

Literature and practice in the creation of online information literacy tutorials in New Zealand and Australian University Libraries: Results of content analysis of online tutorials

by

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Abstract

Introduction: This research uses inferential statistical tests to explore the statistical significance of observed relationships between the frequencies of elements of online tutorials found within the academic literature, and the frequencies of those same elements as found in online tutorials produced by New Zealand and Australian university libraries. Frequencies were also compared between Australian and New Zealand tutorials, and also between two types of tutorials.

Method: Elements of online tutorials were located in articles from highly ranked journals, and other germane sources. A content analysis of a sample of online tutorials was carried out, using the elements identified as criteria.

Findings and conclusion: No statistically significant differences were found between the frequencies of elements in the literature and elements in the online tutorials, despite descriptive statistics indicating otherwise. A slight positive correlation was found between the frequencies of elements in tutorials produced in the two different countries. However, the small size of the literature sample severely restricts the conclusiveness of these results.

Keywords: Computer assisted instruction, Academic libraries

Problem statement

Online tutorials have been regarded as an integral part of the librarian's information literacy tool kit since the mid-2000's, and they are now commonplace. Preliminary investigation suggests that, in general, published research has helped to determine whether tutorials work as well as live classes (Nichols, Shaffer, & Shockey, 2003); what tutorials' long term effects are (Orme, 2004; Tronstad, Phillips, Garcia, & Harlow, 2009); and what features or elements are commonplace in creating and maintaining tutorials (Blummer & Kritzkaya, 2009).

However, this perception may not adequately reflect that relationship between research and practice in the context of current practice in Australian and New Zealand (ANZ) University Libraries. Research in this area of practice appears to be largely published overseas – primarily the USA and UK (Clayton, cited in Haddow & Klobas, 2004). This study examined 'overseas' literature in relation to antipodean practice, with an eye to learning something about any relationship between the two.

This research used the frequency of elements from the research literature to indicate how relevant the published research may be to ANZ practice. However, the small scale of the project restricted the investigation to comparing online tutorials produced by New Zealand universities with those produced by the Australian 'Group of 8' Universities. This small scale sample of institutions suggests that application of the results be approached with caution; results from the content analysis interpreted with descriptive statistics are not supported by inferential statistical tests.

Research objectives

This study identified design elements from highly ranked journals in *Excellence in Research for Australia* (ERA) 2010 rankings, and other sources where appropriate (see *Definitions* below for further detail on ERA and its relevance to New Zealand tutorials).

Inferential statistical tests (gamma, Kendal's tau) were used to investigate the statistical significance of any observed relationship between research around online tutorials and the tutorials themselves. Any relationship tested was inferred from observation of differences in the frequency of design elements in online tutorials, when compared to their frequency in the literature.

Chi-square tests for independence were also used to investigate facets of any relationships between tutorials by country and by type. Chi was calculated for the frequency of individual elements in New Zealand tutorials and in Australian tutorials; and again for those same elements between the two identified types of online tutorial (screenshot and web-based, see *Definitions*). Tau and gamma were also used in this comparison of type, and also of country of origin.

The originality and relevance of the research

Other authors have used descriptive statistics to investigate elements within single types of online tutorials, using elements or standards that appear to be derived from the

small samples of the academic literature (Bury & Oud, 2005; Su & Kuo, 2010) or from professional standards (Dewald, 1999). This study systematically investigates the LIS literature, with an eye to picking out elements that might be described as ‘best practice’ (more realistically ‘common practice’); potentially capturing the elements that practitioners adopt in the creation of online tutorials. See *table 1* for a list of elements from the literature.

Analyzing the frequency of these elements in different types of tutorials from Australia and New Zealand, may help to address a gap in the LIS knowledge about relationships between this literature and antipodean practice. Contextual knowledge of any relationship between research and practice may then suggest potential implications for the relevance of the research literature to the local situation.

Six hypotheses test for the presence of a relationship between the research literature and online tutorial practice.

Research hypotheses

These six hypotheses investigate the nature of any relationship between elements of the literature and their frequency in online tutorials created by ANZ university libraries.

Expressed as null hypotheses, they state that:

There is *no* statistically significant difference between the frequency of the design elements identified in the literature and:

H1 the elements' frequency in online tutorials created by New Zealand university libraries.

H2 the elements' frequency in online tutorials created by Australian university libraries.

H3 the elements' frequency in screencapture online tutorials created by ANZ university libraries.

H4 the elements' frequency in web-based online tutorials created by ANZ university libraries.

There is *no* statistically significant difference between the frequency of design elements

H5 in tutorials created by New Zealand university libraries and those tutorials created by Australian university libraries.

H6 in screencapture tutorials and web-based tutorials created by ANZ university libraries.

Limitations

Limitations to the study reflect the limited scope and scale of the project. The study's internal validity is affected by the use of a single rater for identification of elements from a convenience sample of the literature. A small sample peer review was used to assess whether the elements were identifiable by another rater. Retesting was performed if bias was identified.

The study was originally quantitative, but investigation of elements in the literature to determine whether they were related to the chosen theoretical framework introduced qualitative features.

The study does not address the literature as a 'cause' of elements appearing in online tutorials. No causal relationship can be drawn with the statistical tests used – Kendall's tau, gamma, and chi-square. Results serve only to indicate if differences (if any) are present.

Assumptions

The use of password protection for two institutions suggests that tutorials are frequently kept on Library Management Systems. There is no immediate means of knowing whether all tutorials found on the website of an institution are all the tutorials that have been produced by that institution.

Delimitations

The scope of searching was also limited to LIS journals. Elements recorded in other fields' journals that have also been used by LIS practitioners may be missing from the content analysis. Literature searches for articles that address elements to be studied were limited by the small scale of the project, largely due to the time required to read each article in-depth.

The target of research is tutorials created by any of the eight New Zealand university libraries and the libraries of the Australian 'Group of 8'. Tutorials were of one of two types: web-based or screencapture (see *Definitions*); PDF and text-based guides were excluded; as were tutorials from any other type of population.

'Tiered' sampling of tutorials (a random sample of tutorials, drawn from a non-probability sample of a population of universities) reduces the generalizability of the results to the total body of Australian tutorials. The study should be taken as indicative for the purposes of comparison between Australia and New Zealand, rather than definite in its conclusions.

Bias with regards to institution or country was avoided through random sampling within the purposive sample.

Two inferential statistical tests used (gamma and tau) compare ranked lists of ordinal data to produce a measure of correlation (-1 to +1, with 0 showing no correlation) (Hernon, 1994, p. 153). However, the test results for these must be interpreted differently, with gamma being the better measure for rankings with more tied pairs (Sheskin, 2004, p. 1109). Results of both tests may be adversely affected by the small sample size of the literature.

Chi-square tests require the elements being measured to be independent of each other (Hernon, 1994). This required that the elements be tested separately in chi tests. Yates' correction had to be applied to several chi-square tests due to expected frequencies of elements being below 5 (p. 143).

Methodology

The research relies more on quantitative than on qualitative methodology. Quantitative methodology involves the identification of variables and their observation (or manipulation) (Pickard, 2007, pp. 10-11). It also involves the testing of hypotheses with statistical analysis. Statistical analysis in this research is quantitative analysis of the frequency of nominal variables (identifiable, regularly occurring, design elements in online tutorials).

Qualitative features include the purposive sampling of institutions and the identification of design elements. Purposive sampling is generally a qualitative technique (Pickard, 2007) that allows researchers to gather an in-depth understanding of a particular group – in this case New Zealand and Australian ‘Group of 8’ universities. Design elements are arguably open to interpretation in some cases, both in terms of their theoretical purpose and their existence as separate elements. They could be construed as being ‘socially constructed’ (Pickard, 2007, p. 13), for which the suitable methodology is qualitative.

Research definitions

Design element

In the context of this research, an element of an online tutorial that is:

- Identifiable in the literature and in the produced tutorials, but separate from the content of that tutorial.
- Potentially related to other selected elements by a common theoretical framework, and assumed to influence how useful a student finds the tutorial. See *Role 2* below for more detail on the chosen framework potentially restricts the scope of the study, but in general, design elements that did not relate to the common theoretical framework, were excluded from analysis.

ERA Ranking system

Excellence of Research for Australia is an initiative that “cyclically and systematically evaluate[s] the quality and impact of ... research” (Adams, King, & Webster, 2010) in Australia. As an indicator in this evaluation, journals are ranked within their discipline, with A* representing top ranked journals.

ERA ranked journals are presumed to be widely used across Australian university libraries. The ranking represents a common standard, and was thought to fit best for this reason.

This Australian ranking system was also thought to be the best fit for studying New Zealand tutorials. Available evidence suggests that New Zealand institutions and organizations have set a precedent in using Australian bibliometric rankings and that there is a lack of an equivalent New Zealand ranking system (AUT Library, 2010; Business & Economics Information Services, 2010; School of Economics and Finance, 2010). This ranking also potentially bears more relevance to New Zealand libraries than ISI or other ranking systems.

Gap Hypothesis

The term used in this research to describe and discuss the observation that published academic work is not used by practitioners and vice versa. Communication (or rather, miscommunication) between researchers and practitioners is supposedly the root

cause of a gap between research and practice (Haddow & Klobas, 2004) presumably to the benefit of neither party (Crowley, 2005).

Online tutorial

Online tutorials refer to interactive or didactic teaching tools of limited time, purpose and scope delivered via the internet. For the purposes of this research project, it refers to those tutorials made available online that may involve progression from webpage to webpage, utilising a range of media to teach library skills to students.

The online tutorials investigated over the course of this project can be divided into two types: web-based, sometimes interactive, text-medium tutorials; and visual-medium, less interactive, screencapture video tutorials. These types are mirrored in the literature, with some studies devoted only to web-based tutorials (Bowles-Terry, Hensley, & Hinchliffe, 2010) and others solely to screencaptures (Oud, 2009). (See *Methods* for more discussion of what constitutes an online tutorial in this research.)

Frequency

Frequency is defined here as a repeated instance of a design element across different articles or tutorials. Elements are counted once per article or tutorial. The higher the frequency of an element, the greater the number of articles or tutorials in which it was encountered.

Principle of Least Effort

A theory of human behaviour that suggests that individuals endeavour to minimize the estimated average rate of work for any task in any situation (Zipf, 1949/1965). This theory has been applied to the LIS context to describe search behaviour of individuals and groups, often in the context of the online environment (Chrzastowski, 1995; Hirsh & Dinkelacker, 2004; Mann, 1993).

University library

A library situated or affiliated with university that is “established, administered, and funded... to meet the information, research, and curriculum needs of its students, faculty and staff” (Reitz, 2004). In this context, ‘university library’ covers libraries affiliated or supported by the eight New Zealand and the ‘Group of 8’ Australian universities.

Australian tutorials from the Group of 8 provide a comparative element for the New Zealand tutorials. This potentially suggests further avenues for research into interesting country- or institution related aspects of the relationship between research literature and online tutorials.

Theoretical framework

This section illustrates the roles of theory in the context of this research. It briefly discusses potential candidates for frameworks for this research that were thought to be related to these roles, and discusses the theories selected as frameworks in more detail.

Note that theories addressed here are middle-range theories. Middle range theories are theories whose concepts can be tested empirically (Bryman, 2008, p.6). This type of theory was preferred as they were thought more likely to enrich the results of this study by providing a connection to other research literature that uses the same theory.

Roles and potential theories

Two roles were initially identified for theory within the context of this research:

- Theory could be employed to inform the discussion of the relationship between the research literature and the online tutorials.
- Theory could be used to aid the selection of design elements.

Role 1: Informing the relationship between the research literature and online tutorials.

Two theories were identified as potential candidates for this first role:

Schon's Reflection-in-Action model: The general focus of research around this model appears to be largely on the interchange between practitioner and theory, and the creation or modification of theory in response to practical situations (Edwards, 2010).

The model can be used to investigate the nature of, and value of, types of knowledge (tacit knowledge and theory). Turner (2001) uses the model to explain why professionals in the New Zealand LIS context appear to use tacit forms of knowledge gathered through, for example, practice and professional conferences, in favor of formal academic knowledge (Turner, 2001, p. 27).

The distinction between types of knowledge (tacit and theory) and the noted preference for practitioner use of tacit knowledge, implies that the nature of the relationship between the research literature and professional practice is that of a gap.

The model's focus on the nature of practitioner practice made it less suitable as a candidate theoretical framework. The researcher thought that good candidate theories for this role should be more concerned with addressing the nature of this relationship, rather than the nature of research or practice themselves. Theory that extended into discussion of what research is, and how the types of research are used by practitioners would potentially require research into practitioner choices of theory in the creation of online tutorials – something beyond the possible scope of this project.

The Gap Hypothesis: As the name suggests, the focus of the Gap Hypothesis (also known as the research/practice gap) also assumes that the nature of the relationship between academic research and practice is that of a gap (Crowley, 2005, pp. 4-6).

Research using the Gap Hypothesis, in LIS and in other fields (Haddow & Klobas, 2004), has focused around determining the overall cause of this perceived gap between research and practice, and also determining the extent of the gap. This focus on the relationship (the gap) rather than the nature of research in this field made the Hypothesis a best fit for the theoretical framework for this research project. The extent of the gap is less defined in the literature (according to Haddow & Klobas, 2004), than the possible causes. Investigating the extent of any gap between research on online tutorials and the online tutorials themselves became the goal of this research project.

Consensus in the literature appears to suggest that the *cause* of the gap between research and practice is academic and practitioner publication and communication culture.

Some scholars focus more on aspects of academic and practitioner publishing culture as the root cause (Crowley, 2005; McKechnie, Julien, Genuis, & Oliphant, 2008; Schlögl & Stock, 2007).

McKechnie, et al., (2008) completed an extensive content analysis of literature published in the ISIC proceedings. This investigated whether journals published and directed towards academics made explicit mention of their findings' usefulness to practitioners. Patterns observed in the discussion of usefulness were observed and were employed as an indicator of academic publishing culture. The authors also

analyzed patterns within the group of articles as to readability, and to the clarity of the articles claims of usefulness. They suggest that research that could be useful to practitioners is not always presented as such; culture-derived barriers such as language may interfere with practitioner access to research literature.

Schlögl & Stock (2008) searched a range of German and English language LIS publications searching for evidence of the research/practice gap. Their careful method of establishing which journals were practitioner focused and which were academic focused and their analysis of contributions to those journals, led them to suggest that practitioners and academics publish largely in their own journals.

Other authors present the cause of the gap as a miscommunication between research and practice. In their investigation into LIS research in this area, Haddow and Klobas identified 11 facets of miscommunication that they claim contributed to the gap (Haddow & Klobas, 2004, pp.31-33). In examples similar to the work of McKechnie, et al. (2008), and Schlögl and stock (2008), they point out a reading gap (p.32) characterized by researchers and practitioners not reading each others' literature; and a culture gap (p.31) that results in communications remaining largely within the peer group.

The extent and nature of this gap in LIS is still felt to require investigation (according to Haddow & Klobas, 2004). Their investigation of the body of LIS scholarly discussion on

the gap suggested that the following areas were in need of investigation: the extent of the gap, whether it applies over the field in general or if there are variations within subfields; which facets of the gap predominate in which areas; and whether the observed gap is the result of surmountable or insurmountable differences (p. 39). It is this uncertainty in the framework that is appealing, as it allows greater investigation of the nature of the relationship between research and practice. For example, this research might also suggest additional facets of the GH to add to the richness of the theory and its applicability to areas of LIS research and practice.

Role 2: Theory as an aid to the selection of design elements.

In this role, theory was thought to alter the scope of the research through restricting or encouraging the selection of design elements from the literature. In particular, only those elements identifiable with the chosen theory would be examined in the literature and the online tutorials. The best theoretical framework was felt to be one that would promote the investigation of a limited number (perhaps under 10) individual design elements. Restricting elements to one particular theoretical framework might also provide for a richer discussion around groups of elements derived from theory that influence the practice of online tutorials, in comparison with other groups.

The context of online tutorials influenced theory selection – frameworks that were designed to discuss search behaviour within other search environments (Kuhlthau's Information Search Process, for example) were not felt to be ideal. This is because these theoretical frameworks have the potential to emphasize elements that could be

unsuitable for online tutorials. It was felt that practitioners would be less likely to refer to articles with unsuitable elements, and subsequently these elements may not be utilized in the construction of online tutorials. This might result in a skewing of results for this project.

Potential frameworks for this role were:

Constructivism: This theory has been used in LIS research on online tutorials to address the value of interactivity in those tutorials (Allen, 2008; Anderson & Wilson, 2009; Wales & Robertson, 2008). Constructivism suggests that students learn best from those tutorials that allow them to construct their own meaning of what the tutorial was designed to teach, and research suggests that interactivity results in a positive outcome for learning (Anderson & Wilson, 2009).

However, potential elements appear less easy to identify, making this theory less suitable as a framework for this research. Allen (2008), states that constructivist elements in tutorials require careful planning and forethought (p.31). This suggests the potential for different interpretations within the research literature as to whether design elements are related to constructivism. Quizzes, if not well constructed, might not count as constructivist elements. Adopting this theory as the framework for the research might, therefore, require careful judgments on whether each instance of an element was suitably constructivist. This interpretation makes the theory unsuitable as a framework, given the limited scope of the project.

Usability / User Centered Design: This is the term for principles for the design of online resources that focus on how useful the resource is to the intended user (Mackey & Ho, 2008, p. 388). These principles may be designed, applied, and tested in order to increase the usability for the intended audience (for undergraduate computer science students in Mackey & Ho's research article) or to increase the usability for people with impairments ("Research-based web design & usability guidelines," c2003).

User Centred Design is unsuited to being used as a theoretical framework in the context of this research for two reasons. Firstly, whereas usability testing is common for library websites, testing of online tutorials remains rare. It was felt that using website testing criteria or elements would present too different a context (as was the case in Bury & Oud, 2005, p. 58).

User Centered Design could also potentially allow too many elements for the scope of the project. "Research-based web design & usability guidelines" lists more than 200 guidelines on how to design web pages, for example. Rather than investigate which could potentially be adapted as design elements in the context of online tutorial, prudence suggests that a theory that used a restricted range of usability related elements might be more appropriate as a theoretical framework. The Principle of Least Effort was thought to be one such theory.

Principle of Least Effort: PLE falls into the spectrum of overarching theories used to describe or suggest likely outcomes of human behaviour or action. According to the Principle, decision-making at the conscious or unconscious level is largely based on estimations of “probable average rate of work” (Zipf, 1949/1965, p. 1); with individuals picking those options that appear to result in less work overall. PLE holds that humans will likely choose the easier path where confronted with several alternatives.

The Principle is used largely in relation to user selection of resources in research into information seeking in the Library and Information Studies (LIS) field. LIS authors portray the Principle as an inclination to seek out the path of least resistance in research. The inclination has been noted in surveys of such diverse groups such as engineers in an international corporation (Hirsh & Dinkelacker, 2004); distance graduate students (Liu & Yang, 2004); forestry workers (Hardy, 1982); and academic chemistry students and staff (Chrzastowski, 1995). Resources are generally selected based on least effort rather than anticipated results (Mann, 1993), but the inclination may be softened by interplay with other factors such as authority of the source in question (Hirsh & Dinkelacker, 2004, p. 816). Here, ‘least effort’ stands as first amongst equals rather than the exclusive controller of action.

The *Methods* section demonstrates that PLE elements were generally extracted from literature that did not directly describe the elements in terms of effort – if the element was thought to potentially add or detract from the effort required to access the tutorial, then it arguably stood as a PLE element. For example, elements of design that might

affect the users' inclination to access and use an online tutorial are likely to be also related to usability. If some element makes a tutorial easier to use, then it may require less effort to use.

Examples of this type that could have counted as elements included: browse time for tutorials, and the number of clicks needed to reach the tutorial from the jump page (Su & Kuo, 2010); the co-occurrence of audio and visual elements (Leeder, 2009; Oud, 2009); web-usability factors such as file sizes, captions, navigation, and emulation of real world objects ("Research-based web design & usability guidelines," c2003); and audio quality, file size and response time (Mackey & Ho, 2008).

Note that the scope of the study prevented the adoption of all of the above as elements (see *Methods* for the final list of elements used). For example, 'emulation of real world objects' would have had to be confirmed with examination of the institution's tools to assess if this were indeed the case; and 'browse time' might have required completing the activities in all tutorials –a considerable undertaking in terms of time, and one outside the scope of the project. Other usability related elements such as standardized task sequences or synchronous image and audio ("Research-based web design & usability guidelines," c2003) were discarded because they could be judged to have little impact on the effort taken to access tutorials.

In conclusion, the two frameworks selected best fit the identified roles of theory in this research. The Gap Hypothesis was felt to be the best fit because it allows greater discussion of the nature of the relationship between the research literature than the other theory represented as a candidate. The Principle of Least effort was felt to be the best fit because of the potential consequences for the user (for example, selection of a poor quality tool), and the similarity of some of its potential elements to usability.

The following diagram illustrates the two roles of theory in this research. The frequency of elements (related to PLE) in the tutorials suggests whether the relationship between research and practice in LIS online tutorials can be characterized as a gap (the Gap Hypothesis).

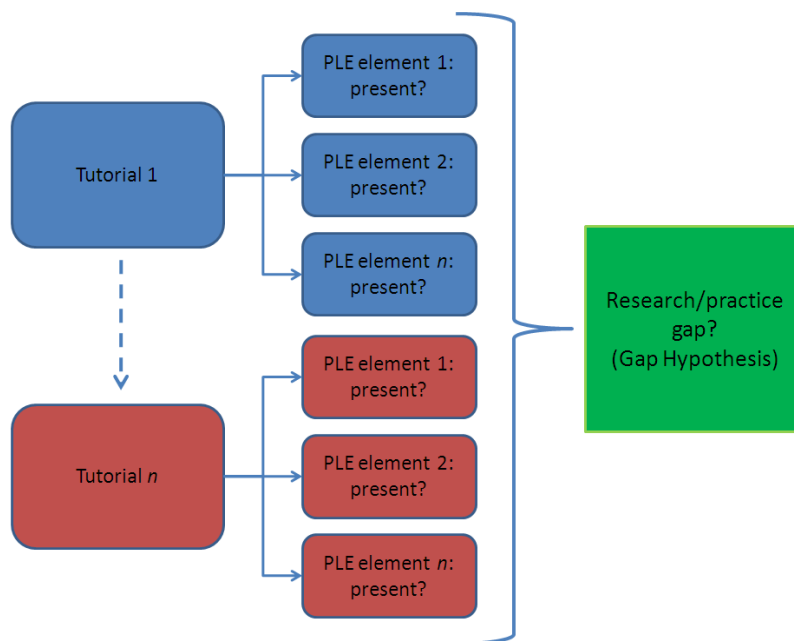


Diagram 1: Role of theory

Review of the literature

This section reviews the literature surrounding online tutorials and their effectiveness in the LIS context.

Online tutorials in the LIS context

Online tutorial creation in the LIS context began with web-based tutorials such as TILT - the *Texas Information Literacy Tutorial*. Web-based tutorials are still created (see <http://www.lib.uci.edu/uc-research-tutorial/begin.html> for example) and discussed in the literature (Su & Kuo, 2010), but screencapture or screencast tutorials appear to be a newer trend (Bowles-Terry, Hensley, & Hinchliffe, 2010; Mages & Garson, 2010; Oud, 2009).

The diversity of content and purpose of online tutorials in general demonstrates their popularity as teaching tools in academic libraries, although the literature does not appear to present an overall consensus on the best sort of skills or competencies to teach using online tutorials.

Web-based tutorials are used to teach general information literacy skills (Fowler & Dupuis, 2000; Tronstad, et al., 2009); to integrate research skills directly into students' progress through their assignments (Bradley & Romane, 2007). One possible exception is screencapture tutorials, which are recommended as better tools for teaching short, focused tasks (Plumb, 2010). Tutorials running to under a minute in total length have

been recorded (Wales & Robertson, 2008). This does not prevent these from being used to create detailed tutorials to teach specialist skills such as APA referencing (Mages & Garson, 2010) or thoroughly cover information literacy competencies (Wales & Robertson, 2008).

The effort required to build these tutorials was remarked on in Wales & Robertson (2008). The authors estimate that the construction of their original series of tutorials (running to 6 hours in total length) required over 100 hours of work time. Other authors have also commented on the effort required to create effective tutorials. Allen (2008), for example, mentions that including properly interactive elements in tutorials requires planning and time. This potential requirement for herculean effort appears to have encouraged the creation of an evaluation culture around online tutorials in LIS.

The effectiveness of online tutorials

A sustained body of research suggests that web-based tutorials are as effective as live classes in teaching library related skills in the short and medium term (Nichols, et al., 2003; Orme, 2004; Tronstad, et al., 2009; Zhang, Watson, & Banfield, 2007). Time taken to complete the Tutorial for Information Power was compared to skills-based post-test results (Tronstad, et al., 2009). The authors suggest that the statistical evidence is that students who spent little time (less than 20 minutes) gained significantly less value from the tutorial than those that spent more time.

More informal evaluation of tutorials is also employed. Mages and Garson (2010), report on the creation of a screencast tutorial used to teach APA. The usefulness of the tutorial was implied by the hit-rate on the tutorial (as measured through Google Analytics) used in conjunction with a user survey and comments received through email feedback. The authors posit that the survey results show people who took the tutorial found it valuable and useful in their studies. The authors do not propose that this perceived value is a valid assessment of the users' skills after completion of the tutorial.

Note that the body of literature on the effectiveness of screencapture tutorials is small in comparison (Oud, 2009). Fewer articles may have been published about this type of tutorial (given their comparative novelty in LIS) and this has an impact on how much they can be said to be effective in comparison to web-based tutorials in general. This may also have implications for this research, in that it suggests that the design elements identified from the literature may be related largely to web-based tutorials. If this is the case, then there might be grounds for examining screencapture tutorials separately from the web-based group.

Design elements of online tutorials

Evaluation and efficacy testing of online tutorials and repeated discussion of tutorial development in the literature suggest practices or elements that are identifiable with successful tutorials (to varying degrees). Broad criteria have been identified in LIS: identifying the tutorial's objectives (including needs assessment); using standards;

collaboration to improve content design; active learning to increase engagement; and evaluating the tutorials' success (Blummer & Kritzkaya, 2009).

Active learning, which is derived from constructivist principles, is mentioned repeatedly in terms of interaction with the tutorial (Anderson, Wilson, Livingston, & LoCiero, 2008; Bury & Oud, 2005) (for a particularly thorough investigation of constructivism in the online tutorial context see Allen, 2008). This stands in contrast to elements related to the Principle of Least Effort – careful searches of the literature revealed articles discussing PLE in a searching context (Hirsh & Dinkelacker, 2004) but no articles relating the theory to elements of tutorial design. As mentioned in the theoretical framework section, however, elements were also be derived from usability studies.

Some elements are cited repeatedly as effective techniques for aiding student learning through and were adopted as criteria (see *Methods* for the full list of elements). Three examples are: statements of goals or objectives, interactivity, and jargon control.

- Statements of goals or objectives are hypothesized to assist learners in consolidating (and retaining) what was taught in the tutorial (Somoza-Fernandez & Abadal, 2009). Revisiting these goals partway through the tutorial, and then again at the end, potentially means the viewer has to expend less effort in recalling content (or in recalling why they are watching the tutorial in the first place).

- Interactivity has been claimed to provoke engagement with the tutorial and its material. Interactivity is usually related to constructivism or active learning in the literature (Allen, 2008), often in the form of quizzes (Blummer & Kritzkaya, 2009), but can be applied to the Principle of Least Effort. Research conducted by Bury and Oud (2005) suggests that this engagement created by interactivity makes it easier for the student to stay focused on the material. There is also the potential benefit that the content will require less effort to understand as an interactive part of the tutorial, than as a paragraph of text.
- Jargon control through glossaries or verbal or text explanations potentially reduces the amount of effort students must expend in understanding tutorial content. Studies or evaluations of online tutorials suggested that even 'advanced' users such as academic staff found library jargon confusing when it was unrelated to their field (Appelt & Pendell, 2010).

There was less of a consensus noted in the literature with other elements that were included in this study. The necessity of including audio, in screencapture tutorials in particular, has been challenged by some authors

Oud (2009) cites studies that suggest that overloading either a visual, audio or image-related 'channel' potentially overburdens the learner's short term memory; seeking to

focus on the text and image, the user may quickly forget the valuable information in the audio or vice versa (p.168). The author also questions the need to reflexively include multimedia elements, and recommends that cognitive load can be reduced by using 'text or audio, but not both' with images, and by removing unnecessary images, audio or writing (p.176-177).

However, other authors promote the inclusion of multiple channels for effective learning. Mestre (2010) recommends that tutorial creators include more 'paths to [the] information' (p.823) to suit learners with multiple learning styles. The results of Mestre's investigation suggest that learning style has some influence on recall of tutorial content in the different type of tutorials, for example aural learners found that audio narration aided recall. The author reasons that inclusion of these different interactive audio, visual or textual paths will perhaps result in more effective tutorials for a greater proportion of the student body.

Conclusion

The literature reviewed here suggests that there is something of a consensus on online tutorials in LIS. In particular, they appear to be thought of as valuable and useful, as implied by their widespread use and different teaching aims; and as effective, suggested by their repeated efficacy testing.

Elements that play a role in making tutorials potentially less effortful to use and access have less of a consensus overall. A content analysis of tutorials produced in Australian Go8 libraries and New Zealand universities searched for some of these elements in order to investigate the relationship between the literature that promotes them and the online tutorials created by practitioners.

Research design

This section lays out the research design for the project. It begins with a brief overview of the research methods, which are then discussed in more detail. This section concludes with an introduction to the methods of data analysis used.

Methods

The methods for this study were:

1. To identify design elements within the literature seemingly related to the Principle of Least Effort, and arrange these by frequency distribution.
2. To use the design elements identified in 1 in a content analysis of a sample of online tutorials produced at university libraries in Australia and New Zealand.
3. To use statistical analysis and relationship identification between findings for 1 and 2 to test the hypotheses H1-H6 (see *Research Hypotheses* above).

Identification of design elements in the literature

This section covers the sampling methods used to select of articles likely to contain elements and to extract elements from those articles; and the peer-review process used to maintain rater-reliability.

Sampling method

Sampling was used to collate a collection of articles that could then be examined for design elements related to the principle of least effort. Convenience sampling (Bryman, 2008, pp. 183-184) involved using all suitable articles that could be found and that matched certain criteria. This method was thought to fit best: drawing a large enough population to get a representative random sample of literature would have been beyond the scope of the project (note that inconclusive inferential statistical test results suggest that the sample size for the literature was perhaps too small – see *Discussion*).

Design elements were identified from journal articles in the academic literature. A variety of methods were used to identify articles that might contain tutorial design elements related to the Principle of Least Effort within journal articles.

The sampling method for articles was a simplified version of searches carried out in systematic reviews investigated in the literature (certainly of a lesser extent than that conducted by Al-Jewair, Azarpazhooh, Suri, & Shah, 2009 but on a similar vein).

A systematic search of *LISA* and *Library, Information Science & Technology Abstracts* was used to draw out an initial selection of articles from the A / A* range of *Excellence in Research for Australia* (ERA) 2010 LIS journal rankings. Preference was given to results from A*, A, and B ranked journals, but articles from lesser ranked journals were assessed if their abstracts appeared pertinent.

Selection of elements from articles in highly ranked LIS journals was intended to limit the scope of the project by restricting the source of potential elements to a smaller sample of journals that are highly cited in Australia in a uniform system. This is reflective of a local perspective that might be lacking from journal ranking systems such as ISI. Journals ranked A* were presumed to be A* over all Australian university libraries.

The Australian ranking system was thought sufficient for the New Zealand context. As noted above in *Definitions* there is an apparent lack of an equivalent New Zealand ranking system and New Zealand research institutions have reportedly consulted Australian rankings over the course of evaluation exercises such as the Performance Based Research Funding process ("Research: New Zealand Journal Research Rankings," 2010).

Two other article search methods were employed to gather literature with a wide a net as possible:

- Highly ranked LIS journals were identified in the Education for Research in Australia (ERA) rankings. These journals were searched individually or in groups (if held in the same databases).
- A snowball search used 'related article' links from germane articles to identify similarly useful articles in LIS databases (primarily ScienceDirect and Scopus).

Keyword search terms for the databases included *online tutorial, video tutorial, web-based tutorial, user training, and information literacy*. 'Principle of Least Effort' and 'Least Effort' were not included as search terms. Trial searches for articles linking PLE with online tutorials did not return any results in Scopus, ScienceDirect, LISA, or Google Scholar.

Searches were limited to journal articles published in 2005 or later, ensuring that the discussion of online tutorials was kept somewhat in the context of modern practice. Articles were counted only once and 'extra' copies of those found in more than one search were discarded. Articles whose full text could not be located electronically were discarded from the analysis, as were those that discussed design elements that unrelated to the Principle of Least effort, or that did not discuss design elements at all.

Extracting design elements from the articles

Article citations were stored as a group on an EndNote X2 library, and annotated to reflect the design elements found within each.

Criteria were used to select articles with design elements in them from the search results.

In keeping with the quantitative nature of the research, elements to be used in later content analysis were those determined by the researcher to be design elements readily identifiable in the literature, germane to the investigation, and also likely to be present in the produced tutorials. Elements implicitly related to PLE were selected on a case by case basis, with the researcher examining each article to determine whether the elements mentioned therein could plausibly affect the ease with which its users access and use the tutorials.

Examination began with the abstract of each article which was read as the article was found. The article was discarded if it did not appear to discuss online tutorials. Articles were then read in full to see if any elements of online tutorials were mentioned or demonstrated. Articles were discarded if there was no mention of anything that was potentially a design element, or if all elements within the article were judged not to relate to PLE.

Notes on the scope of each element were kept as each element was identified. These acted as an aid in determining other incidences of these elements in the literature. Elements identified more than once in an article were counted only the first time.

The selection strategy was intended to gather elements from the broadest range of locations within articles. Elements were selected from any part of an article where they were mentioned explicitly as elements, perhaps as factors relating to the success of a tutorial (Lau & Woods, 2009, appendix A); or implicitly, from descriptions of successful tutorials (Knievel, 2008, pp. 181-183) or as mentioned in the context of a literature review (Ganster & Walsh, 2008, p. 316). Gathering the elements from the article sample in this way was thought appropriate. The strategy was selected as no information was available regarding the behaviour of practitioners reading journal articles that would have permitted targeted selection of elements from particular areas of articles.

Elements were collated and described in a MS Excel spreadsheet, alongside the bibliographic detail of articles that mentioned them. Design elements from highly ranked journals were sorted by frequency from most to least in order of the number of times that they were mentioned in the sample of literature (see Table 1, in *Results*). This was used to inform the content analysis stage for the online tutorials by providing a comparative element when data from tutorials is collected.

Peer review of design elements

To conduct the study in the time available, the researcher tested whether the elements in the literature were identifiable. In this test, a sample of articles and the criteria identified in them were subjected to interrater reliability testing (Hoyt, 2010, p. 141) to establish whether:

- the elements identified by the researcher were likely to be related to PLE.
- the articles said to contain the elements were likely to contain them.
- similar elements from different articles were likely similar enough to count as the same element.

A sample of articles was be read by a colleague who selected elements from those articles. These were compared to elements selected from the same articles by the researcher. A similar peer review process was used to test interrater reliability for the frequency of elements in a sample of online tutorials.

Content analysis of online tutorials

This section covers the selection of tutorials for content analysis; and summarizes the coding schedule, and the content analysis process.

Sample frame for content analysis

A sample of tutorials was selected at random from the population of tutorials produced by the 'Group of 8' (Go8) Australian and all 8 New Zealand university libraries.

Purposive sampling (Bryman, 2008, pp. 458-459) was used to select the initial range of institutions from the total population of Australian and New Zealand universities. Given the limited scope of the project and the study's focus on the online tutorial outputs of ANZ university libraries, it was thought appropriate and feasible to sample all 8 New Zealand universities.

Of the 39 available Australian universities, all universities in the 'Group of 8' (Go8) were selected. The Go8 were selected as a single group as they assess their performance in relation to each other (The University of Melbourne, 2009) and were thought to give a sample of research-intensive, well-funded universities, that might be used to compare against the equivalent number of New Zealand universities. Sampling these institutions served to keep the study within scope; had time allowed, then more institutions would have been included and a different sampling technique used.

Australian tutorials in the Go8 were included for two reasons.

- Preliminary study suggested that some universities place their tutorials within Learning Management Systems (e.g. Blackboard, Moodle), preventing access to these tutorials. If New Zealand university libraries followed this pattern, then

there was a risk that a strictly New Zealand sample might be too small to gather worthwhile data.

- The journal ranking system ERA that was used to restrict scope during the literature search process (see above for detail) is an 'Australian-born' system.

Selection of tutorials

92 Tutorials were sampled at random from the population of tutorials ($n=121$) available at the 16 universities. The random sampling method reflected the limited scope of the project. Had time allowed, then a more thorough census survey might have been applied.

The sample size was calculated to get a 95% standard deviation for the population of available tutorials (calculated using <http://www.surveysystem.com/sscalc.htm>), using a level of significance of 0.05. This level of significance was chosen due to the anticipated small sample of tutorials, and the consequent estimated risk that a (true) null hypothesis might be erroneously rejected (Bryman, 2008, p.333).

In the context of this research, the term 'online tutorial' did not cover PDF or word document teaching aids. 'Tutorials' were restricted to screencapture or web-based tutorials made available online that involved progression from webpage to webpage, or

that utilized a range of media, in order to teach library skills to students. Restriction helped ensure the tutorials in the sample reflected current creation practices – word documents, for example, may be copies of print tutorial resources and potentially out of date.

Limitations to tutorial selection were applied to keep the study within scope. Tutorials were excluded prior to analysis if they were:

- unavailable through the website of the institution's library. This excluded those tutorials in learning management systems, those protected by passwords, and those hosted on other sites and unlinked to from the library webpage.
- produced prior to 2005. Judgment was made based on copyright date, or on the dates used in examples within the tutorials. This is similar to the requirement in Su and Kuo (although less stringent than their requirements) (2010, p. 321) and included for the same reason: this is reflective of current practice.
- not created by the library in question. This excluded tutorials hosted on the websites of other departments in that institution and those created by other libraries or by database companies.
- not interactive library-skills related tutorials. This excluded PDF and plain text 'self paced tutorials' and tip sheets, videos of presentations, virtual tours of libraries, subject guides, citation builders, and library wiki pages.
- inaccessible through common browser software – Internet Explorer or Mozilla Firefox.

Of these limitations, unavailability through the website proved to be the one that excluded the most tutorials from the sample. All eight of Melbourne's publically available tutorials, for example, were unavailable without a password

http://www.library.unimelb.edu.au/services/help_yourself/online_tutorials.

Coding schedule and Content analysis of selected tutorials

Quantitative content analysis was used to determine whether selected ANZ tutorials featured design elements previously identified in the literature. Content analysis is a method of investigation of documents (including online tutorials – see Su & Ko, 2010) that systematically investigates the content of these documents, often through investigating the presence or absence of criteria (Bryman, 2008, p.274) in a coding schedule. Content analysis was selected due largely to the researcher's desire to investigate the relationship between the written 'recommendations' in the academic literature and the electronically produced product (the tutorials).

A coding manual was designed to identify elements within online tutorials. Elements in the manual were derived from those identified in articles captured in the literature search. Design elements were identified, coded, and then sought in the sample of online tutorials.

Scoring

A score of 0, 0.5 or 1 assigned for each element per tutorial. 0 represents an absence of that particular element within a tutorial, 1 represents observable evidence of the element, 0.5 is a special case (drawn from Pigott, 2009) that represents occasions where the element is weakly or poorly represented.

Some elements were easier to judge as 'poor quality' than others, such as audio versus interactivity. For this reason, some elements were never scored as 0.5, The 0.5 score was used instead as an indicator of quality and to provide 'talking points' for discussion. For purposes of simplicity in statistical analysis it was counted as 1.

An overview of the elements within the schedule and manual

The manual and schedule were used to search for 17 elements identified in the initial search within ANZ online tutorials. Detail on the relationship of the element to PLE is also included where relevant.

Assistance: This describes a feature (either verbal or visual) of a tutorial that indicates where tutorial users can go for further assistance. Dewald (1999) is frequently cited in the literature as suggesting that "good library instruction does not end with the class session" either in face to face teaching or online (Dewald, 1999, p.29). In tutorials without any mention of seeking further assistance, links to the library webpage or to the ask-a-librarian service were scored as 0.5.

Audio: A recorded voice track providing part of the contents of the tutorial now common in many tutorials (Su & Kuo, 2010). Audio potentially reduces the need for additional text explanation of content, but can perhaps cause 'overload' if text and visuals are also in use (Oud, 2009). 'Click noises', short snippets of audio or poor quality audio were scored as 0.5.

Captioning: presence of closed captions or of text to aid disabled users (or those without speakers) to access the audio portion of the text (Bowles-Terry, et al., 2010).

Consistency: Consistent text and graphic images – for example colour, logos, branding and font size. May require less mental effort to view and process tutorial content (Oud, 2009).

Different versions: Tutorials in a different media that cover similar content to the selected tutorial. These alternatives are provided at the same location for the benefit of users with impairments or those users that wish to revisit parts of the tutorial (Mages, 2010). 'Printer friendly' (but otherwise identical) versions of tutorial content were scored as 0.5.

File size: Refers to an indication of the size of the file in MB that the user must download to view the tutorial. Most commonly cited in the literature with regards to screencast

tutorials, where large tutorials are thought to potentially be inaccessible to some users with dialup internet connections (Plumb, 2010).

Goals or objectives: Goals or learning objectives for the tutorial or for sections of the tutorial. These are hypothesized to assist learners in consolidating (and retaining) what was taught in the tutorial (Sormoza-Fernandez & Abadal, 2009). If only the title of the tutorial indicated its purpose, then it was scored as 0.5.

Highlighting: Verbal or visual means of flagging important text or images onscreen to draw the attention of the user to critical information (Oud, 2010). The visibility of highlights affected the scoring – poorly visible or very briefly visible highlights scored as 0.5.

Interactivity: Any element in the tutorial permitting interaction between the tutorial and the user: including quizzes, flash reactive animations. Often referred to as ‘active learning’ (Blummer & Kritzkaya, 2009), interactivity is thought to make retention of content easier for the student (Bury & Oud, 2005). Note that ‘interactivity’ excludes: jargon animations such as ‘mouseover’ definitions, links to outside sites, and navigation buttons or ‘stop/start’ controls. These are interactive to some degree, but were thought to be too closely related to other elements to suit the purpose of the content analysis (Bryman, 2008, p. 288).

Jargon control: Definitions of library jargon given through glossaries or text explanations. Undefined library jargon is thought to hinder student understanding of the content of tutorials (Lim, 2010). The accuracy of the definition was not a factor in this study, only the presence or absence of an aid to jargon control. Verbal explanations, unless accompanied by text or superseded by other aids elsewhere in the tutorial, were considered to score 0.5.

Levels: Describes the option of taking a basic or advanced version of the tutorial, or of taking optional exercises at basic or advanced levels (Lim, 2010). This allows access to the tutorial for users of different stages of study.

Modularity: The division of a tutorial into segments based on similar sub-topics that can be accessed sequentially or individually. Segmented tutorials permit users to visit pertinent sections, without the effort or tedium of seeing the whole tutorial repeatedly (Betty, 2008). Poorly modular tutorials were scored as 0.5: these included those tutorials with only a verbal indicator of segmentation of the tutorial.

Multimedia: Presence of more than one type of media in a tutorial, primarily animation or graphics in web based tutorials (Yang, 2009). Multimedia allows for users with different styles or preferences for learning to access the tutorials in their preferred way. This particular context excludes audio from the definition as it is treated as a separate element.

Navigation aids: Visual or verbal aids to navigation through the tutorial and its content.

In modularized web-based tutorials this may allow access to the pertinent areas of the tutorial, or to skip irrelevant or previously viewed segments (Bailin & Pena, 2007).

Allows the user to control the flow of information in screencasts, and replay or revisit important information (Plumb, 2010). Poorly visible navigation aids, such as tiny video controls, scored 0.5.

Tutorial duration or estimated time to completion: The time taken to watch a screencapture or the estimated time to complete a web-based tutorial. Short tutorials (under 3 minutes for screencaptures) are recommended by Mestre (2010), Plumb, (2010), Slebodnick & Riehle (2009) and other authors.

Visibility: Represented by the number of clicks required to reach the title page of the tutorial from the main library website (Su & Kuo, 2010).

In addition, tutorial and institution name, country of origin, URL, date of creation and type of tutorial were recorded to aid retrieval of tutorials and later analysis.

Two types of tutorial were identified in an initial exploration of ANZ tutorials: screencapture video tutorials and web-based (see *Definitions*). These types are reflected in the recent LIS literature on online tutorials (Betty, 2008; Oud, 2009; Su & Kuo, 2010; Wales & Robertson, 2008). For the purpose of this content analysis

'screencast tutorials' covers any tutorial created with tools such as Adobe Captivate, or Techsmith's Camtasia. 'Web-based' tutorials may include small segments that use screencapture software, but are primarily reliant on text and static images.

Content analysis

The coding schedule and content analysis data were collated on a master copy of an MS Excel spreadsheet stored on the Victoria University of Wellington Library's server.

Copies of this spreadsheet were used for analysis.

Tutorials were explored until evidence of all elements in the coding schedule were found or the tutorial ended (whichever came first). Some tutorials, or portions of some tutorials, were viewed twice.

Individual tutorials were assessed against the final list of elements identified in the coding schedule (above), using the same computer. Time for data collection was allocated between 7am and mid-day on weekdays during the Christmas hiatus. The literature suggested this as a way of removing bias: preliminary investigation suggested that the time taken to load a tutorial might be affected if different computers with different Internet connections were used. This might have potentially presented an erroneous impression of the time taken to load some of the larger screencast tutorials or prevented access to them entirely (some authors cite slow 'internet speed' as a

potential factor to take into account in creating screencasts and encourage the creation of short videos for this reason: Plumb, 2010; Slebodnik and Riehle, 2009).

The first ten tutorials were reanalyzed at the end of the content analysis to check for rater reliability over time. A peer-review of randomly selected tutorials was undertaken to determine whether elements identified in the initial round were indeed present in tutorials, and whether the presence of the element was as strong as had first been supposed.

Frequency and contingency tables (Bryman, 2008, pp. 326-327) were drawn up after content analysis to represent the presence or absence of elements in online tutorials for the tutorials taken as a group, for tutorials separated by country of origin, and also for type. Different analyses were used to test different hypotheses (see below).

Methods of data analysis

The content analysis searched primarily for the presence or absence of elements of design, with a score of 0, 0.5 or 1 assigned for each nominal dependent variable found in a tutorial. 0 represents an absence of that particular element within a tutorial, 1 represents observable evidence of the element. For the purpose of statistical analysis, 0.5 (the special case) was counted as 1 (see above). These values cannot be

comparatively ordered: that a tutorial has goals and objectives, for example, is not worth more or less than another with different goals and objectives.

Statistical testing

Variables

The type of tutorial (screencapture and web-based) and the country of origin (NZ or Australia) of the tutorials were identified as independent variables. These were judged to be dichotomous variables for the purpose of this research. Dependent variables were identified as the design elements identified in the literature (as interval variables) and these design elements as present within online tutorials (as nominal variables).

A few interval variables were identified, such as the number of clicks taken to get to the resource from the main library website, the duration (or estimated duration) of the tutorial, and the size of the tutorial in MB. These variables were not tested with inferential statistical tests (gamma, Kendal's tau, Chi-square) that were used for bivariate analysis of nominal data (Bryman, 2008, p. 326). Descriptive statistics were felt sufficient for these few elements, given the scope of the project.

Descriptive statistics

Raw data was described using descriptive in the form of frequency tables (raw frequency and percentage frequency) and charts. Results from these statistics were assumed to illustrate aspects of the relationship between literature and the practitioner created online tutorials (relating to H1-H4), and also between the types and country of origin of the tutorials (relating to H5-H6).

Inferential statistics

Inferential statistical tests (gamma, Kendal's tau, Chi-square) were carried out to determine whether there were statistically significant differences in any of the patterns noted in descriptive statistical analysis. Percentage frequencies of elements were calculated for the element frequencies from the literature, from the total number of tutorials, from tutorials by country, and from tutorials by type. Percentage frequencies were felt necessary, as the number of tutorials and the literature sample varied making raw scores incompatible.

Percentage frequencies were ranked for the first set of inferential statistical tests using Gamma and Kendall's tau. These are tests used to determine whether two sets of ranked data correlate with each other (Hernon, 1993, p. 107). In this context these tests were used to test H1-H4; to determine whether there was a statistically significant correlation between the percentage frequency of elements as found in tutorials (by total, by country and by type) and the percentage frequency of elements identified in the literature. Tau and gamma were also used to investigate H5-H6; with the investigation of whether there are statistically significant differences between the frequency of elements in types of tutorials, and also for tutorials created in New Zealand and Australian Go8 university libraries.

Scores in these tests close to zero may indicate that any correlation between the percentage frequency of elements in the literature and the tutorial are statistically non-significant (Hernon, 1993, p. 106). If the critical value for tau and gamma is exceeded by

the calculated value of (at $p < 0.05$) then the null hypothesis (“that there is no statistically significant difference...”) can be rejected (Sheskin, 2004, p. 1085; Siegel, 1956, p. 297).

Gamma and tau were chosen as statistical tests because they are suitable for ranked ordinal data where values may be tied (Hernon, 1993, pp. 117, 118). Both tests were used to potentially give differing interpretations of the data: gamma is thought to be more suitable for data with many ties (Chen & Krauss, 2003); it would be the better test if the results indicate that many elements share a percentage frequency ranking.

Chi-square (Bryman, 2008, pp. 334-335; Hernon, 1993, pp. 98-99, 1994, p. 143) was used as a test of statistical significance to compare the percentage frequency of individual elements in tutorials by country (H5) and then by type (H6).

Chi-square tests search for statistically significant differences between the expected and the actual results. A null hypothesis (“there is no statistically significant difference...”) was assumed for the chi-square tests for each element. If a chi-square test gave a result (at $p < 0.05$) larger than the value given on a table of chi-square values, then the null hypothesis was rejected (Hernon, 1993, p. 98), and a statistically significant difference between the frequencies of elements in tutorial type (for example) could be assumed. Yates correction (Hernon, 1994, p. 143) was used to adjust the chi-square value for tests where the value of the expected result was less than 5. Yates correction protects against

a false positive test (where one would reject a true null hypothesis as false – type 1 error).

If the null hypotheses for the statistical tests were to be rejected (demonstrating that the results were statistically significant) then descriptive statistics mentioned above might be used to suggest future avenues of research.

Results

This section lays out results felt relevant to the hypotheses: an overview of the results of sampling, demographics of the samples, tables and charts showing descriptive statistics from content analysis results, and tables showing the results of inferential statistical testing. Discussion of results follows in the *Discussion* section.

Overview

48 articles were identified during the search process as potentially containing elements that could be related to the Principle of Least Effort. Limitations whittled this number to 27 articles discussing 17 design elements related to the PLE.

Regarding the literature search and exclusion process, some articles were excluded on the grounds that they appeared to discuss web related usability (Chao, 2002), or mentioned tutorials without going into specifics as to their content. Membership of this

second group is harder to define for certain. Results of initial rater reliability testing indicated some bias. Elements not previously identified as belonging to particular articles were found, and two new elements were identified

139 tutorials were found in the initial search. Of these, 16 were excluded due to requiring password access (University of Melbourne, and Victoria University of Wellington), or not being linkable on the library’s website (University of Otago tutorials available only on UniTube). This reduced the usable sample to 121 tutorials. One institution was excluded as a result of random sampling; AUT University’s Empower tutorial was the only one found through their website and was not chosen during random number generation.

92 tutorials were sampled at random from a population of 121 tutorials produced by Australian Go8 university libraries, and all 8 NZ university libraries (confidence interval of 5%, confidence level 95%).

Descriptive statistics

Articles in literature sample	27
Total no. tutorials identified	92
Total no. screencapture tutorials identified	66
Total no. web-based tutorials identified	26
Total no. tutorials created in Australian university libraries	36
Total no. tutorials created in New Zealand university libraries	56

Table 1: Raw data, total numbers of articles, tutorials and tutorials divided by type.

Table 2a represents all elements identified in the literature search, their raw frequency, and frequency as a percentage of the sample. Note that some elements (date listed, file size, visibility, and tutorial duration) were not strictly nominal, and were excluded from inferential statistical tests. Table 2 b illustrates the number of articles and elements therein in relation to the ERA ranking of the journal.

Element name	Literature frequency (raw)	Literature frequency (% of sample, $n = 27$)
Interactivity	20	74.1
Modularity	18	66.7
Navigability	17	63.0
Audio	13	48.1
Tutorial duration	13	48.1
Assistance	11	40.7
Goals/objectives	11	40.7
Multimedia	11	40.7
Levels	10	37.0
Jargon	9	33.3
Consistent appearance	7	25.9
Highlighting	5	18.5
Visibility	5	18.5
Different versions	4	14.8
Captioning	3	11.1
File size	3	11.1
Date	2	7.4

Table 2a: Raw frequency of elements as found in the literature, in descending order of frequency

ERA Ranking	Number of articles	Number of elements identified
A*	1	8
A	5	40
B	9	45
C	9	53
Not ranked	3	14
Total	27	160

Table 2b: ERA ranking of journals

Content analysis results

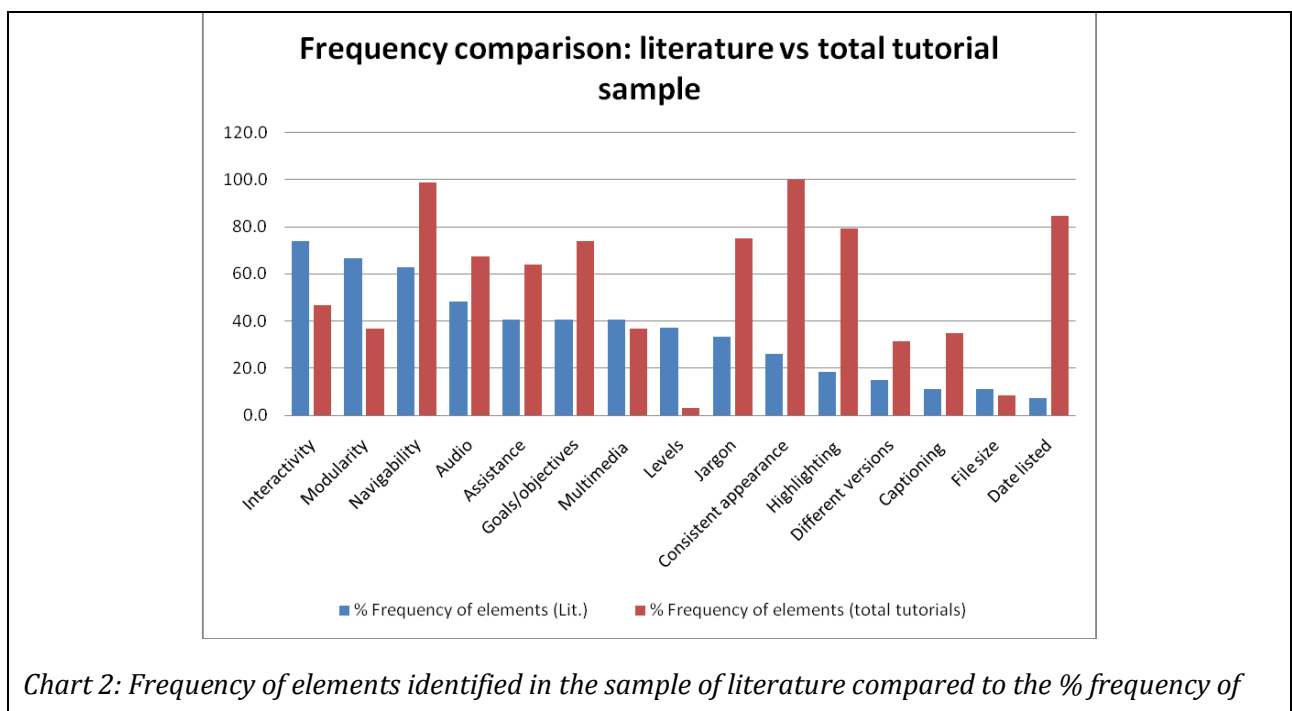
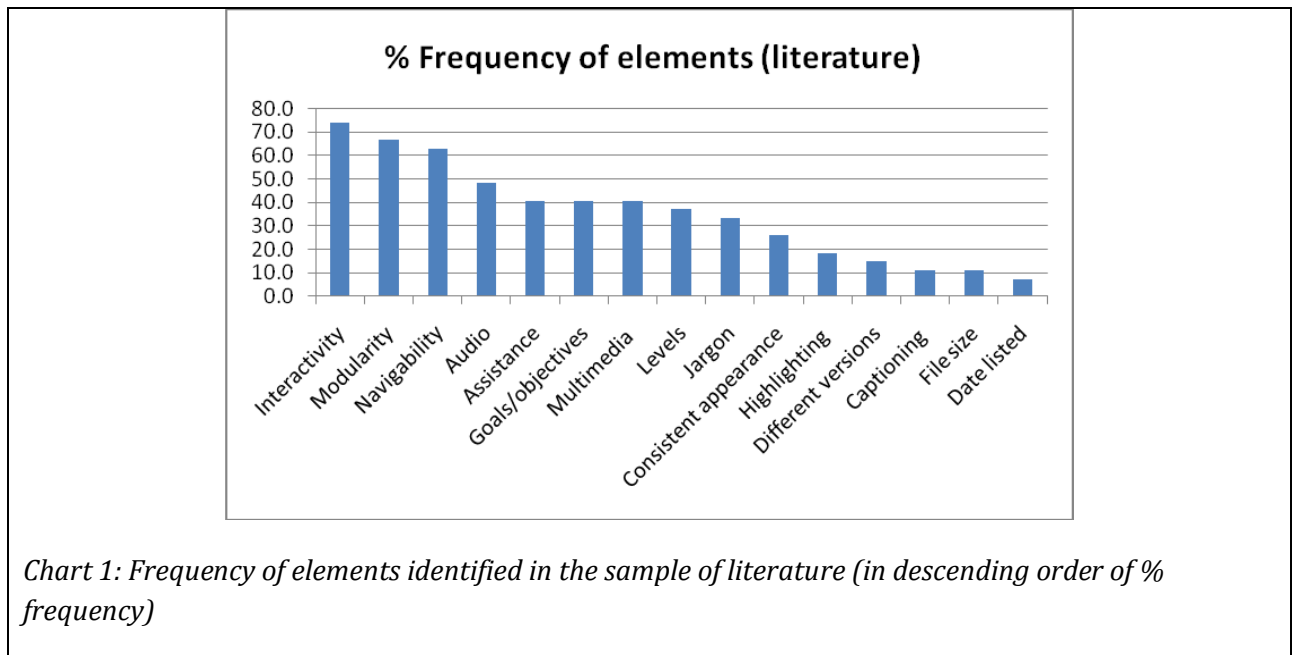
(a)

Element name	Lit fr (raw)	Total fr (raw)	NZ fr (raw)	Aust fr (raw)	Scrn fr (raw)	Web fr (raw)
Interactivity	20	43	32	11	19	24
Modularity	18	34	25	9	9	25
Navigability	17	91	55	36	65	26
Audio	13	62	35	27	59	3
Assistance	11	59	35	24	46	13
Goals/objectives	11	68	44	24	50	18
Multimedia	11	34	26	8	13	21
Levels	10	3	3	0	0	3
Jargon	9	69	43	26	45	24
Consistent appearance	7	92	56	36	66	26
Highlighting	5	73	46	27	51	22
Different versions	4	29	12	17	19	10
Captioning	3	32	13	19	28	4
File size	3	8	8	0	8	0
Date listed	2	78	46	31	58	19

(b)

Element name	Lit fr % (n=27)	Total fr % (n=92)	NZ fr % (n=56)	Aust fr % (n=36)	Scrn fr % (n=66)	Web fr % (n=26)
Interactivity	74.1	46.7	57.1	30.6	28.8	92.3
Modularity	66.7	37.0	44.6	25.0	13.6	96.2
Navigability	63.0	98.9	98.2	100.0	98.5	100.0
Audio	48.1	67.4	62.5	75.0	89.4	11.5
Assistance	40.7	64.1	62.5	66.7	69.7	50.0
Goals/objectives	40.7	73.9	78.6	66.7	75.8	69.2
Multimedia	40.7	37.0	46.4	22.2	19.7	80.8
Levels	37.0	3.3	5.4	0.0	0.0	11.5
Jargon	33.3	75.0	76.8	72.2	68.2	92.3
Consistent appearance	25.9	100.0	100.0	100.0	100.0	100.0
Highlighting	18.5	79.3	82.1	75.0	77.3	84.6
Different versions	14.8	31.5	21.4	47.2	28.8	38.5
Captioning	11.1	34.8	23.2	52.8	42.4	15.4
File size	11.1	8.7	14.3	0.0	12.1	0.0
Date listed	7.4	84.8	82.1	86.1	87.9	73.1

Table 3 (a) & (b): (a) Raw frequency of elements as found in the literature (in descending order of frequency), compared to the raw frequency for the total number of tutorials (Total fr), tutorials by country (NZ fr, Aust fr), and by tutorial type (Scrn fr, Web fr). (b) Percentage frequency of elements as found in the literature, compared to the % frequency for the groups in (a).



elements identified in the tutorial sample (in descending order of % frequency in the literature).

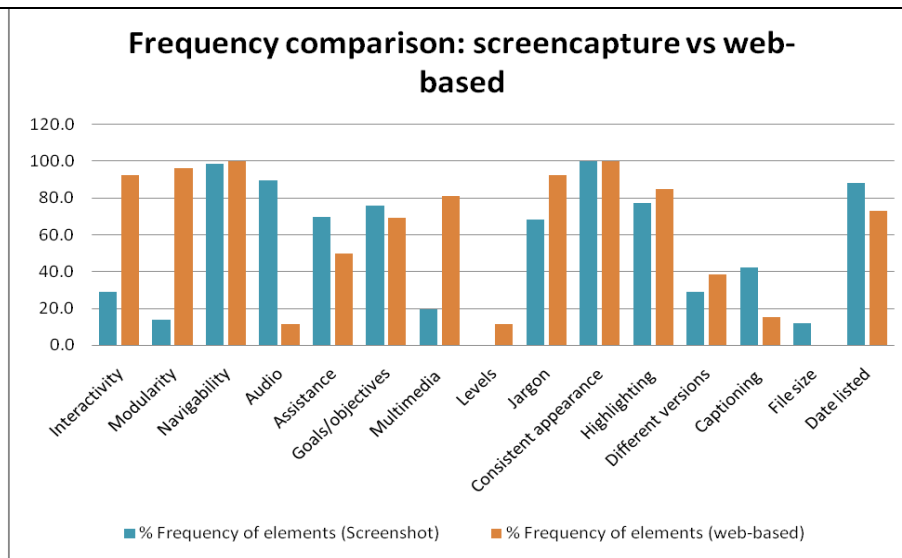


Chart 3: Percentage frequency of elements identified in screencapture tutorials compared to the % frequency of elements identified in web-based tutorials (in descending order of % frequency in the literature).

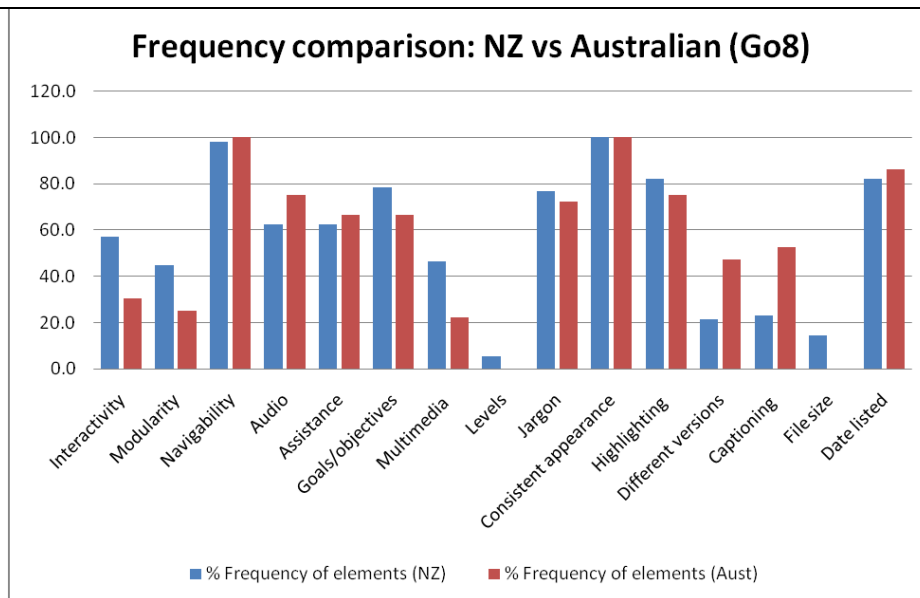


Chart 4: Percentage frequency of elements identified in screencapture tutorials compared to the % frequency of elements identified in web-based tutorials (in descending order of % frequency in the literature).

literature).

Inferential statistics

These tables show the ranking of element frequencies required to calculate gamma and tau statistics

Element name	Lit fr	NZ fr	Aust fr	Scrn fr	Web fr	total fr
Date listed	1	12.5	13	12	8	13
Captioning	2.5	2	1.5	2	1	2
File size	2.5	4	7	7	4	4
Different versions	4	3	6	5.5	5	3
Highlighting	5	12.5	11.5	11	10	12
Consistent appearance	6	14	14.5	15	14.5	15
Jargon	7	10	10	8	11.5	11
Levels	8	1	1.5	1	2.5	1
Assistance	10	6	3	4	9	5.5
Goals/objectives	10	8.5	8.5	9	6	8
Multimedia	10	11	8.5	10	7	10
Audio	11	8.5	11.5	13	2.5	9
Navigability	12	13	14.5	14	14.5	14
Modularity	13	5	4	3	13	5.5
Interactivity	14	7	5	5.5	11.5	7

Table 4: Ranking order of elements, arranged in ascending order of the raw frequency of elements found in the literature, compared to the raw frequency total number of tutorials (Total fr), tutorials by country (NZ fr, Aust fr), and by tutorial type (Scrn fr, Web fr).

(a)

(b)

Element name	Scrn fr	Web fr
Levels	1	2.5
Captioning	2	1
Modularity	3	13
Assistance	4	9
Interactivity	5.5	11.5
Different versions	5.5	5
File size	7	4
Jargon	8	11.5
Goals/objectives	9	6
Multimedia	10	7
Highlighting	11	10
Date listed	12	8
Audio	13	2.5
Navigability	14	14.5
Consistent appearance	15	14.5

Element name	NZ fr	Aust fr
Levels	1	1.5
Captioning	2	1.5
Different versions	3	6
File size	4	7
Modularity	5	4
Assistance	6	3
Interactivity	7	5
Audio	8.5	11.5
Goals/objectives	8.5	8.5
Jargon	10	10
Multimedia	11	8.5
Date listed	12.5	13
Highlighting	12.5	11.5
Navigability	13	14.5
Consistent appearance	14	14.5

Table 5 (a) & (b): Ranking order of elements arranged in ascending order of the raw frequency of elements found in (a) New Zealand tutorials, and (b) screencapture tutorials.

For (a) *scrn fr* = ranked frequency of elements in screencapture tutorials; *web fr* = ranked frequency of elements in web-based tutorials.

For (b) *NZ fr* = ranked frequency of elements in tutorials created in New Zealand; *Aust fr* = ranked frequency of elements in tutorials created in Australia.

Gamma

This table shows gamma calculations for the raw ranked frequency of elements found in the literature compared to the raw ranked frequency of elements found in:

	Gamma	z	N
The total number of tutorials	-0.0192	-0.0205	92
Tutorials created in New Zealand	-0.0204	-0.027	56
Tutorials created in Australia	-0.0495	-0.083	53
Screencapture tutorials	-0.0192	-0.0241	66
Web-based tutorials	0.2745	0.5654	26

Table 6: Gamma calculations for H1-H4

The original for N ($n=92$ for total tutorials; $n=56$ for NZ tutorials etc) is required to calculate a Z-score with which to test for significance (Sheskin, 2004, p. 1115).

The critical value of gamma at $p<0.05$ (as a two tailed test) is 1.960.

This table shows gamma calculations for the raw ranked frequency of elements found in:

	Gamma	z	N
Tutorials created in Australia compared to tutorials created in New Zealand	0.627119	0.6447	92
Screencapture tutorials compared to web-based tutorials.	0.142857	0.1379	92

Table 7: Gamma calculations for H5-H6

Comparing the groups together generates an N of 92 (the total number of tutorials).

The critical value of gamma at $p<0.05$ (as a two tailed test) is 1.960.

Kendall's tau

Tau for each ranking of element frequency versus the literature element frequency was calculated here: http://www.wessa.net/rwasp_kendall.wasp. This table shows Kendall's tau calculations for the raw ranked frequency of elements found in the literature compared to the raw ranked frequency of elements found in:

The total number of tutorials	0.0195
Tutorials created in New Zealand	0.0294
Tutorials created in Australia	-0.0198
Screencapture tutorials	0.0195
Web-based tutorials	0.2759

Table 8: Tau calculations for H1-H4

The critical value of tau at $p < 0.05$ and $N = 15$ is 0.390 (Sheskin, 2004, p. 1165). N is the number of pairs being compared.

This table shows Kendall's tau calculations for the raw ranked frequency of elements found in:

Tutorials created in Australia compared to tutorials created in New Zealand	0.7745
Web-based tutorials compared to screencapture tutorials	0.2816

Table 9: Tau calculations for H5-H6

The critical value of tau at $p < 0.05$ and $N = 15$ is 0.390; at $p < 0.01$ the critical value is 0.505 (Sheskin, 2004, p. 1165). N is the number of pairs being compared.

Chi-square

Element	Chi square value (country)	Chi square value (type)	Yates' correction applied
Interactivity	6.222463293	30.23145183	
Modularity	3.628948131	54.51175194	
Navigability	2.064276993	2.244319783	Yates' correction
Audio	1.558064516	51.44823922	
Assistance	0.16538264	3.14584987	
Goals/objectives	1.610644258	0.412084647	
Multimedia	5.510995203	29.85975215	
Levels	2.700344807	6.810368159	Yates' correction
Jargon	0.243386243	5.79020979	
Consistent appearance	0.01140873	0.013403263	Yates' correction
Highlighting	0.682253579	0.613670396	
Different versions	6.754068166	0.808626878	
Captioning	8.442840608	6.011810412	
File size	5.632653061	3.451659452	

Table 10: Chi-square values for the frequency of elements compared between countries (Chi square value (Country)), and also between type (Chi square value (type)).

Degrees of freedom = 1. The critical chi value for $p < 0.05$ is 3.8414

<http://www.analytictech.com/mb313/percenta.htm>

Tutorials: an overview

This section briefly describes the researcher's impressions of the tutorials sampled for the content analysis to set the scene for discussion of the results.

Screencapture tutorials made up 71% (n=66) of the total sample. 53 % (n=35) of screencapture tutorials were created in New Zealand. However, two Australian libraries, the University of Sydney and the University of Adelaide, appear to have recently invested in producing series' of screencapture tutorials. New Zealand Universities also produced a greater proportion of web-based tutorials than their

Australian counterparts (81% of web-based tutorials in the sample were created by New Zealand university libraries, n=21).

Journal of origin

Table 2b corresponds to the ranking of the journals from which elements were selected. The number of articles represents the number found with elements present in each of the ERA rankings. The number of elements identified shows the total incidence of elements within those ranked articles. 58% (93) elements were counted from journals with rankings of B or above. Of the 27 articles, 7 came from A or A* ranked journals and totaled 48 instances of individual elements. A further 45 instances of elements were counted in B ranked journals. 3 articles were not present on the ERA ranking site (<http://lamp.infosys.deakin.edu.au/era/>), and 9 were found to be C ranked.

Age

'Age' corresponds to the element of 'date listed' and represents the listing of the date of creation of the tutorial. A greater proportion of New Zealand tutorials were older; 41% were produced 2009 or earlier ($N = 25$) compared to those created in Australian Go8 libraries (19%, n=7). Web-based tutorials (of which New Zealand had the lion's share in the sample) were also older for the most part. A greater proportion of web-based tutorials were produced prior to 2010 (79%, n=19) than screencapture tutorials (30%, n = 17).

Visibility

Tutorials were, on average, three clicks away from the main library webpage. This is in alignment with other research findings (Su & Kuo, 2010). The maximum number of clicks required was 5, the minimum was 1. Note that the importance of tutorial visibility as an element assumes that viewers will have browsed their way in from the website. However, observation and professional discussion suggests that the current trend in Australian and New Zealand libraries is point-of-need delivery through the Library Management System (LMS).

Purpose

Intensive discussion of the purpose of tutorials is outside the scope of this project (unlike Su & Kuo, 2010), but variety was noted. A focus on specific tools such as the catalogue, the CINAHL database, EndNote, Medline and other specific databases was common. Two SciFinder Scholar tutorials stood out here for specificity of content – they demonstrated how to search that database by building images of chemical compounds (University of Adelaide Library, 2011b, 2011c).

Several tutorials focused on generic information literacy skills such as how to evaluate information, how to reference, and how to find items from a reference or reading list, whereas others were designed as large overviews of IL skills (UNSW Library, 2007). The University of Otago's OIL tutorial series (<http://oil.otago.ac.nz/oil/>) covered the major

aspects of report writing and research for business studies and for science amongst other topics, combining classic information literacy skills (searching databases) with the 'academic' skills of pulling together a report to fit subject requirements.

Quality

Individual elements were assessed for 'quality', and were observed to vary between tutorials. Judgments on the quality of the elements were made in the content analysis: a score of 0.5 for an element within a tutorial indicated that the researcher thought it to be partially or poorly constructed. Partial appearance of elements was used as an indicative measure of the quality of elements within the tutorials. For example, 6 tutorials were deemed to be partially consistent in appearance and were given a score of 0.5 in the content analysis.

Quality, in the context of this research is highly subjective, and does not play a role with regards to the conclusions drawn about the frequency of elements within tutorials. For the purposes of statistical elements they were counted as '1'.

Quality is important as it may have influence on the ease of use of the tutorial – and so influence whether the Principle of Least effort applies. Allen suggests that some 'active' components of online tutorials are useful only so long as they are carefully thought out in such a way as to provide a problem to the student, without providing obvious solutions to that problem (Allen, 2008).

Illustrative examples of quality across elements follow:

- Assistance was generally of mixed quality, with clear examples such as those at Massey University (<http://connect.massey.ac.nz/scopus>) contrasted with almost hidden links to ask-a-librarian (<http://library.canterbury.ac.nz/infolit/tutorials/catalogue/>) contrasted with no assistance given at all. 33 tutorials (59%) did not mention seeking further assistance.
- Consistency in internal appearance (similar in-tutorial text, pointers, coloration, and branding) was almost universally adhered to, and the majority of tutorials appeared to resemble others created by the same institution. One institution, the University of Sydney, used diversity of appearance to its advantage: these longer, entertainingly diverse tutorials potentially keep students engaged with the learning material (<http://www.library.usyd.edu.au/skills>).
- Audio quality was defined largely by its presence and was certainly not present in all tutorials (11.5% $N=3$ of web-based tutorials used audio to some extent, in comparison to 89% $N=59$ of screencapture tutorials). Presence or quality of audio in screencaptures did not appear to be related to age, or to general appearance of the tutorial (but be aware that these observations were not tested for statistical significance). New tutorials produced by the University of Adelaide are entirely silent, for example, relying on text on screen to get their point across (University of Adelaide Library, 2011a). Audio quality varied somewhat, and

particularly poor quality audio met with 0.5 rating. Some tutorials employed audio in tiny snippets (OIL), or as clicks.

- It was rare to find a different version of a tutorial. 29 universities offered alternate (often PDF) tutorials or tipsheets, and a few web-based tutorials employed printer friendly versions.
- Navigation aids within screencapture tutorials were nearly as common (98% $N=65$) as in web-based tutorials (100% $N=26$). However, quality was observed to be mixed in screencaptures, controls were not always large (some were tiny!), and it was not always obvious that the viewer could move forwards or backwards through the tutorial.

These more qualitative aspects of the research findings, although interesting in themselves, are not the primary focus of this study. Quantitative results – primarily an investigation of statistically significant differences between the frequencies of elements – are the major focus of the following discussion section.

Discussion

This section primarily concentrates on a discussion of the significance of the results with regards to the research hypotheses: chiefly it is an examination of the six hypotheses in light of the results, and the implications of the statistically non-significant results.

Overview of the results

In general, inferential statistical tests suggest that the results of the descriptive statistics are non-significant with regards to the first four hypotheses, and also to the sixth. The fifth hypothesis showed a positive correlation that was statistically significant for Kendall's tau, but not for gamma. Results for chi-square tests for H5 and H6 are suggestive of some relationships (by country or by type) being based on individual elements, but results are not conclusive.

H1 to H4

H1 to H4 put forward the null hypotheses that there is no statistically significant difference between the frequency of elements as found in the literature, and those created in New Zealand university libraries (H1) Australian university libraries (H2); screencapture type tutorials (H3) and web-based tutorials (H4).

Descriptive statistics, such as the tables showing raw (table 2, table 3) and percentage (table 3 a & b) frequencies, and the frequency ranking table (table 4), initially suggest that there is considerable difference between the frequency of elements found in the literature and the frequency of elements as observed in the different groups of tutorials (total, by country and by type).

The 5 most common elements identified in the literature were interactivity (74.1% n=20), Modularity (66.7%, n=18), Navigability (63.0% n=17), Audio (48.1%, n=13), and

Assistance (40.7%, n=11) (this last was tied with Goals/objectives, and Multimedia) (chart 1).

The 5 most common elements found in the total sample of tutorials were consistency of appearance (100%, n=92), navigability (99%, n=91), date present (85%, n=78), highlighting (79%, n=73) and jargon control (75%, n=69). This pattern of 'top 5' elements that appear to differ greatly from the literature was also noted when tutorials were investigated by country of origin (chart 4) and by type (chart 3) - navigability being the sole exception.

These charts and results give the (false) impression that there is no relationship between frequencies of elements in the tutorials and the literature. If this were the case, then it might be seen as evidence for H1-H4. Suggesting that there is little relationship (little correlation) between research and practice might be used to build on evidence concerning the Gap Hypothesis in this area.

However, inferential statistical tests suggest that the observed differences are non-significant. None of the Kendall's tau values shown in table 10 were statistically significant when compared to a critical tau value of 0.397 ($p < 0.05$, $N = 15$). This suggests that the observed correlations are potentially the result of random chance. Gamma calculations carried out to test these same hypotheses suggest a similar interpretation, with none of the correlations exceeding the critical value for gamma (calculated to be

1.960 ($p < 0.05$)). Note that the web-based gamma result (0.2745, $N=26$) should be treated with some suspicion. Hernon (1993, p. 120) suggests that a minimum N of 40 is required to determine statistical significance.

H5 and H6

The fifth and sixth hypotheses are null hypotheses that focus on the claim that there is no statistically significant difference between the frequencies of elements between tutorials produced in the different countries (H5); and no statistically significant difference between tutorials by type (H6).

Unlike the case for H1-H4, raw and percentage frequencies, ranking data and charts and tables serve to give the impression that there is a correlation type relationship between the frequencies of tutorials produced in ANZ university libraries, and also by tutorial type. Chart 4 is a good example: the frequency of elements in the Australian (Go8) produced tutorials appears similar to the New Zealand frequencies. Chart 3 is less suggestive of a close positive relationship – certain elements (multimedia, modularity, interactivity and different versions) appear to be dissimilar in frequency.

Inferential statistical test results suggest that the impression given by the descriptive statistics may be true in part. Results for Kendall's tau (0.7745) for H5 are larger than the critical value (0.39, for $p < 0.05$) for this particular hypothesis (table 10). The Kendall's tau test for H5 suggests that there is a statistically significant positive

correlation between the frequency of elements in tutorials created in New Zealand university libraries and those created in the libraries of the Australian Go8.

However, the score for gamma (0.6271) for this hypothesis does not exceed the critical gamma score of 1.96 ($p < 0.05$), and neither of the scores (gamma or tau) for H6 exceeded their respective critical values. For H6 these scores are gamma 0.1429, critical value 1.96 ($p < 0.05$); tau 0.2816, critical value 0.39 ($p < 0.05$).

The 'split' in statistical significance between tau (significant) and gamma (non-significant) for H5 suggests several interpretations:

- there is the possibility of an error in calculation or transcription of test results in either of the tests. However, retesting using the same formula on data derived from textbook answers suggested that the results are consistent when checked against the answers in the textbook. An error in calculation is thought unlikely, for this reason, but not impossible.
- The list of elements from the literature whose frequency informed the ranking may be incomplete; elements might be missing, or otherwise under- or over-represented. The small sample size for the literature ($N=27$) may be a causal factor here, as might rater bias. Peer review of articles revealed some initial rater bias in the identification of elements – primarily in the non-identification of elements within articles when they were present. To correct for this bias, all articles originally consulted were re-read, frequency tables were re-done, new elements were integrated into the content analysis, and the analysis was re-run

(rater reliability testing for the content analysis of online tutorials did not suggest a similar bias).

- The test types present different sensitivities to types of data. Gamma and Kendall's tau are reportedly differently sensitive to tied results, with gamma being the more suitable of the two (Chen & Krauss, 2003). This suggests that the numerous tied ranks of the results have interfered with the tau calculation, and potentially have produced a type 1 error where a true null hypothesis has been rejected (Hernon, 1993, p. 86).

Further inferential tests were carried out that may shed light on the difference between the results of gamma and tau for H5.

Chi square tests examine differences at the level of individual elements, rather than elements ranked as a group. These were used to test for statistical significance in individual elements for comparisons between country of origin (H5) and also between types (H6) (table 10). Statistically significant test results suggest that the difference observed in frequency of individual elements between screencapture and web-based tutorials for example, is not due to random chance. The chi-square values calculated for frequencies of individual elements when examined by country or by type suggest statistically significant differences for:

- *Interactivity* (chi-square = 6.2225 for country; 30.2315 for type); *Captioning* (8.4428 country, 6.0118 type); *multimedia* (5.5110 country; 29.8598 type)

- For type alone: *Modularity* (54.5118); *audio* (51.4482); *levels* (6.8104 - Yates' correction applied); *jargon* (5.7902).
- For country alone: *Different versions* (6.7541); *file size* (5.6327).

There was no great difference between the number of statistically significant results found for frequencies of individual elements between tutorials created in the two countries (H5), and the two types of tutorials (H6). This does not appear to clearly suggest any cause of the mismatch between gamma and tau for H5, for this particular sample. Further testing is recommended at larger sample sizes to see if the modified frequency rank produces statistically significant results for tau and gamma.

Statistical non-significance of results

That the results above suggest the null not be rejected does not imply that the null should be accepted as a true state of affairs. That we reject the null does not mean that there is necessarily *no difference* between the frequencies of elements as found in the literature and the frequency in tutorials. The non-rejection of the null hypothesis could mean that the null is true, but it could also imply that the size of the sample is too small (see Lowry's case of the non-evidence for a bear; 1998-2011) .

Conclusion

More conclusive results would likely be achievable through increasing the sample sizes – both of literature and of the tutorials sampled. (An increase in the scope of the project

might also allow for greater generalization to Australian tutorials, assuming that more institutions would be sampled from the total of 39 Australian universities.) Leaving critical values aside, the results of inferential statistical testing and the patterns in the descriptive statistics suggest that sampling of a larger population of literature and of tutorials might result in data that adds to the knowledge around the relationship between research and practice for all six hypotheses.

For example, the results of Kendall's tau and gamma calculations give the impression that there is a very slight positive correlation between the frequency of elements in web-based tutorials ($\tau = 0.2759$; $\gamma = 0.5654$) and the frequency of elements derived from the literature. All other calculated values lie very close to 0, which appears to suggest that there is no correlation between the frequency of elements in the literature and the different tutorial groups. If this pattern of results held for larger samples of literature and of tutorials, it might suggest the conclusion that there is a correlation between the frequency of elements in the literature, and the frequency of elements in online web-based tutorials.

This result, if it were conclusive, would not indicate why elements were adopted into practice (that would require extensive qualitative analysis) but it might serve to present an interesting facet of the Gap Hypothesis. Conclusive results could suggest that there is less of a gap between the academic research as presented in internationally read journals, and local practice on the ground in this particular area of LIS research, for that particular type of tutorial.

However, speculation on sample size aside, the overall conclusion reached from interpretation of the results is that none of the differences observed in the descriptive statistics can reliably be considered to be statistically significant.

That none of the differences observed in H1-H4, H5 (to a degree) and H6 were statistically significant, suggests that the null hypotheses should not be rejected and that we cannot conclude that there is a statistically significant difference between the frequencies of elements identified in the literature and the frequencies of elements in the different sub-groups of tutorials. The same holds for the frequencies of elements in the groups of tutorials in relation to each other.

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