provides the basis for module development (eg Self Management, demands for tutor involvement appear to be minimized.

Within the GeTTS project, concept complexity has determined the fundamental approach to module development, text density, content density and interactivity (see Fig 2).



**Figure 2: Designing for complexity**

### **Expectations and e-learning design assumptions**

The difference in approach between the partnering organisations to both funding and staffing contributed to the tensions that arose within and across the GeTTS project team.

In consequence, it became clear that:

1. A learning project cannot succeed without initial agreement on the pedagogical imperatives underpinning the project.

2. Module identification needs to be made on the basis of its evident suitability to e-learning mode development and delivery.

### **independent and empowered or lonely and isolated?**

In abstracting this paper, we observed that one of the great advantages of online access is its anonymity. We noted that while students in class may be identifiable because they respond, or because they don't, the online student has time to think, to consult and to prepare the required response. Observations from the GeTTS user testing program with the target secondary school audience strongly suggest that students became engaged with specific elements of the modules because they were strongly motivated by individual (and not necessarily intentional) aspects of the module. In one sense, this is exciting news. It confirms the constructivist view that students build from what they know towards what they need to know. In another sense, it is a deeply pessimistic observation. Regardless of our best intentions, it is the learner who holds the trump cards, the learner who decides whether the materials are engaging, meaningful, *worth the trouble*.

The need to share observed in the first war story described in this paper suggests that distance learners are likely to need easy access to chat rooms, direct access to tutors and a sense of sharing with 'other humans'. In this context, as has been frequently observed, distance learning remains remote, isolate, lonely. The capacity to skim a well-structured module, to determine where to start and what to value, on the other hand, empowers students to become their own teachers, to determine what is useful and what is not, to defy the apparently natural order determined by the course developer.

Notwithstanding the models and exhortations of Mayes, Laurillard, et al, the user testing groups informing this study are strongly independent and, having control over what they present to themselves and how they assess it, they remain in control of their own learning. They are Jarvis's 'informal learners' and their informality that guarantees their independence remains our greatest single challenge as e-learning educators.

### **Conclusion**

Traditionally, we have designed e-learning materials from two established cornerstones: that teachers teach so students must learn; and, that instructional design is the link between effective content and motivational delivery. Almost unconsciously, we have maintained that what works in a classroom should work beyond that space. We have assumed that we are designing for highly motivated and highly computer-literate users, and that access to high end technology is the province of every e-learner.

This paper has applied user testing data from the 2005 GeTTS project to offer a loose coupling of formal survey responses with informal response patterns from the same data source to argue a disjunction between our intention and our achievement as e-learning developers. In doing so, it has challenged the assumption that increased interactivity and engagement necessarily address diverse learning styles.

Instead, it has been argued that careful attention to the capacities and interests of the learner, the intended learning experiences and styles of these users, and their access to and familiarity with the technology are crucial to establishing relevant

content for effective development and optimum delivery mode. The GeTTS experience suggests, once again, that we neglect these apparently obvious lessons at our peril.

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