Using computer-aided lexical analysis in management research

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Abstract

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The versatility of lexical analysis is demonstrated by means of a two-part case study involving both quantitative and qualitative data. The quantitative part reports the use of lexical analysis to analyse the Web pages of businesses in Japan, the UK and the USA. In the qualitative part analysis of textual interview data obtained in a study of student learning is undertaken.

The study shows that lexical analysis offers a powerful means of analysing both quantitative and qualitative data. Lexical analysis is a research approach that provides a bridge between both research domains.
Abstract

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Introduction

There is increasing interest in analysing textual data in management research. Quantitative data is often supplemented by open-ended questions that also capture qualitative data. Interviews, observation and examination of records are frequently used means of obtaining data that exist in, or are subsequently transcribed into, textual form.

The purpose of this research is to investigate the use of computer-aided lexical analysis for both quantitative and qualitative data. Leximancer data-mining software (Smith, 2003; 2004) is used to conduct content analysis utilising both manifest and latent coding. Manifest coding, that is assigning each word as it appears regardless of its meaning, is usually employed for quantitative analysis. Latent coding, that is assigning words based on meaning, is usually used for qualitative analysis.

A two-part case study is used to demonstrate the use of computer-aided lexical analysis in management research. The first part presents a quantitative analysis of the web pages of businesses in Japan, the UK and the USA. The second part presents a qualitative analysis of interview data collected from overseas students engaged in first-year university studies. The paper concludes with a discussion of the benefits and implications of using lexical analysis for management research.

Background to the study

Lexical analysis predominantly refers to the study of both quantitative and qualitative textual data (Bolden and Moscarola, 2000). Although a debate exists that lexical analysis should be clearly defined as either “quantitative” or “qualitative”, it is a versatile approach that bridges those two orientations (Olson, 1995). Quantitative textual analysis places emphasises more on the structural aspects of language, utilising manifest coding to assign each word as it appears regardless of its meaning (Bolden and Moscarola, 2000; Roberts, 1997). Qualitative textual analysis focuses more on the semantic aspects of language, utilising latent coding to assign words based on meaning (Bolden and Moscarola, 2000; Roberts, 1997).

In addition to the clearly defined uses of computer-aided lexical analysis for both quantitative and qualitative research, this approach also offers researchers the opportunity to combine both approaches in one study (Ryan and Bernard, 2000). The benefits of combining both approaches, or the use of “triangulation”, include increased productivity together with enhanced reliability and validity (Bolden and Moscarola, 2000; Neuman, 2003).
Despite the value of lexical data in human and social science, the tools and techniques pertaining to computer-aided lexical analysis are still not readily used in either the quantitative or qualitative domains. Despite the suggestion that the trend of conducting research is shifting away from traditional research orientations where large volumes of data are captured and analysed (Bolden and Moscarola, 2000) progress has been slow. Although the move is towards more cost and time effective ways of research in applied disciplines (e.g., management, commerce, education and nursing) many researchers are still dealing with time and cost constraints because of entrenched research methods (Bolden and Moscarola, 2000). Lexical analysis provides an effective and efficient means of undertaking research.

**Applications of Leximancer in Management Research**

Lexical analysis in management research using Leximancer can take various approaches. For example, Smith (2004) proposed that Leximancer can be used for analysis of the differences and similarities from various sources provided by organisations, such as information provided by organisations in Portable Data Format (PDF) documents, open-ended questions asked in surveys, emails from respondents or customers, and electronic media articles such as on-line newspapers. Furthermore, Leximancer can read Hyper Text Mark-up Language (HTML) files as well as Extensible Markup Language (XML) files and therefore can be used to analyse commercial Web sites, Web-based forums or discussion boards, Web logs and guestbooks.

For research students and professional researchers, Leximancer’s conceptual mapping technique can be used for advancing qualitative analyses in assisting the definition of coding for other qualitative data analysis (QDA) software, such as NVivo [QSR International]. This may help to increase inter-coder validity. For example, the researcher can confirm whether actual coding is reflected from their literature review by analysing the entire reviewed paragraphs using Leximancer. The conceptual map extracted from Leximancer would suggest what concepts the researcher should focus on when the one uses other QDA software to analyse data collected.

Both Leximancer and NVivo can create file(s) that export to Spreadsheet programs (e.g., MS Excel) and statistical programs (e.g., SPSS). The researcher can export the result of analysis and ensure whether outputs from both programs were consistent to increase inter-coder reliability if necessary.

Despite the potential of Leximancer, its ease of use and capabilities have not been fully realised yet. Current researchers tend to adopt advanced computer-aided QDA packaged programs (Ryan, 2004; Ryan and Bernard, 2000; Weaver and Atkinson, 1994; Weitzman, 2000). However, as the two-part case study presented in this paper will show, understanding and using the full potential of a general-purpose computer-aided QDA program, such as Leximancer, will assist in achieving superior quality of analysis in management research.

**Research design**

A two-part evaluation case study (Creswell, 2003; Yin, 2003) is used to demonstrate the capabilities and usefulness of Leximancer computer-aided lexical analysis software. The first part demonstrates the application of Leximancer within a quantitative research framework, utilising content analysis to analyse the web pages of businesses in Japan, the UK and the USA. The second part demonstrates the application of Leximancer, within a qualitative research framework to analyse interview data collected from Confucian Heritage students attending a first-year university course at an Australian university.
Case study data collection and analysis

Quantitative content analysis

The purpose of this study was to determine the ways in which the 5S concept (5S) has been understood and applied in Japan, the UK and the USA. The 5S is a Japanese management approach that is fundamental to lean production, an approach practiced by many businesses worldwide (Hirano, 1995; 1996; Osada, 1989; 1991). A quantitative content analysis was used to analyse the World Wide Web pages of Japanese and Western (UK and USA) organisations (Kobayashi, 2005). Quantitative content analysis refers to “a research technique for the objective, systematic and quantitative description of the manifest content of communication” (Berelson, 1952, p.18). Manifest content is restricted to visible words that appear in written text (Neuman, 2003). Quantitative content analysis with manifest coding is “a scientific method (including attention to objectivity-intersubjectivity, a priori design, reliability, validity, generalisability, replicability, and hypothesis testing)” (Neuendorf, 2002, p.10). Quantitative thematic content analysis basically counts the frequency of words then statistically tests the significance of differences in words employed between groups (Roberts, 1997; Weber, 1985).

In this study (Kobayashi, 2005), the unit of analysis selected was at the individual word level used to describe 5S on organisational Web pages. The unit of data collection was Web pages provided by each organisation, while the frame of data collection was the database of a popular search engine. A stratified sampling procedure was adopted utilising a sample drawn from a number of separate strata of the population (Babbie, 2004; Daniel, 1990) of available web sites. At the end of the data collection process, 86 pages from the US, 47 pages from the UK and 84 pages from Japan were prepared for analysis. The total number of items collected was 217, which was considered to be manageable, and was treated as a census for content analysis. Each Japanese Web page was then translated into English mainly through the use of a translation program called “King of Translation” [IBM Japan].

Leximancer found variables to be examined, converting Web pages automatically into text files by counting every third sentence and reproducing a new text file without human intervention (Smith, 2004). Files in .TXT format could be easily transferred into SPSS for statistical analysis. Components measured for this study were assigned from the outcome of a pilot test conducted by the initial execution of the Leximancer program. In quantitative content analysis, manifest coding (assigning each word as it is, regardless of its meaning) is usually employed. Leximancer’s automated learning capability generated and put similar words into groups automatically as synonyms, then represented them as a “concept” (Smith, 2004). Afterwards, a collection of concepts was compiled as a “Ranked Concept List” (see Figure 2). As thematic content analysis requires knowledge of the frequency distribution to analyse the major theme embedded within collected data, only descriptive statistics are needed. After the execution of the Leximancer program, the 38 words selected were put into six categories by agreement between three coders as shown in Table I.
Table 1. Six categories and concepts measured

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>EXPLANAT</th>
<th>BENEFIT</th>
<th>TARGET</th>
<th>OBJECT</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>organisation</td>
<td>activity</td>
<td>costs</td>
<td>company</td>
<td>equipment</td>
<td>improvement</td>
</tr>
<tr>
<td>order</td>
<td>easy</td>
<td>effective</td>
<td>customer</td>
<td>information</td>
<td>lean</td>
</tr>
<tr>
<td>cleaning</td>
<td>continuous</td>
<td>efficient</td>
<td>people</td>
<td>items</td>
<td>maintenance</td>
</tr>
<tr>
<td>standard</td>
<td>important</td>
<td>productivity</td>
<td>participation</td>
<td>machine</td>
<td>management</td>
</tr>
<tr>
<td>training</td>
<td>method</td>
<td>time</td>
<td></td>
<td>workplace</td>
<td>manufacturing</td>
</tr>
<tr>
<td>process</td>
<td>necessary</td>
<td></td>
<td></td>
<td></td>
<td>production</td>
</tr>
<tr>
<td>should</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>quality</td>
</tr>
<tr>
<td>system</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>safety</td>
</tr>
<tr>
<td>tool</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Those six categories were:
- GENERAL (general definition-related content): concepts that generally refer to any component of 5S;
- EXPLANAT (explanation-related content): concepts that characterise 5S using nouns or adjectives;
- BENEFIT (benefit-related content): concepts that express the benefit of implementing 5S;
- TARGET (target-related content): concepts with which the organisation communicates when implementing 5S;
- OBJECT (object-related content): concepts which express things that 5S deals with; and
- PURPOSE (purpose-related content): concepts that refer to the purpose of implementing 5S.

Country (COUNTRY) was the lens (independent variable) through which the dependent variables were studied. Dependent variables for this study were six areas of content (GENERAL, EXPLANAT, BENEFIT, TARGET, OBJECT and PURPOSE) these represented the 5S concept together with a general concept. The independent variable COUNTRY was manually assigned with three levels of nominal measurement to represent each of the countries being studied (1-UK, 2-JP and 3-US). Measured components for each dependent variable had two levels of nominal measurement (1-yes and 0-no) based on the presence (1-yes) and the absence (0-no) of each word in order to count its frequency.

Thematic content analysis - involved noting the frequency of appearance in organisational Web pages of the 38 concept words for each country. A summary of the 20 most frequently appearing concept words, in country order, is shown at Table II below.
Table 2. Summary of 20 most frequently occurring concept words by country

<table>
<thead>
<tr>
<th>US Concept*</th>
<th>AC**</th>
<th>RC***</th>
<th>UK Concept</th>
<th>AC</th>
<th>RC</th>
<th>JP Concept</th>
<th>AC</th>
<th>RC</th>
</tr>
</thead>
<tbody>
<tr>
<td>work</td>
<td>211</td>
<td>15.5%</td>
<td>work</td>
<td>118</td>
<td>9.2%</td>
<td>improvement</td>
<td>163</td>
<td>15.6%</td>
</tr>
<tr>
<td>area</td>
<td>155</td>
<td>11.4%</td>
<td>time</td>
<td>111</td>
<td>8.7%</td>
<td>place</td>
<td>161</td>
<td>15.4%</td>
</tr>
<tr>
<td>workplace</td>
<td>142</td>
<td>10.4%</td>
<td>area</td>
<td>107</td>
<td>8.4%</td>
<td>cleaning</td>
<td>153</td>
<td>14.6%</td>
</tr>
<tr>
<td>process</td>
<td>106</td>
<td>7.8%</td>
<td>workplace</td>
<td>95</td>
<td>7.4%</td>
<td>management</td>
<td>128</td>
<td>12.2%</td>
</tr>
<tr>
<td>organisation</td>
<td>95</td>
<td>7.0%</td>
<td>manufacturing</td>
<td>81</td>
<td>6.3%</td>
<td>time</td>
<td>125</td>
<td>11.9%</td>
</tr>
<tr>
<td>place</td>
<td>94</td>
<td>6.9%</td>
<td>improvement</td>
<td>72</td>
<td>5.6%</td>
<td>activity</td>
<td>120</td>
<td>11.5%</td>
</tr>
<tr>
<td>time</td>
<td>92</td>
<td>6.7%</td>
<td>cleaning</td>
<td>72</td>
<td>5.6%</td>
<td>method</td>
<td>100</td>
<td>9.5%</td>
</tr>
<tr>
<td>cleaning</td>
<td>84</td>
<td>6.1%</td>
<td>should</td>
<td>68</td>
<td>5.3%</td>
<td>order</td>
<td>96</td>
<td>9.2%</td>
</tr>
<tr>
<td>waste</td>
<td>73</td>
<td>5.3%</td>
<td>environment</td>
<td>68</td>
<td>5.3%</td>
<td>workplace</td>
<td>86</td>
<td>8.2%</td>
</tr>
<tr>
<td>items</td>
<td>73</td>
<td>5.3%</td>
<td>place</td>
<td>65</td>
<td>5.1%</td>
<td>business</td>
<td>79</td>
<td>7.5%</td>
</tr>
<tr>
<td>manufacturing</td>
<td>64</td>
<td>4.7%</td>
<td>standard</td>
<td>64</td>
<td>5.0%</td>
<td>actual</td>
<td>76</td>
<td>7.2%</td>
</tr>
<tr>
<td>tools</td>
<td>63</td>
<td>4.6%</td>
<td>process</td>
<td>62</td>
<td>4.8%</td>
<td>company</td>
<td>75</td>
<td>7.1%</td>
</tr>
<tr>
<td>training</td>
<td>61</td>
<td>4.5%</td>
<td>production</td>
<td>61</td>
<td>4.8%</td>
<td>people</td>
<td>72</td>
<td>6.9%</td>
</tr>
<tr>
<td>lean</td>
<td>59</td>
<td>4.3%</td>
<td>management</td>
<td>61</td>
<td>4.8%</td>
<td>necessary</td>
<td>71</td>
<td>6.8%</td>
</tr>
<tr>
<td>equipment</td>
<td>59</td>
<td>4.3%</td>
<td>items</td>
<td>57</td>
<td>4.4%</td>
<td>factory</td>
<td>63</td>
<td>6.0%</td>
</tr>
<tr>
<td>people</td>
<td>59</td>
<td>4.3%</td>
<td>quality</td>
<td>57</td>
<td>4.4%</td>
<td>training</td>
<td>60</td>
<td>5.7%</td>
</tr>
<tr>
<td>improvement</td>
<td>59</td>
<td>4.3%</td>
<td>organisation</td>
<td>56</td>
<td>4.4%</td>
<td>work</td>
<td>55</td>
<td>5.2%</td>
</tr>
<tr>
<td>environment</td>
<td>58</td>
<td>4.2%</td>
<td>equipment</td>
<td>55</td>
<td>4.3%</td>
<td>production</td>
<td>48</td>
<td>4.6%</td>
</tr>
<tr>
<td>system</td>
<td>56</td>
<td>4.1%</td>
<td>business</td>
<td>54</td>
<td>4.2%</td>
<td>case</td>
<td>45</td>
<td>4.3%</td>
</tr>
<tr>
<td>should</td>
<td>52</td>
<td>3.8%</td>
<td>people</td>
<td>50</td>
<td>3.9%</td>
<td>quality</td>
<td>42</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

Notes: *Concept = Word employed; **AC = Absolute count; ***RC = Relative count

As outlined above Leximancer extracted the main concepts contained within the data, counted the frequency for each concept (words) and displayed the results in a tabular format (Smith, 2004). Cross-tabulation analysis was used to identify any relationships between specified variables. The chi-square statistic was used to determine the significance of the analysis. Cross-tabulation with chi-square test confirmed the significant differences in the use of the 5S concept between the West (US and UK) and Japan (Kobayashi, 2005).

Qualitative content analysis

The purpose of the research reported in this part of the case study was to investigate the ways in which Confucian Heritage students develop their learning styles during university studies. The study collected qualitative data from students engaged in a first-year course at an Australian university. For most students the course was one of their first university undertakings. Six Confucian Heritage students voluntarily participated in this study. Data were collected using semi-structured formal interviews. Interviews were audio-tape recorded then transcribed using Microsoft Word. The principal researcher converted these files into portable data format (PDF) documents and commenced analysis using Leximancer as a qualitative analysis tool. A co-researcher printed paper copies of the interview transcripts for analysis in the traditional “manual” way. Both analyses were conducted independently.

In computer-aided lexical analysis the latent content or meanings of words form the units of analysis (Krippendoff, 1980). The initial execution of Leximancer identified 18 concepts. The number of concepts to be considered by Leximancer was increased incrementally and the program again executed. This was continued up to a setting of 30 concepts. After these iterations it was observed that no new concepts above 23 were evident; therefore the concepts identified in the analysis were deemed to be saturated by the principal researcher, as proposed by Strauss and Corbin (1998). A feature of Leximancer is its ability to display concepts, and
the relationships between them, in a conceptual map. “Gaussian” mapping was selected as it emphasises similarities between concepts. Although co-occurrence was not a central focus for this study, Leximancer also provides a “Linear” type of mapping which emphasises co-occurrence between concepts (Smith, 2004).

The result of thematic and cluster textual analysis

Thematic analysis of the six transcribed interviews, conducted using Leximancer, suggested that the most frequently occurring concepts were Think, Essay, Understand, Feel, Group, Theory, Learn and Experience (the “boldness” of the words on the conceptual map indicates frequency). Most concepts were clustered in four overlapping areas that represented the ways in which Confucian Heritage students learn in an English environment, as shown in Figure 2 below.

![Figure 2. Conceptual map of learning process by Confucian Heritage students.](image)

Since the most frequently occurring concept was Think, this indicates that thinking is central to Confucian Heritage students’ learning processes. Think, write and essay are closely placed in the map indicating that students think mainly about writing essays.

Model development from conceptual map

The Gaussian conceptual map in Leximancer can be used for developing a model from data. Leximancer’s “thesaurus” and “document-log” functions assist interpretation and deeper analysis. Confucian Heritage students think mainly about writing essays. They look at theories which change their thinking from hard to easier. This experience is related to understanding English and people. They understand from questions through group work and lectures (including tutorials) which require time. Talking among students and getting information in an Australian context is associated with the word “should” which implies dedication to learning. Thinking precedes learning. This iterative process can be represented as a “learning process model of Confucian Heritage students in English speaking environment (Australian context)”, as shown in Figure 3.
Figure 3. Learning process model of Confucian Heritage students in English environment.

The learning styles of Confucian Heritage students can be mapped onto a visual, auditory and kinaesthetic framework, as proposed by Lamarche-Bisson (2002). Furthermore, students appear to have used an action learning method (Revans, 1966), albeit possibly unintentionally or unconsciously, as they progress from learning to understanding. As students pass through the stages of learning, they appear to follow a cycle similar to the plan, do, study, act cycle developed by Deming (1986; 1994) as a knowledge management system with the aim of enhancing learning, innovation and organisational improvement.

Leximancer’s analysis of student interview data shows that around the central activity of thinking, there are four related major activities: experience, understanding, interaction with other students and finally learning, which have frequent occurrence as well as strong co-occurrence with thinking.

The interpretation of the principal researcher was that when a loop starts, students feel uncomfortable about writing essays. When essay writing is a first assessment experience for students, they think and interact first with theories. However, some students realise that certain theories are not related to what they are feeling or that some theories are difficult to understand. They think about tasks in the given assessment as either relatively easier or difficult to understand based on past experiences. These include always thinking about their experiences or of learning, depending on ability, capacity or experience. This link between students’ feelings and theories is reflected by thinking and then applied to their experience. This is reflected in student comments such as “writing is actually easier than looking for the information” or “because English is not my first language, it is hard to have a conversation with the lecturer”.

From theories and their experiences, students attempt to balance understanding the given assessment, communicating in English as a second language and the interpersonal challenges of group work. These experiences and understanding processes are repeated over time until their strategy of learning shifts from theories to interaction with people. They talk with other people to learn, especially in the group environment. They also ask questions using the time after lectures and in tutorials. At the end, they develop their learning style mainly by giving and sharing information.

Traditional qualitative analysis

The method of analysis chosen by the researchers was finding themes or patterns of similarity and difference in students’ experiences of teaching and learning. Data were analysed qualitatively for themes in the manner suggested by Boje (2001). The aim of the analysis was to find out how Confucian Heritage students carried out their studies and how they saw, experienced and made sense of a number of themes such as learning, understanding,
memorising and their own efforts to learn. The second researcher analysed the transcripts of the interviews, initially coding these using an axial coding approach (Strauss and Corbin, 1998) to identify and note concepts arising from the data. Analysis of the first interview was completed, identifying and noting a number of concepts. The second interview was analysed in a similar manner yielding basic similarities and differences. The aim was to grasp the variation in meaning of every theme and the relationships between different possible meanings of the same theme or categories by constantly comparing interviews. Interviews became richer and fuller as analysis progressed. Several interviews were also analysed by the third researcher to ensure that concepts and categories were consistent with the data.

Results of qualitative analysis

Traditional qualitative analysis indicated four main themes arising from the data. Themes were the informality of relationships with teaching staff, English language difficulties, group work and the ways in which Confucian Heritage students learn. The ways in which Confucian Heritage students learn was the predominant theme.

It is apparent from the interviews that Confucian Heritage students utilise repetition and memorising as steps that leads to understanding. Students read, repeat aloud or write several times to ensure their understanding of the material. Comments from students include:

Student three: “When I memorise things, I write them many times and try to speak them out few times.”

Student four: “I learn by myself lots of times and […]. So the more I do it, the more confident I feel. And I think I have a good memory so I keep on repeating the name and remember.

Student five: “I read the textbook; I read the lectures notes and when I do not understand I re-read the lecture notes and try to understand”

Student four: “I always read the lecture notes first and what is going on in each lecture and I take notes, I listen and I take notes as much as I can and after that when I come back home I read the text book and get more information about the lecture. And I reread the lecture notes and make sure that I understand or not.”

Confucian heritage students are also aware that repeating and memorising is not enough if they want to achieve a deep understanding and long term learning. The interviews suggest that memorising, learning and understanding are linked through an active and cyclical process.

Student three: “Memorising is to know and to remember something. To understand you have to go further and try to learn.”

Student six: “Understanding is applying a concept. […] If I just remember or memorise the definition of stereotyping, I just forget it. But if I think about stereotyping as something that we make assumption on something, and if I think about examples like Chinese are...I can say, oh yeah, this is the idea of stereotyping.”
Confucian Heritage students achieve deep understanding by applying a concept and making connections with the real world. This suggests an iterative or cyclical process involving thinking, reflection and application.

Student one: “In China, we think that the learning should be: putting the theory into practice. Use the theory to change your real life, to make your life better. The theory can not just live in the textbook; you should make the theory active. We emphasise the use the theory to indicate your real life.”

Student five: “I think I can say my opinion in a reflective essay so I feel more comfortable writing a reflective essay.”

Student three: “I think it is easier because I have these basic concepts and theories and base on that I need to know what there mean exactly then I can reflect on the outcome or the insights that I gained. It is easier and better to learn for me when I am using the 1st person. I think I better understand what the theories are about. Because when I reflect on the theory I have to know exactly what there are. And I read them many time and try to make these theories fit to myself. So it helps my learning.”

Student two: “I think we can find some differences from our personal experience and the literature and I think some literature is very helpful and it will tell you for your personality what is suitable for you and what you should do and I think that quite helpful. And I can learn what my problems in my studies are and I can say that to the teachers and I can improve myself and my experience I think.”

Student four: “The reflective essay is more for my insights and it makes me realise how I am and how I think.”

Student six: “Reflection is a time where you can actually stop and say” ah, did I do the right thing or could I have been able to do something better?” “…so I guess it is a big opportunity to think if the things that we have done are appropriate or if there is another way that we could have done thing better.”

Student four: “I read the textbook or the lecture note and I always try to read fast and relate to my feelings or my experience. […] If I can say the theory in my own words, it means, “Totally understand” for me […] I change the theory to my own words and I use this technique to remember the theory as well.”

From the main theme identified from the interview data the second researcher, operating independently from the principal researcher, suggested that Confucian Heritage students learn in a way that is consistent with Argyris’(1976b) four step action learning model of Discover, Invent, Produce and Generalise. Furthermore, this learning cycle occurs as single-loop learning within a wider environment which ultimately leads to double-loop learning (Argyris, 1976a). In summary, Confucian Heritage students approach learning initially as a
single-loop or “surface” approach based on repeating, memorising, reflecting and learning. Single-loop learning occurs in an environment of transformational learning, relationships, deep approaches and collective, collaborative study that represents double-loop or “deep” learning.

Discussion

Leximancer is a textual data-mining program that offers utility for management researchers in various ways. These include:

- as a quantitative lexical analysis tool;
- finding concepts and themes as well as clustering concepts (Krippendorf, 1980; Neuendorf, 2002; Roberts, 1997; Weber, 1985);
- linking concepts to theories (Ryan and Bernard, 2000; Weaver and Atkinson, 1994; Weitzman, 2000); and
- assisting qualitative analysis approach, either as a stand-alone package or in conjunction with other computer-aided QDA (CAQDA) packages (Gibbs, 2002; Ryan and Bernard, 2000; Weitzman, 2000).

As a quantitative lexical tool for content analysis, Leximancer is effective in dealing with data that has not been structured or prepared for analysis, such as information located on the World Wide Web. As the quantitative analysis reported in this paper shows, large volumes of unstructured data, some in Japanese, can be readily analysed and meaningful conclusions drawn.

For qualitative analysis, Leximancer is able to identify concepts and themes arising from textual data. This paper suggests that the explanations of the principal researcher using Leximancer and those of the second researcher using traditional “manual” methods of theme analysis were closely related. Using Leximancer to obtain a “feel” for the data, concepts and themes reduces both time and labour in the initial stages of analysis. One caveat that should be mentioned is that Leximancer obviously does not provide reflexivity (Silverman, 2001). Although the qualitative functions of Leximancer, such as the conceptual map, are extremely useful to researchers there is no claim that Leximancer is a substitute for the researcher in the research process.

Thematic analysis is useful when the researcher wants to grasp subject matter within a topic of investigation in management research. This can also be used as a departure point of a study within any methodology (Krippendorf, 1980). Cluster analysis is commonly used as a classification technique to explore patterns of data (Bailey, 1994). Qualitative strategies vary depending on what a researcher wishes to analyse (Gibbs, 2002) but examining themes, concepts, clusters and co-occurrence are the fundamental analyses adopted in computer-aided lexical analysis. Linking concepts to theories is quite important in order to connect the empirical world the researcher is investigating with general theories (Ryan and Bernard, 2000). Linking “competing” research frameworks is also an important issue for researchers (Olson, 1995).

Silverman (2001, p. 37) has proposed that one should not “push the quantitative/qualitative distinction too far”, arguing that both approaches can be complementary within the same research project. Olson (1995) has suggested that there are three main considerations that support the notion of using lexical analysis to build a “bridge” between quantitative and qualitative research.

Firstly, lexical analysis is adaptable; it may be used to analyse data either quantitatively or qualitatively, although some researchers still argue for a quantitative categorisation (e.g., Neuendorf, 2002; Roberts, 1997; Weber, 1985) on the basis that the purpose is to quantify text. Nevertheless, the fact remains, lexical analysis of data may be either quantitative or
qualitative and there is nothing to prevent the use of both approaches within the same research project. Secondly, although the importance of context is much emphasised in qualitative research, a quantitative approach also considers environmental factors in data gathering, especially space and time (Olson, 1995). Thirdly, numerous triangulation techniques are commonly used by researchers, so the mixing of methods is already taking place. Unfortunately the advantages of each approach have the tendency to cancel each other out if care is not taken (Olson, 1995). Such issues should not arise in using lexical analysis as a bridge between quantitative and qualitative frameworks as they are complementary approaches within lexical analysis. Although this paper presents two independent uses of lexical analysis there is no reason why both approaches should not be used in the same study. The use of lexical analysis software allows simultaneous analysis of both forms of data, thus bridging the quantitative/qualitative divide.

A further use for Leximancer, not developed in this paper, is that of code generator for another CAQDA package, such as NVivo. It has been suggested that coding is the most critical part (Dean, Sharp and Gen, 2005) in CAQDA because it involves issues of inter-coder validity (Weitzman, 2000). Leximancer’s automatic conceptualisation assists coding and therefore can be used as a seed for another CAQDA. For example, each concept appearing in Leximancer can be used as a “node” for NVivo. By using the “text browser” function in Leximancer and the “text search” function in NVivo, those concepts may easily be assigned as “nodes”, dramatically reducing the coding process time while achieving increased validity. After the coding in NVivo, the “node summary” may be exported again to Leximancer to confirm inter-coder reliability.

Conclusion

This paper has presented and discussed the use of Leximancer software as a computer-aided lexical analysis tool that has utility for both quantitative and qualitative management research. Data analysis was presented in the form of a case study.

Used as a quantitative tool, in this case to provide a content analysis of business web pages, Leximancer has shown that in-depth manifest analysis of voluminous, complex textual material can be undertaken effectively and efficiently. Non-English text can also be analysed relatively easily.

As a qualitative tool, Leximancer’s conceptual and thematic features were used to analyse interview data transcribed as text. The conceptual map and interpretation of Leximancer’s output by the principal researcher were close to the interpretation of the second researcher, undertaken independently, using “traditional” methods of analysis. Using Leximancer to identify concepts and themes would have reduced both the time and labour involved in the “traditional” analysis.

Computer-aided lexical analysis is an important addition to the researcher’s toolkit. While it is not claimed to replace the role of the researcher in the research process, it does provide a useful and important bridge between quantitative and qualitative research.
References


