Towards Diagrammatic Hypermedia Authoring: Cognition and Usability Issues in Higher Education

Appendices

Geoff Elliott 1999
# Appendices

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Appendix A
MAKING SENSE: A REVIEW OF HYPERMEDIA IN HIGHER EDUCATION

G. J. Elliott, Eleri Jones, A. Cooke
Cardiff Institute of Higher Education, Cardiff, Wales
gelliott@cihe.ac.uk

P. Barker
University of Teesside, Middlesbrough, Cleveland, England

Abstract: This paper explores some of the problems associated with the widespread development and use of hypermedia in higher education relating to motivational issues and technical difficulties associated with the authoring of hypermedia resources in an efficient and cost-effective manner. Concept maps have potential to enhance the development and use of hypermedia. The use and benefits of concept maps as 'CASE tools' for hypermedia development is discussed.

1 INTRODUCTION

Hypermedia is a cognitive tool, allowing students to explore and make sense of a knowledge corpus 'constructing' meaning in self motivated and self directed fashion and developing metacognitive skills [Jonassen, 1992], [Spiro et al., 1991]. For many, the use of advanced information technologies in higher education is seen as inevitable [McFarlane, 1990], for governments such use can underpin the strategic development of open and distance learning and support efficient academic delivery. In the UK £33.5 million has been invested in initiatives like TLTP and CTI [Darby, 1993a], [Darby, 1993b]. Hypermedia's potential in higher education has been much discussed [Oliveira, 1992], [Lennon & Maurer, 1994], [Linn, 1992] and it's impact has been likened to the Gutenburg press [Thimbleby, 1992]. Despite enthusiasm, few teaching staff develop hypermedia applications with development time cited as the main reason for the lack of activity.

The aim of this paper is to: review the role of hypermedia in higher education; to consider hypermedia functionality, to review hypermedia authoring and environments and propose the application of concept mapping as a 'CASE tool' in the development and a 'note-taking tool' in the use of hypermedia thus placing hypermedia on a firmer pedagogical foundation.

2 THE ROLE OF HYPERMEDIA IN HIGHER EDUCATION

There is potential for hypermedia to support knowledge acquisition, through expansion of a learner's semantic network [Jonassen, 1990]. One survey of academics shows a perception that computer - based learning, which arguably includes hypermedia, can allow students to learn at their own pace [Laurillard et al., 1993]. Hypermedia offers new ways to learn through the juxtaposition of text, animation and sound and offers the potential to alter the role of teachers and learners through the creation of a new dynamic form of interactive learning [Marchionini, 1988].

In terms of computer - based learning, hypermedia is perceived to offer learners complete control over the viewing of material [Misanchuk & Schweir, 1992]. Skilled learners can benefit from complete learner control [Steinberg, 1988], [McGrath, 1992] but caution must be taken to avoid cognitive overload [Zhao et al., 1993]. Some direction may be necessary for hypermedia to be an effective educational tool so it is perceived to be of benefit by the student, e.g. [Landow, 1990], [Whalley, 1990], [Beltran, 1993], [Laurillard, 1993].

'Direction' in hypermedia can come from adding instructional or pedagogical elements and least four approaches are currently being used:

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Appendix A

- Intelligent tutoring through the incorporation of intelligence to the hypermedia corpus: the Star Guide system [Bruillard & Weidenfeld, 1990] includes an intelligent tutor, whereas the StrathTutor hypermedia system [Kibby & Mayes, 1993] helps direct the learner through a hypermedia knowledge corpus by calculating the most appropriate node to go to next, based on those already visited.
- Creation of hybrid hypermedia systems which contain interactive sequences: [Beltran, 1993] talks of a hybrid hypermedia model that contains directive sequences.
- Offering varying degrees of restriction according to the user's level of understanding. The question of who should determine variation in the level of restriction is interesting.
- Making the teacher responsible for giving direction, i.e. locate the hypermedia where it can complement rather than supplant the teaching-learning process. [Duffy & Knuth, 1990] talk of the need for setting 'goals' or authentic tasks in hypermedia interactions.

[Nelson & Palumbo, 1992] distinguish three different uses for hypermedia: knowledge presentation; knowledge construction; and knowledge representation. Arguably a good presentation system should explicitly represent the underlying knowledge. The use of hypermedia for knowledge construction is particularly interesting as the process of constructing knowledge can enhance learning. [Beeman et al., 1987] reporting their experiences of Intermedia identify that the constructors of the course material learnt most. [Reader & Hammond, 1994] have demonstrated that student post - test scores were enhanced by using concept mapping tools alongside hypertext, arguing that students should be encouraged to use cognitive tools to structure their thoughts. There was clear agreement at the NATO ASI on Cognitive Tools for Learning [Jonassen, 1992] that hypermedia can be used as a cognitive tool. [Reynold & Danserau, 1990]'s knowledge hypermaps are based on the idea that a hypermedia corpus is a semantic net and hence display the corpus as a net on the screen.

3 FUNCTIONALITY OF HYPERMEDIA SYSTEMS FOR HIGHER EDUCATION

The characteristics of basic hypermedia systems, nodes, links, networks and paths, are well documented [Jonassen, 1989]. [Halasz, 1988] has expressed ideas on the contents of hypermedia systems which coincide with those of [Park, 1991]. Some of these features are already standard in development tools such as ToolBook and KnowledgePro:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface capability with hardware</td>
<td>Use of Videodisc for motion sequences in applications.</td>
</tr>
<tr>
<td>Interface with a high - level language</td>
<td>Use of the HyperTalk language with HyperCard.</td>
</tr>
<tr>
<td>Change of Window size and location.</td>
<td>Developers can create applications with windows that can be altered in size, location, using ToolBook or KnowledgePro</td>
</tr>
<tr>
<td>Opening multiple windows</td>
<td>Developers can create applications with many overlaying windows with tools such as ToolBook or KnowledgePro</td>
</tr>
</tbody>
</table>

Other features are still subject to research and development:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Research Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidance for Node Selection</td>
<td>[Tomek &amp; Maurer, 1992] and [Kibby &amp; Mayes, 1993] describe systems that use algorithms to select the most appropriate link.</td>
</tr>
<tr>
<td>Addition of a Browser or Map</td>
<td>HyperCard has a summary window facility that shows the cards visited, similarly StrathTutor [Kibby &amp; Mayes, 1993] has a back-track facility.</td>
</tr>
<tr>
<td>Node selection by keyword search</td>
<td>Separating the content from the links and thus avoiding out-dated links and facilitating key word searches [Davis et al., 1993], [Stubenrauch et al., 1993], [Mulhauser, 1992].</td>
</tr>
<tr>
<td>Automatic generation of new versions</td>
<td>No evidence of versioning found.</td>
</tr>
</tbody>
</table>

Table 1. Hypermedia Features

For hypermedia to become an effective medium on a firmer pedagogical footing extra functionality is recommended. Firstly closer links with concept mapping tools would enhance learning. The facility to extract node and network information from the hypermedia into the student's personal concept map is analogous to note-taking. [Monk, 1990] suggests users should be allowed to select frequently visited nodes for inclusion in...
a 'Personal Browser'. Secondly, a tailorable navigation logger auditing nodes visited would enable better understanding of hypermedia use and enhance design [Horney, 1993]. [Misanchuk & Schweir, 1992] consider that audit trails could be used for formative evaluation, allowing teachers to check material visited against test results. [Kelly, 1993] used SKEIM to monitor student usage of a hypermedia and to provide tutorial feedback. What is to be audited and the presentation format, e.g. tables or graphs, should be definable.

4 HYPERMEDIA AUTHORING IN HIGHER EDUCATION

Enthusiasm for hypermedia has not manifested a plethora of activity. [Rode & Poirot, 1989] found that 65% of even computer literate staff at the University of North Texas were not disposed to writing educational software. Surveys reported by [Hammond et al., 1992] and corroborated by [Laurillard et al., 1993] and [Barker & Banerji, 1994], cited lack of time, lack of training and lack of support staff as the main reasons for non-use of new educational technologies (including hypermedia) by academics. Institutional support for staff developing innovative teaching and learning strategies is needed [Laurillard, 1993]. Some observers, e.g. [Junkala, 1991], are more optimistic and believe that almost anybody can produce college level courseware.

Students and teachers should contribute to creating and authoring of continually evolving campus-wide hypermedia information systems [Landow, 1992], [Stubenauch et al., 1993]. The Microcosm system developed at Southampton University [Davis et al., 1993] is an excellent attempt at this. Within these growing information systems there is still a place for discrete hypermedia applications, carefully and purposely prepared for inclusion in particular curricula. These smaller, discrete, hypermedia systems are comparable to the composite nodes of the Dexter model [Halasz & Schwartz, 1994]. The educational benefit of these smaller, discrete hypermedia corpora has been open to debate [Stubenauch et al., 1993] but can be made effective through a directive - instructional framework.

Discrete hypermedia systems are a reflection of the creator's understanding of the subject matter. Users would probably not be expected to modify the existing corpus but could construct their own 'subset' of the corpus. They could use a concept mapping tool to make their own 'sense' of the material, extracting from the hypermedia system, as required. This ability to annotate a subset of links and nodes from the discrete or global knowledge corpora corresponds to a student's notes reflecting lecture notes and wider reading of books and journals. Indeed, [Davis et al., 1993] suggest that hypermedia material should be added to the campus-wide corpus as explanatory notes.

5 HYPERMEDIA AUTHORING ENVIRONMENTS

Whether authoring campus - wide or discrete hypermedia there are several possible development routes. The most likely choice for non-programming academic staff is the use of PC - based authoring environments. There are many such environments [Barker, 1993] which already provide the basic functionality outlined above. Those with links to high - level languages can provide the other features, albeit with a high programming overhead.

There is considerable benefit to finding ways to make hypermedia development very easy in terms of encouraging the academic community to overcome its tardiness with respect to hypermedia. If authoring hypermedia were as easy as word processing but provided more effective material then more widespread use would be made, in fact it could become the preferred medium. Ease of use is stressed [Barker, 1992]. Increased use of material developed elsewhere [Laurillard, 1993] addresses the issue of hypermedia use but begs the question of it's development. In an attempt to facilitate instructionally-effective hypermedia production, a number of models and systems for hypermedia authoring are appearing , e.g. the Nestor [Mulhausner, 1992] and Hypercourseware [Siviter & Brown, 1992] models and systems. Some tools have additional functionality, e.g. the NEAT system [Mayer et al., 1993] extends ToolBook offering programming-free power with a variety of metaphors. A library of reusable units of learning material which can be supplemented would facilitate courseware production [Midoro et al., 1992]. The on-line ISAAC system [McAleese & Ching, 1993] integrates instructional design help with an authoring tool., other similar systems, e.g. HyperTactics [Jonassen & Harris, 1991] work off-line.

Another way would be by concept mapping the domain. Concept maps are easy to understand and easy to draw. If an authoring environment were to allow developers to 'draw' their subject domain on a screen as a
Appendix A

semantic net and then add the hypermedia features it would considerably facilitate development. Future authoring environments could allow the developer to toggle between different semantic views (concept maps) of the corpus being constructed and to augment the corpus from each view. Most authoring starts with the creation of some domain material, e.g. a short video sequence, with the links added afterwards. The semantic network grows as a ‘by-product’ of the design process, organically and implicitly. An alternative view of authoring would be the explicit expression of the semantic links followed by the addition of the domain material. Designing systems in this way would ensure that hypermedia corpora are linked in the most ‘semantically appropriate’ manner. Concept mapping would thus be a ‘CASE tool’ for hypermedia development analogous to the use of entity-relationship modelling in database creation with similar benefits, i.e. more easily produced, more rational applications. This is similar to the approach adopted by [Reynolds & Danserau, 1990] with their Knowledge Hypermaps and ties in with the belief that cognitive tools should be used in conjunction with hypermedia to enhance learning. Students would be able to see the teacher’s view of the domain and ‘construct’ their own views.

One pedagogical issue relates to students viewing the teacher’s concept map. In a true constructivist sense students should ‘construct’ their own view. It is argued however, that if students are to use hypermedia, they are more likely to benefit from seeing the teacher’s more coherent, deliberate and experienced perspective than any view which has arisen haphazardly. A second issue focuses around the ability of teachers to externalise and make explicit their own understanding of a subject. Knowledge elicitation has proven to be a surprisingly difficult activity for knowledge engineers. Attempting to create concept maps of subjects for hypermedia development may prove an enlightening activity.

6 DISCUSSION

Academie would like to see more computer-based education. Hypermedia, if properly located within the teaching and learning process offers the learner the possibility of a stimulating learning environment. However, there are several issues that need to be resolved before the hypermedia ‘weapon’ finds its place in a lecturer’s armoury.

Time is the major obstacle impeding the increased use of computer-based learning, i.e. the time to learn the development packages, time to prepare the material and time to integrate or restructure the syllabus around the new computer-based material. Changing institutional attitudes to the production and use of hypermedia will require concerted effort [Laurillard, 1993].

Many academic staff are now becoming proficient with wordprocessors, probably due to the advent of cheap, easy to use packages and PCs which clearly make text production more efficient. Similarly, easy to use hypermedia authoring tools which produce more effective teaching materials are likely to revolutionise hypermedia development and use. The use of hypermedia as an alternative to traditional methods will not take place until a cost-benefit analysis shows a clear advantage to hypermedia. [Davis et al., 1993] quoting [Christie, 1990] estimate that it currently takes between 100 and 150 hours to produce one hour of hypermedia instruction even for experienced developers, an experienced lecturer preparing a one hour lecture session could produce the requisite material in less than 10 hours.

Hypermedia’s great weakness is the degree of learner control [Laurillard, 1993]. Giving direction when a user engages with a hypermedia system can overcome this weakness and the easiest and arguably the best way is for the direction to come from the teacher.

Concept mapping could resolve some of the pedagogical and time constraints relating to the production of educational hypermedia. Post-processing of the concept map would result in the production of a skeletal hypermedia which could be enhanced by the addition of hypermedia material. Closely linking a concept mapping tool with the hypermedia corpus would enable learners to create their own view; extracting material as they browse. This view forms their notes which could be taken away on magnetic media.

Taking a concept mapping approach raises a number of fundamental issues. Creating a ‘view’ of a particular subject would seem simple in theory but may be more difficult in practice. A concept map may prove a transitory rather than definitive picture of the domain [Jonassen & Marra, 1994]. In well defined subject areas, where major interrelations are generally accepted, concept mapping may be neither difficult nor transitory.
Certainly, the explicit representation a domain, however transitory, can only be seen as beneficial to promoting debate.

Externalising knowledge through concept mapping is one thing, doing this directly on a computer is another. The analogy here is of people who create with pen and paper and use the computer to present the creative work. Pen and paper are the creative medium. Better word processing packages can facilitate composition directly at the keyboard. To similarly facilitate the development of hypermedia would seem a sensible and, through concept mapping, tangible, goal.

7 REFERENCES

Appendix A


THE APPLICATION OF CONCEPT MAPPING TO HYPERMEDIA AUTHORING

G. J. Elliott, Eleri Jones, A. Cooke
Cardiff Institute of Higher Education

P. Barker
Teesside University

Abstract: The development of computer-based learning packages is an extremely time consuming process for subject specialists inexperienced in hypermedia authoring. Considerable difficulties can arise as a consequence of 'cognitive overload' for two reasons: (1) having to organise the content; and (2) having to represent this using an appropriate hardware/software environment.

Unfortunately, most hypermedia authoring tools are either extremely prescriptive (and so, can constrain developers) or else, they are extremely complicated to use. The strategic importance of a very simple approach to hypermedia authoring therefore cannot be ignored.

There is a considerable similarity between the technique of concept mapping (as a means of knowledge representation) and the uses of hypermedia (as a means of knowledge emulation). Both techniques represent knowledge domains diagrammatically using graph structures that involve a set of nodes that are connected together by means of labelled and directed arcs. Obviously, the expressiveness of any concept mapping tool that is used for hypermedia authoring must be sufficient to reflect the comprehensive range of hypermedia structures that developers have to produce. Given that this is the case, a potential developer should be able to a selected concept mapping tool in order to explore the knowledge domain of interest; then by means of a suitable 'post-processing' system the resultant model could be compiled into an appropriate skeletal hypermedia knowledge corpus.
The paper explores the similarity between concept mapping and hypermedia modelling of a knowledge corpus. It attempts to evaluate the functionality of the currently available PC-based concept mapping tools in order to determine their potential for use as intermediaries in the hypermedia authoring processes. Some recommendations are then made on the ways in which concept mapping tools could be augmented in order to produce a software systems that is sufficiently expressive for the tasks involved in hypermedia authoring—thus reducing the cognitive overhead for potential developers.

INTRODUCTION

Hypermedia is a cognitive tool, allowing students to explore and make sense of a knowledge corpus 'constructing' meaning in self motivated and self directed fashion, developing metacognitive skills (Jonassen; 1992, Spiro et al.; 1991). For many, the use of advanced information technologies in higher education is seen as inevitable (McFarlane; 1990), for governments such use can underpin the strategic development of open and distance learning and support efficient academic delivery. In the UK £33.5 million has been invested in initiatives like TLTP and CTI (Darby; 1993a, Darby; 1993b). Hypermedia's potential in higher education has been much discussed (Oliveira; 1992, Lennon & Maurer; 1994, Linn; 1992) and it's impact has been likened to the Gutenberg press (Thimbleby; 1992). Despite enthusiasm, few teaching staff develop hypermedia applications with development time cited as the main reason for the lack of activity. Time is taken in the organisation of the content into an appropriate format for multimedia presentation and the mastering of the authoring tool before an effective hypermedia can be developed. To do these processes simultaneously can lead to 'cognitive overload'.

The aim of this paper is to: consider hypermedia authoring; determine what makes effective educational hypermedia; explore the application of concept mapping as a 'CASE tool' in the development of educationally effective hypermedia; and examine the functionality of existing concept mapping tools to determine their suitability to this task.

HYPERMEDIA AUTHORING IN HIGHER EDUCATION

Enthusiasm for hypermedia has not manifested a plethora of activity. Rode & Poirot (1989) found that 65% of computer literate staff at the University of North Texas were not disposed to writing educational software. Surveys reported by Hammond et al. (1992), and corroborated by Laurillard et al (1993) and Barker & Banerji (1994), cited lack of time, lack of training and lack of support staff as the main reasons for non-use of new educational technologies (including hypermedia) by academics. Institutional support for staff developing innovative teaching and learning strategies is needed (Laurillard; 1993). Some observers (e.g. Junkala; 1991) are more optimistic and believe that almost anybody can produce college level courseware.
Students and teachers should contribute to creating and authoring of continually evolving campus-wide hypermedia information systems (Landow; 1992, Stubenrauch et al.; 1993). The Microcosm system developed at Southampton University (Davis et al.; 1993) is an excellent attempt at this. Within campus-wide information systems there is still a place for discrete hypermedia applications, carefully and purposely prepared for inclusion in particular curricula. These smaller, discrete, hypermedia systems are comparable to the composite nodes of the Dexter model (Halasz & Schwartz; 1994). The educational benefit of these smaller, discrete hypermedia corpora has been open to debate (Stubenrauch et al.; 1993) but can be made effective through a directive-instructional framework.

Discrete hypermedia systems are a reflection of the creator's understanding of the subject matter. Users would probably not be expected to modify the existing corpus but could construct their own 'subset' of the corpus. They could use a concept mapping tool to make their own 'sense' of the material, extracting from the hypermedia system, as required. This ability to annotate a subset of links and nodes from the discrete or global knowledge corpora corresponds to a student's notes, integrating lecture material with wider reading of books and journals. Indeed, Davis et al. (1993) suggest that hypermedia material should be incorporated with the campus-wide corpora as explanatory notes to the lecturer's own discrete hypermedia.

HYPERMEDIA AUTHORING ENVIRONMENTS

Whether authoring campus-wide or discrete hypermedia there are several possible development routes. The most likely choice for non-programming academic staff is the use of PC-based authoring environments. There are many such environments (Barker; 1993) which already provide basic functionality. Those with links to high-level languages can provide the other more sophisticated features like interactivity, albeit with a high programming overhead.

There is considerable benefit to finding ways to make hypermedia development very easy in terms of encouraging the academic community to overcome its tardiness with respect to hypermedia. If authoring hypermedia were as easy as word processing but provided more effective material then more widespread use would be made, in fact it could become the preferred medium. Ease of use is stressed (Barker; 1992). Increased use of material developed elsewhere (Laurillard; 1993) addresses the issue of hypermedia use but begs the question of it's development. In an attempt to facilitate instructionally-effective hypermedia production, a number of models and systems for hypermedia authoring are appearing, e.g. Nestor (Mulhauser; 1992) and Hypercourseware (Siviter & Brown; 1992). Some tools have additional functionality, e.g. the NEAT system (Mayer et al.; 1993) extends ToolBook® with programming-free power and a variety of metaphors. A library of reusable units of learning material which can be supplemented would facilitate courseware production (Midoro et al.; 1992). The on-line ISAAC system (McAleese & Ching; 1993) integrates instructional design help with an authoring tool - other similar systems, e.g. HyperTactics (Jonassen & Harris; 1991), work off-line.
Another way to facilitate multimedia development would be through concept mapping the domain. Concept maps are, at least superficially, easy to understand and easy to draw. If an authoring environment allowed developers to 'draw' their subject domain on a screen as a semantic net and then add the hypermedia features this would considerably facilitate development. Future authoring environments could allow toggling between different semantic views of the corpus being and augmentation from each view. Most authoring starts with the creation of some domain material, e.g. a short video sequence, and then the links are added. The semantic network grows as a 'by-product' of the design process, organically and implicitly. An alternative view of authoring would be the explicit expression of the semantic links followed by the addition of the domain material. Designing systems in this way should ensure that hypermedia corpora are linked in the most 'semantically-appropriate' manner. Concept mapping would thus be a 'CASE tool' for hypermedia development analogous to the use of entity-relationship modelling in database creation, with similar benefits, i.e. more easily produced, more rational applications. This is similar to the approach adopted by Reynolds & Danserau (1990) with their Knowledge Hypermaps and ties in with the belief that cognitive tools should be used in conjunction with hypermedia to enhance learning. Students would be able to see the teacher's view of the domain and 'construct' their own views.

One pedagogical issue relates to whether students benefit from seeing the teacher's concept map - in true constructivist sense students 'construct' their own view when learning. When students use hypermedia, they are more likely to benefit from seeing the teacher's more coherent, deliberate and experienced perspective than any view which has arisen haphazardly as a by-product of the design process. A second issue focuses around the ability of teachers to externalise and make explicit their own understanding of a subject. Knowledge elicitation has proved a surprisingly difficult activity for knowledge engineers. Attempting to create concept maps of subjects for hypermedia development may prove an enlightening activity.

WHAT MAKES EDUCATIONALLY EFFECTIVE HYPERMEDIA?

Jonassen & Grabinger (1990) list knowledge seeking, knowledge acquisition and problem solving as the main ways in which it is possible to learn with hypermedia. Hypermedia should support search and query for knowledge seeking and retrieval. Hypermedia supports the knowledge acquisition processes of accretion, restructuring and tuning of existing cognitive schema. Complex real world problems with their multifaceted, multi-perspective issues and views can be instantiated in a Hypermedia corpus.

Laurillard (1993) is critical of the value of 'plain' hypermedia in higher education, describing it as essentially un-interactive - a sophisticated information base but not an effective tool for teaching.

There are a number of taxonomies for hypermedia structure e.g. (Leggett et al; 1990; Ross; 1990), but there is no list of preferred structures for educational hypermedia, indeed there is no reason why an application should not encompass a number of different structures. Hutchings et al (1992) present a taxonomy of educational
hypermedia with engagement (active - passive), control (student - teacher) and synthesis (presentation - creation) being the major parameters which have bearing on the quality of educational hypermedia. Current hypertext/hypermedia applications provide the learner with passive engagement, significant control and zero synthesis. Hutchings et al. (1992) advocate a move from this generation of hypermedia towards providing active engagement and constructive synthesis. Barker (1993) cites self-generated tours, annotation facilities, creation of concept maps and co-working with other users as examples of what new generation applications should contain. It would also be possible to create simulations and microworlds in a hypermedia corpus to help support problem solving. Hypermedia application to problem based learning, allowing the learner to search the domain in a variety of views, ways and perspectives, is highly desirable (Spiro et al.; 1991; Savery & Duffy; 1994) and this approach is well-grounded in educational theory (Piaget; 1977). Beltran (1993) talks of a hybrid hypermedia model that contains directive, thus interactive, sequences which enhance engagement. These approaches to hypermedia development should go some way towards addressing Laurillard's concerns.

Mayes et al. (1990) advocate that hypermedia applications should come with good search and query facilities, distinguishing between spatial and conceptual disorientation and stressing that some conceptual disorientation in the use of a hypermedia can be a good thing for learning. Problems associated with spatial disorientation - 'lost in hyperspace' - seem to receded (Landow; 1990, Ellis et al.; 1993).

The work carried out by Ellis et al (1993) indicates the need for applications to support many modes of usage - learning styles. There are a plethora of learning style taxonomies, however as Stanton and Baber (1992) note these could result from the design of the courseware used rather than reflecting any universal set of learning styles, the important principle here is that the learning environment should be sufficiently flexible to allow the user to adopt their preferred style during use.

The size of nodes appropriate to education is still subject to debate and research - McAleese (1990) gives guidelines on appropriate node size depending on the degree of consensus surrounding the knowledge domain.

In summary, more educationally effective hypermedia will come with new generation applications featuring:

- Multifaceted, multiperspective views of real world problems / issues;
- Active engagement;
- Flexible support of a number of different structures;
- Good search and query facilities;
- Support of different learning styles;
- Interactive sequences;
- Appropriate node size.

MAPPING CONCEPT MAPS TO HYPERMEDIA

Concept maps correspond well with basic hypermedia as illustrated in table 1 below:
Table 1: Mapping concept maps to hypermedia

<table>
<thead>
<tr>
<th>Concept Map Feature</th>
<th>Hypermedia Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Chunk or Concept Identification</td>
<td>Name of object</td>
</tr>
<tr>
<td>Size and Complexity</td>
<td>Name of page</td>
</tr>
<tr>
<td></td>
<td>Name of composite object</td>
</tr>
<tr>
<td></td>
<td>Name of Window</td>
</tr>
<tr>
<td>Annotation</td>
<td>Whole screen/page</td>
</tr>
<tr>
<td></td>
<td>Part of screen/page</td>
</tr>
<tr>
<td></td>
<td>Set of objects</td>
</tr>
<tr>
<td></td>
<td>Single object</td>
</tr>
<tr>
<td></td>
<td>Single window</td>
</tr>
<tr>
<td></td>
<td>Set of windows e.g. child/parent</td>
</tr>
<tr>
<td>Links Identification</td>
<td>Name of button, hotword, hotregion, pull down menu option</td>
</tr>
<tr>
<td>Direction</td>
<td>Single/Two way button</td>
</tr>
<tr>
<td></td>
<td>Single/Two way Hotword</td>
</tr>
<tr>
<td></td>
<td>Single/Two way Hotregion</td>
</tr>
<tr>
<td>Annotation</td>
<td>Interim displayed content between hyperlinks</td>
</tr>
<tr>
<td>Semantic proximity of concepts</td>
<td>Explicit hyperlinks rather than selection from a list</td>
</tr>
</tbody>
</table>

How can the features required of educationally effective hypermedia be reflected in a concept map? Heeren (1992) has investigated the functions of concept mapping tools as listed below. Unfortunately, not all these functions are to be found in any one tool.

- Submap-hierarchical
- Submap-zoom
- Outliner
- List of concepts
- List of relations
- Logical find function
- Filebox for organising concepts hierarchically
- 3D representation
- Text can be attached to concepts
- Graphics can be attached to concepts
- Text can be attached to relations
- Graphics can be attached to relations
- Selective representation of concepts and relations
- Computation and representation of concept centrality
- Dynamic path presentation
- Formulate and answer questions (self test)
- Mask concepts (self test)
- Mask relations (self test)

Some of these functions partially map to the requisite features needed in educationally effective hypermedia shown in Table 2 below:

<table>
<thead>
<tr>
<th>Hypermedia Feature</th>
<th>Concept Mapping Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requisite for Educational Effectiveness</td>
<td>Filebox for organising concepts hierarchically</td>
</tr>
<tr>
<td>Multifaceted, multiperspective views of real world problems</td>
<td>Sub-map hierarchical</td>
</tr>
<tr>
<td>Active engagement</td>
<td>Text can be attached to concepts</td>
</tr>
<tr>
<td></td>
<td>Graphics can be attached to concepts</td>
</tr>
<tr>
<td></td>
<td>Text can be attached to relations</td>
</tr>
</tbody>
</table>
Table 2: Mapping Requisite features of educationally effective hypermedia against concept mapping tool functionality.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Hypermedia Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible support of a number of different structures</td>
<td>Sub-map hierarchical</td>
</tr>
<tr>
<td>Good search and query facilities</td>
<td>Fileboxes for organising concepts hierarchically</td>
</tr>
<tr>
<td>Support of different learning styles</td>
<td>List of Concepts</td>
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<tr>
<td>Interactive sequences</td>
<td>List of relations</td>
</tr>
<tr>
<td></td>
<td>Logical find function</td>
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<td></td>
<td>Selective representation of concepts and relations</td>
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<td></td>
<td>Formulate and answer questions (self test)</td>
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<tr>
<td></td>
<td>Mask concepts (self test)</td>
</tr>
<tr>
<td></td>
<td>Mask relations (self test)</td>
</tr>
</tbody>
</table>

Despite the above correspondences, existing concept mapping tool functions do not sufficiently facilitate educationally effective hypermedia, even if all the functions were all available in one tool. Active engagement and the provision of search and query facilities are dynamic features of a hypermedia, therefore any corresponding functionality available in concept mapping tools would be irrelevant. There is probably merit in making these functions similar in both concept maps and hypermedia for reasons of consistency and parsimony.

The interactive sequences found in some concept mapping tools, e.g. formulation of tests, masking of concepts and relations, are a starting point and post-processing into a skeletal hypermedia would be useful. Further work is required to see how interactive post-processed concept map hypermedia (PPCMH) could be.

The provision of multiple perspectives and views of a problem or domain requires different concept maps with different semantic links for each of the multiple views and perspectives. Different views/perspectives would need to be overlaid. No concept mapping tool, it seems, currently provides this facility.

PPCMH must result in applications that accommodate as wide a variety of learning styles as possible. McAleese (1990) suggests that creating the maximum number of links between the nodes of the hypermedia facilitates multiple learning styles. Multiple links in the hypermedia would correspond to multiple semantic connections in the concept map.

A concept mapping tool that has facilities for creating concept-hierarchy, submaps and submap-hierarchy should, in principle, be able to reflect any hypermedia structure.

DISCUSSION

Academe would like to see more computer-based education. Hypermedia, if properly located within the teaching and learning process offers the learner the possibility of a stimulating learning environment. However, there are several issues that need to be resolved before the hypermedia 'weapon' finds its place in a lecturer's 'armoury'.

Time is the major obstacle impeding the increased use of computer-based learning, i.e. time to learn the development packages, time to prepare the material and time to integrate or restructure the syllabus around the new computer-based material. Many
academic staff are now becoming proficient with wordprocessors probably due to the advent of cheap, easy to use packages and PCs which clearly make text production more efficient. Similarly, easy to use hypermedia authoring tools which produce more effective teaching materials are likely to revolutionise hypermedia development and use. The use of hypermedia as an alternative to traditional methods will not take place until a cost-benefit analysis shows a clear advantage to hypermedia. (Davis et al.; 1993 quoting (Christie; 1990) estimate that it currently takes between 100 and 150 hours to produce one hour of hypermedia instruction even for experienced developers, an experienced lecturer preparing a one hour lecture session could produce the requisite material in less than 10 hours.

Concept mapping could resolve some of the pedagogical and time constraints relating to the production of educational hypermedia. Post-processing of the concept map would result in the production of a skeletal hypermedia which could be enhanced by the addition of hypermedia material and functionality. Closely linking a concept mapping tool with the hypermedia corpus would enable learners to create their own view; extracting material as they browse. This view would form notes which could be taken away on magnetic media.

Taking a concept mapping approach raises a number of fundamental issues. Creating a 'view' of a particular subject would seem simple in theory but may be more difficult in practice. A concept map may prove a transitory rather than definitive picture of the domain (Jonassen & Marra; 1994). In well defined subject areas, where major interrelations are generally accepted, concept mapping may be neither difficult nor transitory. Certainly, the explicit representation a domain, however transitory, can only be seen as beneficial to promoting debate.

Externalising knowledge through concept mapping is one thing, doing this directly on a computer is another. The analogy here is of people who create with pen and paper and use the computer to present the creative work. Pen and paper are the creative medium. Better word processing packages can facilitate composition directly at the keyboard. To similarly facilitate the development of hypermedia would seem a sensible and, through concept mapping, tangible, goal.

Creating basic hypermedia from a concept map would seem possible. Creating educationally effective hypermedia may be significantly more difficult. The main problem is enabling the representation of multiple perspectives within the same concept map and the mapping of these into the resultant hypermedia.

There is not an existent computer-based concept mapping tool which can support parallel views of a cognitive domain and its potential to facilitate hypermedia development. Implementation of PPCMII could provide the key to parallel views requisite for realising educationally effective hypermedia.

REFERENCES


Authoring Semantic Hypermedia: A Concept Mapping Approach

G. J. Elliott, E Jones
University of Wales Institute, Cardiff, Colchester Avenue, Cardiff, CF3 7XR. gelliott@uwic.ac.uk

P Barker
Teesside University, Middlesbrough, Cleveland, TS1 3BA
philip.barker@teesside.ac.uk

Abstract: Multimedia/hypermedia authoring is a phased process, each phase posing particular problems: learning/mastering the software; expression of a knowledge domain into a suitable structural format for 'computerisation'; identification and development of appropriate resources for inclusion in the final product and finally transposition of resource materials into a hypermedia application. Often these phases take place simultaneously increasing the already high cognitive overhead. This paper recognises the growing use of concept maps to mitigate some of the problems associated with hypermedia authoring.

There is a considerable similarity between concept maps (as a means of knowledge representation) and hypermedia structures (for knowledge emulation). The similarity is even closer for hypermedia designed to deliberately reflect the underlying structural knowledge of a domain, i.e. semantic hypermedia. Both techniques represent knowledge domains diagrammatically using graph structures that involve a set of nodes connected by means of labelled and directed arcs. This similarity can be exploited in the hypermedia authoring process.

Hypermedia applications designed for education must be effective in enhancing the learning process, otherwise they become nothing more than sophisticated information bases. This paper explores the functionality of computer-based concept mapping tools and educationally effective hypermedia development. There are other authoring programmes that take a graphical approach to authoring, however these focus on flow diagramming and tend to prescribe the order in which the material is viewed and activated. This paper describes SHAPE®, a prototype concept mapping tool interface to - Asymetrix ToolBook®. SHAPE® is designed to facilitate semantic hypermedia authoring whilst reducing the cognitive overhead of expressing a knowledge domain. SHAPE®, therefore, allows a developer to explore the knowledge domain of interest, and then, through suitable 'post-processing', compile the resultant model into a skeletal hypermedia knowledge corpus.
PROBLEMS WITH AUTHORING

Some observers eg [1] are optimistic that almost anybody can produce college level courseware. However, enthusiasm for hypermedia (also used here to include the subset of multimedia) has not manifested a plethora of development. Rode and Poirier [2] found that 65% of computer literate staff at the University of North Texas were not disposed to writing educational software. Surveys reported by Hammond et al [3] and corroborated by Laurillard et al [4] and Barker and Banerji [5], cited lack of time, lack of training and lack of support staff as the main reasons for non-use of new educational technologies (including hypermedia) by academics. Institutional support for staff developing innovative teaching and learning strategies is needed [6].

THE RELEVANCE OF CONCEPT MAPS FOR HYPERMEDIA DEVELOPMENT

Concept mapping of a knowledge domain offers a route for multimedia development. Concept maps are, at least superficially, easy to understand and easy to draw. If an authoring environment allowed developers to ‘draw’ their subject domain on a screen as a semantic net and add the hypermedia features afterwards it would considerably facilitate development.

Some recent authoring environments allow toggling between different semantic views of the corpus to some extent and some enable augmentation from each view. Reynolds and Danseran [7] have developed their idea of Knowledge Hypermaps which are rich in graphical detail of the hypermedia. Freeman and Ryan [8], and Kommers [9] have focused on the use of concept maps to facilitate collaborative authoring. Miller [10] and Elliott et al [11] have constructed tools that sit on the front end of ToolBook® and allow the author to construct concept maps of their domain which are then ‘post-processed’ into hypermedia structures. Zeiliger et al [12] have added a concept mapping tool to their existing hypermedia applications.

Most authoring progresses with the creation of some domain material, eg a short video sequence, sound overlay, chunks of text and mingled with the addition of links, eg buttons, hot words. The semantic network grows as a ‘by-product’ of the design process, organically and implicitly. An alternative view of authoring would be the expression of the nodes and the semantic links followed by embellishment of the nodes and links through the addition of domain material. Such an approach to the design of hypermedia systems should ensure that hypermedia corpora are linked in the most ‘semantically-appropriate’ manner. The concept mapping approach to authoring can be considered to be a ‘CASE tool’ for hypermedia development, analogous to the use of entity-relationship modelling in database creation and with similar benefits ie more easily produced and more rational applications. Students should be able to explore the teaching and learning resources through the teacher’s view of the domain and then ‘construct’ their own view(s) of the domain linking in additional materials, as appropriate.

There is an issue here of the ability of teachers to externalise their knowledge and make explicit their own understanding of a subject. Knowledge elicitation has proved surprisingly difficult for knowledge engineers in the development of expert systems. Attempting to create concept maps of subjects for hypermedia development may prove an enlightening activity for some teachers and could be similarly applied in other areas, eg expert system development, to facilitate applications development.

CORRELATING CONCEPT MAPS WITH HYPERMEDIA

Concept maps correspond well with basic hypermedia as illustrated in Table 1 and thus provide an appropriate paradigm for exploration in hypermedia development. Heeren [13] has listed the functionality of stand-alone concept mapping tools (see Table 2) although, not all these functions can be found in one extant tool.

Table 1 here
Table 2 here

Elliott et al [14] have discussed the requisite features for the new generation of educationally effective hypermedia.
Appendix A

- Multifaced, multiperspective views of real world problems/issues;
- Active engagement;
- Flexible support of a number of different structures;
- Good search and query facilities;
- Support for different learning styles;
- Interactive sequences;
- Appropriate node size.

The output from any authoring tool and including ones based on concept mapping, must ensure that the product is educationally effective. Some of the features required for educationally effective hypermedia partially map to concept mapping tool functionality as shown in Table 3.

Table 3 here

The features requisite for educationally effective hypermedia that are not supported by currently available concept mapping tools or hypermedia authoring packages, are: active engagement, the provision of multiple perspectives; support for different learning styles. Of these, active engagement is probably the most important requisite for educationally effective hypermedia. The ability to append text and graphics allows only superficial engagement. One simple solution would be to allow the learner to be the author and teacher. Once a hypermedia application has been created by a teacher, the learner should be allowed to append, edit, add and delete parts, as desired. Hypermedia should change the role of teachers and learners, creating a new dynamic of interactive learning for both teacher and student alike [14]. Support for different learning styles is dependent upon how hypermedia is applied in the teaching-learning process and thus, will also effect the level of student engagement. As Laurillard [6] points out, most current hypermedia applications are nothing more than sophisticated information access systems, ie electronic books and it is the way they are deployed within the teaching-learning process that is crucial to success. A supplementation approach rather than supplantation seeming appropriate.

The provision of multiple perspectives and views of a problem or domain would require the overlaying of concept maps, each representing a different perspective. There is not an extant concept mapping tool which provides this functionality.

Hypermedia produced from concept maps must result in applications that accommodate as wide a variety of learning styles as possible. McAleese [15] suggests that maximising the number of links between the nodes of a hypermedia application facilitates multiple learning styles. Multiple links in the hypermedia material would correspond directly to multiple semantic connections in the underlying concept map.

THE OPERATION OF SHAPE®

SHAPE® is built in ToolBook® and produces skeletal ToolBook® ‘books’. ToolBook® was selected because it is rapidly becoming the de facto standard for multimedia development in the UK. SHAPE® is a tool which acts as an interface or ‘front end’ to ToolBook®. SHAPE® is designed with a very simple interface so that the learning curve is short and hence can improve access for teaching staff who find progression beyond a word processing application a challenge. It may prove ironic to add many features and functions to SHAPE® only to lose the goal of low cognitive overhead. SHAPE® works on the principle ‘top - down’ design, i.e. an author starts by drawing the top level concept map of a domain which is then deconstructed into a set of second level concept maps and so on until the author has deconstructed the whole subject domain into a set of ‘atomic’ concepts. These atomic concepts are then post-processed to create a skeletal hypermedia with each concept having an associated screen dedicated to its content as illustrated in Figure 1.
Figure 1: Concept Map Heirarchy in SHAPE showing composite and atomic concepts and associated content pages for atomic concepts

Figure 2 shows the opening screen for SHAPE, which is being used to develop a concept map of the subject 'Information Technology'. Concepts can be input via the concept input box at any time during the authoring session. Once the concepts have been linked as desired it is possible to make some concepts 'composite' as indicated by the shading of the concept 'technology' in figure 2. Composite concepts become submaps in their own right hence deconstructing the concept map to the next level.

Figure 2: Top level concept for 'Information Technology' with input dialogue box showing

The top level concept map is then processed to create the skeletal ToolBook book. Each concept name is converted into a hotword that takes user to a newly generated template ToolBook page. Figure 3 below shows the atomic page for 'Definition'. The composite page for 'technology' is a blank
second level concept map with a hyperlink back to the top level concept map. The author subsequently adds the content into the page for each concept.

Figure 3: Content screen/page for atomic concept ‘Definitions’

The semantic links between concepts are manifest as a list of optional hyperlinks to other pages as shown in figure 3 below for the concept ‘Printers’.

The final product is a ToolBook® ‘book’ comprising of concept maps and corresponding content pages with hyperlinks corresponding to the directional arcs on the concept maps.

ISSUES RELATING TO SHAPE®

Links and link direction

SHAPE®, in common with some other concept mapping tools, has no directionality associated with the links because the semantics are in a sense reciprocal and users form their own ideas of the semantics between concepts. It is sufficient for the author to acknowledge that a significant connection exists between two or more concepts. Concepts do not necessarily need to be linked and in some cases clarity may be enhanced by not linking them, for instance the page ‘People’ may contain a set of concepts detailing the people likely to be involved with IT but there may be little or no relation between them.

Cross referencing and relating

A facility to relate concepts at different levels within the hierarchy may be necessary. There is also a problem related to concepts bearing the same name but have very different context, content or meaning, for instance the possibility of several pages all being called ‘Definition’ is very likely.

Disorientation
There is a possibility of user disorientation with multiple level concept maps, however there are standard search tools built into SHAPE© which should mitigate some disorientation.

**Additional Functionality**

The analysis of educationally effective hypermedia above highlights the need for the development of SHAPE©, however as already noted there is a trade off between an easy to use tool and the likelihood of more primitive applications and a sophisticated tool that produces educationally effective hypermedia but requires considerably more effort in its use.

**Comparisons with other Graphical Authoring Packages**

Packages like Authorware Professional™ and Icon Author™ adopt a graphical approach to authoring. The principle behind these programmes is the control flow diagram, so that the author decides beforehand what decisions the user should make and where in the hypermedia they navigate. There is some merit in controlling learner navigation particularly for novice learners, where the author/teacher can ensure particular material is activated however the danger is that learners become stifled. A concept mapping approach leads to hypermedia applications where learners can make their own navigation decisions, hence indirectly supporting them with different learning styles. The optimum solution is probably to support both types of hypermedia structure.

**EVALUATION AND TESTING OF SHAPE©**

SHAPE© is being developed to facilitate the development of hypermedia learning materials from the learning/mastering of authoring software, expressing a knowledge domain in a suitable structural format for 'computerisation'; identification and development of appropriate resources for inclusion in the final product; and finally the transposition of resource materials into a hypermedia corpus. Therefore the focus for the evaluation of SHAPE© will consider each of these phases. The pedagogical evaluation of material developed with SHAPE© will be necessary but is beyond the scope of the current work.

**DISCUSSION**

Many Academic organisations would welcome more material to support open and distance learning. The appropriate location of hypermedia in the teaching and learning process and appropriate enhancement offers learners the possibility of a stimulating learning environment. However, there are several issues that need to be resolved before the hypermedia 'weapon' finds its place in a lecturer's 'armoury'.

Time is the major obstacle to the increased use of computer-based learning, ie: time to learn the development packages; time to prepare the material; time to integrate or restructure a curriculum around the new computer-based material. Many academic staff are now becoming proficient with word processors probably due to the advent of cheap, easy to use packages and PCs which clearly make text production more efficient. Similarly, easy to use hypermedia authoring tools which produce more effective teaching materials would be likely to revolutionise hypermedia development and use. The use of hypermedia as an alternative to traditional methods will not take place until a cost-benefit analysis shows a clear advantage to hypermedia. Davis et al [16] quoting Christie [17] estimate that it takes between 100 and 150 hours to produce one hour of hypermedia instruction even for experienced developers, an experienced lecturer preparing a one hour lecture session could produce the requisite material in less than 10 hours. Whilst in the short term a cost-benefit analysis will show traditional approaches to have the edge, in the longer term and in the context of open and distance learning, hypermedia starts to win providing major increases in flexibility.

Concept mapping could resolve some of the pedagogical and temporal issues associated with the production of educational hypermedia. Post-processing of concept maps would result in the production of a skeletal hypermedia which could be enhanced by the addition of hypermedia material.
and functionality. Closely linking a concept mapping tool with the hypermedia corpus would enable learners to create their own view(s), extracting material as they browse. This view would form notes which could be taken away on magnetic media.

The adoption of a concept mapping approach to hypermedia development raises a number of fundamental issues. Creating a 'view' of a particular subject would seem simple in theory but may be more difficult in practice. A concept map may prove a transitory, rather than definitive, picture of the domain [18]. In well-defined subject areas, where major interrelations are generally accepted, concept mapping may be neither difficult nor transitory, can only be seen as beneficial to promoting debate.

Expressing knowledge through concept mapping is one thing, doing this directly on a computer is another. The analogy here is of people who create with pen and paper and use a computer to present the creative work. Pen and paper are the creative medium. Better word processing packages can facilitate composition directly at the keyboard. Similarly, to facilitate the development of hypermedia through concept mapping would seem a sensible and tangible goal.

Creating basic hypermedia from a concept map has been achieved with the SHAPE© prototype. Creating educationally-effective hypermedia may be significantly more difficult. The main problem is enabling the representation of multiple perspectives within the same set of concept maps and the mapping of these into the resultant hypermedia. There are no computer-based concept mapping tools which can support parallel views of a cognitive domain and its potential to facilitate hypermedia development. Future versions of SHAPE© could provide the key to parallel views, one of the requisites for educationally effective hypermedia. The other vital issue relates to the way in which hypermedia is used; simply allowing a user to wander around within the hypermedia without purpose is quite futile. Some form of narrative, storey-line or guided discovery mechanism is needed in order to 'make sense' of a hypermedia corpus [14]. It is essential also that users have learning objectives and activities embedded within the hypermedia, i.e. active engagement.

REFERENCES


<table>
<thead>
<tr>
<th>Concept Map</th>
<th>Hypermedia</th>
</tr>
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<tbody>
<tr>
<td><strong>Feature</strong></td>
<td><strong>Attribute</strong></td>
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<tr>
<td>Knowledge Chunk or Concept</td>
<td>Identification</td>
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<tr>
<td>Semantic proximity of concepts(represented by thickness of directed arc or spatial proximity of concepts)</td>
<td>Annotation</td>
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</table>

Table 1: Mapping concept maps to hypermedia

- Sub-map hierarchical
- Submap-zoom
- Outliner
- List of Concepts
- List of relations
- Logical find function
- Fileboxes for organising concepts hierarchically
- 3D representation
- Text can be attached to concepts
- Graphics can be attached to concepts
- Text can be attached to relations
- Graphics can be attached to relations
- Selective representation of concepts and relations
- Computation and representation of concept centrality
- Dynamic path presentation
- Formulate and answer questions (self test)
- Mask concepts (self test)
- Mask relations (self test)

Table 2: Functionality of Concept Mapping Tools [13]
<table>
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<tr>
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Table 3: Mapping Requisite features of educationally effective hypermedia against concept mapping tool functionality.
AUTHORING SEMANTIC HYPERMEDIA: A CONCEPT MAPPING APPROACH

G. J. Elliott, Eleri Jones
Cardiff Institute of Higher Education, Colchester Avenue, CARDIFF, CF3 7XR. gelliott@cihe.ac.uk

P. Barker
Teesside University, Borough Road, MIDDLESBROUGH, TS1 3BA. philip.barker@tees.ac.uk

1. The Authoring Dilemma

Most teaching staff can use a word processing package and, perhaps, a drawing package, but would stall at the challenge of progressing to more complex software packages. The multimedia/hypermedia authoring process consists of a set of phases, each posing particular problems; learning/mastering the software; expression of a knowledge domain into a suitable structural format for 'computerisation'; identification and development of appropriate resources for inclusion in the final product; and finally transposition of resource materials into a hypermedia. Often these phases take place simultaneously increasing the already high cognitive overhead. This paper proposes the use concept mapping tools as way to mitigate against such cognitive overhead.

2. Concept Mapping in Reducing Cognitive Overhead

There is a considerable similarity between concept maps (as a means of knowledge representation) and hypermedia structures (for knowledge emulation). The similarity is even closer for hypermedia designed to deliberately reflect the underlying structural knowledge of a domain, i.e. semantic hypermedia. Both techniques represent knowledge domains diagrammatically using graph structures that involve a set of nodes connected by means of labelled and directed arcs. This similarity can be exploited in the hypermedia authoring process.

3. Authoring Educationally Effective Hypermedia

Hypermedia applications designed for education must be effective in enhancing the learning process, otherwise they become nothing more than sophisticated information bases. By mapping the functionality of computer-based concept mapping tools to educationally effective hypermedia the requisite functionality of concept mapping tools for hypermedia development, can be identified. This mapping has resulted in SHAPE®, a prototype concept mapping tool interface to the de facto hypermedia authoring standard - Asymetrix Toolbook.

4. SHAPE®: Semantic Hypermedia Authoring Package for Higher Education

SHAPE® is designed to facilitate semantic hypermedia authoring whilst reducing the cognitive overhead of expressing a knowledge domain. SHAPE®, therefore, allows a developer to explore the knowledge domain of interest, and then, through suitable 'post-processing', compile the resultant model into a skeletal hypermedia knowledge corpus. There are other authoring programs that take a graphical approach to authoring, however these focus on flow diagramming and tend to prescribe the order in which the material is viewed and activated.
Supporting the Paradigm Shift: Hypermedia Construction With Concept Maps – The Easy Way Forward

G J Elliott and Eliri Jones, University of Wales Institute, Cardiff, Wales and P Barker, University of Teesside, Middlesborough, Cleveland, England

SUMMARY

Academic organizations would welcome methodologies to help teaching staff overcome the seemingly insurmountable obstacles of time and effort requisite for structuring and developing learning support materials. This article describes an experiment comparing the use of the ubiquitous book metaphor for hypermedia authoring with a concept map-based authoring tool designed to facilitate expression of knowledge domains. Experiment showed that subjects preferred the concept mapping authoring paradigm although both metaphors produced equitable applications. Both higher spatial relations ability and Windows experience promoted amenability to concept mapping, resulting in more cognitively complex and expressive concept maps. Subjects meeting concept mapping first rated it much easier to learn and use than the book metaphor of which they were subsequently much more negative. Hypermedia authoring metaphors enabling users to 'picture' their knowledge domains are beneficial, although this is confounded by their spatial relations ability and computing experience.

INTRODUCTION

Academic organisations would welcome materials to support the paradigm shift from teacher-centred to student-centred learning. The location and utilisation of such materials, to supplement or supplant traditional approaches and encourage increased flexibility, promote an increasingly stimulating and interactive learning environment more responsive to individual student needs. Despite the growing availability of 'off the shelf solutions' as a result of considerable investment in TLTP, CTI and related initiatives, in the UK alone, obstacles remain to the wide-spread adoption of educational technology (including hypermedia) by academics (Elliott et al., 1995a). Despite some collaborative approaches to materials development, in reality, 'not invented here' is an issue and many academics prefer to develop their own individual teaching applications. Institutional support for staff developing and using innovative teaching and learning strategies is needed (Laurillard, 1993).

Hypermedia will not replace traditional methods until cost-benefit analyses clearly advantage hypermedia. Estimates are quoted of between 100 to 150 hours to produce one hour of hypermedia instruction even for experienced developers. As opposed to less than ten hours for an experienced lecturer to prepare a one hour lecture (Elliott et al., 1995a). While in the short term a cost-benefit analysis will show traditional approaches to have the edge, in the longer term and for open and distance learning, the balance changes as hypermedia shows the potential for a major increase in flexibility of delivery eroding temporal and geographical constraints which limit traditional teacher-centred delivery.

Many academic staff are now becoming proficient with word processors — probably due to the advent of cheap, easy to use packages and PCs which clearly make text production more efficient. Similarly, easy to use hypermedia authoring tools producing more effective teaching materials would probably revolutionize hypermedia development and use. Concept mapping provides an opportunity for enhanced multimedia development which facilitates the expression of the knowledge domain (Elliott et al., 1995a, 1996).
This article describes the results of an experiment to compare a concept map and a book metaphor for authoring hypermedia with the aim of improving development tools.

**EXPRESSIVENESS OF METAPHOR**

There is a trade off between the expressiveness and simplicity of operation for authoring metaphors. Programs that are more versatile are not usually easy to use. In order to create educationally effective hypermedia, the authoring tool needs to enable the creation of hypermedia supporting:

- multifaceted, multiperspective views of real world problems/issues;
- active engagement;
- flexible support of a number of different structures;
- good search and query facilities;
- support for different learning styles;
- interactive sequences;
- appropriate node size (Elliott et al., 1995a).

Furthermore, authors need the ability to reflect sufficiently the knowledge domain underpinning their completed applications. This means being able to display information chunks in whatever form — sound, text, graphics etc, with associated navigation mechanisms — the system of hyperlinking. Some form of narrative, story-line or guided discovery mechanism is needed in order to ‘make sense’ of a hypermedia corpus (Elliott et al., 1995b).

Novice authors prefer simple minimalist human-computer interfaces, ie without too much screen clutter, eg toolbars, pulldown menus, floating pallets. Tension between the simplicity of the interface and the sufficiency of expression is clear and it may be impossible to give users the power to create educationally effective hypermedia in a minimalist environment.

**AUTHORING METAPHORS**

A range of authoring metaphors are available to construct educational hypermedia: the ‘book’ as in ToolBook™; the ‘control flow diagram’ as in IconAuthor™ and Authorware™; and ‘object-oriented program’ metaphors, eg Visual Basic™, Delphi™, Java™. The control flow metaphor focuses on the navigation decisions that users will make and does not allow the author to ‘see’ the developing knowledge structure. Object-oriented programming metaphors are beyond the current abilities of most academic staff and also do not allow authors to visualize the underlying knowledge structure.

**CONCEPT MAPPING**

Concept maps are used to represent subjects diagrammatically: concepts are represented by nodes linked by arcs representing the semantic relationships between concepts. Arcs can be annotated with arrows to imply directionality and the length of the arc can be used to represent the semantic distance between concepts. Concept maps have been used extensively in education in a number of ways: expressing knowledge domains; curriculum development: assessment; as ‘front ends’ to hypermedia knowledge corpora (eg McAleese, 1987). Concept mapping has ‘CASE’ tool potential for hypermedia authoring (Elliott et al., 1995a), resolving some of the pedagogic and temporal issues associated with educational hypermedia production. Post-processing concept maps then produces skeletal hypermedia for supplementation with hypermedia material and functionality. Closely linking a concept mapping tool with a hypermedia corpus enables learners to create their own view(s), extracting material as they browse to develop their own notes — to be taken away on suitable media. It is recognized that simple concept maps may limit the expressiveness needed for educationally effective hypermedia and additional functionality may be required.

Adopting concept maps for hypermedia development raises fundamental issues. Creating a ‘view’ of a particular subject would seem simple in theory but may be more difficult in practice due to the transitory nature of the cognitive representation. Although in well-defined subject areas, where major interrelations are generally accepted, concept mapping may be neither difficult nor transitory. There can be dangers associated with forcing ideas into inappropriate representations and concept maps may not be the most appropriate metaphor for all knowledge domains.

Expressing knowledge through concept maps is one thing, doing this directly on a computer is another. The analogy here is of people who create with pen and paper and use a computer to present their creative work. Pen and paper are the creative medium. Better word processing packages can facilitate composition directly at the keyboard. Similarly, concept map-based authoring tools, eg SHAPE®, may enhance hypermedia design at the keyboard.
THE CONCEPT MAP-BASED METAPHOR

SHAPE® (Elliott et al., 1996) is a concept mapping tool written in ToolBook™ and acts as an interface or ‘front end’ to ToolBook™ books with automatically indexed, cross-referenced pages for content addition. SHAPE® is a minimalist design environment containing only essential screen-objects. SHAPE® works on the principle of ‘top-down’ design, i.e. an author starts by drawing a top-level concept map of a knowledge domain and proceeds to deconstruct it into successively lower level concept maps until the desired degree of detail is achieved. The hierarchy of maps is post-processed to create skeletal hypermedia where each concept has an associated content-page and the semantic links between concepts are translated into hyperlinks between content-pages.

THE BOOK-BASED METAPHOR

Books are collections of pages of textual material linearly arranged to form an integrated whole and with protective covers. Books are powerful, pervasive and ubiquitous vehicles for externalizing knowledge. The book metaphor was therefore a natural choice to act as a ‘benchmark’ against which the concept map-based metaphor could be compared. ToolBook™, a Windows-based application, was selected because it is extensively used for multimedia development and has an explicit association with the book metaphor.

ToolBook™ was simplified for the purposes of this experiment so subjects would not have to confront the full extent of ToolBook™ but would still experience development with the book metaphor. It is fairer to refer to the simplified program as the ‘The Book Metaphor’ (TBM) and not as ToolBook™. The modified program allows users to create empty standardized pages and easily, albeit manually, hyperlink to other pages.

HYPOTHESES

Concept mapping using SHAPE® would facilitate the development of hypermedia by allowing subjects to develop pictorial representations of knowledge domains without the cognitive overhead of learning and using an authoring package and thus the Ease of Learning and Ease of Use (ELU) for SHAPE® would be much higher than TBM. Neither metaphor would produce superior hypermedia products since subjects could only construct content-chunks or hyperlinks and both metaphors had mechanisms for this. Rating of the task match of the two metaphors to authoring hypermedia would not significantly differ. Computing skills as measured with CSM(Windows) would affect rating of task match and ELU for both metaphors and subjects with high computing skills would rate SHAPE® higher than TBM. The order of using each authoring metaphor (SHAPE®/TBM or TBM/SHAPE®) would affect ELU rating and task match, and more specifically the preference of SHAPE® over TBM would diminish for subjects using SHAPE® first as they would have already developed a better mental image of the knowledge domain. A preference for concept mapping would be associated with high spatial relations ability and previous experience with concept maps.

METHODOLOGY

Comparison of the concept map and book-based metaphors was undertaken with teaching staff, many without previous experience of hypermedia authoring, at a University College in South Wales. Following a pilot study with five subjects, to date 15 subjects have been evaluated. The experiment has focused on authoring issues rather than on the complexity of the knowledge domain and thus subjects were asked to construct a trivial hypermedia application. It was important that the task related to a knowledge domain that was equally familiar to ensure parity for all subjects. The task chosen was to construct a skeletal hypermedia application containing at least three hyperlinks that described the faculty, its courses and staff to potential students. All subjects tested to date are situated in the same faculty and should have a similar understanding of the term ‘faculty’. Subjects were not required to add content in the form of text and other media as the techniques involved are the same for both metaphors.

EXPERIMENTAL DESIGN

Independent variables

Along with gender and age, previous experience of concept maps, the other independent variables measured were:

- Prior computing skill;
- Computing experience, and specifically Windows
skills, were seen as an important variable in evaluating the two authoring metaphors due to the skills transfer between programs. More experienced users of Windows programs should be able to learn a new Windows application more rapidly. To measure computer skill, subjects completed the Computer Skills Metric for Windows (CSM(Windows)) (Elliot et al., 1997) which consists of a Computer Skills Inventory (CSI) identifying Windows experience together with five practical skills tests;  
- Spatial ability. It was hypothesized that a subject's spatial ability would affect the ease with which they constructed a concept map of a knowledge domain. Thus the spatial relations element of the Technical Skills Battery (The Psychological Corporation, 1996) was administered prior to the experiment;  
- Order of use of packages; after subjects have attempted the task using one metaphor they will have developed a mental 'picture' of the subject domain which could influence their understanding of the task when using the other. To compensate for this subjects were randomly placed into two groups which used the metaphors in different order.

Dependent variables

The dependent variables were: ELU, Task-Match and Motivation-to-Continue (measured using Likert scale-based questionnaires).

EXPERIMENTAL PROCEDURE

After measuring CSM(Windows) and spatial relations, subjects were randomly divided in two groups, one using TBM then SHAPE£ and the other using SHAPE£ then TBM. Each session was undertaken consistently using a set of researcher-administered prompts. Subjects learnt to use each application by completing the task described above. Following the learning session, subjects were asked to complete an ELU and task-match questionnaire. After completing the exercise with one authoring metaphor subjects attempted the exercise with the other metaphor.

RESULTS

The mean ELU for SHAPE£ was significantly higher (83.31 ± 10.40 (mean ± SE of mean)) than for TBM (69.7 ± 11.38) (Paired t-test, t = -3.7, P = 0.002). Figure 1 plots ELU scores for TBM and SHAPE£ against CSI score.

![Figure 1](image)

There was a significant correlation between a subject's CSI score and their ELU rating of TBM (Pearson correlation, r = 0.54, P = 0.03) but not between CSI score and ELU rating for SHAPE£ (r = 0.46, P = 0.07), indicating that SHAPE£ is rated easier than TBM whatever a subject's computer skill.

There was no significant difference between task match for TBM (5.75 ± 1.24 (mean ± SE of mean)) and SHAPE£ (6.38 ± 0.72) (paired t-test, t = -1.84, P = 0.086). The order of learning affected the ELU ratings for TBM: subjects who learned SHAPE£ first, rated the ELU for TBM significantly lower (mean = 64.00) than those who learned TBM first (mean = 75.37) (t-test, t = 2.25, P = 0.041).

There was a significant correlation between the number of links (Pearson correlation, r = 0.65, P = 0.008) and concepts (r = 0.51, P = 0.049) created using SHAPE£ and spatial relations ability. Interestingly, there was no significant correlation between the number of hyperlinks (Pearson correlation, r = 0.04, P = 0.896) and pages (r = 0.22, P = 0.462) created with TBM and spatial relations ability, indicating that there was a definite relationship between spatial relations ability and aptitude to represent knowledge diagrammatically. There was also significant correlations between previous use of concept maps and the task match of SHAPE£ (Pearson correlation, r = 0.68, P = 0.016) although previous use of concept maps did not affect ELU rating of SHAPE£ (Pearson correlation, r = 0.53, P = 0.074). Subjects expressed a higher motivation to continue with SHAPE£ than TBM.

DISCUSSION

This study compared the use of concept mapping and book-based metaphors for hypermedia authoring by
teaching staff. While the study is limited by a small sample size and use of a task involving the development of a trivial application which could pose problems in relation to scaling up to a full-scale project, it clearly shows that concept mapping is significantly easier to learn and use than the book metaphor, although both approaches were seen as equitable in achieving the objectives of the exercise. This study thus supports the use of graphical interfaces to express knowledge domains, allowing users to 'draw' their subject areas on the screen. A development tool should take account of user aptitudes, in this case prior computing skills and spatial ability. Subjects with higher spatial relations ability created more links between concepts and hence hyperlinks than those with lower spatial relations abilities. Subjects who used SHAPE first were subsequently much more negative about TBM, finding it clumsy and 'with too much going on' on the screen.

There is a clearly a trade-off between displaying too much information on the screen which can confuse and too little which can disorientate and SHAPE is no different. Subjects observed that they felt lost in the hierarchy of concept maps created and several requested the aid of an 'overview map' so that they could 'see where they were'. This enhancement will be implemented in future versions of SHAPE.

CONCLUSIONS

Subjects preferred concept mapping to the book-based metaphor although they recognized that both create equitable hypermedia products. The preference was heightened for subjects with previous experience of concept mapping and higher spatial relations scores. Windows skills had an effect on how easy they rated the book metaphor but not the concept mapping metaphor. Subjects with higher spatial relations ability created more complex concept maps with more links and levels but there was no similar correlation with the complexity of the applications created with the book metaphor. The order of learning of the metaphors affected ELU rating, ie subjects using concept mapping first were subsequently much more negative about the book metaphor. Despite the ubiquity of the book metaphor, diagrammatic knowledge representation using concept mapping is beneficial and can facilitate hypermedia authoring.

REFERENCES


BIOGRAPHICAL NOTES

Geoff Elliott is a Senior Lecturer in the Faculty of Business, Leisure and Food, University of Wales Institute, Cardiff, specializing in information processing and management. Geoff is currently completing a PhD focusing on cognition in hypermedia development and specifically on reducing cognitive overhead associated with hypermedia development.

Eleri Jones is Dean of Resources and Special Projects in the Faculty of Business, Leisure and Food, University of Wales Institute, Cardiff, and leads the Centre for the Support of Lifelong Learning which is an aggregation of projects promoting flexible delivery of accredited learning and learning support strategies for work-based learning.

Phil Barker is Professor in the Interactive Systems Research Unit, School of Computing and Mathematics, University of Teesside, where he leads a number of projects promoting the design of usable and ergonomically sound computer systems.

Address for Correspondence: Faculty of Business, Leisure and Food, University of Wales Institute, Cardiff, Colchester Avenue, Cardiff, CF3 7XR. e-mail: gelliott@uwic.ac.uk
Development of the Computer Skills Metric for Windows

G. J. Elliott, Eleri Jones,
University of Wales Institute, Cardiff, Wales
gelliott@uwic.ac.uk

P. Barker
University of Teesside, Middlesbrough, Cleveland, England

Abstract: This paper describes the development of a metric for Windows 3.x computer skills. The metric consists of a Usage and Skill Level Inventory and a Computer-based Skills Test. The Usage and Skill Level Inventory rates previous experience of using Windows 3.x programs and generic Windows skills. The Computer-based Skills Test is a set of trivial tasks designed to reflect Windows skill. The two parts independently assess self-declared experience and actual performance in Windows. The results of the evaluation of the metric so far suggest that for the group of higher education teaching staff there is a significant (P<0.05) correlation between Inventory score and performance in the Skills Test, whereas for students the correlation is non-significant. Explanations for this disparity are explored and recommendations are made to improve the metric.

Introduction

Work at University of Wales Institute Cardiff in hypermedia authoring has focused on the development of SHAPE\textsubscript{E} - a Semantic Hypermedia Authoring Package for higher Education which is designed to use concept mapping techniques to reduce the cognitive overhead of expressing a knowledge domain and produce a skeletal hypermedia knowledge corpus which can be ‘fleshed out’ by the addition of multimedia materials, e.g. text, graphics, video clips [Elliott et al 1995]. [Elliott et al 1996], SHAPE\textsubscript{E} has currently been produced as an interface to the standard authoring package Asymetrix ToolBook\textsuperscript{TM} which is a Windows-based product. Thus, in evaluating the ease of learning and ease of use of SHAPE\textsubscript{E}, one runs into problems associated with the transferability of Windows skills. Windows, like other graphical user interfaces (GUIs) e.g. Macintosh Desktop, was specifically designed to provide a consistent user interface using menu symbols or names already familiar to the user to facilitate more rapid learning [Foley et al 1994] and thus Windows experience/expertise was an independent variable which needed to be controlled, since subjects with a greater Windows experience should be better able to engage with a new Windows-based program more rapidly.

This paper describes the development of a metric for assessing an individual’s Windows skill. The metric, Computer Skills Metric for Windows (CSM(Windows)), is defined here as a person’s transferable skill of using Windows and Windows-based packages, excluding Windows 95 and Windows 95-based products on personal computers. Van Vliet et al [Van Vliet et al 1994] point out that there have been a number of attempts to develop tests to measure computer skill, although each is intended for particular subject group and computer skill. In their experiment Van Vliet et al found that self appraisal tests used alone can introduce a leniency bias where subjects inflate their own skills and Van Vliet et al concluded that to get a true picture of skill, a number of different measures should be triangulated to give a more accurate assessment.

Definition of Computer Skill

A simple definition of skill has eluded both behavioural and cognitive psychologists although defining characteristics of skill include: a wide behavioural domain in which behaviours are assumed to be complex; an understanding that skills are gradually learned through training; and attaining a goal is dependent upon motor behaviour and processes. Gattiker [Gattiker, 1992] categorises the meaning of the term ‘skill’ in relation to its potential ease of transferability and reasons that computer-interface-skills have low transferability.

Each individual is equipped with innate motor behavioural abilities and an ability for cognitive processing (abstract reasoning, problem solving, etc.) which they can develop generally or achieve specific tasks/jobs.
Appendix A

CSM(Windows) measures both motor-behavioural (e.g. mouse and keyboard) skills and cognitive process abilities (e.g. finding/knowing the correct icon, command sequences, menus). Subjects with a high skill level in Windows generally, should be able to rapidly orient themselves in an unknown Windows program, provided that the objective of the unknown program is fairly easy to understand.

From observations of four cohorts of students taking a course in basic computer skills over a four year period a list of elementary skills for using Windows and Windows-based packages has been compiled:

<table>
<thead>
<tr>
<th>Psycho-motor skills:</th>
<th>Cognitive Processes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Single click with left mouse button</td>
<td>- Successfully carry out a sequence of the above activities to complete a task e.g. draw a shape on the screen</td>
</tr>
<tr>
<td>- Double click with left mouse button</td>
<td>- Learn a sequence of the above activities to complete a task</td>
</tr>
<tr>
<td>- Drag and drop</td>
<td>- Search for assistance to carry out an action and follow instructions</td>
</tr>
<tr>
<td>- Select from button types, menu options, dialogue boxes as required</td>
<td>- Understand/create/update/delete file and catalogue structures</td>
</tr>
<tr>
<td>- Input via keyboard</td>
<td>- Understand salient aspects of hardware: hard drive; floppy drive</td>
</tr>
</tbody>
</table>

The CSM (Windows) Metric

The metric is computer-based and has two parts: a Usage and Skill Level Inventory, and a Computer-based Skills Test (a battery of 5 exercises that aim to test the list of motor-behavioural and cognitive processing skills above). The philosophy behind the inclusion of an inventory and a test-battery was that each part could help validate the other.

Usage and Skill Level Inventory

This is designed to find how extensively subjects use Windows and Windows-based applications and is completed by the subject under the supervision of the researcher. The inventory asks salient questions about the subject’s experience in terms of experience of using Windows and Windows-based applications. It is recognised that even if a subject uses Windows all the time they may still have a low skill level. The last inventory question asks subjects about their perceived skill level is on a scale from None to Very High.

Computer-based Skills Test

The exercises are monitored exercises which incorporate typical Windows-based tasks. Whilst it is recognised that the exercises also test other cognitive factors, such as problem solving skills, the tasks are designed to be trivial as possible with simple instructions printed on the screen to reduce cognitive overhead. The underpinning hypothesis is that subjects with prior Windows skills should complete more of the exercises more quickly than those without. CSM (Windows) calculates the time taken and the percentage of each exercise completed.

Use of help facility

A standard help facility is available throughout the exercises to help subjects complete them although no help is given on basic Windows skills. Use of the help facility is seen as an important Windows skill so any use of the help menu, particularly in exercises 3, 4 and 5 which are more complex exercises are counted and registered by the system.
The Exercises:

The exercises attempt to measure different aspects of Windows skill however it was anticipated that there would be some overlap of these aspects. It was therefore of interest to see the extent to which the results of the exercises co-varied. Significant covariance between the exercises would suggest that one exercise could be substituted for another if necessary. The table below explains what each exercise is designed to measure.

<table>
<thead>
<tr>
<th>Tests ability to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 'Drag and drop'. The cursor changes when dragging the shapes which is a familiar Windows requirement. If subjects do not know how to 'drag and drop' they will not be able to complete this exercise.</td>
</tr>
<tr>
<td>2 Click to move the cursor into the text entry box and keyboard knowledge. Subjects are asked to copy type a short paragraph that includes some of the less commonly used keyboard characters that require the use of the shift key, etc. The time to complete this exercise should be directly related to typing ability (for non-typists). The program measures any mistakes that subjects make in carrying out the task.</td>
</tr>
<tr>
<td>3 Construct objects on screen, using a series of commands and pull-down menus / tool-buttons / mouse - activities.</td>
</tr>
<tr>
<td>4 Carry out a sequence of activities using a command-driven interface. This exercise attempts to test a subject's understanding of the computing paradigm, i.e. the logical sequence of activities and the need for precision in syntax in specifying an action/command. Subjects with a background in general computing should be able to carry out this test better than those who without.</td>
</tr>
<tr>
<td>5 Carry out a bogus task using a number of standard Windows features: double-clicking; restoring and minimising objects; using option buttons and sliders; selecting files. Although subjects will not understand the task they should, if they are proficient at using Windows, be able to carry it out. CSM (Windows) measures which elements of the exercise has been completed</td>
</tr>
</tbody>
</table>

Procedure

CSM (Windows) has been used by 97 subjects to date, 74 first year students who had just completed a course in basic computer skills and Information Technology and 23 higher education lecturing staff. The program was administered to the students in a computer laboratory and they were told that the results were confidential, would only to be used for research purposes and would have no effect on their assessed mark for the course. The program was administered to lecturing staff in a similar fashion with the assurance that the results were confidential and would be used for research purposes only.

Results

The results are presented as a comparison between the two subject groups because of the differences observed between them.

Reliability

A Cronbach alpha test was carried out on the two parts of CSM(Windows) and the results showed that the Inventory was reliable, probably because it has so many component elements, whereas the exercises are less reliable, probably because there are only 5 elements.

Usage and Skill Level Inventory

Table 1 shows the median and interquartile range (IQR) for experience for the use of Windows and Windows-based programs for staff and student groups. The higher the median score the higher the experience and self-declared expertise in that area.
Appendix A

<table>
<thead>
<tr>
<th>Windows Program</th>
<th>Usage (Median)</th>
<th>IQR</th>
<th>Declared skill (Median)</th>
<th>IQR</th>
<th>Usage (Median)</th>
<th>IQR</th>
<th>Declared skill (Median)</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word-processing</td>
<td>3.00</td>
<td>1.00</td>
<td>3.00</td>
<td>1.00</td>
<td>3.00</td>
<td>2.25</td>
<td>2.50</td>
<td>2.25</td>
</tr>
<tr>
<td>Spreadsheets</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.25</td>
<td>2.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Databases</td>
<td>0.00</td>
<td>2.00</td>
<td>2.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.50</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Email</td>
<td>1.00</td>
<td>0.50</td>
<td>2.00</td>
<td>1.25</td>
<td>0.50</td>
<td>1.00</td>
<td>2.00</td>
<td>3.25</td>
</tr>
<tr>
<td>DTP/Drawing</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Table 1: Median and IQR values for usage of typical Windows applications by staff and students.

The mean overall accumulated inventory score for staff was 38.59 with a standard deviation of 25.45 and for students the mean was 28.59 with standard deviation of 10.05, the difference between the two groups was not significant (Student's t test, t=1.8, P=0.085).

Computer-based Skills Test

Table 2 Compares the mean times and mean fraction-completed of each exercise by staff and students.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Time</th>
<th>Fraction-completed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 shows the Pearson correlation coefficient between the mean times and fraction-completed for each exercise and the inventory score.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Students</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Pearson correlation coefficients between the mean times and fraction-completed for each exercise and the inventory score for the two subject groups.
Appendix A

Correlations between the exercises

Some of the between-exercise correlations for exercise times for staff (between exercises 1 and 2 \((r=0.66)\), 3 and 4 \((r=0.80)\) and 4 and 5 \((r=0.45)\)) and students (between exercises 1 and 2 \((r=0.29)\), 2 and 3 \((r=0.28)\), 2 and 4 \((r=0.31)\), 3 and 4 \((r=0.31)\) and 4 and 5 \((r=0.28)\)) are significant \((p<0.05)\). There were very few significant correlations between the exercises for fraction-completed.

Use of the help facility

Table 4 below shows the mean number of times help used and its correlation with the inventory score for each subject group.

<table>
<thead>
<tr>
<th></th>
<th>Staff</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean usage of help facility</td>
<td>4.30</td>
<td>6.55</td>
</tr>
<tr>
<td>Standard deviation of usage of help facility</td>
<td>6.50</td>
<td>6.62</td>
</tr>
<tr>
<td>Correlation of use of help with inventory score</td>
<td>-0.09</td>
<td>0.03</td>
</tr>
<tr>
<td>Significance of correlation of use of help with inventory score</td>
<td>0.67</td>
<td>0.80</td>
</tr>
<tr>
<td>Correlation of use of help with overall completion Rate</td>
<td>0.39</td>
<td>0.22</td>
</tr>
<tr>
<td>Significance of correlation of overall completion rate</td>
<td>0.07</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Table 4: Mean number of times help used during exercise and correlation with the inventory score for each subject group

Discussion

The staff inventory scores covered a wider range of values than the students even though the sample was smaller. This is not surprising since the students (mean age 20) represent a more homogeneous group with less overall experience of computers. The application skills were similar for both groups, however staff had greater experience in email, other Windows programs and Windows utilities. The responses to the questions appeared to be a fair reflection of both groups computer experience. The differences between the overall inventory scores was not significant because of the wide variation of the staff group and the homogeneity of the student group.

The differences between timings for exercises 1 and 2 for staff and students was not significant, however it was for the other exercises. The differences between the fraction-completed for staff and students for all exercises were not significant, indicating that although their timings for the exercises differed they did not complete anymore. All subjects completed exercise 1 and the timings correlate with the inventory score significantly for both groups, indicating that exercise 1 is a measure of a subject's Windows expertise. Students spent considerably more time trying to complete exercises 3, 4 and 5 than did the staff. This may be because the students felt that they were 'competing' with their peers and did not want to be seen to have failed whereas the staff seemed more circumspect about their performance. Another reason might be that since the average age of the staff group was greater i.e less 'attuned' to computers and the group had proportionally more low inventory scores so they were less confident and gave up quicker. Another confounding factor could be that this group of students had just completed an introductory course in using Windows-based programs. These factors need further study.

The times taken to complete the exercises 1 and 2, 3 and 4, and 4 and 5 co-varied significantly in both groups. There was a significant correlation for fraction-completed for the student group only between exercise 4 and 5. The picture for the staff group is very different with significant correlations between exercise 3, 4 and 5. These covariances point to overlaps in the skills being measured and will require further analysis to explain the observations.

Students were more inclined to use the help facility than staff suggesting that they were again more confident in using computers. There was no correlation between use of the help facility and inventory score and use of help
and completion rate for either group, suggesting that use of help is idiosyncratic and does not have a bearing on the success of subject in a new computer situation.

The correlation between student performance in the exercises and their inventory score was not significant, but it was for staff. Accounting for this discrepancy is difficult - if the exercise were badly designed one would not expect a high correlation for either group. If the exercises are viewed simply as problems, one might expect subjects with good problem solving skills to do better. A measure of the students’ generic problem solving skills is not readily available, however performance in an assignment not closely related to computer skill has been made available. This assignment required students to analyse the information technology needs of a known organisation. The correlation between their performance in this assignment and the fraction-completed of the exercises is significant (r=0.33, P=0.005). Interestingly there are no significant correlation between their assignment mark and the inventory scores, use of the help facility and the times spent on each task, suggesting that it was the students’ problem solving skills that largely dictated their success in the exercises and not their experience in using computers. Subjects were asked to rate their overall skill from none the very high in using Windows, this correlated significantly for both groups with the inventory score (students r=0.66, P=0.00, staff r=0.93, P=0.00)indicating that their answers were consistent and supported by the reliability analysis.

Conclusions and further research

Both students and staff seemed to be honest in their answers to the Usage and Skill Level Inventory which reliably reflects their usage and skill in using Windows and Windows-based packages. Although, as [Von Vliet et al 1996] note, there is a danger of an inflationary bias in the results of self-appraisal tests if they are to be used for a formal evaluation of performance. There was a good correlation between staff inventory scores and their performance in the exercises but almost none for the students. A possible explanation for this may be that students are more comfortable with computers than staff, are more tenacious and more willing to experiment. Another reason might be that Windows has become transparent to the students and it is only their problem solving abilities that are being assessed.

The degree to which Windows is transparent to students and the exercises only measuring problem solving skill needs to be explored. The co-variances between the exercises needs to be further studied to discover what are the overlapping components of Windows skill. The lack of correlation between the use of the help facility and performance in the exercises for either group is a salutary lesson for help facility designers and could be investigated further.

CSM(Windows) will be re-examined and refined following this initial evaluation, but the usage and skill level, inventory has been found to be a good measure of a subject’s experience of Windows.

References

Appendix B
Appendix B: Summary of Raw results

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Appendix C
Appendix C Ease of Learning and Ease of Use Questionnaire

The Ease of Learning and Ease of Use questionnaire is computer based, below is a paper version for TBM

Name: ___________ Learning the Package TBM

Mark the point which best represents your attitude when reflecting on your experiences of learning this program

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<td>TBM is no more difficult than other Windows based programs</td>
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</tr>
<tr>
<td>9</td>
<td>I often became confused learning TBM</td>
<td>I did not become confused learning TBM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>10</td>
<td>It took too much time to learn TBM</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>I could easily understand how TBM resulted in a hypermedia application</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>The time and effort learning TBM were well spent</td>
<td></td>
</tr>
</tbody>
</table>
Name: ____________________ Using the Package TBM

Mark the point which best represents your attitude when reflecting on your experiences of using this program

<table>
<thead>
<tr>
<th></th>
<th>It was easy to use TBM</th>
<th>It was difficult to use TBM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It was easy to use TBM</td>
<td>It was difficult to use TBM</td>
</tr>
<tr>
<td>2</td>
<td>I liked using TBM</td>
<td>I didn't like using TBM</td>
</tr>
<tr>
<td>3</td>
<td>I had no difficulty understanding how to use TBM</td>
<td>I had difficulty understanding how to use TBM</td>
</tr>
<tr>
<td>4</td>
<td>The set of operations one needed to use were easy to remember</td>
<td>The set of operations one needed to use were difficult to remember</td>
</tr>
<tr>
<td>5</td>
<td>The set of operations one needed to use TBM were easy to carry out</td>
<td>The set of operations one needed to use TBM were difficult to carry out</td>
</tr>
<tr>
<td>6</td>
<td>It was obvious what to do next</td>
<td>It was not obvious what to do next</td>
</tr>
<tr>
<td>7</td>
<td>I became confused trying to complete the task</td>
<td>I did not become confused trying to complete the task</td>
</tr>
<tr>
<td>8</td>
<td>I did not have a clear picture of how TBM would lead to a final application</td>
<td>I had a clear picture of how TBM would lead to a final application</td>
</tr>
<tr>
<td>9</td>
<td>TBM made it difficult to complete the task</td>
<td>TBM made it easy to complete the task</td>
</tr>
<tr>
<td>10</td>
<td>I really felt I had accomplished something using TBM</td>
<td>I didn't really feel I had accomplished anything using TBM</td>
</tr>
<tr>
<td>11</td>
<td>I felt frustrated using TBM</td>
<td>I did not feel frustrated using TBM</td>
</tr>
<tr>
<td>12</td>
<td>I felt comfortable using TBM</td>
<td>I felt uncomfortable using TBM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>13</td>
<td>TBM was fun</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>It took too much time to use TBM</td>
<td></td>
</tr>
</tbody>
</table>
Appendix D Script for One-to-One Training Sessions

Final Script used in study:

SHAPE® Session Interview

Name: ____________________________

Explanation of what I am doing

I am looking at the problems that lecturing staff have with the development of multimedia or hypermedia applications for their teaching programs. More specifically I am looking at how to make the process of developing hypermedia easier for lecturers to accomplish. What I what you to do is to carry out a simple exercise to develop a basic application using a program called SHAPE® and another called ToolBook®. This session will run as follows:

- I will ask you some questions and want you to complete a number of exercises.
- Then I will ask you to complete a test which measures your spatial ability.
- Then there will be a training period during which time you will develop a simple multimedia application using SHAPE®.
- Following the training period I will ask you some other questions.
- The process will then be repeated using the other ToolBook®.

I would now like to show you an example of a multimedia application.

(Demonstrate Click-IT)

How would you now rate your understanding of hypermedia/multimedia?

<table>
<thead>
<tr>
<th>Very Low</th>
<th>Low: Vaguely heard of the idea before being shown the demonstration.</th>
<th>Fair: I have seen several applications</th>
<th>High: I am very familiar with the idea of hypermedia and have used several applications</th>
</tr>
</thead>
</table>

(Demonstrate a hyperlink)

How would you now rate your understanding of hyperlinking?

<table>
<thead>
<tr>
<th>Very Low</th>
<th>Low: Vaguely heard of the idea before being shown the demonstration.</th>
<th>Fair: I have seen and used hyperlinks</th>
<th>High: I am very familiar with the idea</th>
</tr>
</thead>
</table>

(Show example concept map) Explanation of concepts and links
Appendix D

How would you now rate your understanding of concept maps?

<table>
<thead>
<tr>
<th>Some familiarity:</th>
<th>Reasonable</th>
<th>Fairly familiar:</th>
<th>Very familiar:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seen a few concept maps but never drawn one.</td>
<td>I have drawn a few and I understand their use.</td>
<td>I use them occasionally and understand what they do.</td>
<td>I use them often</td>
</tr>
</tbody>
</table>

Explanation of the use of SHAPE®

SHAPE® utilises concept maps to create the structure of the material you wish to turn into a multimedia application. SHAPE® works by first creating a set of concept maps of your teaching material, these are then converted into a set of pages like I showed you above. The textual content etc can then be added. (Show diagram of the layering of concept maps)

How would you now rate your understanding of the use of SHAPE®?

<table>
<thead>
<tr>
<th>None: I don’t understand the use of SHAPE®</th>
<th>Low: I am still unclear what SHAPE® does</th>
<th>Fair: I think I understand what SHAPE® does?</th>
<th>High: I understand the use of SHAPE® well</th>
</tr>
</thead>
</table>

Explanation of the Task

The task I want you to attempt is to develop a multimedia application that describes the faculty i.e. the people the structure and activities etc. The application will be used by potential students to learn more about the faculty, i.e. a computerised brochure. In creating the application I want to you to have included information about

- The structure of the faculty
- The people of the faculty and what they do
- The Schools and their activities
- The courses run by the faculty
- Anything else you think merits inclusion

I want you to create at least three hyperlinks that you think are needed for users to navigate between related material e.g. Schools and courses.

It will not be necessary to complete the whole exercise, only as much as is required to describe down to the details of your school.
Appendix D

Post-SHAPE® Session Interview

How would you now rate your understanding of the use of SHAPE®?

| None: I don’t understand the use of SHAPE® | Low: I am still unclear what SHAPE® does | Fair: I think I understand what SHAPE® does? | High: I understand the use of SHAPE® well |

Describe to me what SHAPE® does?

What general impressions did you have using SHAPE®?

How easy did you find the ideas behind SHAPE® to grasp?

Was there anything confusing about using SHAPE®?

Was there anything about SHAPE® you would change?

I’d like you to comment on the follow screens

How well do you think SHAPE® allowed you to achieve the objectives of the exercise?

How well do you think SHAPE® would allow you to produce an application for your own teaching?

Was there anything about SHAPE® that made it difficult or unsatisfactory in producing an application that matched the objectives of the exercise?

Was there anything about SHAPE® that made it easy in producing an application that matched the objectives of the exercise?

After having learnt to use SHAPE®, do you have any general thoughts on what makes a program easy to learn?

After having learnt to use SHAPE®, do you have any general thoughts on what makes a program easy to use?

How motivated are you to continue to use SHAPE® to develop an application for your own teaching?

| Very little: I don’t feel very inclined to continue at all | A little: I am interested but I don’t have the time or inclination to continue | Fair: I am interested and I would like to continue if I had the time | High: I am very interested I will make an effort to continue |

What would prevent you from using SHAPE® to create an application for your own teaching?

Please could you mark your answers to the following statements (EoL and EoA)
TBM Session

I want you to repeat the same exercise using TBM.

Explanation of the use of TBM.

TBM is a commercial program designed to create multimedia applications like the one I have just shown you. TBM uses conventional books as the metaphor for designing your application. This essentially means that you, the designer create pages or screens of content with text pictures, sound etc and then add the hyperlinks to connect one page of content to another.

How would you now rate your understanding of the use of TBM?

<table>
<thead>
<tr>
<th>Very Low: Only what has just been explained to me</th>
<th>Low: Vaguely heard of the idea before the explanation</th>
<th>Fair: I have seen TBM but have not used it and understand its use</th>
<th>High: I have used TBM and I am familiar with its use</th>
</tr>
</thead>
</table>

I have made some alterations to TBM to make the task as simply as possible.

Post-TBM Session Interview

How would you now rate your understanding of the use of TBM?

<table>
<thead>
<tr>
<th>Very Low: Only what has just been explained to me</th>
<th>Low: Vaguely heard of the idea before the explanation</th>
<th>Fair: I have seen TBM but have not used it and understand its use</th>
<th>High: I have used TBM and I am familiar with its use</th>
</tr>
</thead>
</table>

Describe to me what TBM does?

What general impressions did you have using TBM?

How easy did you find the ideas behind TBM to grasp?

Was there anything confusing about using TBM?

Was there anything about TBM you would change?

I'd like you to comment on the follow screens

How well do you think TBM allowed you to achieve the objectives of the exercise?

How well do you think TBM would allow you to produce an application for your own teaching?

Was there anything about TBM that made it difficult or unsatisfactory in producing an application that matched the objectives of the exercise?
Appendix D

Was there anything about TBM that made it easy in producing an application that matched the objectives of the exercise?

After having learnt to use TBM do you have any general thoughts on what makes a program easy to learn?

After having learnt to use TBM do you have any general thoughts on what makes a program easy to use?

How motivated are you to continue to use TBM to develop an application for your own teaching?

Very little: I don’t feel very inclined to continue at all
A little: I am interested but I don’t have the time or inclination to continue
Fair: I am interested and I would like to continue if I had the time
High: I am very interested I will make an effort to continue

What would prevent you from using TBM to create an application for your own teaching?

Please could you mark your answers to the following statements (EoL and EoA)

Post Sessions Interview

How do you think TBM and SHAPE® compare with each other in terms of:
• ease of learning;
• ease of use; and
• suitability to produce an application that matches the defined task?
Initial Script used in Pilot Study:

Pre-learning SHAPE-Session - Interview

Do you know what hypermedia is?
Do you know what multimedia is?
Do you know what a concept map is?
Do you know what Toolbook is? Have you ever used it and how extensively?
How will you use the product of this work?
Explanation of what I am doing

Post Learning SHAPE Session - Interview
What general impression did you have using SHAPE?
How easy did you find the ideas behind SHAPE to grasp?
Was there anything confusing about using SHAPE?
If you were to rate the ease with which you learned to use SHAPE what would it be?

<table>
<thead>
<tr>
<th>Very easy compared to learning a word processor</th>
<th>Easy compared to learning a word processor</th>
<th>About the same compared to learning a word processor</th>
<th>Hard compared to learning a word processor</th>
<th>Very hard compared to learning a word processor</th>
</tr>
</thead>
</table>

After having learnt to use SHAPE do you have any general thoughts on what makes a program easy to learn?
Appendix E
Appendix E NUD.IST Hierarchical Category Tree of Analysis of One-to-One Training Sessions

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.


(1) /cognition
   (1 1) /cognition/structuring
   (1 1 1) /cognition/structuring/csm
   (1 1 1 1) /cognition/structuring/csm/low
   (1 1 1 2) /cognition/structuring/csm/intermediate
   (1 1 1 3) /cognition/structuring/csm/High
   (1 1 2) /cognition/structuring/sp rel
   (1 1 2 1) /cognition/structuring/sp rel/low
   (1 1 2 2) /cognition/structuring/sp rel/intermediate
   (1 1 2 3) /cognition/structuring/sp rel/high
   (1 1 3) /cognition/structuring/learn-order
   (1 1 3 1) /cognition/structuring/learn-order/t-s
   (1 1 3 2) /cognition/structuring/learn-order/s-t
   (1 1 4) /cognition/structuring/paper
   (1 1 6) /cognition/structuring/SHAPE
   (1 1 7) /cognition/structuring/TBM
(2) /Ease
   (2 1) /Ease/Eol
   (2 1 1) /Ease/Eol/Accommodation
   (2 1 1 1) /Ease/Eol/Accommodation/SHAPE
   (2 1 1 2) /Ease/Eol/Accommodation/TBM
   (2 1 2) /Ease/Eol/Transparency
   (2 1 2 1) /Ease/Eol/Transparency/SHAPE
   (2 1 2 2) /Ease/Eol/Transparency/TBM
   (2 1 3) /Ease/Eol/Accomplishment
   (2 1 3 1) /Ease/Eol/Accomplishment/SHAPE
   (2 1 3 2) /Ease/Eol/Accomplishment/TBM
(2) /Ease/eou
   (2 2 1) /Ease/eou/Accommodation
   (2 2 1 1) /Ease/eou/Accommodation/SHAPE
   (2 2 1 2) /Ease/eou/Accommodation/TBM
   (2 2 2) /Ease/eou/Transparency
   (2 2 2 1) /Ease/eou/Transparency/issues
   (2 2 2 1 1) /Ease/eou/Transparency/issues/misconceptions
   (2 2 2 1 2) /Ease/eou/Transparency/issues/practice
   (2 2 2 1 3) /Ease/eou/Transparency/issues/linking
   (2 2 2 1 3 1) /Ease/eou/Transparency/issues/linking/SHAPE
   (2 2 2 1 3 2) /Ease/eou/Transparency/issues/linking/TBM
   (2 2 2 1 4) /Ease/eou/Transparency/issues/design
   (2 2 2 1 5) /Ease/eou/Transparency/issues/logic
   (2 2 2 2) /Ease/eou/Transparency/purpose
   (2 2 2 2 1) /Ease/eou/Transparency/purpose/shape
   (2 2 2 2 2) /Ease/eou/Transparency/purpose/TBM
   (2 2 2 2 3) /Ease/eou/Transparency/purpose/task match
   (2 2 2 2 3 1) /Ease/eou/Transparency/purpose/task match/SHAPE
   (2 2 2 2 3 2) /Ease/eou/Transparency/purpose/task match/TBM
   (2 2 2 2 4) /Ease/eou/Transparency/purpose/Instantaneous
   (2 2 2 3) /Ease/eou/Transparency/operation
   (2 2 2 3 1) /Ease/eou/Transparency/operation/Reports
   (2 2 2 3 1 2) /Ease/eou/Transparency/operation/Reports/s-t
   (2 2 2 3 1 3) /Ease/eou/Transparency/operation/Reports/t-s
Appendix E

(2 2 2 3 1 4) /Ease/eou/Transparency/operation/Reports/SHAPE
(2 2 2 3 1 5) /Ease/eou/Transparency/operation/Reports/TBM
(2 2 2 3 2) /Ease/eou/Transparency/operation/Mental Model
(2 2 2 3 3) /Ease/eou/Transparency/operation/Logic of Operation
(2 2 2 3 4) /Ease/eou/Transparency/operation/Operational Momentum
(2 2 2 3 5) /Ease/eou/Transparency/operation/Noise-Economy of Dialogue
(2 2 2 3 6) /Ease/eou/Transparency/operation/Consistency/External
(2 2 2 3 6 1) /Ease/eou/Transparency/operation/Consistency/Internal
(2 2 3) /Ease/eou/Accomplishment
(2 2 3 1) /Ease/eou/Accomplishment/SHAPE
(2 2 3 2) /Ease/eou/Accomplishment/TBM
(2 2 4) /Ease/eou/task match
(2 2 4 1) /Ease/eou/task match/SHAPE
(2 2 4 2) /Ease/eou/task match/TBM
(3) /Focus Group
(3 1) /Focus Group/SHAPE
(3 2) /Focus Group/Web Maker
(3 3) /Focus Group/Authorware
(3 4) /Focus Group/Authorware
(3 5) /Focus Group/ToolBook
(3 6) /Focus Group/Post session
(3 7) /Focus Group/Greg’s interview
(3 8) /Focus Group/Analysis
(3 8 1) /Focus Group/Analysis/Usability
(3 8 2) /Focus Group/Analysis/mental model match
(3 8 3) /Focus Group/Analysis/transparency of operation
(3 8 4) /Focus Group/Analysis/knowledge
(3 8 5) /Focus Group/Analysis/linking
(3 8 6) /Focus Group/Analysis/learnability
(3 8 7) /Focus Group/Analysis/operational momentum
(3 8 8) /Focus Group/Analysis/accomplishment
(3 8 9) /Focus Group/Analysis/utility
(3 8 10) /Focus Group/Analysis/task match
(3 8 11) /Focus Group/Analysis/transparency of purpose
(3 8 12) /Focus Group/Analysis/complexity
(3 8 13) /Focus Group/Analysis/accomodation
(4) /Subjects
(4 1) /Subjects/s12pc
(4 2) /Subjects/s02tg
(4 3) /Subjects/s03rw
(4 4) /Subjects/s05ms
(4 5) /Subjects/s10pb
(4 6) /Subjects/s11tc
(4 7) /Subjects/s18aj
(4 8) /Subjects/s25ar
(4 9) /Subjects/s36kt
(4 10) /Subjects/s20rk
(4 11) /Subjects/s37hj
(4 12) /Subjects/s28ts
(4 13) /Subjects/s08fb
(4 14) /Subjects/s35db
(4 15) /Subjects/s28ds
(4 16) /Subjects/s04mj
(6) /Base
Appendix E

(6 1) /Base/Ability
(6 1 1) /Base/Ability/Sp Rel
(6 1 1 3) /Base/Ability/Sp Rel/Low
(6 1 1 4) /Base/Ability/Sp Rel/Intermediate
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(6 1 6) /Base/Ability/C-Skill
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(6 1 6 4) /Base/Ability/C-Skill/Intermediate
(6 1 6 5) /Base/Ability/C-Skill/High
(6 2) /Base/Gender
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(6 2 2) /Base/Gender/Female
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(6 3 1) /Base/Age/20-30
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(7 4 1 5) /Project/SHAPE/questions/Change
(7 4 1 6) /Project/SHAPE/questions/objectives
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(7 4 1 8) /Project/SHAPE/questions/difficult
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(7 4 1 1 1 12) /Project/SHAPE/questions/Motivation
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(7 4 2) /Project/SHAPE/Pictures
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Appendix E

(7 4 2 4) /Project/SHAPE/Pictures/pict4
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(7 5 1 8) /Project/TBM/questions/difficult
(7 5 1 9) /Project/TBM/questions/easy
(7 5 1 10) /Project/TBM/questions/EOL
(7 5 1 11) /Project/TBM/questions/EOL
(7 5 1 12) /Project/TBM/questions/Motivation
(7 5 1 13) /Project/TBM/questions/Barriers
(7 5 1 14) /Project/TBM/questions/Understanding
(7 5 2) /Project/TBM/Pictures
(7 5 2 1) /Project/TBM/Pictures/pict1
(7 5 2 2) /Project/TBM/Pictures/pict2
(7 5 2 3) /Project/TBM/Pictures/pict3

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(7 5 2 4) /Project/TBM/Pictures/pict4
(7 5 2 5) /Project/TBM/Pictures/pict5
(7 5 2 6) /Project/TBM/Pictures/pict6
(7 5 2 7) /Project/TBM/Pictures/pict7
(7 5 2 8) /Project/TBM/Pictures/pict8
(7 5 2 9) /Project/TBM/Pictures/pict9
(7 5 3) /Project/TBM/Develop
(7 5 3 1) /Project/TBM/Develop/Entering TBM
(7 5 3 2) /Project/TBM/Develop/Opening Screen TBM
(7 5 3 3) /Project/TBM/Develop/Creating Pages
(7 5 3 4) /Project/TBM/Develop/Content Page
(7 5 3 5) /Project/TBM/Develop/Creating Links
(7 5 3 6) /Project/TBM/Develop/Navigation
Appendix F
Appendix F Representation of Web Sites

Syntax used in representations of Web sites

Faculty
   Schools   Other

School A
   Courses

Course A   Course B

Encapsulating concept, represented by HTML page
Encapsulating concept, within an HTML page
Hyperlink to lower level

Cheltenham and Gloucester College of Higher Education, Faculty of Business and Social Studies (www.chelt.ac.uk).

Schools   Staff   Other

School A
   Courses

Course A   Course B   Course C

Staff A   Staff B   Staff C

Lowest level concept

Bath Spa University College, Faculty of Humanities (www.bathspa.ac.uk/ehs1.html).
Southampton Institute of Higher Education Social Science Faculty (www.southamton-institute.ac.uk/extranet)

Cardiff University Business School (www.cardiff.ac.uk/uwcc/carbs/carbs.html)
Swansea Institute of Higher Education, Faculty of Education and Humanities
(www.sihe.ac.uk/educate/humanities/EDFAC).

[Diagram of Swansea Institute of Higher Education]

Glamorgan University Business School (www.glam.ac.uk/bus)

[Diagram of Glamorgan University Business School]
Appendix G
### Appendix G Results of Content Analysis

The content analysis was done on a piece of A3 paper, a small font size has been used in order to reproduce it.

<table>
<thead>
<tr>
<th>Subject</th>
<th>TBM versus Ideal</th>
<th>SHAPE® versus Ideal</th>
<th>TBM versus SHAPE®</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nodes</td>
<td>Links/Levels</td>
<td>Estimate of Match (Percent)</td>
</tr>
<tr>
<td>S36</td>
<td>Non staff represented No management represented</td>
<td>None</td>
<td>55</td>
</tr>
<tr>
<td>S03</td>
<td>Schools represented at top level No other standard nodes represented</td>
<td>Faculty down to one level</td>
<td>40</td>
</tr>
<tr>
<td>S11</td>
<td>Matches standard quite well</td>
<td>Faculty down 2 levels</td>
<td>60</td>
</tr>
<tr>
<td>S35</td>
<td>No courses</td>
<td>None</td>
<td>50</td>
</tr>
<tr>
<td>S28</td>
<td>Good match with standard 1 level, no links</td>
<td>60</td>
<td>No Links</td>
</tr>
<tr>
<td>S26</td>
<td>Good match with standard 1 level</td>
<td>65</td>
<td>None</td>
</tr>
<tr>
<td>S25</td>
<td>Good match with standard</td>
<td>1 level</td>
<td>60</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------</td>
<td>--------</td>
<td>----</td>
</tr>
<tr>
<td>S20</td>
<td>Good match with standard</td>
<td>2 levels</td>
<td>60</td>
</tr>
<tr>
<td>S18</td>
<td>Good match with standard</td>
<td>2 levels</td>
<td>55</td>
</tr>
<tr>
<td>S12</td>
<td>Good match with standard</td>
<td>1/2 levels</td>
<td>60</td>
</tr>
<tr>
<td>S10</td>
<td>Limited mention of staff or management</td>
<td>2 levels</td>
<td>55</td>
</tr>
<tr>
<td>S04</td>
<td>Good match with standard</td>
<td>~2 levels</td>
<td>60</td>
</tr>
<tr>
<td>S08</td>
<td>Good match with standard</td>
<td>1 level</td>
<td>55</td>
</tr>
<tr>
<td>S05</td>
<td>Good match with standard</td>
<td>3 levels</td>
<td>60</td>
</tr>
<tr>
<td>S37</td>
<td>Limited match with standard</td>
<td>1 level</td>
<td>45</td>
</tr>
<tr>
<td>S02</td>
<td>No mention of</td>
<td></td>
<td>45</td>
</tr>
<tr>
<td>staff</td>
<td>research centres</td>
<td>schools. Good match with standard</td>
<td>but SHAPE® is a richer picture</td>
</tr>
</tbody>
</table>
Appendix H
Appendix H Focus Group Procedure and Questions

Setting the Scene

The participants were given the context text below to read and were then told the following:

- Thank you for agreeing to participate in this study
- The context for this study are the barriers confronting HE staff developing hypermedia
- The objectives of this study are:
  1. Assess the usability, learnability and utility of a number of hypermedia authoring programs based on different paradigms
  2. Investigate what makes a program suitable for HE staff to author hypermedia
  3. Investigate the issues surrounding creating-on-paper versus creating-on-computer
  4. Validate or otherwise the factors developed in the previous study
- You are invited to comment at any stage

Procedure

The paradigm and process of construction of each program will be explained to the focus group participants and any comments they make will be recorded. A demonstration exercise is conducted by attempting to build a specific application. Following the demonstration exercise, a set of open questions are asked. Participants are also invited to ask if they are unsure of any terms used or the meaning of the questions. The four programs will be assessed in one session. After examining each program the discussion will be opened up for debate, mediated by the researcher.

The programs under examination are:

HAPs based on concept map:
  SHAPE
  Webmapper

HAP based on Icon/Control flow:
  Authorware

Book-based HAP:
  ToolBook®
### Knowledge

<table>
<thead>
<tr>
<th>Can you see the structure of the knowledge?</th>
<th>None</th>
<th>Fragments</th>
<th>All</th>
<th>Switchable</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>What types of knowledge can be represented?</th>
<th>None</th>
<th>Declarative</th>
<th>procedural</th>
<th>Metaknowledge</th>
</tr>
</thead>
</table>

### Construction

<table>
<thead>
<tr>
<th>What are the methods of construction?</th>
<th>Code</th>
<th>Dialogue boxes</th>
<th>Diagrammatic</th>
<th>Other</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Can links be labeled/supplemented?</th>
<th>Labeled</th>
<th>Supplemented</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>What link types are supported?</th>
<th>Non-typed</th>
<th>User-definable</th>
<th>Set types</th>
<th>Text to text</th>
<th>Media to media</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Are links ‘visible’?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

### Usability

<table>
<thead>
<tr>
<th>How intuitive is hyperlinking?</th>
<th>Very intuitive</th>
<th>Reasonably intuitive</th>
<th>Confusing</th>
<th>Very unintuitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>How intuitive is hyperlinking for a learner?</td>
<td>Very intuitive</td>
<td>Reasonably intuitive</td>
<td>Confusing</td>
<td>Very unintuitive</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How obvious are the operations of this program?</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>How obvious are the operations of this program for a learner?</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How well does the program ‘carry’ you through?</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>How well do you think the program</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
</tbody>
</table>
will ‘carry’ the learner through? |  |  |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>How much do you feel the program is making decisions for you?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>How much do you feel the program would make decisions for the learner?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>How ‘logical’ is the overall operation of this program?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>How ‘logical’ do you think the overall operation of this program will be for the learner?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>How well does this program match how you would expect it to operate?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>How well do you think this program will match how the learner would expect it to operate?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>How consistent are the operations of this program?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>How consistent do you think the learner will find the operations of this program?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>How much unnecessary detail is there on the screen for the learner?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>How at ease are you with this program?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>How at ease would the user be with this program?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Do you think this program gives you a sense of accomplishment?</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Do you think this program will give the learner a sense of accomplishment?</td>
<td>High</td>
<td>Medium</td>
</tr>
</tbody>
</table>

**Utility**

| To what extent do you get a sense of how the final product will look like while you use this program? | High | Medium | Low |

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Appendix H

<table>
<thead>
<tr>
<th>Question</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>To what extent do you think a learner would get a sense of how the final product will look like while they use this program?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How well does this program create a product that matches the task?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How easily does this program create a product that matches the task for the learner?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Post-Session Discussion

Cues

- Comparison of the usability, utility and learnability of the programs under study?
- What makes knowledge construction easy?
- How can you make a hypermedia authoring program more usable for HE staff?
- How can you get staff to create at the screen?
- What do you think of the concept of Transparency of Operation?
- What do you think of the concept of Operational Momentum?
- What do you think of the concept of Transparency of Purpose?
Context - Abtracted from a paper published in I.E.T.I:


Many academic organisations would welcome more materials to support the paradigm shift from teacher-centredness to student-centredness and, in particular, to support open and distance learning. The appropriate location and utilisation of teaching and learning support materials within the educational process, either to supplement or supplant traditional approaches, offers the potential for an increasingly stimulating and interactive learning environment which is more responsive to the needs of individual students. Despite the growing availability of 'off the shelf solutions' as a result of considerable investment in TLTP, CTI and related initiatives, in the UK alone, there are still a number of obstacles to the wide-spread adoption of educational technology (including hypermedia) by academics including lack of time, lack of training and lack of support staff (Hammond et al 1992; Laurillard et al 1993b; Barker and Banerji 1994). Although there have been a number of collaborative approaches to educational technology development (Dobson 1993), in reality, many academic staff would prefer to develop their own individual teaching applications.

Whilst some observers, e.g. (Junkala 1991), are optimistic that almost anybody can produce college level courseware. Rode and Poirot (1991) found that 65% of computer literate staff at the University of North Texas were not disposed to writing educational software. Institutional support for staff developing innovative teaching and learning strategies is needed (Laurillard 1993a).

However, enthusiasm for hypermedia (also used here to include the subset of multimedia) has not manifested a plethora of development.

The use of hypermedia as an alternative to traditional methods will not take place until a cost-benefit analysis shows a clear advantage to hypermedia. Davis et al (Davis et al 1993) quoting Christie (Christie 1990) estimate that it takes between 100 and 150 hours to produce one hour of hypermedia instruction even for experienced developers, an experienced lecturer preparing a one hour lecture session could produce the requisite material in less than 10 hours. Whilst in the short term a cost-benefit analysis will show traditional approaches to have the edge, in the longer term and in the context of open and distance learning, the balance changes as hypermedia shows the potential for a major increase in flexibility of delivery and erosion of the temporal and geographical constraints which dog traditional teacher-centred delivery.

Many academic staff are now becoming proficient with word processors probably due to the advent of cheap, easy to use packages and PCs which clearly make text production more efficient. Similarly, easy to use hypermedia authoring tools which produce more effective teaching materials would be likely to revolutionise hypermedia development and use.

**EXPRESSIONIVENESS OF METAPHOR**
There is a trade off between the expressiveness of an authoring metaphor and its simplicity of operation. Chapanis (Chapanis 1991) calculates that 'versatility' is negatively correlated to other ease of use parameters, i.e. programs that are versatile (i.e. more complex) are not usually easy to use. To create educationally effective hypermedia, the authoring tool needs to allow the author the ability to create hypermedia that has the following identified features (Elliott et al 1995a):

- Multifaceted, multiperspective views of real world problems/issues;
- Active engagement;
- Flexible support of a number of different structures;
- Good search and query facilities;
- Support for different learning styles;
- Interactive sequences;
- Appropriate node size.

Furthermore, authors need the ability to sufficiently reflect the knowledge domain underpinning their completed applications. This means being able to display information chunks in whatever form - sound, text graphics etc., with associated navigation mechanisms - the system of hyperlinking. Some form of narrative, storyline or guided discovery mechanism is needed in order to 'make sense' of a hypermedia corpus (Elliott et al 1995b). It is essential also that users have learning objectives and activities embedded within the hypermedia, i.e. active engagement.

Recommendations from others, e.g. (Molich & Nielsen 1990), show that novice authors prefer simple minimalist human - computer interfaces, i.e. without too much functionality displayed on the screen in the form of toolbars, pulldown menus and floating pallets etc. The tension between simplicity of interface and sufficiency of expressiveness is clear and may be impossible to give users the power to create educationally-effective hypermedia without increased sophistication of tools.

AUTHORING METAPHORS

A range of authoring metaphors are used to construct educational hypermedia, the book metaphor of e.g. ToolBook™, the control flow diagram e.g. IconAuthor™ Authorware™ and the object oriented program metaphors e.g. Visual Basic™, Visual C™, Delphi™, Java™. The control flow metaphor, adopted in IconAuthor and Authorware, tends to dictate the navigation decisions that users will make and does not allow the author to 'see' the developing knowledge structure. The object oriented programming metaphor is beyond the current abilities of most academic staff and also does not allow the author to visualise the underlying knowledge structure.

CONCEPT MAPPING

Concept maps have been used extensively in education as a means of expressing knowledge domains (Okebukola 1992), evaluating student misconceptions(Ross and Munby 1991), as study aids, curriculum development (Barenholz and Tamir 1992) even as a form of assessment (Beyerbach and Smith 1990). Concept maps are being increasingly used as 'front ends' to hypermedia knowledge corpora, (Reynolds &
Danserau 1990), (Miller 1995) and (Elliott et al 1996). Concept maps are viewed by some as useful ways to access hypermedia (Gaines & Shaw 1995), (McAleese 1987). Concept mapping could resolve some of the pedagogical and temporal issues associated with the production of educational hypermedia. It is possible to post-process concept maps to produce skeletal hypermedia which can be supplemented with hypermedia material and functionality. Closely linking a concept mapping tool with a hypermedia corpus would enable learners to create their own view(s), extracting material as they browse and allow them to form their own notes, to be taken away on suitable magnetic media. It is recognised that simple concepts maps are not sufficiently expressive to allow for the features of educationally-effective hypermedia and additional functionality may be required.

The adoption of a concept mapping approach to hypermedia development raises a number of fundamental issues. Creating a ‘view’ of a particular subject would seem simple in theory but may be more difficult in practice. A concept map may prove a transitory, rather than definitive, picture of the domain (Jonassen et al 1994). In well-defined subject areas, where major interrelations are generally accepted, concept mapping may be neither difficult nor transitory. Reader (Reader 1996) warns of the dangers of forcing ideas into representations that are inappropriate, concept maps no exception and are probably not the most appropriate representational system for all knowledge domains or are insufficiently expressive as discussed below.

Expressing knowledge through concept mapping is one thing, doing this directly on a computer is another. The analogy here is of people who create with pen and paper and use a computer to present the creative work. Pen and paper are the creative medium. Better word processing packages can facilitate composition directly at the keyboard. Similarly, to facilitate the development of hypermedia through concept mapping would seem a sensible and tangible goal.

Definition of Hypermedia

For the purposes of this study hypermedia is defined as the the interlinking of computer based media units using hyperlinks ie hotwords, hot regions, hot media etc which allows a human ‘viewer’ or user of the hypermedia to navigate around the units of media. Computer based media includes text, sound, video, graphics, movement, pictures, diagrams i.e. any media which humans use to convey meaning and can be communicated via a computer screen.

There are many other hypermedia definitions however the one above is right for the purposes of this study.
Appendix I
Appendix I Raw Results of Principle Components Analysis

Ease of Learning SHAPE®

Analysis number 1  Listwise deletion of cases with missing values
Kaiser-Meyer-Olkin Measure of Sampling Adequacy = .38018
Bartlett Test of Sphericity = 177.34182, Significance = .00000

Extraction 1 for analysis 1, Principal Components Analysis (PC)

Initial Statistics:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Communality *</th>
<th>Factor</th>
<th>Eigenvalue</th>
<th>Pct of Var</th>
<th>Cum Pct</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAR00001</td>
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<td>6.30515</td>
<td>52.5</td>
<td>52.5</td>
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<tr>
<td>VAR00004</td>
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<td>.55123</td>
<td>4.6</td>
<td>91.3</td>
</tr>
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</tr>
</tbody>
</table>

PC extracted 3 factors.

Factor Matrix:

<table>
<thead>
<tr>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAR00001</td>
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Final Statistics:

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<th>Factor</th>
<th>Eigenvalue</th>
<th>Pct of Var</th>
<th>Cum Pct</th>
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<td>1.71616</td>
<td>14.3</td>
<td>66.8</td>
</tr>
<tr>
<td>VAR00003</td>
<td>.74949 *</td>
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<td>1.42699</td>
<td>11.9</td>
<td>78.7</td>
</tr>
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<td>.55123</td>
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<td>91.3</td>
</tr>
<tr>
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<td>6</td>
<td>.47338</td>
<td>3.9</td>
<td>95.2</td>
</tr>
</tbody>
</table>

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### Appendix I

<table>
<thead>
<tr>
<th>Variable</th>
<th>Communality</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
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</tr>
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</tr>
<tr>
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VARIMAX rotation 1 for extraction 1 in analysis 1 - Kaiser Normalization.

VARIMAX converged in 6 iterations.

#### Rotated Factor Matrix:

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Ease of Learning TBM

- - - - - F A C T O R A N A L Y S I S - - - - -

Analysis number 1  Listwise deletion of cases with missing values
Kaiser-Meyer-Olkin Measure of Sampling Adequacy = .50755
Bartlett Test of Sphericity = 152.69719, Significance = .00000
1-tailed Significance of Correlation Matrix:
' . ' is printed for diagonal elements.

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Extraction 1 for analysis 1, Principal Components Analysis (PC)

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PC extracted 3 factors.

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**Final Statistics:**

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VARIMAX rotation 1 for extraction 1 in analysis 1 - Kaiser Normalization.

VARIMAX converged in 9 iterations.

**Rotated Factor Matrix:**

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Ease of Use SHAPE

--- FACTOR ANALYSIS ---

Analysis number 1  Listwise deletion of cases with missing values
Kaiser-Meyer-Olkin Measure of Sampling Adequacy = .53273
Bartlett Test of Sphericity = 124.64758, Significance = .00002

Extraction 1 for analysis 1, Principal Components Analysis (PC)

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PC extracted 3 factors.

Factor Matrix:

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## Appendix I

### FACTOR ANALYSIS

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**VARIMAX** rotation 1 for extraction 1 in analysis 1 - Kaiser Normalization.

**VARIMAX** converged in 7 iterations.

#### Rotated Factor Matrix:

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#### Factor Transformation Matrix:

<table>
<thead>
<tr>
<th></th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
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<tr>
<td>Factor 3</td>
<td>.33064</td>
<td>.44762</td>
<td>-.83085</td>
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</table>
Appendix I

Ease of Use TBM

--- FACTOR ANALYSIS ---

Analysis number 1  Listwise deletion of cases with missing values
Kaiser-Meyer-Olkin Measure of Sampling Adequacy =  .51386
Bartlett Test of Sphericity = 144.74653, Significance =  .00000

1-tailed Significance of Correlation Matrix:
' . ' is printed for diagonal elements.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Communality</th>
<th>Factor</th>
<th>Eigenvalue</th>
<th>Pct of Var</th>
<th>Cum Pct</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAR00013</td>
<td>1.00000</td>
<td>1</td>
<td>5.93345</td>
<td>49.4</td>
<td>49.4</td>
</tr>
<tr>
<td>VAR00014</td>
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<td>2</td>
<td>2.42842</td>
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<tr>
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PC extracted 3 factors.

Factor Matrix:

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<th>Factor 3</th>
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Final Statistics:

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<th>Eigenvalue</th>
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<th>Cum Pct</th>
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<td></td>
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VARIMAX rotation 1 for extraction 1 in analysis 1 - Kaiser Normalization.

VARIMAX converged in 6 iterations.

Rotated Factor Matrix:

<table>
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Factor Transformation Matrix:

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<tr>
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Appendix J
Appendix J Analysis of Raw Results of Principle Components Analysis

Ease of Learning

Table A below shows the comparison of the items loaded against each of the factors of each HAP from a PCA of the Ease of Learning scale. Items above the solid bar have highest loadings against that factor, items below have loadings above 0.30.

<table>
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</tr>
<tr>
<td>2</td>
<td>2</td>
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<td>8</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

Table A Comparison of items loaded against each factor for each HAP for Ease of Use.

The items which had the best overall weightings against each factor from the scales for both HAP were selected as shown in table B below.
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>I liked learning ‘X’</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>‘X’ was easy to learn</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>I felt comfortable learning ‘X’</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>It took too much time to learn ‘X’</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>The ideas behind ‘X’ were difficult to appreciate</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>I often became confused learning ‘X’</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>It took too much time to learn ‘X’</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>I found ‘X’ difficult to understand</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>When ‘X’ was explained it was obvious what to do</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>I gained a lot learning ‘X’</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>‘X’ is no more difficult than other Windows based programs</td>
</tr>
</tbody>
</table>

Table B. Final list of items best loaded against each factor.
Ease of Use

Table C below shows the comparison of the items loaded against each of the factors of each HAP from a PCA of the Ease of Learning scale. Items above the solid bar have highest loadings against that factor, items below have loadings above 0.30.

<table>
<thead>
<tr>
<th>Factor</th>
<th>TBM</th>
<th>SHAPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table C. Comparison of items loaded against each factor for each HAP for Ease of Use.

The items which had the best overall weightings against each factor from the scalees for both HAPs were selected as shown in table D below:
Table D. Final list of items best loaded against each factor for Ease of Use

<p>| | | |</p>
<table>
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<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24</td>
<td>I felt comfortable using 'X'</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>I liked using 'X'</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>It was easy to use 'X'</td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>It took too much time to use 'X'</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>I had no difficulty understanding how to use 'X'</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>The set of operations one needed to use were easy to remember</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>It was obvious what to do next</td>
</tr>
<tr>
<td></td>
<td>26</td>
<td>It took too much time to use 'X'</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>I really felt I had accomplished something using 'X'</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>I felt frustrated using 'X'</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>'X' was fun</td>
</tr>
</tbody>
</table>

Appendix J
Appendix K Evidential Data Bits Indexed on Transparency of Operation

Mental Model Match

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.


Mental Model Match

G: What did you do next?
70 We put in the heading in there at the top but I'm not sure how you did it. To get an au fait with this I would have to do it a number of times.
I think I have a mental block on learning these sorts of things.

GENERAL SHAPE®: What general impressions did you have using SHAPE®?
38 I can see its potential. You have to build up something. My only negative comment would be a help menu. My feeling is that coming from a computing background where I'm used to top-down design, I can think in that way but then actually building up that on the computer as-you-go, its not quite as easy to see the top-down design you are doing on paper (where) its easier to see the thing developing, this way tends to be a bit piecemeal.

GENERAL ToolBook® What general impressions did you have using ToolBook®?
374 I didn't find it particularly easy it wasn't very intuitive. I found it frustrating
378  G: Why
379
380  There seem to be there's quite a lot of pulldown menus which you would
381  have to go behind the menus to find out what you have to do.
382
383  It's fairly easy to get lost but then that could well have been because
384  having used SHAPE® which to me seemed to have more structure to it
385
386  *Ideas TBM How easy did you find the ideas behind ToolBook® to grasp?
387
388  Eventually it was ok. There was one or two things there I didn't think
389  were easy again its that idea of top-down design which obviously TBM
390  doesn't do.
391
392  **************************************************
393  ++ ON-LINE DOCUMENT: s11tc
394  +++ Retrieval for this document: 6 units out of 291, = 2.1%
395  ++ Text units 58-60:
396  58  *Ideas TBM How easy were the ideas to grasp?
397  59  60  Well pretty easy but that's because I am familiar with the concepts
398  already I'm not familiar with ToolBook® and the way it does it but it
399  looks as how you would expect it to.
400  ++ Text units 125-127:
401  125  *EOU TBM What makes a program easy to use
402  126
403  127  A program that once you've learned the fundamentals the extra bells
404  and whistles follow along the same pattern so you don't have to adopt a
405  another dialogue strategy the other features follow the same style.
406  **************************************************
407  ++ ON-LINE DOCUMENT: s21aj
408  +++ Retrieval for this document: 8 units out of 387, = 2.1%
409  ++ Text units 346-353:
410  346  *Easy SHAPE: Was there anything about SHAPE® that made it easy in
411  producing an application that matched the objectives of the exercise?
412
413  347
414  348  The use of graphics makes it easier?
415  349
416  350  G: Why?
417  351
418  352  353  Its the way I think I suppose when I'm creating the structure I like to
419  keep the structure in my mind and this is a structure I'm creating.
420  **************************************************
421  ++ ON-LINE DOCUMENT: s20rk
422  +++ Retrieval for this document: 7 units out of 583, = 1.2%
423  ++ Text units 60-66:
424  60  *General TBM What general impressions did you have using ToolBook®?
425
426  61
427  62  Could be more userfriendly
428  63
429  64  G: In what sense
429  65
429  66  I automatically wanted to structure it with a main headings and
430  subheadings but nothing allowed me to do that.
431  **************************************************
432  ++ ON-LINE DOCUMENT: s36xt
433  +++ Retrieval for this document: 3 units out of 578, = 0.52%
434  ++ Text units 195-197:
435  195  *Difficult TBM Was there anything about ToolBook® that made it difficult
436  or unsatisfactory in producing an application that matched the objectives
437  of the exercise?
438
439  196  197  If there was an idiot proof introduction to TBM it wouldn't be to
difficult. It doesn't seem that complicated. If you don't know what
words to ask you can't get into it.
440  **************************************************
441  +++ Total number of text units retrieved = 57

86
Appendix K

+++ Retrievals in 8 out of 27 documents, = 30%.
+++ The documents with retrievals have a total of 3653 text units,
so text units retrieved in these documents = 1.8%.
+++ All documents have a total of 9235 text units,
so text units found in these documents = 0.62%.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Logic of Operation

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.


********************************************************************
(2 2 2 3 3) /Ease/eou/Transparency/operation/Logic of Operation

*** No Definition
++++++++++++++++++++++++++++++++++++++++
+++ ON-LINE DOCUMENT: s03rw
+++ Retrieval for this document: 3 units out of 282, = 1.1%
++ Text units 25-27:

25 *Confusion TBM Was there anything confusing about using ToolBook® ?
26
27 Yes the confusion I had was the operates - what I had to press.
++++++++++++++++++++++++++++++++++++++++
+++ ON-LINE DOCUMENT: s04mj
+++ Retrieval for this document: 6 units out of 559, = 1.1%
++ Text units 306-308:

306 *Easy SHAPE® Was there anything about SHAPE® that made it easy in producing
an application that matched the objectives of the exercise?
307
308 Straightforward to follow
++ Text units 314-316:

314 *EOU SHAPE® After having learnt to use SHAPE® do you have any general
thoughts on what makes a program easy to use?
315
316 Same transparency and logic of operation
++++++++++++++++++++++++++++++++++++++++
+++ ON-LINE DOCUMENT: s10pb
+++ Retrieval for this document: 3 units out of 416, = 0.72%
++ Text units 79-81:

79 *Confusion TBM: Was there anything confusing about using TBM?
80
81 No its straight forward its just knowing what to do
++++++++++++++++++++++++++++++++++++++++
+++ ON-LINE DOCUMENT: s28ds
+++ Retrieval for this document: 6 units out of 572, = 1.0%
++ Text units 60-65:

60 *General SHAPE® What general impressions did you have using SHAPE® ?
61
62 I think if you want to do it properly you really need to sit down and
think it through and the links between different things. I think I would
feel more confident doing it on paper first. But I can see its value in
relation to education and lecturing
63
64 Its quite user friendly and it allows you to go through it in a logical
way.
65
++++++++++++++++++++++++++++++++++++++++
+++ ON-LINE DOCUMENT: s35db
+++ Retrieval for this document: 5 units out of 528, = 0.95%
++ Text units 29-33:

29 *General SHAPE® What general impressions did you have using SHAPE® ?
It seemed to be working pretty well—it didn’t seem to interrupt the thinking that I was having about the topic. There was the odd occasion where I felt I was being driven down a kind of knowledge system and in fact I was already beginning to see how things at different levels could be interrelated rather than simply be functions of the previous level. I think I needed the instruction, the icons still did not have any meaning to me.

Maybe it’s the power of the mapping that exposes these hierarchies of thinking—all the more threatening and a testament to its usefulness that it should make you feel like that. If you’d asked me to write a text about the faculty I wouldn’t feel like that. If you’d asked me to write a text about the faculty I wouldn’t feel like that. I think I needed the instruction, the icons still did not have any meaning to me.

On-line document: s36kt
+++ Retrieval for this document: 5 units out of 578, = 0.87%
+++ ON-LINE DOCUMENT: s36kt
++ Total number of text units retrieved = 28
+++ Retrievals in 6 out of 27 documents, = 22%
+++ The documents with retrievals have a total of 2935 text units, so text units retrieved in these documents = 0.95%
+++ All documents have a total of 9235 text units, so text units found in these documents = 0.30%

Operational Momentum

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI. Licensee: Geoff.


(2 2 3 4) /Base/eou/Transparency/operation/Operational Momentum
+++ No Definition
+++ ON-LINE DOCUMENT: s05ms
+++ Retrieval for this document: 3 units out of 412, = 0.73%
++ Text units 224-226:

224 *Objectives SHAPE: How well do you think SHAPE allowed you to achieve the objectives of the exercise?

225 226 I haven’t done the detail and how easy it is to put in the bells and whistles at the detail level but its easy to do that (the structure).

+++ ON-LINE DOCUMENT: s08fb
+++ Retrieval for this document: 12 units out of 561, = 2.1%
++ Text units 289-291:

289 *Difficult SHAPE: Was there anything about SHAPE that made it difficult or unsatisfactory in producing an application that matched the objectives of the exercise?

290 291 As long as the person using it can flick backwards and forwards and doesn’t get lost in where they are going there’s no problem. As long that’s made quite clear how to go backwards and forwards there’s no problem.
++ Text units 374-382:

374 *General TBM What general impressions did you have using ToolBook?

375 376 I didn’t find it particularly easy it wasn’t very intuitive. I found it
frustrating

G: Why

There seem to be there's quite alot of pulldown menus which you would have to go behind the menus to find out what you have to do.

It's fairly easy to get lost but then that could well have been because having used SHAPE® which to me seemed to have more structure to it

++++++++++++++++++++++++++++++++++++++++++++++++++++++

ON-LINE DOCUMENT: s10pb

Retrieval for this document: 3 units out of 416, = 0.72%

Text units 79-81:

*Confusion TEM: Was there anything confusing about using TEM?

No its straight forward its just knowing what to do
++++++++++++++++++++++++++++++++++++++++++++++++++++++

Retrieval for this document: 1 unit out of 341, = 0.29%

*Comparison How do you think ToolBook® and SHAPE® compare with each other

My initial reaction is that I preferred Tbook cos it was easier to use but I think if I went into SHAPE® a lot more you could probably get a better picture of whatb your structuring quicker cos you can see your concept titles. In the long run I think SHAPE® would give me a better module package but it would take me longer to get there. I would probably find Tbook easier to use but I would probably have to go back and make amendments. I got a feeling with SHAPE® that if you did it properly to start you wouldn't end up going back to it as much.

++++++++++++++++++++++++++++++++++++++++++++++++++++++

Retrieval for this document: 7 units out of 387, = 1.8%

*Picture TEM 3 Opening page of ToolBook®

It's a blank page waiting for some input although its not very clear.

G: Would you know what to do next?

I'd probably go into the help menu

*Picture TEM 5 Page input box

Probably now, from this point on I could probably create some more work it was being faced with a blank page I couldn't remember how to get started There wasn't a cursor blinking

++++++++++++++++++++++++++++++++++++++++++++++++++++++

Retrieval for this document: 5 units out of 583, = 0.86%

*Change TEM G: Was there anything about ToolBook® you would change?

To be able to structure your pages or being able to show the links or the main frame. The remembering where the page and the history functions was a little bit annoying.

G: I'd like you to comment on the follow screens

++++++++++++++++++++++++++++++++++++++++++++++++++++++

Retrieval for this document: 4 units out of 391, = 1.0%

*Easy SHAPE: Was there anything about SHAPE® that made it easy in producing an application that matched the objectives of the exercise?

I quite liked the idea of the boxes and move things around

++++++++++++++++++++++++++++++++++++++++++++++++++++++

Retrieval for this document: 4 units out of 561, = 0.71%

*Ideas TEM How easy did you find the ideas behind ToolBook® to grasp?
Same as before but a slightly different way of presenting the info I think think the general understanding of achievement of where you wanted to get to is there but a slightly different method of achieving it, rather than seeing the links physically your having to know more precisely where you want to go after when you're in a prarticular level. In other words you have to have the whole thing mapped out at the start.

*General SHAPE® What general impressions did you have using SHAPE®?

It seemed to be working pretty well it didn't seem to interrupt the thinking that I was having about the topic. There was the odd occasion where I felt I was being driven down a kind of knowledge system and in fact I was already beginning to see how things at different levels could be interrad rather than simply be functions of the previous level. I think I needed the instruction, the icons still did not have any meaning to me.

Maybe its the power of the cmapping that exposes these hierarchies of thinking which makes it more threatening and a testament to its usefulness that it should make you feel like that. If you'd asked me to write a text about the faculty I wouldn't feel like that.

*EOL SHAPE® After having learnt to use SHAPE® do you have any general thoughts on what makes a program easy to learn?

What I quite liked was when I typed the words in it came up automatically with a series of boxes you could see what was going on. I wasn't quite sure how I was going to move them around but I felt I had to move them around so I could see the next logical stage.

*Confusion TBM G: Was there anything confusing about using ToolBook®?

The difference between this and SHAPE® because with this you have to remember more because it goes onto the next page and you haven't got the information there. With the concept maps you've got more information in front of you.

*Change TBM G: Was there anything about ToolBook® you would change?

NO, is a bit more confusing, you have to use the program more and if you're not a computer person it might be more off-putting.

---

Noise/Economy of Dialogue

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
License: geoff.

Appendix K

*Easy SHAPE: Was there anything about SHAPE® that made it easy in producing an application that matched the objectives of the exercise?

Not too many buttons

General TBM: What general impressions did you have using TBM?

I found it confusing

I understand the concept but I don’t like the screens. I don’t like way that its says I am on page 3, what’s page 3 what’s page 1 and 2 I don’t understand any of that. I’ve got all these blank pages sitting in from of me - what are they for - I don’t want to see those.

*EOL SHAPE® After having learnt to use SHAPE® do you have any general thoughts on what makes a program easy to learn?

A small set of instructions also error messages - walk back

The more basic it is the more

*Ideas SHAPE: How easy did you find the ideas behind SHAPE® to grasp?

I little bit more difficult

Why was that?

I seems to be a little bit more complicated.

*EOL SHAPE: After having learnt to use SHAPE® do you have any general thoughts on what makes a program easy to use?

Easy steps/ small steps. simple steps
Appendix K

76 *Change TBM G: Was there anything about ToolBook® you would change?

77 To be able to structure your pages or being able to show the links or the main frame. The remembering where the page and the history functions was a little bit annoying.

80 G: I'd like you to comment on the follow screens

+++++ ON-LINE DOCUMENT: s25ar
+++ Retrieval for this document: 2 units out of 391, = 0.51%
++ Text units 258-259:

89 *Confusion TBM: Was there anything confusing about using TBM?

89 Sheer quantity of information available at the top, 'history' confused me a bit - I wasn't too sure the business about the author and the other one. I understood the idea behind it but whether I could have found it

+++++ ON-LINE DOCUMENT: s28ds
+++ Retrieval for this document: 7 units out of 572, = 1.2%
++ Text units 325-328:

105 *EOL SHAPE® After having learnt to use SHAPE® do you have any general thoughts on what makes a program easy to learn?

105 Not having too many different commands.

105 ++ Text units 544-546:

106 *EOL TBM After having learnt to use ToolBook® do you have any general thoughts on what makes a program easy to use?

107 Too much involved language - you have to use the language

+++++ ON-LINE DOCUMENT: s36kt
+++ Retrieval for this document: 9 units out of 578, = 1.6%
++ Text units 204-207:

107 *EOL TBM After having learnt to use ToolBook® do you have any general thoughts on what makes a program easy to learn?

107 Limited number of instructions/options.

107 ++ Text units 209-213:

107 *EOL TBM After having learnt to use ToolBook® do you have any general thoughts on what makes a program easy to use?

110 Simplicity

112 G: What do you mean by simplicity

+++++ Total number of text units retrieved = 55
+++ Retrievals in 7 out of 27 documents, = 26%.
+++ The documents with retrievals have a total of 3513 text units,
so text units retrieved in these documents = 1.6%.
+++ All documents have a total of 9235 text units, so text units found in these documents = 0.60%.

Internal Consistency

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
(2 2 3 6 6) /Ease/eou/Transparency/operation/consistency/inneral
*** No Definition
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
What makes a program easy to use

A program that once you've learned the fundamentals the extra bells and whistles follow along the same pattern so you don't have to adopt another dialogue strategy the other features follow the same style.

After having learnt to use ToolBook do you have any general thoughts on what makes a program easy to use?

Familiarity with certain icons and navigation methods.

Was there anything about ToolBook that made it difficult in producing an application that matched the objectives of the exercise?

Fairly straightforward and there was a logic to it but if you got into a fairly big application you will need a piece a paper

Needs a sort of logic to it and its structure and menus so that if you need to get back to something its fairly easy to find out where - Obviousness.

Consistency, different objects don't have different rules - standardised.

After having learnt to use ToolBook do you have any general thoughts on what makes a program easy to learn?

After having learnt to use ToolBook do you have any general thoughts on what makes a program easy to use?

Consistency, different objects don't have different rules - standardised.

Was there anything about ToolBook that made it easy in producing an application that matched the objectives of the exercise?

Fairly straightforward and there was a logic to it but if you got into a fairly big application you will need a piece a paper

Needs a sort of logic to it and its structure and menus so that if you need to get back to something its fairly easy to find out where - Obviousness.

Consistency, different objects don't have different rules - standardised.

After having learnt to use ToolBook do you have any general thoughts on what makes a program easy to use?
Appendix K

255  Consistent with other programs - balloons, hot buttons
+++++ ON-LINE DOCUMENT: s12pc
+++ Retrieval for this document: 3 units out of 341, = 0.88%
++ Text units 130-132:

130  *EOU TBM After having learnt to use ToolBook® do you have any general
      thoughts on what makes a program easy to use?

131
132  Same answer as easy to learn - Windows format being able to use a mouse
      and the visual display.
+++++ ON-LINE DOCUMENT: s18aJ
+++ Retrieval for this document: 7 units out of 387, = 1.8%
++ Text units 149-152:

149  *EOL TBM After having learnt to use ToolBook® do you have any general
      thoughts on what makes a program easy to learn?

150
151  Conforms to general Windows approach. if you're familiar with Windows
      you can navigate your way around reasonably well.

152  ++ Text units 154-156:

154  *EOU TBM After having learnt to use ToolBook® do you have any general
      thoughts on what makes a program easy to use?

155
156  Familiarity with certain icons and navigation methods.
+++++ Total number of text units retrieved = 12
+++ Retrievals in 3 out of 27 documents, = 11%
+++ The documents with retrievals have a total of 1140 text units,
      so text units retrieved in these documents = 1.1%.
+++ All documents have a total of 9235 text units,
      so text units found in these documents = 0.13%.
+++++ >>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>}
Appendix L
Appendix L Evidential Databits Indexed on Effect of Computer Skill

Low Computer Skill

SHAPE®

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.


*******************************************************************************
(7 4 1 1 1 1 ) /Project/SHAPE/questions/Define/csm/Low

*** Definition:
See memo for node definition.
*******************************************************************************
+++
ON-LINE DOCUMENT: SO3RW
+++
Retrieval for this document: 10 units out of 282, = 3.5%
++ Text units 121-130:

121 *Define SHAPE® Describe to me what SHAPE® does?
122
123 SHAPE® takes concepts and allows you to break them down into different concepts and different relationships between them. You take a concept and break it down into lower levels. A concept may be misleading because it could be just a subject.
124
125 G: And what happens then
126
127 A better understanding how the whole thing is interlinked.
128
129 G: What happens to those links?
130
*******************************************************************************
+++
ON-LINE DOCUMENT: S04m]
+++
Retrieval for this document: 6 units out of 559, = 1.1%
++ Text units 48-53:

48 *Define SHAPE® Describe to me what SHAPE® does?
49
50 It provides a file which gives info on a particular topic in a hierarchical fashion so it will start ith the most general concept and then break that down to another lower level of concepts particularly one you want and that will break it down even further and so on and so on until you have got down to the lowest level where it will actually give you the info you want.
51
52 It allows you - people don't necessarily know what you want or how its going to be described cos you're trying to find something and you can't find it in the index cos the index its under is slightly different wording and able to go in and look around fairly easy and find out how its been described and where its been put.
53
*******************************************************************************
+++
ON-LINE DOCUMENT: S25AR
+++
Retrieval for this document: 7 units out of 391, = 1.8%
++ Text units 5-11:

5 *Define SHAPE: Describe to me what SHAPE® does?
6
7 SHAPE® will create a piece of work that is built up of different concepts, the top concepts can then be broken down into subsidiary levels and the links between those subsidiary levels can all be hyperlinked together.
8 Ant there for it is possible once the thing is created to jump from one to the other where ever direct links made and you can also move to separate pages.
9
10 G: And what would the final result be
11 The final result would be a concept document that can be linked
************************************************************************************

Appendix L
Appendix L

++ ON-LINE DOCUMENT: 535db
++ Retrieval for this document: 6 units out of 528, = 1.1%
++ Text units 23-28:

23 *Define SHAPE® Describe to me what SHAPE® does?
24
25 It offers a vehicle of sequential ordering of info and converts some
26 thoughts about important concepts that relate to a subject and puts them
27 into a kind of hierarchical structure that offers the opportunity to
28 connect one level to another level, and then within levels it also offers
29 the opportunity to show how different subconcepts link together.
30
31 To translate a curriculum into some multimedia application.
32
33 *Define SHAPE® Describe to me what SHAPE® does?
34
35 It basically allows in an IT version of concept mapping it allows links
36 to be made between concepts or 'bungs' of relevant information
37
38 G: What is the purpose of it?
39
40 I assume its like an index if you look up something it tells you what is
41 linked to it.
42
43 *Define SHAPE® Describe to me what SHAPE® does?
44
45 It enables the user to develop ideas and concepts using this particular
46 packages and technology.
47
48 G: To what purpose?
49
50 Brings teaching out of the Victorian age and assists with the breakdown
51 of the fear of computers.
52
53 *Define SHAPE® Describe to me what SHAPE® does?
54
55 Total number of text units retrieved = 46
56
++ Total retrievals in 6 out of 27 documents, = 22%.
++ The documents with retrievals have a total of 2887 text units,
so text units retrieved in these documents = 1.6%.
++ All documents have a total of 9235 text units,
so text units found in these documents = 0.50%. 

TBM

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.


/Project/TBM/questions/Define/csm/Low

*** Definition:
See memo for node definition.

*** ON-LINE DOCUMENT: S03RW
++ Retrieval for this document: 8 units out of 282, = 2.8%
++ Text units 9-16:

9 *Define TBM Describe to me what ToolBook® does?
It creates a means of communication information on the computer between different pages which are not -- Are linked.

What purpose would that be for?

It enables you to create pages of a book and then to decide whether there are any direct links between

It allows in 'booked' form, people to switch from material at the end of the book to material at the beginning of the book without necessary turning all of the pages. A sort of layering process

TBM allows you as an author to produce pages that you can move ideas from one to another and provide links with.

For what purpose

To take general ideas and formulate and expand them.

Intermediate Computer Skill

SHAPE®

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.

Appendix L

******************************************************************************
(741112) /Project/SHAPE/questions/Define/cm/Intermediate
*** Definition:
See memo for node definition.
******************************************************************************
++ ON-LINE DOCUMENT: S10PB
+++ Retrieval for this document: 7 units out of 416, = 1.7%
++ Text units 234-240:

"Define SHAPE© Describe to me what SHAPE© does?"

Its just developing to a topic, its like a family tree which relates to it or there. It's like you have a specific objective and you have got these objectives underneath attached to it and all interrelated. It gives you an overview of all the sub topics related to the major topic.

G: Does it do the same as ToolBook©, or less or more?

Probably a little bit more in depth.

*** ON-LINE DOCUMENT: S12PC
+++ Retrieval for this document: 6 units out of 341, = 1.8%
++ Text units 181-186:

"Define SHAPE© Describe to me what SHAPE© does?"

Like the other (Tbook) is the actual mechanism for putting the structure in place. Where as with the other one you were developing pages with this tool you're developing concepts. The principle is the same you are dividing the faculty into various headings and sub dividing them again.

/+ ON-LINE DOCUMENT: S18aj
+++ Retrieval for this document: 5 units out of 387, = 1.3%
++ Text units 203-207:

"Define SHAPE: Describe to me what SHAPE© does?"

It allows you to set up a framework for a hierarchy of sections and pages within sections.

/+ ON-LINE DOCUMENT: S20rk
+++ Retrieval for this document: 9 units out of 583, = 1.5%
++ Text units 271-279:

"Define SHAPE© Describe to me what SHAPE© does?"

Creates concept maps, - it looks as if it sits on top of TBM and so you can diagrammatically show the various links between the sections and hierarchy of each page.

G: Why

To make TBM more userfriendly.

Its what you would use TBM for - for creating online interactive book - or pages.

/+ ON-LINE DOCUMENT: S28ds
+++ Retrieval for this document: 12 units out of 572, = 2.1%
++ Text units 48-59:

"Define SHAPE© Describe to me what SHAPE© does?"

It allows someone to look at an issue or subject in stages and it allows them to find their own way around it and look at aspects of it they choose to it allows them to be selective in the way they look at a topic or an issue.

G: What is the end result
They are autonomous in terms of what aspects of a subject they look at.

G: What is the product?

You cover a subject from more or less every angle.

TBM

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.


*Definition:
See memo for node definition.

** Definition:

+++ ON-LINE DOCUMENT: S10PB
+++ Retrieval for this document: 3 units out of 416, = 0.72%
++ Text units 63-65:

63 *Define TBM: Describe to me what TBM does?

64

65 I suppose it's like a database of information and how all this information can be related very quickly

+++ ON-LINE DOCUMENT: S12PC
+++ Retrieval for this document: 5 units out of 341, = 1.5%
++ Text units 48-52:

48 *Define TBM: Describe to me what ToolBook® does?

49

50 ToolBook enables you to put together the whole thing so if your developing a course or information brochure of the faculty whatever, then ToolBook is the mechanism for putting the structure into place, with pages the hyperlinks, etc

51

52

+++ ON-LINE DOCUMENT: S18AJ
+++ Retrieval for this document: 3 units out of 387, = 0.78%
++ Text units 50-52:

50 *Define TBM: Describe to me what TBM does?

51

52 It allows you to set up a framework for something which is analogous to a book the framework would then dictate what was in chapters and pages within chapters and allows you to link between pages within a chapter.

+++ ON-LINE DOCUMENT: S20rk
+++ Retrieval for this document: 9 units out of 583, = 1.5%
++ Text units 51-59:

51 *Define TBM: Describe to me what ToolBook® does?

52

53 A virtual book (ie the product)

54

55 (Rod is fixed on the idea that TBM is only a book)

56

57 A tool for creating a book
**SHAPE**

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.


(7 4 1 1 3) /Project/SHAPE/questions/Define/csm/High

*** Definition:
See memo for node definition.

*** ON-LINE DOCUMENT: S08FB
*** Retrieval for this document: 4 units out of 561, = 0.71%
** Text units 33-36:

33  *Define SHAPE: Describe to me what SHAPE does?
34  
35  
36  It structures access to information in such a way that it aids/guides a student through a particular learning process.

36  *** ON-LINE DOCUMENT: S11tc
*** Retrieval for this document: 4 units out of 291, = 1.4%
** Text units 147-150:

147  *Define SHAPE: Describe what SHAPE does
It allows the user to express concepts at various levels, takes some concept and move them down to a lower level and express links between those concepts or interrelations which results in the generation of Tbook pages which have their links embedded in them due to the definitions which have been produced in SHAPE.

*Define SHAPE® Describe to me what SHAPE® does?

Allows one to have one particular area of interest and we have been able to associate different levels of information associated with that interest and we use the example of the faculty as the example and we have been able to branch off and look at the parts that make up the faculty so we looked at the various schools from that we looked at the various courses we are using SHAPE® to - wells its a maps isn't it so your're mapping out well its a contour map I suppose.

G: What is the end product

What we've got is a network of information which you can move to if you want to find more out about particular area so you go to different level which tells you more detail.
TBM

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.


********************************************************************************************************
( 7 5 1 1 2 3) /Project/TBM/questions/Define/csm/High
** Definition:
See memo for node definition.
+++ ON-LINE DOCUMENT: S05MS
+++ Retrieval for this document: 3 units out of 412, = 0.73%
++ Text units 298-300:

298  Define TBM: Describe to me what TBM does?
299
300 It basically creates pages within a book for an aid to sectionalise and organise your course and also allow the person to explore linked items.

+++ ON-LINE DOCUMENT: S08FB
+++ Retrieval for this document: 4 units out of 561, = 0.71%
++ Text units 370-373:

370 Define TBM Describe to me what ToolBook\textsuperscript{\textregistered} does?
371
372 TBM allows you to set up individual pages of information which can be linked to other pages. It can also be set up as a hierarchy so again you can direct students in to a certain path.
373
+++ ON-LINE DOCUMENT: S11tc
+++ Retrieval for this document: 4 units out of 291, = 1.4%
++ Text units 50-53:

50 Define TBM Describe what ToolBook\textsuperscript{\textregistered} does?
51
52 ToolBook\textsuperscript{\textregistered} allows you to to define pages within a book, conceptual pages and to define links between these pages as many links as one might like to do I suppose and allows you to enter information on to those pages.

53
+++ ON-LINE DOCUMENT: S26ts
+++ Retrieval for this document: 8 units out of 561, = 1.4%
++ Text units 379-386:

379 Define TBM Describe to me what ToolBook\textsuperscript{\textregistered} does?
380
381 Its an application that allows you to create pages of info about a certain topic and going from that topic or area enables your student to record further info about the structures within that area and going down from there and building up the info about each different level in the overall structure.
382
383 G: For what purpose
384
385 For the user to find out to be able to find out info on what a particular book is giving you info and and enables you to track through that info by exploring info from each level
386
+++ Total number of text units retrieved = 19
+++ Retrievals in 4 out of 27 documents, = 15%
+++ The documents with retrievals have a total of 1825 text units, so text units retrieved in these documents = 1.0%.
+++ All documents have a total of 9235 text units, so text units found in these documents = 0.21%.

********************************************************************************************************
Appendix M
Appendix M Evidential Data Bits Indexed on Transparency of Purpose

Task Match

Q.S.R. NUDIST Power version, revision 3.0.4 GUI.
Licensee: geoff.

******************************************************************************
(2 2 2 2 3) /Ease/eou/Transparency/purpose/task match
*** Definition:
Copy of node (2 2 4) and its subtree.
******************************************************************************
+++ ON-LINE DOCUMENT: SO2TG
+++ Retrieval for this document: 3 units out of 245, = 1.2%
234 *EOU SHAPE Easy to learn/use
  ++ Text units 238-240:
238 G: What if you were dealing with a problem that wasn't hierarchical.
      Would SHAPE be appropriate
239
240 Yes I'd say so because you'd use atomic boxes (concepts)
******************************************************************************
+++ ON-LINE DOCUMENT: SO2RW
+++ Retrieval for this document: 3 units out of 282, = 1.1%
++ Text units 253-255:
253 *Teaching SHAPE How well do you think SHAPE would allow you to produce
    an application for your own teaching?
254
255 Exactly the same as before but this is on a different level.
******************************************************************************
+++ ON-LINE DOCUMENT: SO4MJ
+++ Retrieval for this document: 16 units out of 559, = 2.9%
++ Text units 511-513:
511 *Objectives TBM How well do you think ToolBook allowed you to achieve
    the objectives of the exercise?
512
513 Yes fine the same as SHAPE
++ Text units 543-555:
543 *Comparison How do you think ToolBook and SHAPE compare with each other
    in terms of:
544
545 ease of learning;
546
547 SHAPE was easier
548
549 ease of use; and
550
551 Equitable
552 suitability to produce an application that matches the defined task?
553
554 Depends upon the task Where the subject is hierarchical SHAPE is better.
******************************************************************************
+++ ON-LINE DOCUMENT: S05MS
+++ Retrieval for this document: 3 units out of 412, = 0.73%
++ Text units 373-375:
373 *Objectives TBM: How well do you think TBM allowed you to achieve the
    objectives of the exercise?
374
375 I didn't I didn't like it
******************************************************************************
+++ ON-LINE DOCUMENT: SO8FB
+++ Retrieval for this document: 3 units out of 561, = 0.53%
Appendix M

++ Text units 539-541:

539  *Barrier TBM What would prevent you from using ToolBook® to create an application for your own teaching

540 541 The result of the prototype didn't give me what I wanted.

++++ ON-LINE DOCUMENT: S10PB
+++ Retrieval for this document: 3 units out of 416, = 0.72%
++ Text units 242-244:

242  *General SHAPE: What general impressions did you have using SHAPE®?

243 244 Its good if you want to describe something. Its good for presentation it can give you an overview of a course. It would be ideal for an open day.

++++ ON-LINE DOCUMENT: S20RK
+++ Retrieval for this document: 4 units out of 583, = 0.69%
++ Text units 226-229:

226  *Barrier TBM What would prevent you from using ToolBook® to create an application for your own teaching

227 228 I am not sure it can do what I would wanted it to.

++++ ON-LINE DOCUMENT: S35DB
+++ Retrieval for this document: 15 units out of 528, = 2.8%
++ Text units 42-50:

42  *Change SHAPE® Was there anything about SHAPE® you would change?

43 44

45 I don't think there was anything I would change about SHAPE® but I was conscious it was making me thinking in a hierarchical way. I was beginning to getting frustrated with that limitation. Maybe that is because I don't know enough about SHAPE® can cope with what I was hinting about.

46 47 There's an issue about how a hierarchy can represent the complexities of the Faculty.

48 49 G: I'd like you to comment on the follow screens

50 ++ Text units 277-282:

277  *Teaching SHAPE® How well do you think SHAPE® would allow you to produce an application for your own teaching?

278 279 It would work but I would have to be convinced about how the complexity of the concepts (Research Methods) can be represented. It may help to simplify some of the concepts but that may deflect from a full understanding.

280 281 SHAPE® is more applicable where one is trying to describe a phenomenon like Org of Tourism Industry. Where one is trying to help people to understand social systems or political structures it would serve a purpose by giving order but it may just deceive in its simplicity.

++++ ON-LINE DOCUMENT: S36KT
+++ Retrieval for this document: 6 units out of 578, = 1.0%
++ Text units 297-302:

297  *Change SHAPE® Was there anything about SHAPE® you would change?

298 299 Maybe multilinking - if you're linking 15/20 concepts it will take you a long time. We are not teaching cul desacs (Defined links) we're not teaching Cul De Sacs we're teaching links. Everything should be linked anyway.

300 301 G: I'd like you to comment on the follow screens
Appendix M

302

+-----------------------------------------------+
++ Total number of text units retrieved = 56
++ Retrievals in 9 out of 27 documents, = 33.
++ The documents with retrievals have a total of 4164 text units,
so text units retrieved in these documents = 1.3%.
++ All documents have a total of 9235 text units,
so text units found in these documents = 0.61%.
+-----------------------------------------------+

Instantaneity

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.

+-----------------------------------------------+
++ No Definition
++ ON-LINE DOCUMENT: S04MJ
++ Retrieval for this document: 3 units out of 559, = 0.54%
++ Text units 514-516:
514 "Teaching TB: How well do you think ToolBook® would allow you to produce an application for your own teaching?"
515
516 It would, but the (the mechanism) relationships would need to be clearly
then both packages would be the same.
+-----------------------------------------------+
++ ON-LINE DOCUMENT: S08FB
++ Retrieval for this document: 6 units out of 561, = 1.1%
++ Text units 384-386:
384 "Ideas TB: How easy did you find the ideas behind ToolBook® to grasp?"
385
386 Eventually it was ok. There was one or two things there I didn't think
were easy again its that idea of top-down design which obviously TB doesn't do.
++ Text units 539-541:
539 "Barrier TB: What would prevent you from using ToolBook® to create an
application for your own teaching?"
540
541 The result of the prototype didn't give me what I wanted.
+-----------------------------------------------+
++ ON-LINE DOCUMENT: S12PC
++ Retrieval for this document: 6 units out of 341, = 1.8%
++ Text units 325-330:
325 "Comparison: How do you think ToolBook® and SHAPE® compare with each other
in terms of:"
326
327 ease of learning;
328
329 My initial reaction is that I preferred Tool Jobs cos it was easier to use
but I think if I went into SHAPE a lot more you could probably get a
better picture of what your structuring quicker cos you can see your
concept titles. In the long run I think SHAPE would give me a better
module package but it would take me longer to get there. I would
probably find Tool easier to use but I would probably have to go back
and make amendments. I got a feeling with SHAPE that if you did it
properly to start you wouldn't end up going back to it as much.
+-----------------------------------------------+
++ ON-LINE DOCUMENT: S26TS
++ Retrieval for this document: 9 units out of 561, = 1.6%
++ Text units 57-59:
57 "General SHAPE: What general impressions did you have using SHAPE®?"
It was easy/straightforward - show the relationships once you know the basic moves - how to create the links its very straightforward - it gives you an instant result and its easy enough to change things.

+++ ON-LINE DOCUMENT: S28DS
+++ Retrieval for this document: 5 units out of 572, = 0.87%  
+++ Text units 528-530:

*Easy SHAPE® Was there anything about SHAPE® that made it easy in producing an application that matched the objectives of the exercise?

Instant results

*Objectives TBM How well do you think ToolBook® allowed you to achieve the objectives of the exercise?

We got there eventually but because we didn't have a pictorial representation of what you had achieved it was probably a bit slower to sink in - it would have been nice to see the results straight away. But we were able to check using the history button where we had come from and what we were supposed to remember but it was slightly more difficult because we had to remember what the headings were required

++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++ ON-LINE DOCUMENT: S28DS
+++ Retrieval for this document: 5 units out of 572, = 0.87%  
+++ Text units 528-530:

*Teaching TBM How well do you think ToolBook® would allow you to produce an application for your own teaching?

It seems a bit early yet (to say) you seem to need to do alot more I don't feel as confident

*Comparison How do you think ToolBook® and SHAPE® compare with each other

I think I am biased towards SHAPE® but that might because we spent longer on it. We didn't seem to go as far with TBM.

s28ds.doc

++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++ ON-LINE DOCUMENT: S35DB
+++ Retrieval for this document: 3 units out of 528, = 0.57%  
+++ Text units 29-31:

*General SHAPE® What general impressions did you have using SHAPE®?

It seemed to be working pretty well it didn't seem to interrupt the thinking that I was having about the topic. There was the odd occasion where I felt I was being driven down a kind of knowledge system and in fact I was already beginning to see how things at different levels could be interrated rather than simply be functions of the previous level. I think I needed the instruction, the icons still did not have any meaning to me.

++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++ ON-LINE DOCUMENT: S36KT
+++ Retrieval for this document: 3 units out of 578, = 0.52%  
+++ Text units 62-64:

* Confusion TBM G: Was there anything confusing about using ToolBook®?

No I couldn't quite see why anybody would want it - but that became clearer as I used it

++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++ Total number of text units retrieved = 35
+++ Retrievals in 7 out of 27 documents, = 26%.  
+++ The documents with retrievals have a total of 3700 text units, so text units retrieved in these documents = 0.95%.  
+++ All documents have a total of 9235 text units, so text units found in these documents = 0.38%

++++++++++++++++++++++++++++++++++++++++++++++++++++++
Appendix N Evidential Databits Indexed on Accommodation

Evidence from One-to-One Training Sessions

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.


*******************************************************************************
'(1 1) /Ease/Eol/Accomodation
*******************************************************************************
*** No Definition
*** ON-LINE DOCUMENT: S03RW
*** Retrieval for this document: 2 units out of 282, = 0.71%
+ Text units 106-107:

106 *EOL TBM After having learnt to use ToolBook® do you have any general
thoughts on what makes a program easy to learn?

107 I don't think I've learnt ToolBook - I don't think I'm qualified to
COMMENT
*******************************************************************************
*** ON-LINE DOCUMENT: S12PC
*** Retrieval for this document: 3 units out of 341, = 0.88%
+ Text units 191-193:

191 *Ideas SHAPE® How easy did you find the ideas behind SHAPE® to grasp?

192 193 Not easy at first. Its interesting in away because I said earlier that
the actual illustration and symbols made it userfriendly, but this is one
instance where the other is (more) user friendly - you need some script
or words or phases as opposed to jiggling from boxes to boxes.
*******************************************************************************
*** ON-LINE DOCUMENT: S20RK
*** Retrieval for this document: 3 units out of 583, = 0.51%
+ Text units 72-74:

72 * Confusion TBM C: Was there anything confusing about using ToolBook®?

73 74 Having come to it cold and quickly getting up and running with it there
was a little confusion but that was just the learning process and getting
used to the package.
*******************************************************************************
*** Total number of text units retrieved = 8
*** Retrievals in 3 out of 27 documents, = 11%
*** The documents with retrievals have a total of 1206 text units,
so text units retrieved in these documents = 0.66%
*** All documents have a total of 9235 text units,
so text units found in these documents = 0.09%.
*******************************************************************************

Evidence from Focus Group

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.


*******************************************************************************
'(3 8 13) /Focus Group/Analysis/accomodation
*******************************************************************************
*** No Definition
*** ON-LINE DOCUMENT: CMP-RSLT
*** Retrieval for this document: 8 units out of 185, = 4.3%
+ Text units 62-64:

62 How can you get staff to create at the screen?

107
Confidence. Value - we can all see the value in using a tool, the students I teach can't see the value in using a wordprocessor - a quality document it's a nuisance for them.

++ Text units 68-72:
68 g why can't they see value?
70 m I think it comes down to access to machines, lack of skill- they can't type
72 g they can't connect to its utility

K thats going to be true of what you're doing here its lack of familiarity. I personally don't think on the screen I am a head person, however with wp I do because i'm competent with word processing. Before I would think 'how will I amend it how will I delete it' if I can't do those things easily then I scribble them onto a piece of paper first and then stick it in.

+++++ ON-LINE DOCUMENT: FRNT-INT
+++ Retrieval for this document: 4 units out of 146, = 2.7%
++ Text units 110-113:
110 How at ease are you with this program?
112 K I don't think it's a very nice program for someone whose is coming to it cold.
113 gr I'd agree with that, when I first came to it I found it frightening well not frightening - that's the wrong word - its a bit - I was thinking oh my 'how am I going to get my head around this.'

+++++ ON-LINE DOCUMENT: TBK-INT
+++ Retrieval for this document: 4 units out of 136, = 2.9%
++ Text units 101-104:
101 How at ease are you with this program?
103 m when you were demonstrating I felt quite comfortable with what you were doing.
104 K it is easier because your coming with an idea of what a book is.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++ Total number of text units retrieved = 16
+++ Retrievals in 3 out of 27 documents, = 11%.
+++ The documents with retrievals have a total of 467 text units, so text units retrieved in these documents = 3.4%.
+++ All documents have a total of 9235 text units, so text units found in these documents = 0.17%.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Appendix O
Appendix O Evidential Data Bits Indexed on linking

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
Licensee: geoff.

******************************************************************************
(2 2 2 1 3) /Ease/eou/Transparency/issues/linking
******************************************************************************
** No Definition
******************************************************************************
+++ ON-LINE DOCUMENT: SO27G
+++ Retrieval for this document: 150 units out of 245, = 61%
++ Text units 32-57:

32 *Create Links TB (shows how to navigate through the pages, the principle of adding content.)
33
34 G: (Explanation of how to create links) Are there any links you wish to create
35
36 Well the obvious one would be between C of L and School of L & T
37
38 *G: If you want to go to the page for L & T (Explanation of navigation to page) (Time creates one half of the link)
39
40 G: (To create the electronic book structure you then need create all links required)
41
42 (Tim creates link) (Tim gets the name of the link wrong and has to check the name with the history function.)
43
44 *General TB General impressions?
45
46 Has great potential for creating teaching material. I get slightly confused with all the links and so on, I know how to create a link as such but uhh I think a lot of time would be taken up with designing the architecture on paper first before put into practice, I think I'd need to do that do you know what I mean? Diagrams for instance with the concept - trees
47
48 A lot to remember but that's like any windows package, once you've sussed it out its second nature.
49
50 *Ideas TB How easy to grasp are the ideas behind ToolBook? The page metaphor etc
51
52 The metaphor is great, y'know it makes a lot of sense - to have a page and then that links to others. The only thing is when you think of a normal book you think of a sequential reading of those pages but with this its all over the place depending on where you want to get to. The fundamental ideas are ok but the technicalities will take some time to train my self.
53
54 G: What technicalities?
55
56 Operating the package,
57
++ Text units 87-166:
87 *Create Concepts SHAPE: Explanation of getting into SHAPE
88
89 G: Top level concept map?
90
91 The Faculty?
92
93 G: Whole Module
G: What concepts would you use at top level?
What top level?
G: Yes
Oh um
G: Would you be more inclined to start bottom up?
Uh Not as such but my anticipated next step would be to do the second strata.
So when you say concepts what do you mean?
G: Well for example 'teacher', 'course'
Oh its the link is it?
G: No, but what you call a link and what you call a concept is conjectural, its up to you to decide which is the semantic relation and what is the concept
Your saying concepts instead of pages?
G: Yes
(Tim enters concepts)
(concepts are generated)
What do I do with these?
G: You can pick them up an drag them around
I can arrange them?
G: Yes
G: You can add concepts whenever you like
G: So the second thing you may want to do is link the concepts
G: Would you want to connect any of these concepts
I would create a link between exec and admin.
*Create Links SHAPE© To create a link you ........
(Tim creates a link)
(Tim confirms how to link ):
I do one with CTRL?
G: Yes
(Tim creates other links)
There are other links as well isn't there - Faculty exec 'decides' the budgets of the schools but they also 'instruct' and so on
G: So you would like to like to add another link between Faculty and Schools
Yes, can you
G: Yes but it will look crowded on the screen.
(Tim creates another link 'command' between faculty and school)
I suppose you'd have a link between all of these, can you do that
G: Yes
g: Are you happy with your top level?
Yes
** Text units 172-203:
Appendix 0

172 "G: Explanation of navigating down the hierarchy
173 (Tim creates concepts for schools)
174 G: Do you want to link these concepts?
175 No
176 177 G: Are any of these composite
178 Yes (Tim creates some composite concepts)
179 So now I generate the next level (Time gens the next level)
180 (SHAPE® gens pages)
181 (Tim navigates to the L & T school and creates concepts for L & T)
182 But this would link back to site because I would like people to know
183 where the school is, do you know what I mean
184 G: What you would have to do is create that link manually afterwards,
185 you can't at this stage create links between levels
186 I wondered about that because say this was my tourism subject I would
187 want users to get back to the 'home' page.
188 G: Do you want to create any links
189 (Tim creates some links)
190 G: Tim you tend to use 'non-verb' constructs for your links why do you do
191 that?
192 I don't know, it seemed the obvious thing
193 (Tim makes 'courses' composite and generates the next level)
194 G: Are these courses composite
195 No I think we've reached the bottom
196 ++ Text units 218-223:

218 "Ideas SHAPE® How easy are the ideas behind SHAPE
219 Very easy like with the book metaphor of ToolBook®, its concept linking,
220 once you have related links as well .................
221 The importance of trying it out live.
222 ++ Text units 228-233:

228 "Difficult SHAPE® Any drawbacks with SHAPE
229 Well the linking but that's because its developmental so ultimately I can
230 see the relevance to the internet where it links back to the home page.
231 It was better than ToolBook® because its hierarchical so it allowed me to
232 describe the faculty. With ToolBook® I created all pages which were on
233 different strata, and they had to be created at the same time., I didn't
234 like that as I said I would have to sit down and describe the
235 architecture. Essentially the mapping is the architecture of design.
236 you can arrange as such that

+++++++++++++++++++++++++++++++++++++++++++++++++++++++ 
*** ON-LINE DOCUMENT: S017W
+++ Retrieval for this document: 53 units out of 282, = 19%
++ Text units 9-16:

9 "Define TEM Describe to me what ToolBook® does?
10 It creates a means of communication information on the computer between
11 different pages which are not -- Are linked.
12 G: What purpose would that be for?
13 For any form of communication
14 ++ Text units 73-80:
Appendix O

*Picture TBM 7. Page for Support Staff with Link added to Leisure and Tourism

G: How did the text get there?

What we did next was, I don't know how we got the name in there, but we got a link up between that and whatever we had here.

G: How would you use this link?

** Text units 121-130:

*Define SHAPE* Describe to me what SHAPE* does?

SHAPE* takes concepts and allows you to break them down into different concepts and different relationships between those. You take a concept and break it down into lower levels. A concept may be misleading because it could be just a subject.

G: And what happens then

A better understanding how the whole thing is interlinked.

G: What happens to those links?

** Text units 195-200:

*Picture SHAPE* 8 Moved Concepts

G: What do you do next?

I would link them I would press 'generate'. and press that down (CTRL) and put then word in

** Text units 207-210:

*Picture SHAPE* 11 Enter link name

** Text units 232-248:

*Picture SHAPE* 19 Next level with atomic concepts hot.

G: What is happening here?

G: Where would these links have come from

** Text units 243-248:

*Picture SHAPE* 21 Content page for 'Management with section field with links to Administration

G: What do you do here?

If I press on that it will take me to 'Administration'

+++++ON-LINE DOCUMENT: 504MJ+++++

+++ Retrieval for this document: 108 units out of 559, = 19%

** Text units 3-20:

*SHAPE* Session Interview
Appendix O

5 G: How would you now rate your understanding of what hypermedia/multimedia is?

7

9 G: How would you now rate your understanding of hyperlinking?

11

13 G: How would you now rate your understanding of concept maps?

15

16 G: How would you now rate your understanding of the use of SHAPE®?

18

19 SHAPE® Session Interview

20 ++ Text units 24-27:

24 *G: Explanation of creating links

25

26

27 ++ Text units 164-188:

164 *Picture SHAPE® 11 Enter link name

165

166 G: What do you do here?

167

168 G: What happens next

169

170 G: Is that confusing?

171

172

173 G: What would you do now

174

175

176

177 *Picture SHAPE® 12 Several linked concepts

178

179 G: What do you do here?

180

181 G: What happens next

182

183 G: Is that confusing?

184

185

186 G: What would you do now

187

188 ++ Text units 263-293:

263 *Picture SHAPE® 19 Next level with atomic concepts hot.

264 G: Why are these red?

265

266 G: What do you do here?

267

268 G: What happens next

269

270 G: Is that confusing?

271

272

273 G: What would you do now

274

275

276 G: Where would these links have come from

277

278

279

280 *Picture SHAPE® 21 Content page for 'Management with section field with links to Administration

281
Appendix O

282 G: What do you do here?
283
284 G: What happens next
285
286 G: Is that confusing?
287
288 G: What would you do now
289
290 G: What happens next
291
292 G: Is that confusing?
293
++ Text units 356-359:
356 *G: Explanation of creating links
357
358
359 ++ Text units 473-490:
473 *Picture TBM 7. Page for Support Staff with Link added to Leisure and Tourism
474 G: What do you do here?
475
476 G: What happens next
477
478 G: Is that confusing?
479
480 G: What would you do now
481
482 G: What has happened at this point
483
484
485 G: How did the text get there?
486
487
488 G: How would you use this link?
489
490 ++ Text units 514-521:
514 *Teaching TBM How well do you think ToolBook® would allow you to produce an application for your own teaching?
515
516 It would, but the (the mechanism) relationships would need to be clearly then both packages would be the same.
517
518 *Difficult TBM Was there anything about ToolBook® that made it difficult or unsatisfactory in producing an application that matched the objectives of the exercise?
519
520 The content and relationships were a bit confusing but nothing a bit of practice couldn't sort out.
521
++ ON-LINE DOCUMENT: S05MS
++ Retrieval for this document: 118 units out of 412, = 29%
++ Text units 8-11:
8 *Create Links SHAPE
9
10 (Mike has trouble labeling the links)
11 ++ Text units 32-56:
32 *General SHAPE: What general impressions did you have using SHAPE®?
33
34 Its good and clunky. its seems straightforward. It would be nice to have an overall *Picture cos then its easier to visualise it.
35 I would want to sit down with a pen and paper beforehand if it was a subject I was happy with I would be quite happy to prototype on here.
36
37 G: If it was a text document where would you start on the computer or a
piece of paper

On the computer.

G: But with this (SHAPE) you would start on a piece of paper?

In this particular application yes because I don’t know enough about it.

G: If you were familiar it, would that make any difference?

I think so because it’s quite easy to go and link things or is it easy to move things around and change things, break links and put new links in, is it easy to prototype on here.

G: It will.

So if you go down to a quite low level you should be able to repoint links at a higher level.

If I was happy with that and happy with the subject I would be happy to prototype on the screen.

*Confusion SHAPE: Was there anything confusing about using SHAPE®?

It’s the thing about the types of concepts - you’ve got hard concepts and hard concepts, navigation map is a soft concept in the sense that its note real, its not tangible whereas a member of staff is a tangible one and creating a link between them - is in three dimensions you can create almost a hierarchy between tangible ones but somewhere behind there is your intangible one.

G: Are you saying that there is a need to classify concepts and what we are doing here is mixing type of concepts almost like trying to multiple ‘E’ by ‘lbs’?

Yes with the navigation map and the staff there is a link but I don’t know quite how to classify what that link might be.

G: Would you therefore say that the concept map is deficient in some way?

Yes you’ve almost got layers, the navigation map is like a layer over the top over those other concepts. How you do that I don’t know.

G: Maybe you shouldn’t be allowed to link these types of concept you can have them on the same screen but there not linkable.

Is the navigation map a concept?

G: Well this maybe something to do with the fact its so free format.

That’s right you might be making a rod for your own back.

G: And it could be that although you would need to include something like a navigation map in a particular application it has no place in the concept map.

*Picture SHAPE® 8 Moved Concepts

G: What do you do here?

I would decide if there were any links between them and I would CTRL-Click each box and then I would type in the name of the association.

*Picture SHAPE® 11 Enter link name

*Picture SHAPE® 12 Several linked concepts
Appendix O

++ Text units 187-196:
187  *Picture SHAPE* 17 Next level down
188  189  G: What would you do next
190  191  Generate book
192  193  What does that do
194  195  It creates all the 'horizontal' links
196  ++ Text units 205-223:
205  *Picture SHAPE* 21 Content page for 'Management with section field with links to Administration
206  207  G: What is this illustrating here now
208  209  For this particular element it shows all links from that element to other elements
210  211  G: Where have they come from
212  213  Various levels from your map
214  215  G: Why 'management' and 'administration'?
216  217  From your map there's a link between 'management' and 'administration'
218  219  If up here (higher level) you've got 'school' and down here you've got 'goat' can you link those even though they are on different levels.
220  221  G: No
222  223  ++ Text units 289-289:
289  *Create Links TBM
++ Text units 298-301:
298  *Define TBM: Describe to me what TBM does?
299  300  It basically creates pages within a book for an aid to sectionalise and organise your course and also allow the person to explore linked items.
301  ++ Text units 318-326:
318  *Change TBM: Was there anything about TBM?
319  320  I wouldn't want to see the workings. These don't bare a lot of relationship to structure
321  322  There's two concepts going on here there's the linear and there's the non-linear and I find it gets confusing
323  324  325  G: I'd like you to comment on the follow screens
326  ++ Text units 353-363:
353  *Picture 7 TBM. Page for Support Staff with Link added to Leisure and Tourism
354  355  G: What has happened at this point
356  357  358  G: How did the text get there?
359  360  361  G: How would you use this link?
Appendix O

363
++++++++++++++++++++++++++++++++++++++++++++
++ ON-LINE DOCUMENT: S08FB
++ Retrieval for this document: 90 units out of 561, = 16%
++ Text units 9-12:

9  *G: Explanation of creating links
10
11
12
++ Text units 49-52:
49 *Confusion SHAPE® Was there anything confusing about using SHAPE®?
50
51 Yes, the name of the links. I'm used to having set name meaning set things for links, looking in the abstract just being able to call (the links) anything.
52 ++ Text units 151-175:
151 *Picture SHAPE® 11 Enter link name
152
153 G: What do you do here?
154
155 G: What happens next
156
157 G: Is that confusing?
158
159 G: What would you do now
160
161
162
163
164 *Picture SHAPE® 12 Several linked concepts
165
166 G: What do you do here?
167
168 G: What happens next
169
170 G: Is that confusing?
171
172 G: What would you do now
173
174 ++ Text units 250-280:
250 *Picture SHAPE® 19 Next level with atomic concepts hot.
251 G: Why are these red?
252
253 G: What do you do here?
254
255 G: What happens next
256
257 G: Is that confusing?
258
259 G: What would you do now
260
261 G: Where would these links have come from
262
263
264
265
266
267 *Picture SHAPE® 21 Content page for 'Management with section field with links to Administration'
268
269 G: What do you do here?
270
271 G: What happens next
272

117
Appendix O

273  G: Is that confusing?
274
275
276
277  G: What would you do now
278
279
280
++ Text units 349-352:
349  *G: Explanation of creating links
350
351
352
++ Text units 370-373:
370  *Define TBM Describe to me what ToolBook® does?
371
372  TBM allows you to set up individual pages of information which can be linked to other pages. It can also be set up as a hierarchy so again you can direct students in to a certain path.
373
++ Text units 478-495:
478  *Picture TBM 7. Page for Support Staff with Link added to Leisure and Tourism
479
480  G: What do you do here?
481
482
483
484
485
486
487
488
489
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++++++++++++++++++++++++++
+++ ON-LINE DOCUMENT: S10PB
+++ Retrieval for this document: 144 units out of 416, = 35%
++ Text units 38-62:
38  *Create Links TBM
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++ Text units 97-145:
97  *Picture TBM 3
That was the first page of the document, a blank one from which you had to build from.

*Picture TBM 5: Page input Box

G: What would you have to do next?

Start making pages up, click on to 'page' and then name the pages

G: (Correction to right pull down menu)

Oh yea, I would probably have got lost there

*Picture TBM 6: Page for support staff

G: Once you've created those pages what happens next?

Name the text field for what the module is going to be and even the section if we want to then we make the interrelationship between them.

G: How do you make the interrelationship?

G: How would you go about completing the exercise.

At this moment in time yes but next week if haven't touched it I'd forget. A bit more tuition and I'd be alright

G: Why would you forget?

Because I'd not be applying it. It's like any knowledge you gain if you don't apply it it goes on the back burner doesn't it

G: Is there any difference between forgetting this and forgetting anything else like making an omelette?

Once you've developed a skill the skill will stay with you even thought the skill will be at a certain level. If you don't practice the skill you lose it.

* 

++ Text units 204-209:

*Create Links SHAPE® Explanation of creating links

G: What is the connection between schools and courses?

'Names of courses' would that be, 'Course titles'

++ Text units 254-270:

*Confusion SHAPE: Was there anything confusing about using SHAPE®?

Not confusing but there's so much more to it. A lot more thought processes to these different levels.

G: Does that apply to ToolBook® as well?
In ToolBook®, it was just set ‘headings’ together. With this one there is a lot more thought processes required.

G: In what sense?

Its in more depth you have to do the relationship between levels as well.

G: Didn’t you have to create links in ToolBook® as well?

Yes but there are two types of links with this one. Atomic and composite and getting the differentiation between those two. It’s probably easy but its the first time I’ve tried to do it.

++ Text units 286-325:

Click on that and you can do your ‘titles’ first of what you want and then you say ok and they come up and you split them all around the screen in the SHAPE® you want them. Then you decide then whether there is any relationship between them.

Press this (CTRL) and put the arrow on the bar (concept), press once and then it comes up and you type in what the relationship is and you type ok and a line comes down between the two.

G: What do you do next?

Don’t we go into generate?

G: Do we do anything before we generate?

Do we move them around to get the SHAPE® we want.

G: You can do

And then we decide then if an atomic or composite, I can’t remember whether that is done now. What we’ve got is that level so we see what we’ve got to go down to a composite relationship or an atomic type of relationship. I can’t remember how to do that.

G: Once you’ve done that what do you do next?

Do you go to Generate

G: What do we do now?

We’re looking at composites so we click composites. We only go to book when we’re ready to sort it out.

G: When we click composites what happens then?

Something goes red, does ‘Schools’ go red?

G: And what does that mean?

That means you can something else going to the next level you can put your relationship down. But the others will just go to the atomic point.

++ Text units 355-361:

*Picture SHAPE® 20. Showing the links field

G: What do these (link names) represent?

They were composite links from management.

***********************************************************
Appendix O

+++ ON-LINE DOCUMENT: S1TC
+++ Retrieval for this document: 137 units out of 291, = 47%
++ Text units 5-45:

5   "G: Explanation of authoring with ToolBook®

6   G: What pages would you include?
7   (Tom enters pages)
8   G: Describe what you have done. Was that the whole entire electronic book?
9   Yes because I think that using the book metaphor I would expect to see a
10  page of contents in a book but I guess that table of contents would be in
11  the faculty page.
12
13  G: Explanation of creating links
14  G: What do you want to link?
15  (Tom links the two pages)
16  G: Would this be a two way link
17  yes
18  Tom tries link
19  G: could you create some more links, what do you think you want to do
20  next?
21
22  I think I would start at the top of the hierarchy as I have the mental
23  image and that would be the 'faculty'. And I would let to add some
24  general information about the faculty put put link links then to schools
25  and put in some information about schools, link schools to 'courses', put
26  information against courses.
27
28  G: You only have one page for schools, would that be all you need
29  I suppose not. I would like a page for each of the schools
30  (Tom creates more pages for each of the schools)
31  G: Create to more links, explanation of navigation tool
32  (Tom creates another link between 'S of FCS' and 'Faculty')
33  G: Explanation of how the book would be created.
34  Post session Interview
35
++ Text units 50-57:

50  "Define TBM Describe what ToolBook® does?

51
52  ToolBook® allows you to define pages within a book, conceptual
53  pages and to define links between these pages as may links as one might
54  like to do I suppose and allows you to enter information on to those
55  pages.

56  "General TBM General impressions

57  I don't think its a particularly good idea to have type in names of
58  other pages because it is entirely dependent on the programmer/author
59  typing in the name accurately [for linking pages] I would prefer some
60  sort of drag and drop or pull down menu select from other page names and
61  not just page. I could imagine sitting in 'faculty' and to make links
62  to other pages so I can imagine pulling down a menu and it has the a
63  names of the other pages, ones already linked would be greyed out or
64  disabled in some way and I could select other ones. Not individually
65  but select as many as you wanted. In the same as you can in access when
66  creating queries. It saves time and its when you have to keep going
67  back - I sometimes forget what I've done already I don't find that very
68  useful.
++ Text units 62-86:

62 *Confusion TBM Was there any thing confusing about ToolBook®?

63
64 It took me a while to work to figure out what I was looking at - the name of the page there, it took me a little bit to focus on that and realise that was the page I was looking at and of course this thing here (link field). Another thing that I find confusing, the usual thing, single click/double click.

65 (commenting on screen)

66 *Picture TBM 1 Entry screen for ToolBook®:

68 G: Do you know what to do here?

71 I think so I would have to create new pages

74 G: Where would you go to create new pages?

77 Objects (menu)

80 *Picture TBM 6

83 G: Once you’ve created the pages would you know how to create links

86 Yes, I would in author mode double click on this area here and enter the name of the page to which I wanted to link.

89 G: How would you get to the other page

92 I would follow the link in reader mode by clicking on it.

++ Text units 110-124:

110 *Easy TBM Was there anything about Toolbook that made it easy/satisfactory to achieve the objectives of the exercise.

113 Forming links seemed pretty easy.

116 *EOL TBM What makes a program easy to learn

119 IF they are able to relate what the user knows about its capabilities in terms of some mental model to the actions they have to perform with the software particularly if for example the names of the pulldown menus are intuitive and relate to the task in hand and that the areas on the screen are properly positioned and seem to interrelate with the authors mental model of how the software operates

122 G: Where does that mental model come from?

125 It may come from initial description of the software or some ideas of the capability of the software so for example Toolbook, as I understand it from what we’ve seen today allows the user to connect pages of information together using hyperlinks so if its easy to create pages of information, identify them, and to create links between those pages then the software is easy to use.

128 Toolbook could be easy to learn, I have a better understanding of the need for the names must match in trying to link a named page to another named page the name must be exactly right

++ Text units 141-154:

141 *SHAPE® Session

144 (Entering concepts)

147 *Define SHAPE® Describe what SHAPE® does
It allows the user to express concepts at various levels, takes some
concept and move them down to a lower level and express links between
those concepts or interrelations which results in the generation of Tbook
pages which have their links embedded in them due to the definitions which
have been produced in SHAPE.

*General SHAPE® General impressions

As I used it I was thinking about what I had seen before in Tbook and
realised it was going to produce pages. and SHAPE® seems to be a more
intuitive approach because it allows me to express concepts behind and
map them into pages with links embedded in them and after all that's
probably the more intuitive way of doing things rather than the having to
deal with the technology at a lower level. I like the higher level
approach.

++ Text units 187-194:

*Picture SHAPE® (Concepts created)

Those are the generated concepts overlaying one another I would drag
them around to separate them. Having done that I would CTRL 'point' and
point CTRL another one and then I would supply the name of the link.

*Picture SHAPE® (Creating and showing of link)

That's the creation of a link and that shows the link graphically.

++ Text units 232-245:

*Picture SHAPE® (Showing links field of one of the atomic pages)

G: What are these

Those are the links

G: Where have they come from?

They have come from the concept links

G: How do those (semantic) links distinguish themselves from those (the

composite concept pages)

On the other side they are between levels

++ Text units 250-261:

*Teaching* SHAPE® How well do you think SHAPE® allowed you to create an
application for your own teaching?

Yes I think pretty well

G: How well compared to Tbook

This would be my preferred route

G: Why would that be?

Its easier to cope with it corresponds better to my mental model of the
structure of some sort of learning package, the way I would break down
the topic into areas of interest and interrelate them rather than just be
going straight to pages and trying to define links at that level. This
is much better - work out the concepts first because I guess if I was
going to do a Tooky thing I would actually draw it out on paper and what
I draw on paper would be rather similar to what I would draw with SHAPE.
Its much better to cut out paper exercise to do it directly on screen
itself.

+= ON-LINE DOCUMENT: S12PC
++ Retrieval for this document: 165 units out of 341, =48%
ToolBook® Session Interview

1. Name: _S12_

2. G: How would you now rate your understanding of what hypermedia/multimedia is?
3. G: How would you now rate your understanding of hyperlinking?
4. G: How would you now rate your understanding of the use of ToolBook®?
5. G: Explanation of the task
6. Session Interview
7. G: Explanation of entering ToolBook®
8. G: Explanation of entering pages
9. We have 4 (pages) have we?
10. G: You can have as many as you like
11. G: What pages would you include?
12. Its all about the faculty and the structure of the faculty?
13. Is it actually a title to each page is that what you want me to add?
14. Do I have to put capitals or do I just type?
15. (Phil enters his pages and they are then generated)
16. G: Explanation of the order of pages and basic navigation
17. G: Explanation of Title fields
18. G: Explanation of section field
19. G: Explanation of creating links
20. G: Explanation of Reader/Author mode
21. G: Do you want to add any other pages?
23. G: Explanation of navigation/ the final application
24. Could you start writing text in and start developing your module and when you decided you needed another link you could just create that other link?
25. G: Absolutely
26. You don't have to do all your linking first?
27. G: No you can create and add as you go.
28. Post ToolBook® Session Interview
29. G: How would you now rate your understanding of the use of ToolBook®?
30. G: Would you say you knowledge of ToolBook® has increased
31. *Define TBM Describe to me what ToolBook® does?
32. Tbook enables you to put together the whole thing so if your developing a course or information brochure of the faculty whatever, then Tbook is the mechanism for putting the structure into place, with pages the hyperlinks, etc
33. ++ Text units 61-64:
34. *Confusion TBM Was there anything confusing about using ToolBook®?
35. Yes this bit (Sections field) sections in the book I'm still a bit muddled about that but I think I'm getting to grips with setting up the pages and the links.
36. ++ Text units 78-103:
37. *Picture TBM 3 Opening page of ToolBook®
38. There are four pages
Appendix O

G: Can you explain that (page navigation) at the bottom there
Well there are four pages at the moment and the basic structure is
already set up if you press on the right arrow it takes through each
blank page
G: What would you have to do next?
Click on 'Page' at the top no is it 'Object
G: What comes up next?
We go onto 'NewPage' and you get the little grid where you put the titles
G: What comes up next?
We clicked on the OK button and the pages down the bottom changed, the
number of pages we then had well we could have started putting in pages
but we started to create some links.
G: If you want to create a link what would you do?
We doubleclik in that left hand box which put the cursor there and then
typed in the name of the page we wanted to link with
G: How did you use the link
We have to go into user model.
** Text units 137-180:

*Barrier TBM What would prevent you from using ToolBook® to create an
application for your own teaching
Time, lack of.
If I got to the stage where the program became too complicated for me and
I couldn't get backup - tuition my motivation would decrease.
*SHAPE® Pre Session
G: How would you now rate your understanding of concept maps?
G: How would you now rate your understanding of the use of SHAPE®?
SHAPE® Session Interview
G: Explanation of entering concepts
(Phil enters pages and says) 'They've got to be fairly similar (to those
created in ToolBook®)
G: Explanation of creating links
G: Explanation of composites/atomic
G: Explanation of Generate composites
G: Explanation of moving to next level
There's a link between staff and courses but what's the link.
This is where I am having a problem with this one (SHAPE) is actually
understanding what the link is and saying what the link is
What's going through my mind now is that I know certain staff teach
certain courses but actually say what that link is, I'm not sure. The
link is subject area.
I don't think I started off well I didn't structure it well to start with
and thats causing problems.
*G: Explanation of generate book
*G: Explanation of navigation/ the final application
SHAPE® Session Interview
178 How would you now rate your understanding of the use of SHAPE®?
179
180 ** Text units 195-198:
195 *Confusion SHAPE® Was there anything confusing about using SHAPE®?
196 197 Putting in the links between the different concepts that was confusing.
198 ** Text units 218-228:
218 *picture SHAPE®:Opening screen of SHAPE
219 220 G: Can you describe to me what you see now
221 222 Well all that's there at the moment in terms of concepts and all there is
223 224 G: What do you do here?
225 226 Dclick on the concept box, which then throws you up a table which you
227 228 ** Text units 234-251:
234 *Picture SHAPE®12:
235 236 G: What happened next?
237 238 Forming links that you thought was between these and by holding down the
239 240 G: And now what would you do?
241 242 You can now go down to a further level of concepts by clicking sorting of
243 244 G: And now what would you do?
245 246 Bring up the concept box and type in the next level
247 248 G: How do we get to the next level?
249 250 By Dclicking on the concepts box
251 ** Text units 272-277:
272 *Picture SHAPE®20. Showing the links field of Management page
273 274 G: What do these (link names) represent?
275 276 They are two links between concepts at the top level.
277 +++++ ON-LINE DOCUMENT: S18AI
278 +++ Retrieval for this document: 98 units out of 387, = 25%
279 ** Text units 29-53:
29 *Create Links TBM
30 31
32 G: Explanation of navigation/ the final application
34 35 36
37 G: Do you want to add any other pages?
Appendix O

40 G: explanation of history navigation.

44 Post ToolBook® Session Interview

47 G: How would you now rate your understanding of the use of ToolBook®?

50 *Define TBM: Describe to me what TBM does?

52 It allows you to set up a framework for something which is analogous to a

book the framework would then dictate what was in chapters and pages

within chapters and allows you to link between pages within a chapter.

++ Text units 93-101:

93 *Picture TBM 5 Page input box

94 This is setting up the initial set of pages with links between them.

97 G: Would you be able to continue now?

100 Probably now, from this point on I could probably create some more work

it was being faced with a blank page I couldn't remember how to get

started There wasn't a cursor blinking

101 ++ Text units 105-119:

105 *Picture TBM 7 Page for Support Staff with Link added to Leisure and

Tourism

106 G: What has happened at this point

109 Leisure and Tourism is a page

111 G: How did the text get there?

113 You're in author mode.

115 Is that the link you have set up?

116 G: How would you use this link?

118 You would dclick on it to go to that page.

119 ++ Text units 128-136:

128 *Picture TBM 9 Page for Leisure and Tourism

131 It looks like you've got a link down and a link up, form Leisure and

Tourism to Support and from Support to Leisure and Tourism.

133 *Objectives TBM How well do you think ToolBook® allowed you to achieve the

objectives of the exercise?

137 Reasonably well

139 ++ Text units 176-182:

176 *G: Explanation of entering concepts

178 G: Explanation of creating links

181 ++ Text units 268-279:

268 *Picture SHAPE® 8 Moved Concepts

269
First of all you want to say whether they are composite or not and you would also want to create links or not between them.

**Picture SHAPE®** 9 CTRL-Clicked concept

Starting a link

**Picture SHAPE®** 11 Enter link name

Now you want the type/name of the link

**Picture SHAPE®** 12 Several linked concepts

**Content page for 'Management with link field with links to Administration**

This is just specifying the links from the management page to Administration and schools

G: Where would these links have come from

You would have done them by when you have the concepts on the screen. Thinking about it I'm not sure whether it is links from the concepts or links from a lower level to an upper level concept.

A diagram showing the levels would be useful here

A **Picture SHAPE®** 20 Content page for 'Management with section field with links to Administration**

G: What is happening here?

This is just specifying the links from the management page to Administration and schools

G: Where would these links have come from

You would have done them by when you have the concepts on the screen. Thinking about it I'm not sure whether it is links from the concepts or links from a lower level to an upper level concept.

A diagram showing the levels would be useful here

Text units 110-118:

**Content page for 'Management with section field with links to Administration**

G: What is happening here?

This is just specifying the links from the management page to Administration and schools

G: Where would these links have come from

You would have done them by when you have the concepts on the screen. Thinking about it I'm not sure whether it is links from the concepts or links from a lower level to an upper level concept.

A diagram showing the levels would be useful here

**Picture SHAPE®** 21 Content page for 'Management with section field with links to Administration**

G: What is happening here?

This is just specifying the links from the management page to Administration and schools

G: Where would these links have come from

You would have done them by when you have the concepts on the screen. Thinking about it I'm not sure whether it is links from the concepts or links from a lower level to an upper level concept.

A diagram showing the levels would be useful here

Text units 110-118:
Appendix O

166 G: Is that confusing?
167 168 G: What would you do now
169 170 G: What has happened at this point
171 172 173 G: How did the text get there?
174 175 176 G: How would you use this link?
177 178 ++ Text units 235-236:
235 *G: How would you now rate your understanding of hyperlinking?
236 ++ Text units 247-250:
247 *G: Explanation of creating links
248 249 250 ++ Text units 271-279:
271 *Define SHAPE® Describe to me what SHAPE® does?
272 273 Creates concept maps, - it looks as if it sits on top of TBM and so you
274 275 can diagrammatically show the various links between the sections and
276 277 hierarchy of each page.
278 279 G: Why
280 281 To make TBM more userfriendly.
282 283 Its what you would use TBM for - for creating online interactive book -
284 285 or pages.
286 ++ Text units 294-300:
294 *Change SHAPE® Was there anything about SHAPE® you would change?
295 296 Linking between pages of the same level. Information boxes saying what
297 298 is going on. It wasn’t as bad as TBM where ‘bang’ its just a white piece
299 300 of paper - Are you going to develop a tutorial?
300 ++ Text units 393-417:
393 *Picture SHAPE® 11 Enter link name
394 395 G: What do you do here?
396 397 G: What happens next
398 399 400 G: Is that confusing?
401 402 403 G: What would you do now
404 405 406 *Picture SHAPE® 12 Several linked concepts
407 408 G: What do you do here?
409 410 G: What happens next
411 412 413 G: Is that confusing?
Appendix O

416  G: What would you do now
417  **Text units 493-523:**
493  *Picture SHAPE® 19 Next level with atomic concepts hot.
494  G: Why are these red?
495  G: What do you do here?
497  G: What happens next
499  500  G: Is that confusing?
502  503  G: What would you do now
505  506  G: Where would these links have come from
507  508  509
510  *Picture SHAPE® 21 Content page for 'Management with section field with
      links to Administration
511  512  G: What do you do here?
513  514  G: What happens next
515  516  G: Is that confusing?
517  518  519  G: What would you do now
520  521  522  523
++ Text units 539-542: 539  *Difficult SHAPE® Was there anything about SHAPE® that made it difficult or
unsatisfactory in producing an application that matched the objectives of
the exercise?
540  541  Not being able to link concepts at the same level.
542
++++ON-LINE DOCUMENT: 823AR
+++ Retrieval for this document: 110 units out of 391, = 28%
++ Text units 5-12:
5
*Define SHAPE: Describe to me what SHAPE® does?
6
SHAPE® will create a piece of work that is built up of different concepts:
the top concepts can then be broken down into subsidiary levels and the
links between those subsidiary levels can all be hyperlinked together.
And there for it is possible once the thing is created to jump from one
to the other where ever direct links made and you can also move to
separate pages.
8  9  G: And what would the final result be
10  11 The final result would be a concept document that can be linked
12  ++ Text units 83-95:
83  *Picture SHAPE® 8 Moved Concepts
84  85  G: What do you do here?
86  87  G: What would you do now
88  89 If I want to show there is a direct link between these I would then I
would click on there and it would turn yellow.
90
Appendix O

91 G: No
92
93 Oh click on that one and a little box will come up saying 'Escape' and then - if I saw it I would remember.
94
95 ++ Text units 111-154:

111 *Picture SHAPE©11 Enter link name

112
113 G: What happens next
114
115 A line linking the two.
116
117 *Picture SHAPE©12 Several linked concepts

118
119 G: What happens next
120
121 Now you need to explain a little more about these three - create a separate page, breaking down the different parts of the management structure.
122
123 G: How would you do that?
124
125 Click on it? Press the control?
126
127 G: Dclicking the concept
128
129 Oh yes, and a little box comes up saying 'Is this the end of the line' or is it concept
130
131 G: Did you have a problem with the idea of composite concepts
132
133 I was being a little vague about it first I don't there is anything wrong with the way you've written it there no I understand the idea that composite means 'builds on'. What does the atom bit mean?
134
135
136 G: What happens next
137
138 We reached that stage so we want to create a new page/screen
139
140 G: So how do we get to the schools page
141
142 Generate composite
143
144 G: What does that do?
145
146 It creates the new page
147
148 G: How do we get to that new page
149
150 Do we press concept or pressing that?
151
152
153
154 ++ Text units 175-181:

175 *Picture SHAPE©17 Next level down

176
177 G: What do we do next
178
179 Decide whether there are any links between these concepts and whether there any of these screens are linked to another one again.
180
181 ++ Text units 196-201:

196 *Picture SHAPE©21 Content page for 'Management with section field with links to Administration

197
198 G: Describe this page
199
200 This tells you what this page is linked to.
Appendix O

201
**Text units 233-240:**

233  *Define TBM: Describe to me what TBM does?

234
235  Tbook creates links in a directory in the same way that the other program did. I think it will achieve all the same objectives as the program we used before but in a slightly different manner. In what appears to me to be a slightly more complicated manner.

236
237  G: Can you describe how it does it

238
239  Probably not. That's it. I know that it creates a series of separate pages and then its up to me then to decide what I want written on these pages. It uses the same format of box for the different concepts and it does give me the opportunity to link with the other sections the ones at the top and to go on and link composites, the other ways.

240
**Text units 312-335:**

312  *Picture TBM 6: Page for Support Staff

313
314  G: What has happened at this point

315
316  It has now broken down the pages

317
318  G: What has happened at this point if say we wanted to create a link

319
320
321  Would I have to click on that (Andy doesn't know)

322
323
324
325  *Picture TBM 7. Page for Support Staff with Link added to Leisure and Tourism

326
327  G: What has happened at this point/ how do we get this to work

328
329  Something about having to go from author to history

330
331
332  G: How would you use this link?

333
334  I can't remember

335

+++++++++++++++++++++++++++++
***ON-LINE DOCUMENT: S26TS
+++ Retrieval for this document: 122 units out of 561, = 22%**

3  *SHAPE® Session Interview

4
5  G: How would you now rate your understanding of what multimedia is?

6
7
8
9  G: How would you now rate your understanding of hyperlinking?

10
11
12
13  G: How would you now rate your understanding of concept maps?

14
15
16
17
18  SHAPE® Session Interview

19
**Text units 24-27:**

24  *G: Explanation of creating links

25
26
Appendix O

27 ++ Text units 57-61:
28 *General SHAPE®: What general impressions did you have using SHAPE®?
29
30 It was easy/straightforward - show the relationships once you know the
31 basic moves - how to create the links its very straightforward - it gives
32 you an instant result and its easy enough to change things.
33
34 ++ Text units 95-102:
35 *Picture SHAPE®: Opening screen of SHAPE
36
37 G: What do you do here?
38
39 That enables you to go off and generate your links from that opening that
40 describe the faculty whatever and we did that by double-clicking the cmap box.
41
42 G: What happens next
43
44 ++ Text units 168-192:
45 *Picture SHAPE®: Several linked concepts
46
47 G: What do you do here?
48
49 G: What happens next
50
51 G: Is that confusing?
52
53 G: What would you do now
54
55 ++ Text units 267-297:
56 *Picture SHAPE®: Next level with atomic concepts here.
57
58 G: Why are these red?
59
60 G: What do you do here?
61
62 G: What happens next
63
64 G: Is that confusing?
65
66 G: What would you do now
67
68 ++ Text units 284-286:
69 *Picture SHAPE®: Content page for 'Management with section field with
70 links to Administration
71
72 G: What do you do here?
287 G: What happens next
289
290
291 G: Is that confusing?
292
293
294 G: What would you do now
295
296
297 ++ Text units 359-362:
359 *G: Explanation of creating links
360
361
362 ++ Text units 391-395:
391 *Ideas TBM How easy did you find the ideas behind ToolBook® to grasp?
392
393 Same as before but a slightly different way of presenting the info I think think the general understanding of achievement of where you wanted to get to is there but a slightly different method of achieving it, rather than seeing the links physically your having to know more precisely where you want to go after when you're in a practical level. In other words you have to have the whole thing mapped out at the start
394
395 ++ Text units 480-497:
480 *Picture TBM 7. Page for Support Staff with Link added to Leisure and Tourism
481 G: What do you do here?
482 G: What happens next
484 G: Is that confusing?
486 G: What would you do now
488 G: What has happened at this point
490
491 G: How did the text get there?
493
494 G: How would you use this link?
496
497 ++ Text units 530-533:
530 *Easy TBM Was there anything about ToolBook® that made it easy in producing an application that matched the objectives of the exercise?
532 If had done something on a bit of paper before you knew where you were going to go and what links were going to happen there's some preparatory work required
533
534 ON-LINE DOCUMENT: S28DS
+++ Retrieval for this document: 119 units out of 572, = 21%
++ Text units 3-20:
3 *SHAPE® Session Interview
4
5 G: How would you now rate your understanding of what hypermedia/multimedia is?
6
7
8
9 G: How would you now rate your understanding of hyperlinking?
Appendix O

13 G: How would you now rate your understanding of concept maps?
14
15 G: How would you now rate your understanding of the use of SHAPE®?
17
18 SHAPE® Session Interview
20 ++ Text units 24-27:
24 *G: Explanation of creating links
25
26 ++ Text units 60-66:
60 *General SHAPE® What general impressions did you have using SHAPE®?
61
62 I think if you want to do it properly you really need to sit down and think it through and the links between different things. I think I would feel more confident doing it on paper first. But I can see its value in relation to education and lecturing.
63
64 Its quite user friendly and it allows you to go through it in a logical way.
65
66 ++ Text units 174-198:
174 *Picture SHAPE® 11 Enter link name
175
176 G: What do you do here?
177
178 G: What happens next
179
180
181 G: Is that confusing?
182
183
184 G: What would you do now
185
186
187 *Picture SHAPE® 12 Several linked concepts
188
189 G: What do you do here?
190
191 G: What happens next
192
193
194 G: Is that confusing?
195
196
197 G: What would you do now
198
++ Text units 273-303:
273 *Picture SHAPE® 19 Next level with atomic concepts hot.
274 G: Why are these red?
275
276 G: What do you do here?
277
278 G: What happens next
279
280
281 G: Is that confusing?
282
283
284 G: What would you do now
285
286
287 G: Where would these links have come from
288
289
Appendix O

290 *Picture SHAPE* 21 Content page for ‘Management with section field with links to Administration

291
292 G: What do you do here?
293
294 G: What happens next
295
296
297 G: Is that confusing?
298
299
300 G: What would you do now
301
302
303
++ Text units 308-319:

308 *Teaching SHAPE* How well do you think SHAPE would allow you to produce an application for your own teaching?

309
310 RTC, T and Env. can you do slides?
311
312 It would be good but but I still think students need the opportunity to discuss the issues.
313 In relation to the factual knowledge it would be useful.
314
315 *Difficult SHAPE* Was there anything about SHAPE that made it difficult or unsatisfactory in producing an application that matched the objectives of the exercise?

316
317 My own understanding and having time to think these (The concepts and relations) through.
318
319 ++ Text units 366-369:

366 *G: Explanation of creating links
367
368
369 ++ Text units 486-503:

486 *Picture TBM 7. Page for Support Staff with Link added to Leisure and Tourism
487
488 G: What do you do here?
489
490 G: What happens next
491 G: Is that confusing?
492
493 G: What would you do now
494
495 G: What has happened at this point
496
497
498 G: How did the text get there?
499
500
501 G: How would you use this link?
502
503
503
+++ ON-LINE DOCUMENT: S15DB
+++ Retrieval for this document: 99 units out of 528, = 19%
++ Text units 3-12:

3 *SHAPE* Session Interview

4 G: How would you now rate your understanding of what hypermedia/multimedia is?
5 G: How would you now rate your understanding of hyperlinking?
6 G: How would you now rate your understanding of concept maps?
G: How would you now rate your understanding of the use of SHAPE®?

SHAPE® Session Interview

** Text units 14-14:

*G: Explanation of creating links

** Text units 23-28:

*Define SHAPE® Describe to me what SHAPE® does?

It offers a vehicle of sequential ordering of info and converts some thoughts about important concepts that relate to a subject and puts them into a kind of hierarchical structure that offers the opportunity to connect one level to another level. and then within levels it also offers the opportunity to show how different subconcepts link together.

To translate a curriculum into some multimedia application.

** Text units 143-167:

*Picture SHAPE® 11 Enter link name

G: What do you do here?

G: What happens next

G: Is that confusing?

G: What would you do now

*Picture SHAPE® 12 Several linked concepts

G: What do you do here?

G: What happens next

G: Is that confusing?

G: What would you do now

** Text units 242-272:

*Picture SHAPE® 19 Next level with atomic concepts hot.

G: Why are these red?

G: What do you do here?

G: What happens next

G: Is that confusing?

G: What would you do now

G: Where would these links have come from

*Picture SHAPE® 21 Content page for Management with section field with links to Administration

G: What do you do here?
262 G: What happens next
264
266 G: Is that confusing?
267
268 G: What would you do now
270
271
272 ++ Text units 337-340:
337 *G: Explanation of creating links
338
339
340 ++ Text units 357-360:
357 *Define TBM Describe to me what ToolBook® does?
358
359 It enables you to create pages of a book and then to decide whether there are any direct links between
360 ++ Text units 449-466:
449 *Picture TBM 7. Page for Support Staff with Link added to Leisure and Tourism
450 G: What do you do here?
451
452 G: What happens next
453
454 G: Is that confusing?
455
456 G: What would you do now
457
458 G: What has happened at this point
459
460
461 G: How did the text get there?
462
463
464 G: How would you use this link?
465
466
+++++++ ON-LINE DOCUMENT: S36KT
++++ Retrieval for this document: 103 units out of 578, = 18%
++ Text units 31-33:
31 *G: Explanation of creating links
32
33 ++ Text units 150-167:
150 *Picture TBM 7. Page for Support Staff with Link added to Leisure and Tourism
151 G: What do you do here?
152
153 G: What happens next
154
155 G: Is that confusing?
156
157 G: What would you do now
158
159 G: What has happened at this point
160
161
162 G: How did the text get there?
163
164
165 G: How would you use this link?
166
167 ++ Text units 219-222:
Appendix O

219  *Motivation TBM  How motivated are you to continue to use ToolBook® to develop an application for your own teaching?

220  If I had seen something in relation to my own module I might have seen some of the benefits. I am having difficulty translating something from boring old UWIC to something more specific for students. I don't want just to join the crowd because it's glamorous to do so I want to the benefits it gives students over and above the traditional methods that's where I can't see it yet.

222  **Text units 231-233:

231  *G: How would you now rate your understanding of hyperlinking?

232  233

244  *G: Explanation of creating links

245  246

247  **Text units 268-275:

268  *Define SHAPE® Describe to me what SHAPE® does?

269  270  It basically allows in an IT version of concept mapping it allows links to be made between concepts or 'bungs' of relevant information

271  272  G: What is the purpose of it?

273  274  I assume its like an index if you look up something it tells you what is linked to it.

275  **Text units 297-303:

297  *Change SHAPE® Was there anything about SHAPE® you would change?

298  299  Maybe multilinking - if you're linking 15/20 concepts it will take you a long time. We are not teaching cul des acs (Defined links) we're not teaching Cul De Sacs we're teaching links. Everything should be linked anyway.

300  301  G: I'd like you to comment on the follow screens

302  303

395  *Picture SHAPE® 11 Enter link name

396  397  G: What do you do here?

398  399  G: What happens next

400  401

402  G: Is that confusing?

403  404

405  G: What would you do now

406  407

408  *Picture SHAPE® 12 Several linked concepts

409  410  G: What do you do here?

411  412  G: What happens next

413  414

415  G: Is that confusing?

416  417

418  G: What would you do now

139
Appendix O

419
++ Text units 494-524:

494 *Picture SHAPE® 19 Next level with atomic concepts hot.

495 G: Why are these red?

496 G: What do you do here?

498 G: What happens next

500

501

502 G: Is that confusing?

503

504

505 G: What would you do now

506

507

508 G: Where would these links have come from

509

510

511 *Picture SHAPE® 21 Content page for 'Management with section field with links to Administration

512

513 G: What do you do here?

514

515 G: What happens next

516

517

518 G: Is that confusing?

519

520

521 G: What would you do now

522

523

524

**************

+++ ON-LINE DOCUMENT: S37HJ

+++ Retrieval for this document: 106 units out of 549, = 19%
++ Text units 3-20:

3  *SHAPE® Session Interview

4  G: How would you now rate your understanding of what hypermedia/multimedia is?

6

7

8

9 G: How would you now rate your understanding of hyperlinking?

10

11

12

13 G: How would you now rate your understanding of concept maps?

14

15

16 G: How would you now rate your understanding of the use of SHAPE®?

17

18

SHAPE® Session Interview

++ Text units 24-27:

24  *G: Explanation of creating links

25

26

27

++ Text units 167-191:

167 *Picture SHAPE® 11 Enter link name

168

169 G: What do you do here?

170

171 G: What happens next
Appendix O

173 174 175 176 177 178 179
G: Is that confusing?
G: What would you do now

180 *Picture SHAPE® 12 Several linked concepts

181 182 183 184 185 186 187 188 189 190
G: What do you do here?
G: What happens next
G: Is that confusing?
G: What would you do now

++ Text units 266-294:

266 *Picture SHAPE® 13 Next level with atomic concepts hot...

267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282
G: Why are these red?
G: What do you do here?
G: What happens next
G: Is that confusing?
G: What would you do now

++ Text units 266-294:

283 *Picture SHAPE® 21 Content page for 'Management with section field with links to Administration

284 285 286 287 288 289 290 291 292 293 294
G: What do you do here?
G: What happens next
G: Is that confusing?
G: What would you do now

++ Text units 266-294:

348 *G: Explanation of creating links

349
350
351

++ Text units 368-375:

368 *Define TBM Describe to me what ToolBook® does?

369 370 371 372 373 374 375
TBM allows you as an author to produce pages that you can move ideas from one to another and provide links with.
G: For what purpose
To take general ideas and formulate and expand them.

++ Text units 468-485:

468 *Picture TBM 7. Page for Support Staff with Link added to Leisure and Tourism

141
Appendix O

G: What do you do here?
G: What happens next
G: Is that confusing?
G: What would you do now
G: What has happened at this point
G: How did the text get there?
G: How would you use this link?

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++ Total number of text units retrieved = 1832
+++ Retrievals in 16 out of 27 documents, = 59%.
+++ The documents with retrievals have a total of 7256 text units,
so text units retrieved in these documents = 25%.
+++ All documents have a total of 9235 text units,
so text units found in these documents = 20%.

******************************************************************************
Appendix P
Appendix P Notions Derived from Focus Group Analysis

### Learnability

- Long learn time is undesirable (A)
- Motivation to learn driven by accomplishment/utility - computer skill dependent (A)
- Content can affect learnability (S)
- Iteration helps learnability (S)

### Complexity

- Required wider knowledge increases cognitive overhead (F)
- Associating with prior ideas can mislead and cause misconceptions (F)
- Inadequacy of representational scheme to model what is required (S)
- The need for a complexity gradient for learners (T)

### Usability

- Usability versus functional power (A)
- Affected by prior knowledge (F)
- Eliminate activities that don't contribute to the end result - Transparency of purpose (W)
- Finding a handle - looking for an equivalent idea to understand the new HAP - Mental model match. (in reference to hypermedia generally)
- Various Prompt types helps the user to proceed (S)
- Speed of result improves transparency of purpose (S)
- The need for Memorability (S)

### Linking

- Semantic links are useful but are not the only way to create hyperlinks (S)
- Intuitiveness of hyperlinking is dependent on prior knowledge (F)
- Intuitiveness of linking is dependent on the domain (S)
- The importance of naming semantic links is not necessarily important to creating hypermedia. (GD)
- Things can be linked with 'frames' instead of 'lines' ie embracing similar things (S)
- What is the purpose of linking visually? (W)

### Knowledge

- How explicit can you make the knowledge? (A)
- How much of the knowledge should be visible? (general comment)
- The need for clarity of representation (S)
- What constitutes a representation of knowledge? (F)
- Knowledge needs to be visible to increase functionality (GD)
- How to represent procedural knowledge? (S)
- The need for zoom in and out of knowledge representation (W)

Key to origin of notion/idea:

- (A) Authorware®
- (S) SHAPE®
- (W) Webmapper
- (T) ToolBook®
- (F) FrontPage®
- (GD) From interview with Greg Dainty on his experiences of developing an application with FrontPage® and SHAPE®
- (D) Discussion following demonstration of HAPs
## Transparency of Operation
- The need to see the whole 'structure' (D)
- Separating the phases increases
  Transparency of Operation (D)
- It is difficult to make complex applications
  transparent (D)
- The need for prior knowledge (F)
- The danger of hidden information (F)
- The need to avoid misconceptions (F)
- The need to separate the phases of authoring
  (F)
- Prior knowledge can lead to misconceptions
  or transparency (F)
- The concept maps are intuitive not the
  program (S)
- Extent of use of the metaphor or prior
  knowledge (T)
- Logical consistency of the HAP may not
  correspond to the user's sense of logic (W)

## Mental Model Match
- Users seek for a 'handle' to understand (A)
- HAPs must respond to a wide range of prior
  knowledge (D)
- Prior knowledge can lead to misconceptions
  (F)
- Hidden conditions (F)
- The need to provide a handle (F)
- Some people will always need some
  instruction (S)
- Preconditioning dictates usage (W)

## Task Match
- Identity of HAP with final product is
  important (A)
- Proficiency precedes an appreciation of task
  match (A)
- Concept maps don't match entirely to the
  task (D)
- Hidden limitations reduces task match but
  only after discovery (F)
- Usefulness of design metaphor to end
  product (T)
- Variety of final products expected of HAP.
  (GD)

## Operational Momentum
- Some programs do have a sense of
  momentum (A)
- Complexity reduces momentum (A)
- Providing cues increases momentum (D)
- Feeling that one is on a trip is synonymous
  with operational momentum (D)
- Making decisions for the learner can
  increase operational momentum (S)
- Functional power can increase operational
  momentum (W)

## Utility
- Proficiency precedes perceived usefulness
  (A)
- Visual representations increase utility (D)
- Separate phases can increase utility (D)
- Accomplishment and utility are not
  necessarily related (D)
- The speed of visibility of result is important
  (D)
- Functional power versus usability (D)
- Connectedness to other tools (D)

## Transparency of Purpose
- Utility is a component of transparency of
  purpose (D)
- Concurrent visibility of final product when
  authoring (F)
- Any activities must be reflected in the final
  product (W)
**Accomplishment**
- Motivation and accomplishment are interrelated (A)
- Accomplishment derives from accommodation and is a property of the user

**Accommodation**
- HAPs must induce confidence (D)
- Confidence partially dependent on familiarity (D)
- The need to reduce cognitive overhead (F)
- Accessibility of design metaphor (F)
Appendix Q
Appendix Q Evidential Data Bits Indexed on Learnability from Focus Group

Q.S.R. NUD.IST Power version, revision 3.0.4 GUI.
License: geoff.


*******************************************************************************
(3.8.6) /Focus Group/Analysis/learnability
*** No Definition
*******************************************************************************
*** ON-LINE DOCUMENT: AUTH-INT
*** Retrieval for this document: 18 units out of 152, = 12%
++ Text units 23-33:
 23 Can you see the structure of the knowledge?
 24 25 m sort of you can see the structure of the presentation
 26 g what I have found that by attempting to use it to create hypermedia to
 27 end up creating a structure like a frame within frame within a frame
 28 gr you can see the structure but its very rigid it says go that way or
 29 that way whereas in a hypermedia you can go anywhere.
 30 m it's horses for courses I wouldn't use this for concept mapping
 31 g well its not designed for concept mapping
 32 m exactly I'd use it for presentations.
 33 L again the structure is fragmented into frames so that you can't see the
 34 whole thing.
 35 g yes you're creating a hierarchy whether you like it or not.
 36 m I think when you're proficient it would be extremely useful
++ Text units 141-147:
 141 How easily does this program create a product that matches the task for
 the learner
 142 143 gr this question is probably the most important of all and this program
 144 isn't very easy at all.
 145 gr for a learner it would be very difficult. It would take quite a long
 146 time to get enough skill at it to know how to visualise how you're going
 147 to do it and then actually construct and make a vision appear on the
 148 screen. You said yourself that it took a long time to get used to it and
 your computer literate. Compared to SHAPE® where you can get on and use
 it with this even to create a concept map(knowledge representation) would
 probably take quite a long time.
 149 m From my point of view as a learner I would be very motivated by this
 150 because of the quality of the final product
 151 g that's from the point of view of a very IT literate sort of person what
 about the learner like X
 152 m he wouldn't go near it.
*******************************************************************************
*** ON-LINE DOCUMENT: SHAPEINT
*** Retrieval for this document: 11 units out of 272, = 4.0%
++ Text units 135-145:
 135 e I think it is intuitive as it is, depending on the underlying knowledge
 and that might be very or not very depending upon what you're talking
 about.
 136 it doesn't take a lot a instructions to link but for first time users
 there are a lot of issues in terms of how they would approach this. I
 think they would well want to come back and create addition links once
 they knew where they were going. and I think they could very quickly go
 in there do something, come out, reflect on it and go back in and do it
 like they really want to.
 137 138 M sort of prototyping.
 139 140 gr but you couldn't do that without any instructions.
 141 e no its not intuitive in that sense.
 142 143 L After doing it once it is very easy to do but that once is dependent
 upon training
 144 145 g well that's an interesting question about any program when you're
 confronted with a program for the first time
*******************************************************************************
*** Total number of text units retrieved = 29
*** Retrievals in 2 out of 27 documents, = 7.4%
*** The documents with retrievals have a total of 424 text units,
 146 so text units retrieved in these documents = 6.8%.
*** All documents have a total of 9235 text units,
so text units found in these documents = 0.31%.

**************************************************
Appendix R
Appendix R

Appendix R Summary of Research Findings

Quantitative Results

1. Ease of Learning and Ease of Use were positively correlated.
2. SHAPE was significantly easier to understand than TBM.
3. SHAPE produced richer hypermedia than TBM.
4. SHAPE had a higher utility than TBM.
5. The ease of use of SHAPE was largely independent on computer skill.
6. The ease of use of TBM was highly dependent on computer skill.
7. The order of use of each HAP was significant in a number of ways but did not detract from the main findings.
8. Spatial relations ability was significantly correlated to the number of links and concepts created in SHAPE.
9. Spatial relations ability was not significantly correlated to the number of links and concepts created in TBM.
10. Subjects were more motivated to continue with SHAPE than TBM.
11. There was no significant correlation between subjects’ intrinsic and extrinsic motivation and their motivation-to-continue with either SHAPE or TBM.
12. Principle components analysis suggested that the ease of learning and ease of use comprised of three main factors called Transparency, Accommodation and Accomplishment.

Qualitative Results

Analysis of the one-to-one training sessions

1. Evidence was found to support the existence of the three factors discovered in the PCA.
2. Transparency can be subdivided into Transparency of Operation and Transparency of Purpose.
3. The existence of a number of subfactors was discovered:
   - Operational Momentum
   - Logic of Operation
   - Noise/Economy of dialogue
   - Mental Model match
   - External Consistency
   - Internal consistency
4. Subjects with lower computing skills gave more precise descriptions of SHAPE than of TBM supporting the finding above that users found SHAPE easy to understand.
5. Subjects found SHAPE more enjoyable than TBM.
6. When asked to comment on what factors contribute to ease of use, subjects suggested simplicity after using TBM and playable/enjoyment after using SHAPE.
7. Comments on linking with SHAPE focused on the semantics and with TBM they focused on the mechanics of linking.
8. Subjects were quick to point out that they required expert support when learning the HAPs.
9. There was evidence to suggest how these factors interacted as shown in figure 6.4 chapter six.
10. More evidence was found to support the finding above that ease of learning and ease of use are closely related.
11. The content analysis of the subjects’ output from the two HAPs showed that they corresponded well with the standard model although the output from SHAPE was more complete.
12. There were interesting idiosyncrasies present in the output from SHAPE in terms of the labels of the links even though they were valid links.
13. Some subjects came up against limitations in the ability of concepts to represent what they wanted.
14. Subjects perceived SHAPE to be more of an ‘ideas developer’ and TBM as an information constructor.

**Desk-based analysis of HAPs**

1. The desk-based analysis indicated that HAPs should allow the user to:
   - Switch between views.
   - Zoom in and out of detail.
   - Represent different knowledge types.
   - Create hyperlinks in a number of ways.
   - Allow the definition of different knowledge types

**Analysis of focus group and experiences of constructing a real application**

1. Further evidence was found to support the existence of the factors discovered in previous activities.
2. Evidence was found to support the existence of other factors,
   - Utility
   - Hidden structure
   - Complexity
   - Motivation
3. Suggestions on how to improve the characteristics of HAPs were made.
4. Some issues related to knowledge construction and representation were made, namely:
   - Inadequacy of the HAPs to represent what is required
   - Facility to zoom in and out
   - visual representations are general a good thing
   - How necessary is it to ‘see’ knowledge
5. The separation of the authoring process into two phases, the knowledge definition and the functional definition phase.

The interaction of factors model was modified to include Utility, Hidden Structure, Complexity and Motivation.
Appendix S
Appendix S Concept maps of CLICK-IT®

Top level concept map of CLICK-IT®

Second Level Concept Map of CLICK-IT®
Second Level Concept Map of CLICK-IT® Information System Fundamentals

Third Level Concept Map of CLICK-IT® Buying a PC
Third Level Concept Map of CLICK-IT\textsuperscript{\textregistered} Software

Second Level Concept Map of CLICK-IT\textsuperscript{\textregistered} The Future of IT.
Second Level Concept Map of CLICK-IT® Basics and Background
### Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSI</td>
<td>Abbreviation of Computer Skills Inventory, part of the Computer Skills Metric. (See appendix A for paper on CSI).</td>
</tr>
<tr>
<td>CSM</td>
<td>Abbreviation of Computer Skills Metric, a measure of Microsoft Windows 3.1 skill. (See appendix A for paper on CSM).</td>
</tr>
<tr>
<td>Discrete hypermedia</td>
<td>Hypermedia that is self contained and embodies all that is pertinent to a particular domain (like the history of church architecture) and purpose (like an encyclopedia). Applications that are distributed via CD are most likely examples of discrete hypermedia (like electronic books and encyclopedia).</td>
</tr>
<tr>
<td>Design metaphor</td>
<td>Design metaphor is the mechanism by which a HAP enables hypermedia to be produced. Typical metaphors include, music score, book, control flow diagram.</td>
</tr>
<tr>
<td>HAP</td>
<td>A Hypermedia Authoring Programs is a program designed to enable hypermedia to be produced. HAPs vary in how they enable hypermedia to be authored and the functionality that they can imbue in the resultant product.</td>
</tr>
<tr>
<td>HE</td>
<td>Abbreviation of Higher Education.</td>
</tr>
<tr>
<td>One-to-one Training Sessions</td>
<td>These are the individual sessions in which each subject has the task of learning and using the two HAPs.</td>
</tr>
<tr>
<td>Open hypermedia</td>
<td>Open hypermedia is an extended continuum of links and documents that have links to other extended hypermedia documents. The World Wide Web is an example of extended hypermedia in which links to material anywhere on the Web is permissible.</td>
</tr>
<tr>
<td>QDA</td>
<td>Abbreviation of Qualitative Data Analysis.</td>
</tr>
</tbody>
</table>
Second Generation Hypermedia

Hypermedia with significantly enhanced functionality. Basic hypermedia has simple hyperlinks second generation hypermedia can have computed links, searches and dynamically produced documents.
Intelligence is another way of increasing functionality where some knowledge of the user is generated and acted upon.

Tools, Programs Packages

These terms are interchangeable in the context of this study. For authoring hypermedia the term Hypemedia Authoring Program is used. See HAP.