

**Towards the Generalisation of a Case-Based
Aiding System
to
Facilitate the Understanding of Ethical and
Professional Issues in Computing**

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Abstract

Modern computers endow users of Information and Computer Technology (ICT) with immense power. The speed of the computing revolution has enabled the novel implementation of ICT before consideration of consequent ethical issues can be made. There is now a demand by society that students, ICT novices, and professionals should be aware of the social, legal, and professional issues associated with ubiquitous use of computers.

This thesis describes the development of an Internet-based tool that may be used to raise students' awareness of the ethical implications of ICT. It investigates the application, meaning, and scope of computer ethics. Theoretical foundations are developed for the construction of the tool that will classify, store, and retrieve a suitable analogous case from a collection of real-world, ethically analysed ICT case studies. These are used for comparison with ethically dubious events that may be experienced by students. The model draws upon the theoretical aspects of mechanisms for the modification of users' ethical perception. This research is novel in linking these theories to ethical understanding and case retrieval.

Little information is available upon the retrieval of documents addressing ethical issues. The classification and retrieval of material using an ethical framework has some commonality with legal retrieval. Similarities are investigated, and concepts are adapted for the retrieval of ethical documents. The differences that arise present challenges for new research.

The use of artificial intelligence (AI) retrieval techniques is not acceptable to meet the pedagogic aims of the retrieval tool. A model is developed, avoiding the use of AI in the reasoning process, requiring the student to consider and evaluate the ethical issues raised. The model is tested and evaluated. The research suggests that non-AI paradigms may be used for retrieval of ethical cases, and that areas for future investigation and development exist.

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Glossary

Adversarial Legal System

A system of jurisprudence where a case is argued between the prosecution and the defence, usually before a judge and jury.

ACM

Association of Computing Machinery.

AI

Artificial Intelligence.

Analogous Case

A case retrieved by the case retrieval tool that is similar in many respects to the student's given case description.

Analogous Reasoning

Reasoning by the comparison of analogous cases.

BCS

The British Computer Society.

Big Bang Approach

The application of all criteria simultaneously to a retrieval query (as in a 'query by example' retrieval undertaken by a relational database) – the reverse of a stepwise process for the formulation of a retrieval query.

Boolean Responses

Responses having only 'yes' or 'no' as acceptable values.

Case-Based System

An information system using case studies and analyses for the provision of facts and guidance.

CBR

Case-Based Reasoner.

CCSR

Centre for Computing and Social Responsibility, De Montfort University.

CPD

Continuing Professional Development.

Cybernetics

The science of information feedback systems.

Database Engine

The retrieval and data manipulation system used in relational database management systems.

Database Management System

The database application program incorporating the retrieval algorithm and facilities for accessing and manipulating the data held as tuples within the data structure of the program.

DSS

Decision Support System. A system providing information and advice upon the formation of a decision, based upon stored information within the data store of the DSS.

Flow Theory

The theoretical basis for the stimulation of a state where a human becomes so involved in a task that time and reality apparently cease to exist. Decisions flow unconsciously, and an individual becomes involved in the task for its own sake.

Given Case Scenario

A case study given to students for ethical analysis and comment as part of an assignment.

Hypernorms

Behaviours that are guided by ethical principles so fundamental to human existence that they transcend religious, cultural and philosophical beliefs. They remind us of the duties that we *ought* to honour.

IBM

International Business Machines, a US multinational company specialising in the manufacture and supply of computers, software, and office machinery.

ICT

Information and Communications Technology.

IEEE

The United States' Institute of Electrical and Electronics Engineers.

ImpactCS

A joint taskforce of the ACM and IEEE, funded by the USA's National Science Foundation, to examine and advise upon the content of the Computer Science curriculum.

Inquisitorial Legal System

Usually applied to largely rule-based Romano-Germanic legal systems, adopted in continental Europe, using a judge as an investigator to establish guilt or liability of an accused party.

IS

Information System.

Knowledge-based System

A system that uses accumulated knowledge and reasoning strategies to provide guidance and advice upon problem domains.

Lexis

An internationally recognised database for the reporting of legal judgements.

MLE

Mediated Learning Experience.

Non-ICT Professional

One who has special responsibilities to society, but does not have specialist training in the use of ICT.

RAE

United Kingdom Royal Academy of Engineering.

Retrieval Vector

A feature or issue in a case that may be used for classification and retrieval.

Safety Critical System

A computer system that directly affects the physical safety of human beings.

SCM

Theory of Structural Cognitive Modifiability

Stakeholder

An actor in an event under investigation, who either affects or is affected by the actions that occur.

TPB

Theory of Planned Behaviour.

TRA

Theory of Reasoned Action.

TSE

Theory of Self-Efficacy.

NAO

United Kingdom National Audit Office.

UN

The United Nations Organisation.

Weighting Factor

A factor applied to a retrieval vector to increase its sensitivity to contextual issues.

Westlaw

An internationally recognised database for the reporting of legal judgements.

Chapter 1 - The Research Context

1.1 New Technology and Its Ethical Challenges

Throughout its evolution, humankind has passed through a series of identifiable developmental phases. Each phase, beginning with the adoption of primitive stone or bone implements, has been in response to the discovery and integration of new forms of tool or technology (Mithen 1996, pp.17-27). As the power of the human mind has emerged, the period taken for the development and maturation of the succeeding technologies has decreased. In earlier times, the slow pace of technological development allowed humanity to consider and evaluate the effects of the new technologies upon others. People were able to take time over reconciliation between the increasing sophistication of the technologies and the clarification of societal standards for their use. However, Mithen (1996, p.23) observes that the pace of development has steadily increased with successive waves of technological invention. The pace of technical development and implementation of information and communications technology (ICT) has now outpaced the ability of humanity to evaluate and integrate it into society using previously accumulated technological norms. Information technology has permeated the lives of much of the earth's human population (Gorniak-Kocikowska 2004, p.319; Bracken 2003, pp.358-359).

The power, connectivity, and ubiquity of computers bestow upon computer users immense power for good or evil use (Sproull, Kiesler, and Zubrow 1994, pp.583-587). Rogerson and Bynum state that:

"Computing Technology is the most powerful and flexible technology ever devised. For this reason it is changing everything – where and how we work, learn, shop, eat, vote, receive medical care, spend free time, make war, friends and love." (Rogerson and Bynum 1995, p.4).

Society must now learn to meld societal norms and standards with the precision and power of ICT. This research considers how those who develop and use ICT can be influenced to adopt an ethical, benevolent, and responsible approach to its deployment.

1.1.1 Issues of Power and Invisibility

The power of computers is exercised through the medium of software that is invisible under most conditions (Moor 1985, p.273). This creates a mystique in the perception of many,

granting power to those who are able to program computers and manipulate the information that computers contain. New uses of ICT are implemented before a full and considered evaluation can be made of the ethical issues that it raises (Rogerson and Bynum 1995, p.4). Rogerson and Bynum foresee problems in this situation unless the moral issues raised are addressed. They consider that the use of computers has created an information revolution, a tidal wave of information that has now become the life-blood of society. The current state of technology and society requires that individuals submit, often unknowingly, to the invisible power of the computer. Modern society in the developed world now exists, and its needs are addressed, through digital icons representing individuals and the information about them that can be processed by the computer. This implies a trust by those individuals in the developers and users of ICT.

Bracken (2003, pp.358-359) describes several ICT disasters where public trust in ICT practitioners appears to have been misplaced. She seems to suggest that those who develop computer applications should be more aware of the trust placed in them. The issue of blind trust in the products of computer processes is also raised by Moor (1985, p.275), who links it to the issue of visibility. He comments that manipulation of data can be done invisibly, with those affected by the actions of the computer often being unaware of the processing that can be, or is taking place. Gotterbarn (1998b, p.245) notes that the software engineering community has a significant impact on society, and is finally moving towards acceptance that it should adopt high standards. He suggests that professional ICT societies should introduce self-regulation for their members. This will, he postulates, provide evidence to the public that ICT practitioners are professional in their conduct, and that the products they produce are safe and ethical.

1.1.2 Issues of Relevant Policies for the Ethical Use of ICT

The belief of Rogerson and Bynum (1995, p.4) and Conger and Loch (2001, p.60), that the development of technology is outstripping society's ability to consider the ethical consequences of its use, is recognised by Moor (2001b, pp.89-90). He notes that the inability of current ethical thinking to address the challenges posed by the development of computers continually raises novel ethical problems. It has led to a policy vacuum (Moor 2001b, pp.89-90) concerning how ICT should be used by society. Moor also believes that there is a conceptual vacuum created by

doubts concerning which ethical issues can truly be attributed to the use of ICT. Many so-called 'ICT problems' are fundamentally similar to ethical problems in other areas of life, but are given a unique bias by the involvement of a computer. This has led to a misconception concerning the application of ethical principles to the deployment of ICT. Moor observes that:

"What is unique about computer ethics is the technology. Computers are unique, for they are, at least in principle, universal machines like no other. They are **logically malleable** both syntactically and semantically. By constructing new algorithms or new interpretations of machine states we can adjust their functionality almost without limit. We can design them, teach them, and even evolve them to do what we want them to do." (Moor 2001b, p.89).

On computer ethics, Moor comments:

".... computer ethics is a dynamic and complex field of study that considers the relationships among facts, conceptualizations,¹ policies, and values with regard to constantly changing computer technology. Computer ethics is not a fixed set of rules which one shellacs and hangs on the wall.. Computer ethics requires us to think anew about the nature of computer technology and our values." (Moor 1985, pp.267-268)

This makes a strong case for those who develop and use ICT to adopt a dynamic approach to the ethical application of the new technology. However, the ubiquitous use of computer technology has given the immense power of computers to a wide spectrum of society. The consequences of ICT use will therefore affect much of society, either as direct users of the technology, or as recipients of its effects. Nafstad considers the effects upon those entrusted with our personal, sensitive data, and notes that:

"Medical doctors, psychologists, engineers, teachers, researchers, and others have become important agents in our everyday lives.....Consequently, the production, dissemination and application of scientific knowledge has a fundamental impact on the modern human being. In turn, the ethical and value standards of the production of knowledge becomes an important issue, not only to the scientific community and the professions, but to all of us." (Nafstad 2003, p.145)

The implication is that professionals who have easy access to private or sensitive data have a moral obligation to use it in an ethical or professional manner. However, the actions of non-ICT professionals are moderated by the professional standards used by ICT professionals to create the technology and information processing applications.

¹ Where quotations from US authors are used in this thesis, their original US spellings are used.

1.1.3 Issues of Responsibility and Accountability

The world has now entered the information age, fuelled by the wide application of computers to store and manipulate information. However, such dependence upon computers comes at a price. Bissett (2001, p.242) notes that the power of the computer can now uphold or deny an individual's right to fair consideration by society. He suggests that 'social' computer systems, such as that of the UK Social Fund,² deserve as much audit consideration as safety-critical systems. The implementation of systems that remove the overriding element of human judgement tend to ignore the social consequences of applying the simple production rules often used in such systems. Bissett appears to suggest that this case is a typical failure by so-called professionals to consider the consequences of unevaluated deployment of computer technology upon a naïve public. Without fair and accurate representation of individuals by their digital icons, and attention to the human rights of those affected by the application of ICT, much of modern life would be impossible. The information revolution is fundamentally social and ethical (Bynum 2000a, p.274). Government, organisations, and individuals would be making a grave mistake to view it as simply a technological phenomenon (Rogerson and Bynum 1995, p.4).

Here is the nub of the problem. Although many use computers, the responsibility for their ethical development must remain with those who design and program ICT. The developers decide, consciously or unconsciously, what actions a computer will take for a given input. The public has a right to expect that those who have the power to develop ICT applications so deeply influential upon the lives of much of humanity will exercise that power in a just and ethical manner. This is the basis for Moor's (1985, p.268) claim that computer ethics is a discrete branch of ethics deserving special attention and study. Unfortunately, deeper consideration and

² The UK's Social Fund is administered by the Government's Benefit Agency. It is intended to provide discretionary, interest free loans of up to £1000 to the poorest families, those with special needs, the elderly, and the disabled for the purchase necessities such as shoes, clothing, cookers and beds. The system was computerised in April 1999. Before computerisation, approximately 11,000 applications per year were rejected by human assessors, but the number of rejections rose more than thirty-fold following computerisation. Disabled people and those with special needs have been especially affected by the new automated system. The enormous increase appears to be an unintended consequence of the system automation that previously allowed the human assessors some room for manoeuvre.

reflection of the consequences emanating from the deployment of ICT are not always practised. Anderson comments upon the UK approach to the preparation of computing students for the workplace, stating:

"The power, which even the simplest computer bestows, is chilling. Given that power and its potential consequences, the fact that British students can complete their education all the way to PhD level without ever having had to consider a single moral question seems to me to be a national disgrace". (Anderson 1998, p.27)

There is also evidence suggesting that experienced computer professionals themselves fail to recognise many of the basic ethical issues associated with the use of ICT (Maner 2004, pp.39-40). Anderson (1998, p.27) comments that, during his time in computing, he has never heard raised a single moral question that addresses the ethical issues associated with ICT. This situation is only now beginning to change (RAE 2005a). Lelewer (1994, p.253) believes that computer professionals can and should prepare themselves to face the ethical challenges that the use of ICT brings. Gotterbarn observes that:

"As the practice of computing has changed, so have the computing practitioner's ethical obligations changed in both degree and kind". (Gotterbarn 1994, p.178)

This statement recognises the comment of Moor (1985, pp.267-268) that computer ethics is a constantly changing environment. It will therefore require both novice and expert, professional and non-professional users of ICT to be aware of the effects of their actions upon others. They need to develop and continually update their awareness so that they can identify and address the new challenges that ICT will present. This begs the question of how this awareness may be stimulated and raised, and how present and future computer professionals can be prepared to address these challenges.

1.2 Ethical Implications for Education and Professionalism

Several authors have considered the effect of ICT upon modern societal and personal ethics. Gotterbarn states:

"First, the general populace wants some way to ascertain that the computer developer has the skill and commitment to perform the job they are hired to do. Second, computing as a profession needs to codify what they expect of themselves as a profession, so that anyone entering the profession clearly understands their responsibilities as a computer professional" (Gotterbarn 1994, p.178).

Evidence suggests that unethical behaviour is present in the workplace (Wahlstrom and Roddick 2000; Leonard and Cronan 2001, p.2; Calluzzo and Cante 2004, p.301). Calluzzo and Cante note that in a recent US survey, 45% of the users of ICT questioned admitted unethical behaviour. Prior, Fairweather, and Rogerson (2001), Prior, et al. (2003), and Prior, et al. (2005) found continuing evidence of indifference or opposition to the requirement for ethical conduct amongst a selection of ICT students and professionals. Peppas and Diskin (2001, p.347) believe that students have become accustomed to seeing unethical behaviour by many who should be role models. De Ronde (1996, pp.54-56) suggests that practical guidance is required for students so that their actions in commerce and industry may be prevented from causing harm to their employers or to others. Students, the future computing professionals, should be the primary focus of efforts to raise awareness of the effect that ICT can exert on society.

Much literature is available concerning the education of computing students to address the ethical issues that are produced by the deployment of ICT. However, De Ronde (1996, p.54) finds that many academics have lost touch with real-world situations. The solutions to ethical business dilemmas that are provided by educators in academia seldom provide the real-world guidance needed by the students for the development of their careers. Nafstad (2003, p.145) suggests that university courses attempting to teach ethics tend to deal primarily with codes of conduct, and often lack any relevance or relationship to real life. She notes that ethics should be concerned with recognition of ethical values and assumptions, and the development of ethical competence and sensitivity.

There is little evidence to demonstrate the development of practical, real-world systems that are useful to students by addressing the perceived gaps in the students' experience (Artz 1998, p.11). Research by Prior, Fairweather, and Rogerson (2001) reveals that the issues of surveillance, security, privacy, ownership of intellectual property, responsibility to clients and users, and use of employers' ICT facilities are typical areas of uncertainty. Most educational systems appear to be based upon contrived or sensationalist case studies that fail to address real-world issues, and are often heavily edited for publication (Gotterbarn 1998a). Furthermore, Harmon and Huff (2000, p.25) find that there are few suitable ICT-specific cases available for student consideration. Most existing cases are overly short and simplified, failing to promote

discovery and experiential learning, or to stimulate reflective, deeper thinking. Furthermore, the use of only case studies addressing catastrophic events tends to convey to students the impression that ethics is solely concerned with this type of incident (Gotterbarn 1998a). Deeper thinking is essential to develop students' analytical capabilities when addressing the novel ethical situations. This supports Moor's (1985, p.268) call "to think anew about the nature of computer technology and our values".

1.3 Ethical Awareness - Current Concepts and Avenues for Progression

Perceived solutions to the problem of raising the ethical awareness in ICT professionals span a continuum. Some authors see the solution to the apparent lack of ethical awareness in the development and the enforcement of the codes of ethical conduct by professional computing bodies (Gotterbarn 1994, p.178; Gotterbarn, Miller, and Rogerson 1999, p.103; Buchanan 2001, p.529). Others (Anderson 1994, p.49; Gorniak-Kocikowska 2004, p.324) note that most computer users are not members of such organisations. Nevertheless, although not bound by professional codes, non-professionals still need to adhere to acceptable ethical norms. Gorniak-Kocikowska (2004, p.324) agrees with Moor (2001b, pp.89-90) that ethics in its present state is unable to address adequately the problems presented by ICT. She proposes that ethics should be redefined to take account of the ubiquity of ICT. Computer ethics should become part of a wider, global ethic. This would allow all users of ICT to be included, as all are inevitably endowed to varying degrees with the power that ICT bestows. She concludes that all who use computers be regarded as falling into the category of computer professionals. This view has prompted much discussion concerning who should be regarded as 'computer professionals'. If it is followed to its logical conclusion, anyone working with a computer should be aware of the effects of their computing activities upon others.

The need for attention to be focused upon students has been identified in section 1.2 above. Calluzzo and Cante (2004, p.301) found that most students have misconceptions about what represents unethical behaviour. They argue that students' uncertainty about ethical standards will carry over into their workplace after graduation. Gautschi and Jones (1998, pp.206-207) observe that business students often have an incomplete schema identifying a moral concept of

a particular ethical issue. The level of recognition will flow from the degree of 'fit' between a student's schema and the facts presented by the occurrence of the issue. The more experience that the student gathers, the more complete will be the schema, and the better will be the recognition of the underlying dilemma. Ability to recognise that an ethical issue exists relies heavily on previous experience.

It is almost inevitable that modern business will utilise ICT. The introduction of new technologies can have a profound effect upon interpretation of ethical principles (Wahlstrom and Roddick 2000). Furthermore, the education of students who will graduate as future professionals in the business and computing environment has, until recently, omitted any meaningful consideration of ethical issues. This point, so clearly identified by Anderson (1998, p.27), is now being addressed by governments and professional societies (Anon 2006). Students need to be made aware of what constitutes unethical behaviour, and to develop critical thinking skills (RAE 2005a). Van Gelder (2001, p.539) observes that critical thinking is exercising the forms of thought most conducive to sorting the true from the false - 'the art of being right'.

1.4 The Awakening of Responsibility

Globalisation of ICT has now made the responsibility for the consequences of ICT deployment a pressing international issue (Hamilton 2006). Some institutions, particularly governments of the Western world, have turned their attention to the problem through legislation (Spinello and Tavani 2001, pp.215-225), or through the encouragement of education and training (Frankel 1989, p.110; Anderson 1994, pp.50-51; Race 2000, pp.16-17; RAE 2005b). Professional computing bodies in many countries require that students be made aware of the ethical issues affecting ICT users. These issues will inevitably affect society in general. Mature ICT professionals have a moral duty to educate novices in understanding the consequences of the work that the novices will be asked to undertake in their future careers (Prior, Fairweather, and Rogerson 2001, p.36).

Before leaving university, students must accumulate knowledge of the culture and professional standards required in the workplace, and develop a professional ethos (Castleman and Coulthard 1999, p.181; RAE 2005a). Castleman and Coulthard consider that both students and

industry depend upon this transfer of knowledge. Furthermore, their research elicited that students need to accumulate more than just technical skills if they are to be successful in their chosen careers. They require a good appreciation of appropriate professional conduct, working styles, and general characteristics of industry. Employers are shifting the focus of their requirements from technical skills to a more people-based approach, requiring a strong appreciation and understanding of ethical issues (Turner and Lowry 1999, p.1056).

Some authors consider that the most effective approach for the modification of an individual's ethical stance is to target their personal ethical code and raise awareness of the issues involved (Friedman and Khan 1994, p.67; Fleischman 2001, pp.172-173). Others believe that strict imposition of external codes of conduct upon, and licensing of individuals is the way forward (Gotterbarn 1994, p.178). Mason (1995, p.55) rightly tends to favour a combination of the two approaches.

1.5 Awareness through Case Studies

Piaget's Theory of Cognitive Development postulates that intellectual development is an intrinsic continuum of learning, not requiring external mediation (Gross 1996, p.696; Child 1997, p.191). Feuerstein (1998, pp.10-22) takes the opposing view, suggesting that external mediation significantly affects cognitive development. His Theory of Cognitive Modifiability postulates that human intentions and actions are constantly being modified by the application of external mediation and stimuli through exposure to novel situations and experiences. How, then, can such external stimuli be presented to a wide cross-section of students in an understandable, interesting, and accessible manner in readiness for life beyond university?

Engineering has developed through the inspection and analysis of former events.³ Examination of such events may be presented to students for analysis and discussion in the form of case studies (Benbunan-Fich 1998, p.20). Rahanu (1999) employs Feuerstein's concepts, using case

³ The basic concept of professional institutions and practice has developed from retrospective examination of past disasters that raised public concern, such as the Tay Bridge disaster in the UK on 26 September 1879. This disaster led to public pressure for the formation, in 1909, of the Institution of Structural Engineers.

studies as external mediation in his model. However, Rahanu considers only 'failed computer systems'.⁴ Extension of Rahanu's concept to the wider range of ICT ethical issues offers the potential for guidance to ICT novices on a broad spectrum of ICT ethical issues. Interestingly, law also develops similarly (O'Connell 1996, p.42), allowing the establishment of precedent, or case law in the English-speaking tradition.

The use of case studies in engineering, however, brings with it certain disadvantages. Artz (1998, p.12) notes that few good case studies exist. Frequently, the tutor is tempted to use sensational cases, curtailed for the sake of clarity, which convey to students a misleading impression of events. Complex cases, when curtailed, lose some of the factual richness that would be of benefit to students. Artz (1998, p.11) suggests that case studies that are too long distract the student and the lecturer. Furthermore, few teachers have developed the skills to use case studies effectively (Artz 1998, p.13). Orpen (2003, pp.81-82) suggests that some case studies do not translate well from one culture to another.⁵ De Ronde (1996, p.56) suggests that care must be taken to avoid 'preaching' when using case studies. He also considers that the use of case studies promotes an excess of problem solving, obstructing development of moral character. Furthermore, he suggests that if all case studies focus only upon failures, there is a tendency for students to develop a low opinion of their chosen career, lowering their own moral standards. He disregards the possibility that, conversely, it may stimulate a 'missionary zeal' to correct the perceived deficiencies.

Most authentic case studies contain positive as well as negative aspects. This thesis demonstrates that a selection of suitable current, interesting cases having a direct relevance to students, and containing adequate background information, may be assembled if relevant information sources are identified. Education can be improved by providing students with

⁴ This is Rahanu's definition of the cases used in his research. All his case studies were limited to the issue of professional malpractice in failed ICT systems

⁵ This issue is an interesting point in this research. Students from different cultures appear to approach the ethical consequences of the case studies from different standpoints, but still seem to appreciate and understand the importance of the ethical issues raised. This is discussed in later sections of this thesis.

examples of analogous, ethically interesting episodes that have been analysed to form an 'aide-memoire' based upon ethical principles, illustrating good practice as well as bad.

1.6 Development of a System to Stimulate Deeper Ethical Reflection

A few authors have developed artefacts to assist in raising awareness of the ethical issues posed by the ubiquitous use of ICT. Maner (1998, pp.463-466) describes an instrument that prompts computer professionals to reflect upon their own personal ethical values. Rahanu, Davies, and Rogerson (1999, pp.3-5) developed a five-stage, case-based reasoner (CBR) system for ethical analysis of cases addressing professional malpractice,⁶ designed for use by undergraduate and postgraduate students to address social, legal and professional aspects of computing.

However, retrieval of an analogous case from a library of pre-analysed cases can be difficult. Unethical practice is difficult to classify. Many retrieval systems have an inherent, intentional tendency to 'interpret' information when retrieving. Some systems adopt a semantic approach to classification and retrieval. Others attempt to apply rule-based algorithms. A similar problem exists in the area of jurisprudence, where such models give difficulty with legal retrieval systems (Zeleznikow 2004, p.4). Computerised interpretation is not relevant for the retrieval required by this research. Furthermore, selection of suitable features used by the retrieval process for legal or ethical cases can be difficult. Eastman (2003, p.19) finds that students have difficulty in determining which issues raised by a case study are relevant to the root cause of a problem when presented in narrative form, often the case with ethical dilemmas. Eastman describes a system that is particularly suitable for students who have a poor appreciation of problem-solving techniques, and is similar to the approach used by Kallman and Grillo (1996, p.34), and by Rahanu, Davies, and Rogerson (1999, pp.3-5).

This research seeks to address many of the issues outlined above, and to extend the work of Rahanu (1999). His system's retrieval vectors, specifically addressing issues of information systems failure, are unsuitable for the wider gamut of computer ethics. Consequently, a new

⁶ See footnote 4.

retrieval algorithm is required using other retrieval vectors to address alternative areas of ICT unethical practice.

1.7 The Scope of the Retrieval Tool

The retrieval tool aims to assist novices to learn from the experiences of others, and to use that knowledge as a basis for their own self-development. Students are urged to realise that their actions will affect the lives and well being of others. They have a responsibility to act ethically, avoid the naïve application of rules, and adhere to the social and professional norms required by those who may be affected by ICT.

No attempt is made by the retrieval tool to teach, or preach to novices concerning fundamental ethical theories. It is intended to stimulate recognition and the exploration of ethical issues. The tool assumes that all users have an inherent set of ethical values. However, some individuals may have more highly developed values than others. It is inevitable that there will be differences in the perception of ethical issues due to cultural, environmental, religious, or other factors. Consequently, there is often no one morally 'right' answer to an ethical dilemma (Beu, Buckley, and Harvey 2003, pp.89-90). The tool does not attempt to provide one. It suggests avenues for consideration and further investigation that users might adopt in order to refine and develop their own ethical values.

Although ethics is a personal, internally created phenomenon, it is intrinsically linked to relationships with others. James Moor (Moor 2001a) notes that "Ethics begins with respect for people, both oneself and others." He also notes that ethics can be approached individually or socially. It is more than simply following a set of rules or guidelines. Students using the case retrieval tool, developed as a major part of this research, should not simply use it in isolation. Although the tool is designed for individual use, and has no group communication facilities, it is important that the user discusses the issues raised by the case analyses with others in a face-to-face situation. Loch and Conger (1996, pp. 76-77) suggest that individuation, the negative attitude that can be developed by computer users working in isolation, can lead to a feeling of anonymity and a decrease in ethical standards.

The tool is therefore intended to complement the input from peers and lecturers. It does not replace them. The tool aims to expand the student's knowledge store. It thus increases the student's ability to draw upon prior knowledge when discussing novel ethical dilemmas, and to consider more deeply the issues raised by the given case scenario. In practice, it has been found that the retrieval tool is most effective when students are organised into small groups of four to six people. They might be allowed a period of five to six weeks to consider and analyse a given case scenario and to carry out their own additional research into issues raised. The final product of their deliberations could be either a written report and analysis of their given case scenario, or a short presentation with a 'question and answer' session with class peers. However, it should be noted that during the period allowed for deliberation, the lecturer continues to provide, through lectures and tutorials, guidance and information upon ethical theory and its application to discrete areas of unethical conduct. The tool in its present form assumes that students have a fundamental concept of ethical behaviour.

However, the concept of the tool as a teaching aid to be used in a group context does not rule out the possibility that the tool could be developed further, if so required, to incorporate a stronger individualist approach. This development might be undertaken as a future research activity, and is identified and discussed in more detail in section 7.4.4.

The scope for unethical practice in the use of ICT is vast. The construction of a case library addressing all areas of unethical practice is beyond the scope of this research. The research therefore concentrates upon proving the principle that cases can be successfully retrieved from the library by the use of ethics-based retrieval criteria. However, it limits itself to two strands of ethical concern; ICT contractual issues in the UK⁷ and ICT privacy issues in the USA. Both clearly demonstrate the effectiveness of the retrieval algorithm.

⁷ This definition encapsulates the Rahanu concept of 'failed computer cases', and allows the use of some of his case studies in the retrieval tool.

1.8 The Main Aims of the Research

The solution to raising ethical awareness of ICT novices might be achieved by presenting analogous, analysed cases for use by students to compare and review against a given scenario, and thus refine their ethical perceptions. The research outlined in this thesis is a continuation of the strand of research begun by Maner, and developed by Rahanu. It generalises their work, and is part of a longitudinal study of computers in society. The research addresses the issues raised by the generalisation of the Rahanu model. Its main aims are therefore:

- To establish a theoretical basis for the development of a system that can address ethical scenarios involving a wide range of unethical practice in ICT.
- To devise, construct and test a tool, founded upon the theoretical principles developed above, to enable computing novices to assimilate knowledge drawn from a set of ethically analysed case studies contained within the retrieval tool case library.

A considerable volume of information is available upon cases containing ethical issues. Cases taken from current events reported in the media and recognised legal databases provide a rich source of materials. Furthermore, a review of the relevant literature suggests that the concept of applying retrieval techniques to cases of unethical practice has been applied only within a very limited sphere.

1.9 The Structure of the Thesis

The following chapters of this thesis describe the concepts and development of a tool that addresses the aims listed above.

- Chapter 2

It is important to establish a theoretical basis for the development of the tool. Chapter 2 investigates and discusses the relevance of available research literature to the concepts of the research. The scope of the research is wide, and this leads to an extensive review of the relevant literature. Chapter 2 is thus considerably longer than other chapters. It

examines the basis for computer ethics, discussing the need to establish what computer ethics is, and addresses the differing views about how computer ethics will develop influenced by the use of increasingly sophisticated and powerful ICT. The claims for the uniqueness of computer ethics are examined, and the links of personal and societal ethical standards to requirements for professional status are established. The training of professionals and the use of case studies to transfer the experiences gleaned from analyses of previous ethical incidents are investigated. Factors that affect personal intentions and actions are identified and related to the requirements of the retrieval tool to raise ethical awareness and promote deeper thinking by students on ethical issues. The chapter also explores the effect of personal and cultural traits on the formation of personal intentions. It discusses the research of Hofstede and Triandis in relation to the formation of personal, organisational, and national culture, and suggests the possible effects of using the case retrieval tool within differing cultural and national environments.

- Chapter 3

The development of information systems - for the retrieval tool is essentially an information system - is still regarded by many as an emerging discipline. It draws upon research approaches and methodologies from several other disciplines. Chapter 3 establishes the justification for the research and development of the retrieval tool. The various research methodologies applicable to the development of information systems are identified. These are then related to the activities of both the researcher and the users of the retrieval tool. The retrieval tool is designed to promote deeper thinking by users, and to encourage them to undertake further exploration of the relevant issues. This is a form of self-development, and is mapped to the data-gathering processes associated with information systems research.

- Chapter 4

Rarely does the first attempt at developing a new concept achieve immediate success. Chapter 4 describes the development and testing of the initial, exploratory retrieval tool. The Chapter outlines the concepts for the establishment of a schema for storing and retrieving

analysed case studies. It examines the lessons that can be learned from the retrieval of legal cases, an area having many similar difficulties to those identified in the retrieval of ethical case analyses. The restraints imposed by the use of artificial intelligence to retrieve analogous cases are also identified. The limitations of the initial retrieval model that led to the cessation of its development are briefly discussed, and lessons are identified for incorporation in the design and development of a revised retrieval model.

- Chapter 5

The main criticism of the initial retrieval model identified the complexity of the retrieval algorithm and the misguided application of weighting factors to the criteria used for retrieval. Chapter 5 describes the revision of the retrieval algorithm, employing a system of linked hypertext based upon the concept of a simple decision tree. The basis for the formation of the questions in the retrieval tool interface is discussed, and the subsidiary investigation of the use of Boolean responses to the questions posed is explained. The application of the linked hypertext to the need to promote student deeper thinking and encouragement of exploratory learning is reviewed. This element also leads to the discussion of the format of the case analyses and the basis for the ethical evaluations contained in them. The observations of Kolodner upon the use of case-based reasoners to retrieve analogous cases are assessed, and reasons for the incorporation of some principles drawn from Kolodner's comments are given. The possibility that the decision path resulting from the responses to the retrieval interface questions will vary with the need to cluster or discretely identify cases is also identified. A brief description is given of the human-computer interaction issues employed to improve acceptance and usability of the retrieval tool interface.

- Chapter 6

Testing of the effectiveness of the retrieval tool was carried out both in the UK and Malaysia. Chapter 6 describes the test procedures used, and evaluates the responses obtained from four cohorts of students, two from the UK and two from Malaysia. The results address both students' assessment of the acceptability of the retrieval tool, and of the tool's

effectiveness in raising students' ethical awareness to the issues raised in their given case studies.

- Chapter 7

This thesis raises a number of issues that remain unanswered, and that that might be addressed in future research. Chapter 7 considers these issues. It also evaluates the usefulness and acceptability of the retrieval tool, and identifies areas where improvements might usefully be made.

Chapter 2 - A Review of Relevant Literature

2.1 Introduction: The Computer Ethics Research Environment

This research follows four interrelated strands:

- Computer ethics and the impact of computer developments on society.
- The requirement to focus future computer professionals' awareness upon their social and moral obligations.
- The psychological concepts that underlie the formulation and implementation of human action.
- The classification and retrieval of case studies that may be used to demonstrate to potential computer professionals the effects of unethical behaviour on society.

Many social science aspects identified within this review are drawn from traditional sources. They tend to compete with each other because of the varying influences of law, ethics, education, philosophy, and psychology. The literature review for this research focuses mainly upon the junction of these disciplines. The involvement of computers in these areas, drawing together strands from each discipline, is a relatively recent phenomenon.

Possible implications of the ubiquitous use of ICT on society were identified by Wiener (1954). However, it was not until the 1980s that unethical acts involving ICT began to cause concern. It was then recognised that the situation would further deteriorate as technology advanced unless action was taken to raise awareness of the consequences of ICT deployment. Until that time, computing was restricted to mainframe operations, controlled by professionals bound by their own professional codes of practice. For many years, ICT remained closed to all non-professionals, with policing reliant upon the indirect regulation offered by the professional codes of the developers.

Computing is still a comparatively new discipline (Gotterbarn 1995, p.20). Gotterbarn notes that some believe ICT has yet to reach a fundamental ethical standard, and has presently achieved only a partial degree of maturity (Gotterbarn 2004b, p.159). It has not yet reached a level of maturity having a common lexicon of technical terms (Thompson 2001, p.14). ICT has facilitated

communications between researchers who are able continuously to adjust their concepts and attitudes. This has resulted in a graduated change on a global scale in the perception of the potential for the development and deployment of ICT (Baase 1997, p.3; Watson 1994). However, with the rapid pace of ICT development, it will be harder for ICT to reach the state of maturational equilibrium suggested by Gotterbarn (1995, p.20). Few other professions have been afforded the opportunity to develop in an environment of such rapid and easy exchange of views and information, or faced similar ethical difficulties created by the nature and pace of their development.

The development of the personal computer has transferred to the non-professional the ability to harness the emerging power of computers, and raised further issues of ethical computer use. Anderson (1998, p.27) comments that the power bestowed by even the simplest modern computer is chilling. The adoption of ICT was driven by visions such as that of the Microsoft Chairman, Bill Gates, who predicted "a computer on every desk and in every home" (Gates 1996, p.4).

Three factors appear to be the driving forces behind the wider, common use of the new technology:

- Broadening of the user base.
- Easy availability of comparatively cheap, portable computers.
- Availability of powerful proprietary software.

Commercial and industrial adoption of ICT to improve work rate and profitability exposed new users to the technology (Birrer 1998, pp.90-92), creating further social implications for society. Large sections of society in the developed world are compelled to address the overt requirements of ICT as part of their employment (Spinello 1997, pp.233-240). Furthermore, the covert incorporation of ICT into everyday artefacts brings the designer and manufacturer into indirect contact with much of the population of the developed world (Araya 1998, p.33). Nichols and Weldon (1997, p.329) note that engineering, including ICT, has an inherent and unavoidable impact on society. They justifiably suggest that the main tenet of engineering

practice⁸ is the application of scientific knowledge to societal need, shown diagrammatically in Figure 2.1. Televisions, washing machines, cars, automated bank teller machines, and building environmental controls, all containing ICT, are typical examples of everyday artefacts that have a direct impact on those who use, or are exposed to the technology.

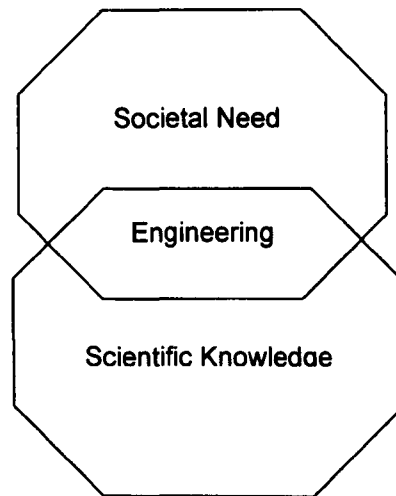


Figure 2.1 – The Congruence of Societal Need and Scientific Knowledge

Those who develop and deploy ICT have responsibilities for its effects upon society (Gotterbarn

1995, p.23; Hollander et al. 1995, p.84; Granger and Little 2001, p.243; Nissenbaum 1996, p.26; Moor 1998). Conger and Loch (2001, p.60) suggest that there are some fundamental freedoms and rights, 'hypernorms', that apply to all humanity to a greater or lesser degree. Such 'universal' rules are sometimes difficult to achieve in practice due to the differing interpretations placed upon them by the society in which they are framed (Johnson 1994, p.21). Paradoxically, one of the negative effects of ICT is that the powerful communications capability of the technology allows easy but remote communication (Moor 1998, p.14). This reduces the need for face-to-face interaction (Tait and de Young 2000, p.191). Interposition of a computer between the developer or business and the client tends to weaken the links of trust fostered by face-to-face communication (Castelfranchi 1999). The lack of direct interaction decreases awareness and consideration towards those affected by ICT. It is easy for the user or developer of the technology to become egoistic and self-centred, and either intentionally or unintentionally to cause harm, distress, or loss to the recipient. It also becomes easy to perpetrate unethical actions anonymously and remotely, and to commit 'conventional' crimes such as theft on a

⁸ For the purposes of this thesis, ICT is regarded as a branch of engineering – see section 2.3.1

faceless victim (Grodzinsky 1999). The power of ICT is beyond the comprehension of many that use it. They are often unaware of the consequences of their actions (Siponen and Kajava 1998, p.674; Wu, Rogerson, and Fairweather 1999). Guidance upon ethical issues related to ICT is needed. This research seeks to provide such guidance.

Several research approaches can be taken to apply different ethical theories to the problems raised by the deployment of ICT. Before any form of guidance can be developed, deeper consideration of the relationships between the use of ICT and conventional ethical theory is necessary.

2.2 Perplexing Issues in the Use of Information and Communications Technology

It was not until the 1940s that practical uses for computing technology became evident. Wiener (1954) considered how the power of ICT would fundamentally affect society. He predicted that the combination of cybernetics⁹ and digital computers would cause momentous changes in societal values and ethics. He likened the integration of ICT into human activity, causing a complete remodelling of society and affecting every aspect of life, to a second industrial revolution.

Wiener's vision was deep and complex, and was widely misinterpreted as advocating automation of human life. He believed that machines would allow people time for relaxation and creative pursuits by releasing them from relentless and repetitive tasks at work, and from the drudgery in their everyday lives. He also realised that there was a danger that people would become dehumanised and de-skilled, their jobs taken over by machines using the new technologies. He does not mention computer ethics by name, but he outlines the implications of cybernetics for society in the fields of education, law, language, science, and technology. However, society failed to recognise Wiener's warning, and to impose any control over the use of new technology.

⁹ The science of information feedback systems.

2.2.1 The Advent of Computer Ethics

It was not until the 1980s that the validity of Wiener's predictions was realised, and ways in which the potential problems might be addressed were considered. The opportunities to use ICT for unethical acts were beyond previous experience. Maner identified a need for guidance on the deployment of ICT in the field of medicine (Bynum 2001, p.12) to consider novel ethical dilemmas that were not addressed by the then current ethical standards. It was unclear which rules should be used, or how they should be applied. Could existing rules, enshrined in legislation or codes of professional conduct, be adapted to meet the new challenges? Alternatively, was the new technology so strong and innovative that it required a completely new approach to its deployment? Many of the issues raised could only occur because of the existence of ICT (Maner 2004, p.41). Maner considers ICT problems as beyond the scope of existing ethical codes, justifying the creation of a discrete branch of ethics, 'computer ethics.'¹⁰

The publication by Moor (1985) of his paper 'What is Computer Ethics?' highlighted the dilemma faced by society. Moor discusses the fundamental social issues of computer ethics. This research takes Moor's essay as its starting point. Moor defines computer ethics as:

"The analysis of the nature and social impact of computer technology and the corresponding formulation and justification of policies for the ethical use of such technologies" (Moor 1985, p.266).

The essay was a significant evaluation and prediction, considering the status of computer technology at that time. Moor recognised that the new technology posed ethical problems beyond the capabilities of the then existing ethical guidance, stating:

"A typical problem in computer ethics arises because there is a policy vacuum about how computer technology should be used. Computers provide us with new capabilities and these in turn give us new choices of action. Often, either no policies for conduct in these situations exist or existing policies seem inadequate. A central task of computer ethics is to determine what we should do in such cases, i.e. to formulate policies to guide our actions. Of course, some ethical situations confront us as individuals and some as

¹⁰ Opinion is still divided upon the issue of whether new types of unethical ICT acts are completely new issues, or whether they can be regarded as old issues concealed by modern technology. However, this interesting topic does not impinge directly upon the main aim of this research – to raise awareness of ethical issues in ICT. Ethical dilemmas will arise whether they are unique or not.

society. Computer ethics includes consideration of both personal and social policies for the ethical use of computer technology." (Moor 1985, p.266).

Moor also suggests that the simple application of a traditional ethical theory to generate an appropriate policy is usually not possible for ethical dilemmas involving ICT. A policy vacuum often results from a conceptual vacuum. By this, Moor means that insufficient thought has been devoted to the implications and underlying problems associated with the ethical dilemma, resulting in a conceptual muddle over some of the issues. He advocates an analysis to establish a coherent conceptual framework within which to formulate a policy (Moor 1985, p.266). However, many of the underlying computing concepts are also new, and are affected by technology. Computing involves the conversion of words, data, and thoughts to electronic signals, which are intangible and often invisible (Bracken 2003, p.359), and difficult to conceptualise. In addition, values of the concepts may change with the passage of time and the context in which the concepts are set. Ethical values are constantly changing, and must be continually reviewed and re-evaluated (Simpson 2000).

2.2.2 The Effect of Computers on Society

How, then, does ICT affect society? Moor considers why computers pose such difficult ethical problems, arguing:

"What is revolutionary about computers is logical malleability. Computers are logically malleable in that they can be shaped and molded to do any activity that can be characterized in terms of inputs, outputs, and connecting logical operations. The computer is the nearest thing we have to a universal tool. Indeed, the limits of computers are largely the limits of our own creativity" (Moor 1985, p.269).

Moor believes that understanding logical malleability is essential when determining policies for the use of computers. He also believes that the issues raised by this capability are not addressable by conventional ethics.

ICT is secretive (Moor 1985, pp.272-275). Software has evolved to the point where many programs adopt procedures that automatically make decisions affecting humanity, but without any form of human mediation.¹¹ Software can include intentional or accidental biases that are imperceptible. This raises important issues of trust in the use of computers (Hamilton 2006) and

¹¹ See footnote 1.

in those who develop and operate ICT. The human recipient of the computer's decision is effectively trapped by the actions of the computer. Recent moves by some developers of ICT have attempted to remove partially the secrecy surrounding the functionality of ICT by the development of 'open source' software. Software developers are encouraged to contribute their code to the growing open source library, or to modify existing non-proprietary code without fear of retaliation. There are, however, those who would misappropriate much of the open source software, and are prepared legally to defend unjustified claims of ownership (Savvas 2005, p.8).

Computer malleability and the lack of transparency in ICT operation can merge to raise apparently new unethical possibilities. This issue causes Moor to conclude that there is a need to develop computer ethics as a discrete branch of ethics, similar to medical or legal ethics. Gorniak-Kocikowska (2004, p.321) strongly concurs with Moor's comments upon the uniqueness of computer ethics. She considers the ethics of those who develop ICT as only a small part of a greater concept of computer ethics, believing that all ICT users are computer professionals. They should espouse professional standards according to a new 'universal' ethic. This approach holds interesting considerations for the research. The students who will be exposed to the tool produced by this research will also assume this power in their future careers. It also has important implications for those who are not educated as ICT professionals but who still exert considerable influence over the deployment of ICT resources.

So far in this thesis, the adjective 'computer' has been used in a broad sense to describe anything associated with computing and ICT. However, when considering whether the adjective can be used in a similar way to classify malpractice involving ICT, some difficulties arise. This will have a significant effect upon the development of the case retrieval tool that is an essential part of this research.

2.2.3 An Understanding of the 'Computer' Epithet

There is much disagreement within the ICT community upon what should justify the epithet 'computer' in 'computer ethics'. Tavani (2001, p.104) correctly observes that there is no clear procedure for determining the classification of a computer crime. Baase's (1997, pp.2-3) observations of the ubiquity and power of computers suggest possibilities for wide range of

unethical acts. Some criminal activities are genuinely computer crimes, requiring the intimate involvement of ICT, whilst others are simply ordinary crimes that coincidentally involve ICT. Moor (1985, p.267) considers that the description 'computer' should only be used where a computer plays an essential part in the issue. He considers that the basic ethical principles applicable to all professions are applicable to ICT ethical issues, but that some offences can only be achieved by using ICT. Only these should attract the adjective 'computer'.

The question of the 'essentiality' of computer involvement requires consideration when selecting case studies for the retrieval tool case library. Gotterbarn (1995, p.21) usefully suggests that a case should not be classified as a computer ethical offence simply because a computer is involved. The ubiquity of computers makes it difficult to isolate them from some involvement in many offences. However, computers are simply tools that may facilitate an unethical action by an unscrupulous perpetrator. Computer ethics has been clouded and confused by the consideration of cases involving only peripheral involvement of computers. The perception of computing as a somewhat secretive activity sometimes causes simple ethical cases, resolvable through existing ethical theory, to be unjustifiably amplified or simplified by accentuating the computer's role, often for sensationalist reasons. Johnson (1994, pp.11-12) notes that many 'computer' offences could be committed without the use of a computer, albeit more slowly or with greater difficulty.

The inclusion of relatively 'computer-weak' cases within the context of this research will reduce students' perception of the relevance of the cases, failing to demonstrate the true importance of the need for ethical awareness. Moor (1985, pp.267-268) and Spinello (1997, p.18) believe that a continual dynamic and developing framework is required to reassess and redefine computer ethics. In addition, Spinello (1997, p.x) notes that the rapid development of computing technology causes perceptions to change, and makes ethical standards difficult to define.

The concept that cases should only be considered as 'computer' issues if ICT is an essential element in the crime (Gotterbarn 1995, p.21) appears to meet the requirements of this research. Spaul (1995) emphasises the importance of human intentions in the use of ICT. He aptly suggests that the **way** in which the computer is used is the deciding factor rather than the fact

that a computer is used. The user's ethical standards contribute strongly to their intentions to carry out an action. Tavani (2001, pp.97-98) notes that the impact of computer technology in 1985, at the time of the publication of Moor's essay, is very different from its impact today. Many of the ethical issues associated with the use of ICT had not arisen, and there was still much speculation over how the technology would evolve. What could only once be dreamed of is, in many cases, now not only possible but has become a reality.

The research focuses upon prompting the user to consider more deeply the effects of their actions, and to judge the likely outcome against the outcomes of similar previous cases. The concept is that one may evaluate a proposed action by comparing it with similar past events, or may extrapolate from the results of past events. In particular, those who design and develop ICT need to be aware of the consequences of their decisions, and to have an understanding of their responsibilities to their profession, their colleagues, and the public. This basic tenet of all professional societies is one requiring careful attention by the professionals concerned (THES 2006, p.9; CST 2006a; CST 2006b). Tavani (2002, p.44) agrees that there will need to be some re-modelling and redrafting of existing ethical principles to encompass computer ethics issues, but this will not alter the fundamental concepts of the principles.

2.2.4 Ubiquity, Uniqueness, and the Legal Response

The ubiquity of ICT, together with the issue of responsibility for one's actions, raises interesting challenges for existing and future computer professionals. Control over ICT developments that allow those who are not ICT professionals to build powerful programs is not an issue that can be easily addressed by the formulation of guidelines or codes of conduct. These persons are outside the control of professional ICT bodies, and may not be bound by any professional codes of conduct or ethics.

The many attempts made to extend the scope of computer ethics to include areas that have only a peripheral association with computing technology result in computer ethics becoming fragmented and confused (Gotterbarn and Rogerson 1997). Gotterbarn and Rogerson believe that consideration of the issues should focus only on those issues that are truly relevant to computers and cannot be adequately addressed by existing legal or moral codes. This will

promote a deeper consideration of the true professional issues associated with the moral use of computing technology. Governments in the UK, US, and Australia have been reluctant to enact new statutes addressing the perceived unethical effects of ICT until courts have tested existing legislation and determined its effectiveness to address apparently new ethical dilemmas. However, this raises the question of when an unlawful or unethical action involving a computer should be considered a 'computer crime'. The question of relativity – whether the issue is a matter of the simple involvement of a computer, or whether it is more complex - remains unclear.

Governments and legislatures appear to assume that, in questions of public safety and well being, the appropriate professionals will take it upon themselves to act in a lawful and ethical manner. Indeed, this is a basic tenet of professionalism, a point not always supported in practice (Hamilton 2006). Furthermore, the reliance upon professionals to conduct themselves in a defensible legal and ethical manner assumes that they have an intrinsic set of ethical values, 'ethical virtue', that they use constantly in their everyday lives to resolve all ethical dilemmas. Professional institutions require their members to adopt both legally and morally defensible approaches to their work. This issue is incorporated by Kallman and Grillo (1996, p.9) in their model for ethical analysis. They suggest that the first factor in undertaking an ethical analysis is to understand which statutes apply to the issue under consideration (Kallman and Grillo 1996, pp.8-11). Only then should the professional proceed to apply ethical norms. This issue has powerful implications for the development of the retrieval tool that is part of this research. Many users of ICT, particularly young people, do not have an understanding of the issues that surround incidents of unethical practice (Kallman and Grillo 1996, p.7). This, together with poorly developed ethical standards, will inevitably lead to difficulties when presented with novel ethical issues (Simpson 1999). Law and ethics, whilst not synonymous, frequently tend to work in harmony (Kallman and Grillo 1996, p.8). It is essential, therefore, to provide students who will use the tool with some legal background to the analyses in the case library.

Professionals function in a special context (Johnson 1994, p.40), operating within legal, political and economic restraints. However, non-professionals are exempt from many of the onerous

restrictions placed upon professionals. Yet, the majority of those who use computers are not computer professionals in the accepted sense. They often have no special training, do not usually carry full responsibility for the consequences of their actions, and have reduced responsibility towards their clients. They have no professional ICT code of conduct/ethics to follow. Nevertheless, they still exercise considerable power using ICT. Gorniak-Kocikowska's (2004, p.324) argument that all who use computers may be regarded as computer professionals leads to an interesting consideration of what is, and who may be classified as a 'computer professional'.

2.3 ICT Professionalism

To most people, the word 'professional' conjures up images of well-trained, highly qualified individuals, working diligently to serve the needs of their clients (Gleason 2002, p.113). Van Dael and van Lieshout (1999) believe that the term is generally used to refer to people who are engaged in a desirable and special kind of occupation. They make several relevant observations concerning professional conduct. Professionals should:

- Deal with the most important and difficult problems in society.
- Remain emotionally remote from their clients, treating all clients similarly.
- Focus upon doing good, but only within their specialist area.
- Focus on the common good, setting them above others who work simply for reward.
- Have a responsibility and status resting upon a clear delineation of who they are and what area of expertise they provide.

Unfortunately, this idyllic concept is not always realised in practice (Hamilton 2006). Korac-Kakabadse and Korac-Kakabadse (1998, pp.378-379) identify three points that militate against professions.

- Professionals, particularly traditional professions, tend to procrastinate over decisions involving their area of expertise. Their knowledge is their power, with little motivation to allow others to share this valuable resource.

- Loyalty to the profession is often seen as more important than loyalty to the employer or client. Professionals often show little respect for those outside their profession, but expect others to show respect to them.
- Professionals tend only to associate with others of similar expertise and background, forming a closed society that is introspective, insular, and resistant to change.

A profession should provide a service to individuals, but, more importantly, to society as a whole (Gibson 2003, p.22). Gibson suggests that professional roles are largely the products of public policy and culture. As professionals usually perform a public function, professional codes are underwritten at a societal level.

One might therefore ask why ICT should strive to attain professional status. Johnson (1994, p.40) links the work of ICT specialists to a high degree of responsibility for the immediate deployment of ICT, and its longer-term consequences. The diffusion of ICT throughout society has carried with it the need for responsibility by all developers and users of the technology. Implicit in that responsibility is the requirement to act in justifiably ethical ways, following and developing acceptable societal ethical and statutory norms. It is essential that those who exercise the power of ICT do so in the knowledge of what society expects of a full professional. It is the recognition of responsibility and need for ethical conduct that is at the heart of this research.

Despite the requirement for formal education on ethical issues, the computing community has not yet reached a stable equilibrium in its approach to such matters (Van Dael and van Lieshout 1999). Forester and Morrison (1994, p.17) believe that computing has not had the time or organisational capability to emerge as a fully-fledged profession. This appears to militate against the suggestion that computing, *per se*, is a suitable candidate for professional recognition.

There is considerable doubt in society concerning the responsibilities of aspiring ICT professionals, and the demands of professional status. Consequently, debate continues upon whether the term 'professional' can be used when referring to a skilled and responsible ICT practitioner if the traditional model of a profession is taken as a yardstick. However, before

consideration is given to the question of professional status it is necessary to consider the nature of the ICT discipline.

2.3.1 The ICT – Engineering Link

ICT contains many strands, each with its own speciality (Denning 2001, p.15). Several authors (Bracken 2003; Gotterbarn 1996b; Gotterbarn, Miller, and Rogerson 1999; Hirschheim and Klein 2003; Storey and Thompson 1999; Wilkes 1997) use the term 'engineer' in relation to ICT personnel, usually associated with the production of software. The term 'software engineer' is a common nomenclature. It is therefore relevant at this point to examine the relationship between ICT and engineering.

Ayres (1999, pp.140-149) identifies two predominant hallmarks of engineering:

- The solution of practical problems for the benefit of mankind.
- The use of scientific and other formalised knowledge to design and build artefacts within economic constraints.

This suggests that engineering is the application of scientific principles to meet the needs of humanity. Engineering applies accumulated awareness and understanding of facts, mathematics, and practical experience to the design of useful objects or processes. Engineers take the results of phenomena investigated by scientists, and determine how the results may be employed in proximate or empirical methods to solve practical problems. Johnson (1994, p.41) also notes that professions are often divided into two branches – those that carry out research and those who apply that research to the resolution of practical problems.

The development of ICT began in earnest in the 1950s, making it a comparative newcomer to the field of engineering (Ayres 1999, p.142). Notwithstanding its comparative youth, Gotterbarn (2004a, p.115) comments that software development already has many similarities to other professions. The responsibility carried by software practitioners can be equated to that carried by other recognised engineering professions.

There is also evidence of acceptance by governments that ICT is an important factor in national prosperity. Booch (2001, p.119) observes that "Software is arguably the world's most important industry." The inclusion of the British Computer Society within the UK Engineering Council, and

the establishment of a software engineering section by the Institution of Electrical Engineers in the UK, recognises that ICT in its broadest sense is an engineering activity. Similar moves in the US recognise ICT as a branch of engineering (Gleason 2002, pp.115-116). Furthermore, the establishment, with governmental support, of the Software Engineering Code of Ethics (Gotterbarn, Miller, and Rogerson 1999) provides the final seal of approval to the concept. However, the title of this document appears misleading. The document adopts principles applying to all areas of ICT, not simply to software production. Its endorsement by the Association of Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE) therefore implies approval to the whole realm of ICT.

It would be almost impossible to separate the production of software from other aspects of ICT. Denning (2001, p.16) lists forty specialities in three categories that could be identified as forming the ICT industry, of which software engineering is but one. This would tend to suggest that ICT generally meets the two criteria identified by Ayres as necessary for recognition as an engineering profession. All ICT professionals, therefore, may rightly be included under the umbrella nomenclature of 'engineer'. Consequently, comments upon the broader aspect of engineering will apply equally to ICT professionals.

This research adopts the approach that software engineering is but one facet of the broader ICT arena. Unethical practice may be committed by the use of any computer technology. The cases within the case library should therefore be drawn from a wide spectrum of ethical issues, chosen to demonstrate the need for a considered, professional approach to the resolution of ICT ethical problems. They must reinforce the need for adherence to the obligations placed upon all branches of ICT by both societal norms and explicit professional standards.

2.3.2 ICT Practitioners and True Professionalism

The link between business and ICT is strong, and software engineers become professionally involved in every aspect of commercial activity (Gleason 2002, p.118). There are many ways of considering the professional status of ICT specialists. Engineering, including ICT, can be considered in at least four ways: as a function, discipline, occupation, or profession (Davis 2003, p.358). Davis notes that:

"For most of us who work in engineering ethics, however, engineering is a profession (as well as a discipline and occupation). We work in a field of professional ethics. Working in a field of professional ethics presupposes a definition of "profession" (Davis 2003, p.359).

This suggests that Davis accepts engineering as a profession, bringing with it professional responsibilities and obligations. He defines a profession as:

"...a number of individuals in the same occupation voluntarily organized to earn a living by openly serving a certain moral ideal in a morally permissible way beyond what law, market, and morality would otherwise require". (Davis 2003, p.359).

This is a very esoteric definition. It is unclear how it relates to ICT. Spinello (1997, p.47) finds that there are a number of common characteristics expected of a profession's members, and identifies the following as essential requirements:

- Extensive intellectual training and mastery of a complex body of knowledge together with the accumulation of relevant technical and theoretical experience.
- Provision of a contribution to society through the services provided.
- The ability to exercise autonomous judgement in the performance of their work because of the expertise obtained from their studies and experience.
- Acceptance of, and adherence to a set of behavioural standards, usually embedded in a code of conduct or code of ethics, policed by an overall governing body with the power to enforce adherence to the standards and proper conduct.

Ayres (1999, pp.159-60) suggests that professions should include the requirement to **uphold and seek to improve** standards of practice. This suggests that a profession should be a flexible association that is able to address the challenges of the changing world in which society exists, a point supporting Moor's (1985, p.266) concept of reflection and re-evaluation.

Upholding and improving standards of practice is of particular relevance to this research. It carries with it obligations beyond the statutory requirements of society, and involves the practice of personal ethics to interpret and address sensitively the future ethical dilemmas that will face ICT professionals in their careers. However, Gotterbarn (1994, p.178) comments that "Many people have decided to call themselves 'software engineers' without meeting a single standard". It is essential, therefore, that those who enter the profession have at least a basic understanding of their obligations to their clients, society, and the profession. This research

aims to encourage ICT students to reflect upon and update their perception of the consequences of their actions in the development and use of ICT.

The criteria listed above are often claimed to apply to the traditional professions such as law and medicine, but not necessarily to the newer professions such as computing and engineering (Spinello 1997, pp.46-49). For example, unlike the more traditional professions of medicine and law, computer professionals have no effective system of apparent public scrutiny or control. Similarly, ICT professionals often lack the degree of autonomy attributed to legal and medical professionals. There is little control over who may consider themselves ICT professionals. There are no universally recognised standards for the profession (Hanchey and Kingsbury 1994, p.3) and no overall regulatory body to enforce standards and discipline (Gotterbarn 1995, p.24). This has led some to claim that ICT cannot aspire to be a traditional profession (Johnson 1994, pp.41-42).

However, closer examination reveals that the traditional professions themselves fall short of the full criteria required for full professionalism (Gotterbarn 1996b). Johnson (1994, p.41) suggests that a changing society is reshaping the traditional concepts of professionalism. Van Dael and van Lieshout (1999) find that societal changes have called into question the very notion of expert professional knowledge. Expert knowledge, traditionally the preserve of the professional, is now being made available to lay people. Baase (1997, pp.341-341) rightly suggests that even non-professional ICT users have a responsibility to know or learn enough about the equipment and software to understand any potential problems that may be generated. Gotterbarn (1992) suggests that professionals have a responsibility to develop and set standards. The non-professional should follow those standards. Furthermore, Van Dael and van Lieshout (1999) believe that knowledge itself has increased in volume and complexity so that experts may differ in their interpretation of issues, resulting in alternative opinions as to what is true and valid knowledge. Professionals can therefore no longer claim to be the guardians of a closed volume of expert knowledge.

An initial examination of the ICT arena therefore tends to suggest that ICT specialists would not qualify for recognition as traditional professionals. The standards adopted by ICT professionals

would be unacceptable in medicine or law (Sims 1996, cited in Korac-Kakabadse and Korac-Kakabadse 1998, pp.381-382). However, Spinello (1997, pp.47-48) considers that many computer scientists, programmers, and information technology specialists are much closer to the traditional model of a professional than many of the other aspiring professional groups. It therefore seems unjustified to regard the requirements of the traditional professions as unassailable role models of professionalism.

Changes in society have diluted the role of the traditional professional (Hamilton 2006). Many professionals find it difficult to function in isolation. Forester and Morrison (1994, p.19) argue that full-time ICT specialists who carry high levels of computing responsibility deserve equal recognition to that of clinicians or lawyers. Furthermore, society appears to be moving towards a state of mutual professional support, a point addressed in more detail in the following section.

Others have doubts concerning the award of full professional status to ICT specialists. Korac-Kakabadse and Korac-Kakabadse (1998, p.375) suggest that some in the computing community might better be designated as computer 'para-professionals'. Siponen and Kajava (1998) prefer to use the term 'semi-professionals'. Both follow the suggestion of Anderson (1994, p.49) that professionals might be classified as 'less established' or 'more established'. Anderson suggests that ICT falls into the former category. Notwithstanding these drawbacks, Gotterbarn (1995, p.24) maintains that this is not a barrier to the development of professional ICT standards.¹²

This research seeks to stimulate those who use ICT to reflect upon the ethical consequences of their decisions, and to accept responsibility for the consequences of their actions in a professional manner. Nevertheless, the ubiquity of ICT raises questions upon who can be regarded as an ICT professional.

¹² The discussion upon whether ICT professionals are 'true' professionals is one that is ongoing. However, for the purposes of this research, ICT specialists are regarded as professionals, expected to espouse the standards demanded of members of a professional society.

2.3.3 Professional Ubiquity

The concept of ICT as a service profession (Gotterbarn 1995, p.23) seems most apt. Gotterbarn observes that professional values have a high degree of similarity amongst most professions. The distinguishing feature is the context in which these values are applied. As more professionals from other disciplines use computers, the use of the technology is becoming the accepted norm. The social aspects of computing strongly affect the conduct of many aspects of life, and hence the environments in which professional activities of all disciplines are conducted. Spaul (1995) suggests that professional activity makes sense only when set in context against a particular social order that the professionalism itself helps to shape. This challenges the scope of the term 'computer professional'. Simpson (1999) comments that almost every field of endeavour is now heavily dependent upon ICT. The ubiquitous use of computers in the industrialised world brings ICT into almost all professions.

It is usual for non-ICT professionals, who can often develop extensive ICT skills, to use advanced computing technology without recourse to ICT professionals (De George 2000, p.66). Gorniak-Kocikowska's (2004, p.324) premise that all who use computers can be regarded as computer professionals suggests that much of the population of the industrialised world should be so regarded. Consequently, non-ICT professionals might also claim to be computer professionals in addition to their primary profession. Gorniak-Kocikowska (2004, pp.324-325) seems to hint that melding of professions dilutes the 'purity' of each. She questions whether the discrete computer professional is needed.

Current practice does not support the view of Gorniak-Kocikowska. Wilkes (1997, p.87) considers the different models of professionalism: paternalistic, agency, and fiduciary. It is difficult to see how the view of Gorniak-Kocikowska fits into any of these models. She provides no basis upon which to build the new global ethic that she feels will lead to the universalisation of computer professionalism. The adoption of different models will affect the concept of the role in which the professional is involved. However, societal changes are blurring the apparently clear divisions between the models. In addition, there is controversy over how far a computing professional's responsibility extends.

The rapid development and availability of powerful computer languages and technology has opened the discipline (as opposed to a profession) to a wide cross section of the public (Hamilton 2006). There is no restriction on who may use the technology, or over how the technology may be applied, apart from the general control of legal statute. Many who become involved in the use of computers do so as a hobby, or as an adjunct to their workplace duties. In-depth information is available for the development and use of ICT. In this sense, the sharing of computer expertise has already begun. Moor (1998, p.14) states "The digital genie is out of the bottle on a world wide scale". ICT therefore has tended to develop more as a discipline than a profession largely because of the efforts of certain sections of the ICT community to make ICT 'user friendly'. However, any element of ethical control and social responsibility in the deployment of ICT, particularly towards the client, seems to be missing.

The concept of universalisation of ICT is relevant to this research. The case retrieval tool is aimed primarily at ICT novices. However, students taking higher degrees including elements of ICT are often drawn from disciplines other than ICT. The retrieval tool will therefore need to be acceptable and comprehensible to non-ICT students. This would tend to suggest that the case analyses in the case library should include elements of real-world issues from other disciplines besides ICT.

2.3.4 Effects Upon this Research

The diverse views about who may be regarded as a computer professional, and their rights and obligations, have significant bearing upon this research. The research concept is that a tool can be developed for use by anyone who needs to be aware of the consequences of their actions in the use of ICT. The tool should not be aimed simply at ICT students. Indeed, many students who undertake postgraduate courses in computing sciences are not primarily 'computer' students. They may come from many other disciplines where ICT is now an integral part of professional practice. This does not diminish the requirement for them to use ICT ethically. Frankel (1989, p.110) observes that all those who provide services to the public have a particular responsibility to consider the effects of their products or actions on others. In this sense, the observations of Anderson (1994, pp.60-61), Gorniak-Kocikowska (2004, pp.324-325) and Langford (1999, p.3), that all who use the technology should use its power in a responsible

and professional manner, are highly relevant. Anderson (1994, p.61) puts this succinctly when he states "We should not forget that ultimately our hope for survival in the face of computer-based risks depends largely on the ethical standards of individuals working with computers." It is significant that Anderson does not confine this statement simply to 'computer professionals'.

Accepting the role of a professional clearly carries with it a commitment to adhere to a set of ethical principles (Gotterbarn 2004a, p.116). Gotterbarn believes that those who might be regarded as computer professionals require self-discipline and a set of strong moral norms. There is therefore a need to ensure that developers and users of ICT receive guidance to act responsibly as individuals, but simultaneously maintain the proper respect for the culture and environment in which they work.

2.4 Professional Codes

The essence of professionalism is the relationship between the professional and the client. Bynum (2000a, pp.284-285) suggests that the professional may have one or more of four different types of professional relationship.¹³ Wilkes (1997, p.88) makes a number of pertinent points concerning the relationship between ICT professionals and the public:

- ICT has now developed to a level that allows ICT professionals to cause harm to society, often greater than that caused by mishaps in the traditional professions.
- The perception of ICT is vague, clouding the identification of where ICT is active.
- ICT is secretive.
- The public accepts lower standards of usability and reliability in computer-assisted products than in other artefacts.

It has so far been to the advantage of the computing profession to maintain these conceptions (Wilkes 1997, p.88). Wilkes rightly suspects that it has resulted in a lack of trust between the computer profession and the public, a hiatus in the development of computer ethics, and delay in the establishment of a true role of computer professional.

¹³ Employee to employer; client to professional; professional to professional; society to professional.

As organisations or specialist groups assume a wider significance to the public and strive to attain professional recognition, pressure mounts within them to demonstrate clear standards of service (Gotterbarn 1996b).

2.4.1 The Concept of a Professional Code

Professional codes form the structure within which professionals are expected to operate. They are intended to form both the yardstick for professional standards, and to demonstrate to the public a commitment to internally regulated standards of performance and conduct by the profession's members (L'Etang 1992, p.738). However, there is some confusion over what constitutes a professional code. Gotterbarn (1996b) identifies three types of code: Codes of Practice, Conduct, and Ethics. All three terms are used throughout the literature of professional ethics, often causing some confusion (L'Etang 1992, p.737). They are often all regarded as being identical as each may include technical, ethical, and social connotations. L'Etang declares:

"Codes of ethics can be distinguished by being a fairly short set of ethical principles expressed in the imperative mode; codes of conduct are much more specific in detailing exceptions and particular circumstances and are practical in nature, dealing with the relationship with the customer/client; codes of practice may contain ethical principles but relate to technical standards and are often addressed to customer/clients in terms of the standards that the members of the occupation/profession have a duty to uphold." (L'Etang 1992, p.737)

There is some disagreement over L'Etang's perception. Ladd (1995, pp.581-582) argues that professionals have no moral superiority over other humans, and consequently professional codes cannot be regarded as ethical codes. He suggests that codes may be unjustifiably perceived by some traditional professions as a form of mandatory legal requirement, reinforced by sanctions to punish those who dissent. Ladd believes that all codes listed by L'Etang are simply codes of conduct, but address the relationships identified by Bynum (see footnote 14). These, Ladd (1995, p.583) and L'Etang (1992, p.737) note, address both professionals and non-professionals. Gotterbarn (1996a) believes that professional codes, usually claimed to be codes of ethics, are, in fact, hybrids of the three types listed by L'Etang.

Beyond doubt, codes of all types contain compelling moral obligations. Ethical undertones are evident in most of the articles within the codes (Bynum and Rogerson 2004, p.137). The

objective of all codes appears to be guidance of a professional's ethical processes preceding a decision to undertake a particular course of action. Because of the wide interpretation of the focus on professional codes of conduct, ethics, and practice by different authors (Bynum and Rogerson 2004, pp.137-140), this research will include all types of code under the generic term 'professional codes'. The differing format and emphasis of codes from the many ICT professional societies present problems if any one is singled out as an exemplar. The research does not, therefore, adopt the requirements of any discrete professional society's code, but attempts to adopt an holistic view. In this way, it is hoped to promote students' inquiry and exploration into the meanings of their own society's professional codes.

2.4.2 The Aims and Implications of Professional Codes

The greater responsibilities exercised by ICT specialists, surpassing those of ordinary computer users, are sufficient justification the adoption and use of professional codes (Spinello and Tavani 2001, p.517). Spinello (1997, p.48) lists four major objectives for a professional code:

- Creation of an environment that is conducive to moral rectitude.
- Provision of guidance to professionals who find themselves in a moral quandary.
- Encouragement of novices to recognise quickly and attain the standards expected of members of the profession.
- Stimulation of reflection within the profession on standards and activities that might otherwise be overlooked.

These major objectives for a professional code include a strong educational and advisory element. However, there is also a cogent sense that the educational process should be internalised. Ethics is an issue formulated within one's own intellect. Professionals must therefore have strong internalised values of ethics in order to follow a code. Greening, Kay, and Kummerfeld (2004, p.93) believe that 'internalisation' of ethical standards is an essential element when providing instruction to students and novices on ethical issues. Furthermore, the effect of instruction on an individual will be mediated by personal traits. For the code to be effective, individuals must support it and be receptive to its teaching.

Professional codes appear to be aimed at the model professional. Useful research by Friedman and Phillips (2003, p.17) has identified that the model professional is:

- A model citizen.
- Competent in his/her area of practice.
- Characterised by a set of behaviours that relate to the manner in which they practice rather than to the content of their work.

The preceding discussion would inappropriately seem to imply that all that is necessary to fulfil one's professional duties is to adhere strictly to the codes of one's profession. Moor notes:

"Even within a coherent conceptual framework, the formulation of a policy for using computer technology can be difficult. Because computer technology provides us with new possibilities for acting, new values emerge. And old values have to be reconsidered..... computer ethics is a dynamic and complex field of study which considers the relationships among facts, conceptualizations, policies and values with regard to constantly changing computer technology. Computer ethics is not a fixed set of rules Nor is computer ethics the rote application of ethical principles to a value-free technology. Computer ethics requires us to think anew about the nature of computer technology and our values". (Moor 1985, pp.267-268).

The comment of Moor upon the dynamism of ICT is a salient point. The infrequent updating of codes (Rosenberg 1998, p.18) causes today's professionals often to evaluate and interpret the changing contexts within which ethical issues occur without the guidance of a fully relevant, modern code. Moor's (1985, p.266) conceptual muddles and policy vacuums continually arise because the development of ICT produces novel ways for the deployment of ICT that few, if any, have previously considered. Professionals are therefore entrusted with the disentanglement of ethical issues, and formulation of suitable policies that will address the novel situations in which the issues occur. Such crises often arise with unexpected rapidity. It is most useful to the professional to have an intrinsic set of values that have already been shaped by similar issues to serve as a basis for extrapolation. This allows novel issues to be resolved in a speedy and defensible manner.

The case retrieval tool created as part of this research is designed to address the issues described above by exposing ICT novices and students to previous real-world ICT problems. This will stimulate users to build their own internal set of ethical and professional norms for rapid application to dilemmas that will face them in their workplace. In the case of novel or unusual

issues, it will help them to undertake the reflection suggested by Moor (1985, p.266) so that they may efficiently formulate their own defensible policies and actions.

2.4.3 The Limitations of Professional Codes

The establishment of a professional code is not a panacea for all a profession's ethical and moral problems (Grodzinsky 1999). Fairweather (2005, pp.153-154) notes that "those who write moral codes (or things that could be mistaken for them) need to be aware of the possibility that they may be misused". Codes tend to differ in the issues that they address, depending upon the priorities of the composer. Codes thus become 'incomplete' or fail to address many of the issues faced by professionals who are expected to adhere to the codes. Brinkmann and Ims (2003, p.266) note that "In a virtue ethics perspective, external rules or institutional settings count less than good personality and character". This suggests that codes should attempt to stimulate the inherently virtuous qualities of aspiring professionals rather than impose rigorous rules that are likely to be ignored or maliciously manipulated by them.

The contents of five professional codes are compared by Oz (1992), who criticises their general lack of guidance and support for professionals. Spaul (1995) believes that many computer users regard codes of conduct to be of little use, a view supported by the empirical research of Prior, Fairweather, and Rogerson (2001). Brinkmann and Ims (2003, p.269) caution that codes are simply guidance and have no mandatory basis. Frankel (1989) observes that codes should not be followed blindly whenever this produces an obvious distortion or too narrow an interpretation of their intention. The creation of a code of conduct does not guarantee that members of the profession will follow it. Neither will it prompt an unethical person to carry out ethical actions. Although codes tend to assume that all members of a profession are of good character, this cannot be taken for granted.

Codes are not complete ethical frameworks seeking to cover every eventuality that the professional may encounter. Neither are they exhaustive checklists that can be executed on the supposition that the correct ethical outcome will always result (Bynum and Rogerson 2004, pp.135-137). Bynum and Rogerson (2004, p.141) disagree with Ladd (1995, pp.581-582) over

the perceived inherent power of professional codes. They comment that codes are not the equivalent of laws, but can exert considerable influence over professionals.

The ethical climate in which computer professionals operate will affect adherence to codes of conduct. Spaul (1995) notes that professional bodies reflect the working environment and do not dictate it. Codes tend to be either vacuous or controversial, and policing of breaches is unrealistic. Gotterbarn (1996b) challenges this belief, suggesting that the profession should impose a professional code upon its members, and violations should lead to disbarment from practising.

So far, this thesis has tended to confine itself to the discussion of professionalism and ethics at local level. However, De George (2000, p.69) comments that "In the Information Age, national borders are easily traversed and become invisible as data are sent around the world in fractions of a second". Conger and Loch (2001, p.60) note that there is no universal code of conduct/ethics. They suggest the development of universal codes that will span differing cultures and social environments over which the codes will have limited influence.

2.4.4 Globalisation and Policing of Universal Professional Codes

A universal code of computer ethics is seen by several authors as a possible way forward. Peppas (2002, p.45) believes that the use of codes results in higher standards of behaviour, but recognises that cultures may prioritise similar values differently. Others consider whether a universal code of computer ethics is possible. Oz (1992, p.431) concludes that there are too many codes to obtain a uniform perception of ethical values. Leneric (1999, pp.203-205) believes that indifference to the many ethical attitudes within different cultures, and the development of ICT using structures and languages based mainly upon English, will block this concept. Conger and Loch (2001, p.60) encourage the development of 'hypernorms', behaviours that are guided by ethical principles so fundamental to human existence that they transcend religious, cultural, and philosophical beliefs, a concept developed by Donaldson and Dunfee (2000, p.265).

Others (Blackman and Leake 2000) question whether a world of constantly changing morals and ethics allows any one moral view that is more correct than others. They support the view of

Simpson (2000), that eight common values¹⁴ shared by many cultures and religions might be used as a basis for a universal code of ethics. Simpson, supporting the view of Gorniak-Kocikowska (2004, p.324), suggests that there can be no effective computer regulation and enforcement of ethical standards without an agreed framework of global ethics. Blackman and Leake (2000), and Johnston and Acquah-Gaisie (1999) suggest that enforcement of ethical standards should be entrusted to the United Nations (UN). However, recent problems in Bosnia, Afghanistan, Iraq, and other areas within the purview of the UN, have not been resolved harmoniously, or with unanimity by UN members. There is no reason to believe that UN policing of universal codes of computer ethics would be any more successful.

2.4.5 The Inculcation of Professional Principles

Some individuals appear to have a predisposition towards unethical behaviour (Beu, Buckley, and Harvey 2003, p.88). The basic moral norms described in codes sometimes conflict, or do not provide sufficient direction. Measures must therefore be taken to ensure that future ICT professionals are able to develop their own intrinsic set of parameters that will encourage them ethically to address apparent contradictions and difficulties. Simpson (1999) believes that an excess of ethical and legal theory is taught, with insufficient emphasis on experiential learning. Teaching should be preceded by an investigation of students' personal ethical beliefs. The investigation also needs to focus on students' understanding of codes of conduct. This research attempts to bring to ICT novices and students the experiences gleaned from previous events, presented in ways that stimulate consideration of the different ethical and legal aspects within the incidents. Gleason (2002, p.113) considers that "a move to software engineering professionalism and licensing is inevitable, and that careful attention to the parameters of professionalism is needed now". This research attempts to provide a tool that will assist in the development and consideration of the parameters that are essential to a true professional.

For effectiveness, codes must be inculcated as part of a planned education process (Doig and Wilson 1998, pp.146-147), reinforcing the reflective aspects identified by Moor (1985, p.266). Williamson and Nodder (2002) define reflective practice as "the ongoing process of a proactive

¹⁴ Love, truthfulness, fairness, freedom, unity, tolerance, responsibility, and respect for life.

examination of beliefs and practices that explores the origins and impacts of these beliefs." A commitment to self-reflective practice is an essential facet of the modern professional (Friedman and Phillips 2003, p.22). This view is supported by many of the professional institutions' inclusion of a mandatory duty to attend continuing professional development training during the member's career.

It is unclear whether individuals react because of blind adherence to rules, or whether they find themselves compelled to act when driven by some indefinable inner force that responds to an event (Introna 2002, p.73). Introna believes that it is the latter, and that codes are forgotten under these circumstances. He is disturbed that codes are enthusiastically adopted by many as the solution to ensuring progress towards professionalism (Introna 2002, pp.73-74). Simpson agrees, commenting:

"Idealism is a wonderful motivator, but to put ideals into practice requires awareness, positive attitude, practical tools, skill to use them and both willingness and courage to match the task by taking on requisite responsibility. But the ultimate question is still unanswered: how?" (Simpson 2000).

Simpson suggests that it is vital for all ethical decisions to become issues of personal attitude reflecting responsibility and caring for others, the humility to recognise one's limitations, and the will to improve one's strengths and positive ethical conduct. Education at all levels is a major element in response to Simpson's question. A powerful method that may be used to raise ethical awareness is to examine the previous real-world performance of others, and to learn from their mistakes or successes. This is the concept behind the case retrieval tool that is the product of this research.

2.5 Creation of Professional Attitudes and the Role of Case Studies

Ethical decision making is complex and multidimensional. Beu, Buckley, and Harvey (2003, p.88) remark that:

- Different people will examine the same ethical dilemma and behave in very different ways.
- Some individuals have a predisposition towards unethical actions.
- Sometimes ethical rules are not enough, causing basic principles to conflict.

- Some situations arise where complex ethical dilemmas cannot be resolved by the application of basic moral rules.

They suggest that humans tend to solve ethical problems using the foundation of their own individual characteristics, the culture in which they are embedded, the realities of the ethical context, and their relationships with others.

Paradoxically, Anderson (1998, pp 27) states that moral issues are rarely, if ever, raised in computing circles. He considers this a direct result of an educational system relying too much on rote learning and failing to promote deeper consideration of the consequences flowing from the deployment of ICT. Few students appear to have significant awareness of social trends, global problems, or organisational issues (Simpson 1999). Simpson suggests that student courses should place less emphasis upon conventional technical skills, and focus more upon skills relating to humanity, vision, learning, sustainability and responsibility, leading to an 'ethical self'.

2.5.1 The Attainment of the Ethical Self

The 'ethical self' is an essential prerequisite to becoming an ethical ICT professional (Grodzinsky 2000, p.3). It requires the professional to have a firm sense of who he or she is, and to have a moral framework within which to make ethical judgements. Simpson (2000) suggests that one needs to be proactive in one's ethical actions, drawing upon previous experiences and knowledge in the decision-making process. The ethical professional therefore needs to assemble and evaluate a range of scenarios as a basis for future decision-making. The education of ICT professionals must focus upon the establishment of such a repository of ethical resources, and inculcation of skills for its use, particularly when faced with novel issues. The case retrieval tool developed as part of this research is intended to contribute to the student's experience, and to encourage reflection that will lead to the development of an ethical self.

Novices exposed to unethical activities in their workplace tend to mimic those whom they see as role models (Peppas and Diskin 2001, p.347). That is not to say that the role models necessarily violate the law. Unethical practices can be carried out intentionally or unintentionally

to gain some advantage for either the individual or the organisation. Gotterbarn (1996a) observes that ICT professionals are not intrinsically morally evil. Problems for ICT professionals are twofold:

- A lack of knowledge of ethics and the application of ethical principles.
- A lack of support that would assist professionals when faced by a novel ethical dilemma.

Gotterbarn notes that professional codes designed to provide a source of advice upon the practical application of ethical principles often fail to do so, or are ambiguous and confusing. He also finds that it is often almost impossible to link the requirements of the aspirational or imperative requirements of the codes to real world situations. Furthermore, ICT practitioners often seem unaware of, or have given little thought to the possibility that their actions may be of dubious ethicality, adversely affecting their clients and the public. This issue is a major element in this research. Raising of awareness of ethical issues that may arise from the use of ICT will do much to alleviate the consequences of unethical acts.

ICT professionals need to understand what is acceptable behaviour in the society in which they work in order to respond to Simpson's (2000) conclusion that one needs to be proactive in one's ethical actions. This will define what rules society will accept as its guiding principles of conduct and behaviour. It has implications for the relationship between society's unwritten codes - ethics, and more formal, written standards - statutes and laws. Wiener observes that law is a particular aspect of ethics. He states that:

"Law may be defined as the ethical control applied to communication, and to language as a form of communication, especially when the normative aspect is under the control of some authority sufficiently strong to give its decisions an effective social sanction."
(Wiener 1954, p.105)

Precedent strongly influences legal issues (Wiener 1954, p.107). Case analyses are the equivalent in the ethical domain. Similarly, professional codes of conduct/ethics may be regarded as the profession's equivalent of society's laws, but without some of the more severe punitive sanctions. Calluzzo and Cante (2004, p.311) consider how this concept affects the attitude of students, and suggest that students have misconceptions about what constitutes unethical behaviour which, unless addressed, will carry forward into their activities in the workplace.

Professional ICT associations and governments, notably the US and the UK, have recognised that human shortcomings create difficulties in the ethical use of ICT. They have agreed that ICT students should be educated to see computing issues in the context of the greater society (Huff et al. 1996, p.212; Mason 1995, p.55; Greening, Kay, and Kummerfeld 2004, p.91; RAE 2005a). However, some authors cast doubt upon the efficacy of teaching computer ethics (Spaul 1995). Introna (2002, p.83), and Granger and Little (2001, p.242) agree that if codes are to be effective, they must be backed up in the workplace by effective sanctions. Kaiser (2000, p.146) suggests that students should be encouraged to develop personal ethical standards in their early school years. This suggests that a much more broadly based ethical awareness should be instilled into all students at a very early age. However, Introna (2002, p.72) observes that sources of ethical guidance are declining. He finds that determining the way one ought to live has become ever more difficult as the traditional sources of religion, state, and family become weaker following societal challenges to their dominance.

There remains, however, the need to raise awareness and reflection of the more complex consequences flowing from the use of ICT. These issues are not always immediately apparent to those who make continuous and extensive use of ICT (Walsham 1996, p.78). The use of technology to store and present information to students and novices is, in effect, an information system (IS) supplying the students with an extension to their own intrinsic store of personal information. Walsham (1995a; 1995b) adopts the use of case studies to address the interpretation of human actions in the use of ICT. The use of the retrieval tool developed as a central part of this research is tantamount to a research activity by the student. It may thus be addressed under the umbrella of IS research.

2.5.2 Case Studies and the Stimulation of a Professional Ethos

Stories have been used for centuries to teach and inform, especially for culture and socially acceptable behaviours (Jacobs and Bone 2003, p.619; Watson 2003, pp.96-103). Watson (2003, p.104) considers that stories are an effective method of developing students' character and morals. Artz (1998, p.11) recognises the importance of stories and case studies in determining and enforcing ethical standards.

The education of ICT students must focus on the dilemmas that they will face in their everyday lives (Pena, Botfa, and Extremera 1999). Pena, Botfa, and Extremera also believe that education should not attempt to impose external collective rules upon the inherent personal ethical values of the students. The perceived student lack of ethical awareness (Simpson 2000) will require the identification of relevant sources of information allowing students to assemble and formulate their own personal, defensible ethical standpoint. Golja (2003, p.203) suggests that the education of ICT students tends to focus heavily on discussion of ethical issues, with insufficient practical application of didactic tools. The combination of case studies and role-play encourages a culture of questioning and development of their repository of guidance, stimulating deeper consideration of issues raised by their case scenarios (Golja 2003, pp.204-207). Students need to be immersed in a virtual world to obtain maximum benefit from the study of cases intended to influence their inner selves (Jacobs and Bone 2003, p.620). Students essentially then begin to research the ethical values of the stakeholders within a given scenario. However, student groups are not homogeneous or uniform, and bring differing experiences to discussions and role-play when considering case studies (Golja 2003, p.205).

Other commentators (Kallman and Grillo 1996; Baase 1997; Mason, Mason, and Culnan 1995; Forester and Morrison 1994; Johnson 1994) use case studies to illustrate violations of ethical principles. Murray-Harvey and Slee (2000) find that problem-based learning using case studies improves connections between students' perception of the classroom and the real world. Jones and Bloxham (2001, p.318) suggest that students construct their own virtual world in which to study. The choice of the virtual world is related to students' awareness of their learning environment. Case studies provide a good basis for the development of the virtual environment, but should be real-world scenarios that are empathetic and current. Jones and Bloxham discuss the deep learning approach, noting that it is most effective when knowledge is applied to concrete problems and tasks. The learning technology should engage students in constructing knowledge, and by acquiring, generating, analysing, manipulating, and structuring information (Jones and Bloxham 2001, p.319).

Other disciplines have adopted the use of case studies for the stimulation of students' deeper thinking. A system using case studies for training health care professionals is discussed by

Oliver, Munn, and Pedder (2003). They comment that this type of system is an excellent way of promoting the role-play approach through problem solving assignments. It adopts a constructivist approach to learning, and is a natural extension of the human ability to learn from previous experience. It complements human reasoning and problem solving. In this research, the issue of role-play is a major factor when considering the motivation of the stakeholders in an ethical scenario. Students are required to adopt the personae of the stakeholders, and to examine the actions taken by the stakeholders within a given case scenario from an ethical perspective.

However, whilst the traditional case studies method of studying ethics gives the student an understanding of issues that are case-specific, there is little evidence that this translates into ethical behaviour in the business world (Mauro, Natale, and Libertella 1999, p.24). This suggests that the case analyses used in the retrieval tool will need particularly to address the association between the actions of the stakeholders and the underlying ethical and legal principles. Healy (1997) claims that problem-based learning using case studies provides a straightforward method of discussing situations. However, he notes the concerns of Gotterbarn (1998a) that studies are often written quite briefly, omitting contextual information for the sake of simplicity. Dick (1994, p.71) believes that it is difficult to translate cases from the real world with sufficient richness for student consideration.

Interestingly, Fleischman (2001, p.173) discusses his experiences in teaching ethics to undergraduate students using current, real-life cases, and suggests that students are affected by such studies. However, many students initially resist involvement in discussions because they lack the historical, geographical, and cultural awareness necessary to engage immediately in meaningful debate. Simpson (1999) comments upon the attitude of lecturers, and suggests that youth responds energetically to enlightened teaching that goes beyond the prescriptive into the experimental. It requires good examples and support through debate of ethical issues, a point incorporated by the professional institutions into their requirement for continuing professional development. The retrieval tool seeks to encourage student engagement with current instances of unethical practice, supporting many of the principles expected of an active computer professional.

2.5.3 Case Studies and Learning Styles

The use of case studies is a widely accepted method of disseminating knowledge. In the legal domain, case law is a similar phenomenon whereby previous legal cases are used to clarify and refine statute law, leading to the generation of precedent or case analyses that may be used for future reference. This is an interpretive, developmental, and cognitive process. There are many similarities between law and ethics (Kallman and Grillo 1996, p.8). The training of legal personnel rests very strongly upon their ability to analyse and interpret cases in order to accommodate new and evolving legal issues, thereby adding to previous knowledge (O'Connell 1996, pp.41-42). Furthermore, the close, if imperfect, correspondence between ethics and law suggests that some instruction in the operation of legal codes and systems should be included in the education of ICT students (Kallman and Grillo 1996, p.19).

Students have their own preferred types of learning strategies (Carrick-Simpson and Armatas 2003, p.105). The most frequently examined has been the shallow and deep learning paradigm. For the most effective deep learning, materials available to students should relate to their prior knowledge and experience. Students learn from experience and examples, and increase their logical thinking skills when presented with real-world problems (Parham 2003, p.118). Barak and Rafaeli (2004, pp.86-87) opine that the essence of thinking is asking questions. However, many students consider learning to be simply a study of facts.

The shallow learning strategy adopted by many students requires unthinking regurgitation of previously memorised facts in their original format, with little time or effort expended on learning and understanding their implications (Carrick-Simpson and Armatas 2003, p.105). By contrast, deep learning encourages students to explore and debate issues, seeking a wider range of materials for themselves. Carrick-Simpson and Armatas also note that interest in, and prior knowledge of the subject are major factors in engagement with the learning process. It will be necessary for students to adopt a deep learning style if they are to fulfil Horner's (1999) suggestion that they should quickly respond to new ethical challenges.

Society is generally concerned that students should develop critical thinking skills and social consciousness (Lelewer 1994, p.253). Students may come across ethical dilemmas in almost

any area of ICT. Lelewer believes that a case study approach is more effective than lectures in stimulating interest by students in the computer science curriculum, and that there is a need to link the content of case studies to students' own experiences. In this research, the case analyses selected for inclusion in the case library are structured so that they follow the suggestions of Lelewer, attempting to identify the everyday issues that students will experience in the workplace.

Experiential learning encourages reflection upon real world experiences (Williamson and Nodder 2002). Williamson and Nodder consider that the reflective practice essential for professionalism is also an important learning style, echoing the views of Friedman and Phillips (2003, p.22). They define deep learning as "an ongoing process of proactive examination of beliefs and practices that explores the origins and impacts of those beliefs". They also comment that the promotion of a deeper learning style accords well with Laurillard's (2002) conversational framework. Laurillard suggests a deep approach to learning be achieved by engaging students in real world scenarios, and encouraging students to discover meaning in the activities by examination of their structure. She draws a distinction between academic knowledge and knowledge derived from experience (Laurillard 2002, p.21), noting that knowledge derived from experiencing the world at one remove must be accessed differently from that known through first order experience. She suggests that education must act as a second order level of reflecting on experience of the world. Students must be helped to go beyond their experience, to use it and reflect on it, changing their perspective of it, and subsequently changing the way that they experience the world.

2.5.4 Character and Moral Development

There is a pressing need to incorporate an ethical dimension into the students' educational process so that they use the power of computers in a socially acceptable manner (Anderson 1998, p.27). Anderson tellingly notes that (until recently, at least) in the UK it has been possible for computing students to complete their studies all the way to PhD level without ever having to face a moral question concerning the use of ICT. Granger and Little (2001, p.239) believe that the growth of ICT that should have been developed to serve the world's population instead

provides increasing opportunities for abuse of the technology. However, awakening users to the perils of unethical use of ICT is difficult.

A central requirement for professionalism is to be able to make sound judgements based upon an understanding of ethical principles. Ethical competency reflects the character of the individual (Mauro, Natale, and Libertella 1999, p.22). Luntley (2003, p.326) believes that character may be regarded as a set of cognitive skills that are constitutive of judgement in decision-making. He argues that the central skills are perceptual skills that provide the capacity to consider and evaluate properties and things. They provide the capacity for judgement. Luntley (2003, p.332) finds that judgement is a non-rule governed response to situations. He considers that wise decisions flow not simply from one's observance of general rules, but from a capacity to find relevant points, recognising issues that a novice would fail to observe. Ethical competence therefore depends directly upon perceptual competence. Consequently, there is a need to raise skills in identifying and evaluating ethical issues.

Experiential learning must be central to the development of character (Luntley 2003, p.332). Raising ethical awareness comes from acquiring the specialised and sophisticated attentional abilities that allow the linking of ethical issues to their environment. It is necessary to progress beyond simple internalising of rules and ethical theory. Any material may thus be used if it contributes to the development of an ethically aware character. Rules are, at best, summaries of past acts of wise judgement. Case studies, however, are an excellent means to focus students' attention upon societal rules, and to initiate consideration of possible implications from their application. Luntley's arguments thus tend to suggest that professional rules may be used to influence and build the character and ethicality of individuals, but are not to be treated with unwavering certitude.

Caution should be exercised in the teaching of ethics and ethical standards (Horner 1999). Horner notes that there is a distinction between ethical standards in public and private life. He sees private morality in terms of personal conscience and ethical ideals, and public morality as that which is democratically acceptable to society. Public policy should be based on the principles of utilitarianism, concerned with the rational evaluation of relative harms and benefits.

Private morality should be concerned with the dictates of private ethical standards. Grodzinsky (2000, p.4) appears to disagree with Horner's view that public and private morality may differ, and suggests that individuals should develop a virtuous internalised ethical attitude so that no sharp distinction can be drawn between personal and professional actions. Horner (1999) posits that individuals store a wealth of experience, built up incrementally over time from a wide range of sources, so that, at crucial moments, most of the reasoning upon ethical principles has already been done. This concept implies that experience is a major factor in the evaluation of potential ethical choices. A significant difference could possibly exist between awareness based upon theoretical ethics and the practical application of ethical principles.

The case retrieval tool developed as part of this research contributes to the student's body of ethical knowledge, and attempts to bridge the gap between theoretical and practical knowledge. Awareness of ethical concerns should extend beyond professional or public standards, and into private life and attitudes (Simpson 1999). There is thus a strong motivation to encourage students to examine past examples of unethical and unlawful behaviour, and to learn from them. These will provide a 'fast track' method to the assembly of an extensive range of ethical experiences. This will give guidance in the basic ethical principles, promoting interpretation of those principles through statute and professional codes that will lead to considered and defensible ethical actions. Consequently, the deficiencies in the use of case studies identified by Gotterbarn (1996a) can be addressed.

2.5.5 Cultural Factors Affecting Learning and Ethical Values

Cultural differences can cause problems when attempting to teach ethics to a culturally diverse group (Maxwell et al. 2000, p.3). The globalisation of ICT has emphasised the need for instruction in ethics to students from many nationalities. Asian teaching institutions usually tend to regard students as 'empty vessels' to be filled with facts (Dhillon 2005, p.20). Maxwell et al. found that South East Asian students adopt a passive approach to learning (Maxwell et al. 2000, pp.5-7). Asian culture expects information to be provided in the form of books or other media, to be regurgitated upon request. No additional reflection or deeper thinking is encouraged (Maxwell et al. 2000, pp.5-7). Asian students generally avoid being drawn into discussion, unquestioningly accepting the word of the lecturer, and unwilling to become involved

in role-play or to express an opinion. Furthermore, recent research by Oxford University and the Universities and Colleges Admissions Service tends to suggest that many students from all cultures expect to be 'spoon-fed' a 'right' answer (Shepherd 2006a). They seem unable to accept that there may be many different solutions to an ethical dilemma.

Cultures may prioritise similar values differently (Peppas 2002, p.44). Some cultures appear to foster a significant relationship between ethical standards and work experience (Peppas 2002, p.48). Those without work experience tend to see ethical issues as 'black and white' whereas those with experience are more cautious about making positive judgements. Orpen (2003, p.81) suggests that theory should be interlaced with practical examples of incidents that are affected by differing cultures. He suggests that this might be done by the consideration of a few ethically significant incidents from the US or Europe to serve as a catalyst for deeper discussion and learning. However, his proposals appear to ignore the findings of Maxwell et al. concerning the learning styles of other cultures, and are likely to meet with less success than that which might be expected from European or US students.

The case retrieval tool developed as part of this research addresses issues raised by the deployment of ICT in Western industrialised countries. The standards adopted are those pertaining to the US and the UK. However, the algorithm used in the retrieval process is capable of accommodating cases of unethical conduct in other countries, including Asian nations. Unfortunately, few Asian cases have been reported that can be included in the case library. Effective functioning of the retrieval tool requires the library to include a critical mass of cases from any given country on any given ethical issue.

Notwithstanding this apparent difficulty, there is some evidence that a 'levelling out' of ethical values is occurring within society on a global basis (De Vijver and Phalet 2004, pp.216-217). This has been created by two major factors: the increase in global commerce, and the movement of migrant populations. De George (2000, pp.64-65) observes that commerce has now become integrated with ICT on a global basis. The expansion of ICT from western nations to the less developed eastern nations has transferred the business and ethical values traditionally espoused by the West. Nations of the east are therefore compelled to adopt

western standards if they wish to become part of the global infrastructure. Evans (1999) describes how his experiences of tutoring a course, applying ethical values of the western countries to IT security, appeared to be acceptable to a multicultural group of students who had little difficulty in deriving benefit from it. Therefore, the case analyses, developed by the researcher, a white Western male, might be acceptable to students from diverse cultures. It is perhaps more important to consider the manner in which the case analyses are presented than the cultural standpoint of the analysis.

2.5.6 Computer Technology and Case Retrieval

The development of ethical awareness through case studies has already been discussed earlier in this thesis. However, students require exposure to real-world pedagogic tasks and case studies that are interesting and stimulating, and build on the students' previous experiences (Cope 2003, p.135).

ICT, when used in modern teaching methods to contrast and compare analysed case studies with a given case study, is usually required to perform a 'matching' function. However, the selection of 'matching' criteria is difficult. Ashley and Rissland (2003, p.18) describe how cases for legal training and reasoning are 'matched' using similarity measures. Legal cases have a core of settled meaning (equated to ethical principles) and a penumbra that is debatable (equated to ethical context and perception). As new situations arise, legal interpretation upon the meaning of the fundamental principles may change because of changing context or because of the time factor. A legal system is a dynamic learning system. Hence, as law influences ethics, and vice versa, ethical retrieval systems may also be regarded as learning systems. The open texture of legal and ethical issues suggests that ethical judgements will require a similar reasoning approach to that for legal verdicts. However, ethics has a major difficulty over the application of ethical standards. It has no equivalent to the courts or other institutions that rule directly upon interpretation of basic principles.

Didactic computer systems are usually a type of information system. These can vary in their objectives. Often, the didactic system is a 'reminding' or 'advisory' system for decision-making. Chen and Lee (2003, p.150) note that decision-makers often reason by analogy. They also

observe that humans have difficulty in recalling past experiences, giving more credence to recent cases. Coldwell (2000) notes that students do not 'see' ethical problems as problems without first being provided with positive direction. It would therefore be helpful if a system were available that prompted recall, recognition, and deeper thinking of ethical issues amongst computer users. However, Chen and Lee (2003, p.150) warn that direct comparisons between cases can sometimes be misleading, particularly if the case has been 'simplified' for ease of use or comprehension.

The employment of pedagogic technology is often suggested as a panacea for many teaching difficulties. Technology should only be included in a course after consideration of its capability for improving student learning (Cope 2003, p.134). Cope seems to suggest that, where exemplars are used, the system should not provide an exact match, but retrieve broadly similar cases, encouraging students to adopt a contrast/compare mode that will promote a deeper thinking approach. Cope also suggests that issues raised by cases need to be examined from several perspectives, supporting the suggestions of Friedman and Phillips (2003, p.22) that students and professionals should develop a reflective element in their search for professionalism.

The retrieval of 'matching' cases raises issues upon the level of detail and content that should be included in the case studies. Eastman (2003, p.19) comments on the difficulty of students in handling problems presented in narrative style. Extra information included to enrich the case studies is often confusing, but its exclusion removes the credibility of the study, separating it from reality. Interestingly, most commentators who describe systems for analysis of real-world scenarios usually include a separate stage designed specifically to identify and extract the pertinent facts of the case from the surrounding contextual information. The 'background' information is initially provided to give context and colour to the case, offering a bridge to students' prior knowledge and ethical awareness. The lack of student worldliness and ethicality makes the drafting of suitable cases difficult, and complicates retrieval from a case library. There is a strong temptation for the researcher to omit the contextual information, and to make case studies simple and obvious. However, such abbreviated cases lack the complexity and nuances found in real-life scenarios.

These points pose a difficult dilemma for the researcher in the drafting and analysis of the cases used in this research. The choice often reduces to whether a particular issue should be highlighted and discussed, or whether a more holistic perception is required. Anecdotal evidence suggests that case studies that are too long and complex fail to transfer any significant understanding of an holistic perspective. The researcher is thus faced with the difficult problem of the level of detail to include within the case studies developed as part of this research, and to what depth they should be analysed.

Some of the cases in the case library have been developed from ethical concerns highlighted in the reputable trade press. Others, reflecting the level of detail considered necessary for the understanding and resolution of the issues raised, have been taken from court transcripts. The standard adopted by the courts has been the yardstick for the case analyses contained in the case library. The case studies issued to students for evaluation and comparison with a retrieved case from the case library are written with the greatest relevant detail and background information available.

2.5.7 The Ethical Attitude of Industry and Commerce towards ICT Deployment

Information management and technology are the essential underpinnings of business globalisation (Strain 2003, p.12). The range of activities associated with ICT is wide (Denning 2001, p.6). It is therefore inevitable that ICT will permeate the activities of most companies at all levels. However, industry and commerce tend to treat ICT as a 'supportive' technology. There is often reluctance to include an ICT representative at company board level. A recent survey of the world's top 500 companies finds that only 5 percent have an ICT director at board level (Dudman 2004, p.32). To some extent, Gotterbarn (2004a, p.110) seems to condone this situation. His view, that ICT is a 'service' profession, tends to militate against its representation at high level in many organisations. Denning (2001, pp.18-19) considers that ICT specialists no longer shape their own destiny. They are now controlled by powerful businesses, government, and industry.

There tends to be a societal view that ICT is a technical domain, beyond the comprehension of all but a few knowledgeable specialists (De George 2000, p.65). Computers are seen as

machines that are value- and ethically neutral, i.e. the technology may be used without thought for the consequences of its deployment. Some ICT professionals also unfortunately support this view (Gotterbarn 2004a, p.110). Gotterbarn believes many ICT professionals simply carry out the tasks demanded of them, and blames the occurrence of ethical neutrality upon the training of ICT professionals. Universities often fail to instil into students that they have a responsibility for any artefact that they produce, leading many to assume that they cannot be accountable should the artefact fail or cause harm to others.

The attitude of employers towards ICT personnel has a pronounced effect upon their motivation and ability to conform to acceptable ethical practice. Nwana (1997, p.324) finds that many computer science students lack social and ethical awareness, and are unacceptable to some employers who prefer to take graduates from other disciplines.¹⁵ Denning (2001, p.18) notes that ICT practitioners are often seen as:

- Single-mindedly focused on ICT.
- Inept at social relations, and difficult to communicate with.
- Centred on technology, with little regard for people.
- Oblivious to the social, political, and business consequences of their tools and services.
- Lacking responsibility for malfunctions of their products and breakdowns in their services.

If ICT is to gain acceptance in society as a profession, it must challenge and overcome this negative image. Huber (2004, p.26) comments that IT departments in organisations can be regarded as one of three types by senior management: strategic partner, necessary evil, or cost overhead. Huber (2005, p.20) suggests that unless senior IT managers shake off the feeling of low esteem and cease to think of themselves as the underdogs in the organisational hierarchy, they will soon be extinct. Industry demands capabilities-driven graduates who are smart, adaptable, and skilled to fill senior positions in ICT (Williamson and Nodder 2002). These qualities are encapsulated in a set of professional skills supported by codes of professionalism. Graduates need to be interpersonally effective, analytical, critical, and reflective. In addition,

¹⁵ Whether the alternative sources of graduates are more ethically aware than ICT candidates, or whether there is a general abhorrence of ICT students, is unclear.

graduates must be responsive to change, and committed to continuous learning in a fast developing industry (Lee 2005, p.20).

Many in business seem to adopt the often misquoted sentiments of Friedman (1970), who is claimed (Baase 1997, p.338) to have advocated that the aim of business is to maximise profitability. Ice (2004, p.18) states that "Companies, large and small, ignore ethics for the grander goal of making profits." This claim is widely accepted by the business community, but is controversial. Friedman actually states:

"That responsibility [*of corporate executives*] is to conduct the business in accordance with their [*the employers'*] desires, which generally will tend to be to make as much money as possible whilst conforming to the basic rules of the society, both those embodied in law and those embodied in ethical custom." (Friedman 1970).

Friedman therefore supports an ethical approach to profit generation, but questions whether corporations act ethically when positively attempting to act ethically! He argues that their remit is not to place ethics as their primary *raison d'être* – corporate managers, as agents of shareholders, must manage the corporation in ways that maximise profits. Chae et al. (2005, p.199) disagree, noting the comments of Handy (1994) who believes that profit should be a means to other ends, not an end in itself. Nevertheless, some take the misinterpretation of Friedman's remarks and apply it wholeheartedly to their business practices. Bakan observes that:

"The corporation is an institution – a unique structure and set of imperatives that direct the actions of the people within it. It is also a legal institution whose existence and capacity to operate depend upon the law. The corporation's legally defined mandate is to pursue, relentlessly and without exception, its own self-interest, regardless of the often harmful consequences it might cause to others. As a result, I argue, the corporation is a pathological institution, a dangerous possessor of great power it wields over people and societies." (Bakan 2004, pp.1-2)

ICT graduates are now expected to have an awareness of international and cultural aspects of their professional discipline (Quinn and Reid 2003). Ahmed, Chung, and Eichenseher (2003, p.89) note that all business transactions rely upon a shared perception of ethical behaviour. Business globalisation has been fuelled by ICT. Buchholz and Rosenthal (2002, p.45) comment that, in a market economy, the corporation is the prime institution through which new technologies are introduced. It is reasonable, therefore, to expect that all staff of organisations

involved in international commerce will be aware of their customers' ethical and behavioural standards, and will adopt fair and just policies for all business transactions.

For some time, international business has been allowed to develop and expand almost unhindered by regulation. Kaldis (2002, p.370) sees the expansion of business and the increase in available data as an opportunity to use that data to enhance the corporations' ethical powers and corporate responsibility. Corporate responsibility, however, requires either self-regulation or external, societally imposed regulation. Nevertheless, many corporations simply use ICT to encourage Friedman's (1970) misinterpreted principle of profit maximisation. Regulations tend to restrict business activities and hence reduce profit (Bakan 2004, p.101). Some observers consider that many corporations have abused the power that they have amassed following adoption of unethical practices (Bakan 2004, p.8). Kaldis (2002, p.370) believes that the wide and pervasive use of ICT by corporations allows them to acquire a new 'persona'. Jarvis (2003, p.204) comments that some large corporations are now more powerful than many nation states.

It is against this background that students of ICT must attempt to formulate their own ethical standards. De Ronde (1996, p.54) questions how far the limits of business practice can be extended whilst remaining ethical. He feels that the teaching of ethics is ineffective, with many courses aimed at higher management who adopt corporate policies that tend to trump fundamental ethical principles. Courses place too much emphasis on problem solving, and little on the development of personal morality. Ethics teaching should focus on development of a keen personal sense of ethics for future chief executive officers, and should develop a strong sense of integrity in each individual. De Ronde suggests that the teaching of ethics, tending to focus upon the selection of case studies that highlight unethical actions, creates a false impression that business, *per se*, is unethical. This should be avoided, with more care taken to emphasise the good points, as there is often more than one socially acceptable answer to an ethical dilemma.

This final point of De Ronde's is of particular interest in the creation of the case analyses used in the retrieval tool. Case studies are usually chosen because they tend to illustrate negative issues. However, the understanding of what ethical or unethical depends upon one's personal

ethical standards. The retrieval tool does not attempt to pass judgement upon any particular stakeholder. However, it may reflect the decision reached by judges, or regulatory bodies such as the UK National Audit Office. The case analyses attempt to identify and compliment acts that support identifiable ethical principles, and to understand the rationale behind those appearing, superficially, to be unethical.

The requirements of industry are demanding, particularly matching the ethical conduct of employees to the needs of business. Furthermore, ICT novices and students are required to reconcile their own personal ethical standards with the demands of industry. The solution is difficult, and rests partly in the influence that can be exerted over the development of the students' ethical values, and their understanding of the context in which ethical issues occur (Harmon and Huff 2000, p.24).

Markula (1998) questions whether personal ethics can be taught, and concludes that it is possible. Other authors (Coldwell 2000; Sims 2004, p.210; Peppas and Diskin 2001, pp.351-352; Hanchey 2002; Grodzinsky 2000, p.7) agree. McLean (1994, p.83) suggests that this process tends to be through repeatable, analytic methods that can be adequately examined. Engineering, including ICT, progresses through examination and reflection of what has gone before. Introna (2002, p.75) notes that it is possible to identify ethical responsibilities through discussion and analysis, but they are experienced in reality. Many authors, including Spinello (1997, p.xii), Artz (1998, p.11), Gotterbarn (1998a), Walker (2002, p.109), and Heywood (2002) show that case studies, reflecting previous experiences, are one of the most effective ways of introducing ethical issues into the education of students. Furthermore, Introna (2002, p.83) suggests that ethical standards are stimulated by the realisation that, despite the remoteness of 'clients', they are nevertheless humans who have faces, feelings, and human needs.

The interpretive approach towards learning taken by Walsham (1993) considers that actions and motives discovered in examination of case studies should be interpreted against the background of their environment. Orlikowski and Barley (2001, p.145) also believe that technological and institutional contexts in the development of ICT cannot be examined in isolation if a suitable explanation of the resulting techno-social phenomena is to be formulated.

Walsham's approach to the use of case studies may be usefully applied to the requirements of teaching. Students may gain a greater insight into the underlying philosophical issues that affect the actions of actors within the case by studying the ethical climate in which the case takes place. In studies used for teaching, however, the hidden interaction between the writer and the student must be recognised. This will lead to both changing their concept of the issues raised in the study, as the perceptions of each will be affected by the perceptions of the other. This is a form of mediation, having strong links to the work of Feuerstein (Feuerstein 1998).

2.5.8 Mediation of Personal Attitudes

In his Theory of Structural Cognitive Modifiability (SCM), Feuerstein (1998, pp.10-22) finds that human intelligence and reasoning, is modifiable. In his description of the theory of SCM, he refers to human 'intelligence'. This might perhaps be better understood if 'intelligence' is considered to be 'intelligent behaviour' (Child 1997, p.244). Feuerstein comments:

"The theory of SCM defines intelligence as the propensity of the organism [*the student learning process and understanding*] to become modified in its very structure, in response to the need to adapt itself to new stimuli, both of internal and external origins. It is the modifiability and plasticity of the organism in its various dimensions of functioning that can be attributed to the construct 'intelligence', rather than to the objectal reified notions used by fixist, psychological theories. The concept of modifiability implies a dynamic and objective view of human existence as reflected in human behaviour. Behaviour is considered as generated by the 'state' of the organism confronted with certain external or internally generated stimuli rather than by 'traits' of his fixed intelligence or characteristic personality." (Feuerstein 1998, p.10)

This would tend to suggest that the application of logical human reasoning to ethical issues would modify one's intrinsic ethical values. Feuerstein writes:

"The Theory of Structural Cognitive Modifiability is to be considered as belonging to a new trend in behavioural sciences which affect in meaningful ways views of the human organism, life span development, the role of the environment in determining behaviour and in particular the structural modifiability which is considered 'as an option' to produce in the individual 'new' previously inexistent 'states' and modes of existence, operations and behaviour." (Feuerstein 1998, p.11).

The most effective learning involves exchanges, or mediation, between the student and tutor in a face-to-face situation (Feuerstein 1998, p.14). The exchanges are usually iterative, and are structured so that the mediator stimulates and supports reflection and decision-making by the student. This approach inherently assumes a synchronous exchange, each actor influencing the other, and that considerable interpretation is involved in the learning process. A diagrammatic

representation of the mediated learning experience (MLE) is shown in Figure 2.2. Intervention by the mediator (usually, but not necessarily, the lecturer) or peers is indicated at two points in the learning cycle: at the introduction of the problem (the stimulus), and after consideration of the problem by the student.

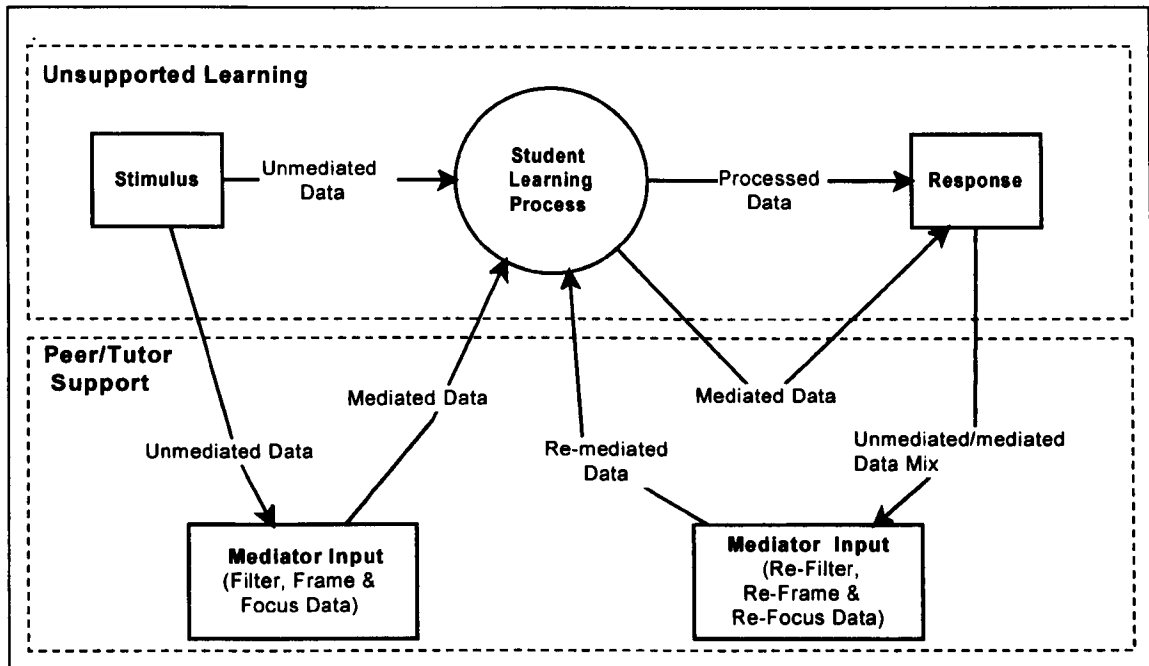


Figure 2.2 – Diagrammatic Representation of the Mediated Learning Experience

The role of the mediator is described by Feuerstein:

“The mediator is animated by an intention to make the other individual perceive, register, understand, and experience cognitively and emotionally, a given stimuli, a given event, relationship, operation or feeling.” (Feuerstein 1998, p.14).

The theory also allows for the application of the ‘transcendence principle’ (Feuerstein 1998, pp.15-16). This proposes that the mediator should seek to extend and enlarge the schemata of the student. This, Feuerstein claims, will create in the student new systems that would otherwise never to have come into existence without the tendency to transcend the immediate experience of the problem resolution.

The concept seems to fit very closely with the needs for reflection suggested by Moor (1985, p.266), and Friedman and Phillips (2003, p.22), and deeper thinking (Barak and Rafaeli 2004, p.100; Laurillard, 2002, p.21). Feuerstein (1998, p.11) observes that human existence is a generator of information rather than just a recipient of it. This tends to support the view of Cope

(2003, p.135) that students need to build on previous experiences for the creation of deeper thinking skills.

It is not necessary for the student to consult the mediator when first presented with the problem. The student may simply follow the unsupported learning path from stimulus to learning process to response. The data gained from the stimulus is unmediated, and the student uses it in its 'raw' state to formulate a response. The response is thus derived from the student's own experience, and the information gleaned from his/her understanding of the problem. The response may then be challenged by the mediator, causing the student to reflect upon his/her initial response. The student is prompted to reconsider whether the learning process has provided a suitable response and is able to repeat the learning process to formulate a new response. The cycle may iterate until both student and mediator reach an acceptable response. Alternatively, the student may obtain guidance at the stimulus point, following the peer/tutor supported learning path, and is able to modify some concepts of the problem following guidance from the mediator/peer. The learning process is thus fuelled by both unmediated, raw data and data mediated by advice. This latter approach will usually reduce the number of iterations required in the second phase of the model before reaching a satisfactory response.

The theory appears to be relevant to the teaching of ethics, allowing the student to reflect upon his/her responses to the ethical issue under consideration, and to incorporate guidance from the mediator/peer. However, in the context of this research it presents some problems. The case retrieval tool produced as part of this research has been designed so that it is accessible to students using Internet connections. This removes by one level the face-to-face interaction between student and tutor, using an asynchronous communication mode. The choice of case study, and the level and method of analysis of the cases within the case library are thus of the utmost importance if a successful mediation is to be achieved. The learning environment must include a diverse selection of cases providing models and experiences (Feuerstein and Falik 1999). In this research, the interposition of the Internet connection and retrieval tool between the student and tutor somewhat weakens the mediation process. However, Feuerstein maintains that mediated learning experience is the main vehicle for the transmission of culture.

It occurs in all cultures, all languages, and all social classes. Therefore, although mediation is diminished by asynchronicity, the effect of mediation is still a most powerful factor in influencing a student's perception of ethical values.

The Theory of Structural Cognitive Modifiability and the MLE might thus be adapted to include the concept of a case-based reasoning tool as an agent used to replace the mediator, encouraging change in students' ethical perception. This modification is shown in diagrammatic form in Figure 2.3.

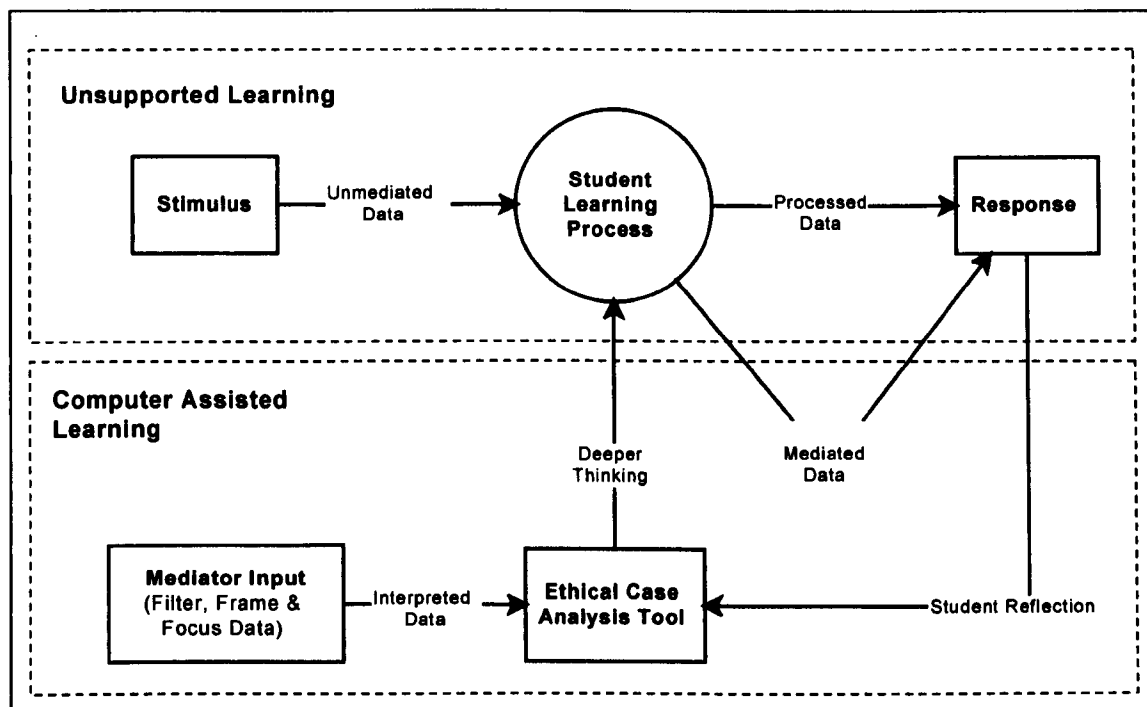


Figure 2.3 – Diagrammatic Representation of Adaptation of the Mediated Learning Experience

Using the revised model of the MLE, the mediator is 'out of the loop', simply generating the data from a series of selected case studies, and making it available to the student on a 'call-off' basis. The process of learning is very similar to the peer/tutor learning paradigm, with the student initially following the unsupported learning path and forming an initial response to the stimulus (given case scenario). However, students are expected to use the case retrieval tool to revise their initial response to the stimulus. The case retrieval tool poses a number of questions, as would a human mediator. The student responds, causing the retrieval tool to deliver an analysed case that will have a high relevance to the given case scenario. Students are then

encouraged to reflect and compare their initial response with the suggestions and information from the case analysis offered by the retrieval tool. The student thus expands and deepens his/her understanding of the ethical issues raised by the given scenario. The case analysis also offers experience to the student in an interesting way, posing further questions, and stimulating the student to explore further other case analyses within the case library. The model offers the possibility for students to modify their responses, and to adopt an exploratory approach to learning. An iterative cycle, from learning process to response to case retrieval tool and back to learning process, is created.

Tutors influence what students learn, but cannot dictate it (Laurillard 2002, p.4). Laurillard observes that lecturers are not mediators. Students do not learn about the world directly from their teachers, but from the views that others have of the world. Spier (2003, p.138) questions whether traditional rote learning provides the time required for reflection and debate. He strongly supports the deeper learning style of education where the student is able to experience and challenge the information offered. Spaul (1995) comments that the many ethical problems that beset the ICT community cannot be tackled by imposing a rigid set of rules upon practitioners. Ethics is a personal matter, triggered from within the personal self, drawn from experience of the world and reflection of the lessons learned from that exposure. The 'teaching' of ethics must attempt to influence the student's persona to accept the norms and standards acceptable to both local and global ICT communities. The challenge for this research is to develop a system that can influence the innermost motivations of ICT practitioners.

2.6 Identification of Factors Affecting Personal Intentions and Actions

Governments and professional institutions have recognised the lack of ethical awareness, now requiring that ethics be 'taught' in universities (RAE 2005a). However, there is still much discussion upon how can this be done. Before it is possible to influence personal ethical values and codes, it is necessary to establish the factors affecting human intentions and actions. In this research, analysis of the motivational factors will be essential at two levels. Firstly, an analysis of factors affecting a student's intention to address the ethical issues raised by a given case is required to give an understanding of how students' personal values have been formed. This will

provide the theoretical foundation for an effective tool to influence and modify those ethical values. The revision of students' ethical values, and the stimulation of the students' awareness of unethical actions, establishes a foundation upon which students can base further understanding of real-world ethical issues throughout their working lives. Secondly, it is important that students understand the motivations of the stakeholders or participants in the case analyses that have been stored in the case library. The examination and evaluation of the case analyses enables the identification of unethical actions, and provides potential criteria for the retrieval of analogous cases from the case library.

It is not within the scope of this research to investigate in detail the theoretical basis for the generation of personal beliefs, intentions, and behaviours. However, a brief review of some of the relevant theories supporting the research is necessary. There is continuing research into learning theory, and theories of motivation and intention. Many intersect, or address the same phenomena from differing viewpoints. The mechanisms of the human psyche and cognition are still unclear, and many theories remain unproven. The review below is not exhaustive, but indicates the relevance of the main theories that are used in this research, suggesting how they may be amalgamated.

2.6.1 Personal Intentions and the Ethical Self

Morals are personal standards, and ethics are those morals and standards expected by society (Hanchey and Kingsbury 1994, p.3). Crawford-Brown observes that:

"Ethics rests ultimately on the decision of an individual to lead a virtuous life through finding, understanding and acting in accordance with truths about the natural world and ideals of the human soul." (Crawford-Brown 1997, p.482)

Ethical training should begin at an early age, and virtuous activity should be encouraged and repeated until it becomes habitual (Moor 2001a). Moor states that building good habits is a crucial basis for all skills. Ethical action has to flow from within an individual's character, even when there is no external stimulus to promote it. Borchmann and Jensen's (2003, p.75) concept of critical agency, and Grodzinsky's (2000, p.3) concept of the ethical self, suggest that ethical

computing professionalism should begin with education in core values and virtue ethics. Moor (2001a) confirms this approach, and strongly espouses the teachings of Aristotle.¹⁶

Theorists have long considered that the origin of the self is within the context of social interactions, with other people's responses and expectations to our own actions providing an indication of who we are (Snyder and Stukas 1999, p.274). Social contexts of interactions can affect our dealings with other people, especially strangers. Expectations and interactions, motivated by personal attitudes, become ritualised, formal, and habitual. Habitual actions become automatic so that the influence of the interactions becomes less recognisable. The formation of expectations can be seen as a bilateral activity. Snyder and Stukas further suggest that personal expectations can become influenced by erroneous or over-generalised expectations developed in response to unfamiliar situations. Expectations and attitudes may be subconsciously influenced by what others expect of us rather than by our own implicit standards.

Some research suggests that individuals are fundamentally egoistic (Beu, Buckley, and Harvey 2003, p.89), and that there is a natural, unethical predisposition to ensure the survival and enhancement of the self. Beu, Buckley, and Harvey disagree, noting that many factors influence one's decision to act. The process of considering the factors affecting an action, and of the likely outcomes, is a decision-making process. That does not imply that the process is always carried out in a fully conscious, reasoned manner. Ajzen (2002b, p.119) agrees that some mental reasoning processes may become automated or habitual, triggered by non-volitional stimuli.

Addressing the position of engineers, Crawford-Brown (1997, p.486) notes that engineering decisions are not made in a vacuum. The demands placed upon the engineer by clients may cause the engineer to face an unacceptable choice between ethically valid demands. This may change the engineer's perception of what is ethically acceptable. Family, society, professional organisations, clients, and employer all make demands, often applying conflicting pressures upon, and expectations of the engineer.

¹⁶ Aristotle suggests that people are not naturally virtuous, but require guidance in the acceptance and understanding of the principles of virtue ethics.

Expectations may come from one's own past experiences, or from others who choose to impose their experiences as a 'targets' (Snyder and Stukas 1999, p.278). Expectations may come from the standards associated with group membership such as professional organisations. These expectations often involve the application of a generalised stereotype such as the 'ethical ICT professional' described by Grodzinsky (2000). The mechanism for reaching decisions that will meet the expectations of others forms an essential part of this research.

2.6.2 A Theoretical Approach to Decision-Making

There is evidence to demonstrate that many factors affect attitudes that form intentions to act, and the execution of the action itself. Ajzen and Fishbein (1975) investigated factors affecting the human formation of intentions, and developed the Theory of Reasoned Action (TRA), later revised by Ajzen (1991) as the Theory of Planned Behaviour (TPB). The additional element elevating the TRA to the TPB, the 'control' strand, is shown in Figure 2.4.

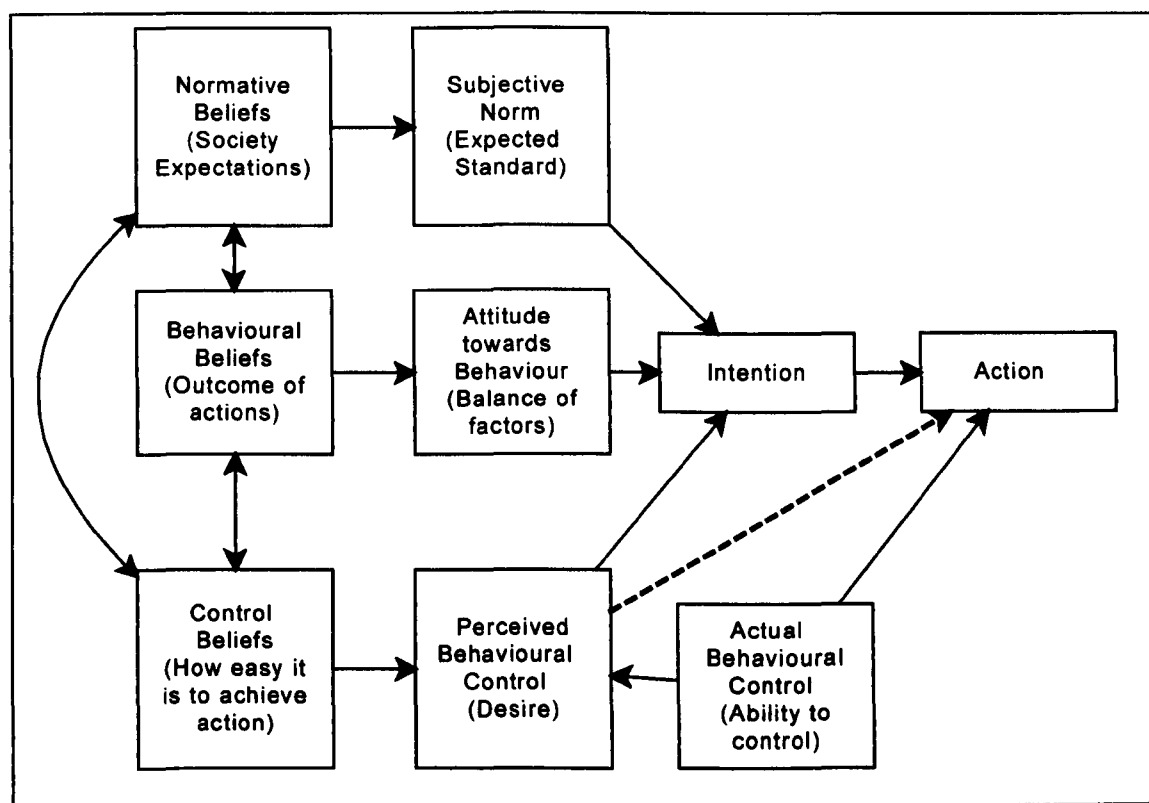


Figure 2.4. Diagrammatic Representation of the TPB (Ajzen 2002c)

Several researchers have used either the TRA or TPB as a basis for their investigations, including: the selection of foodstuffs (Armitage, Connor, and Norman 1999), choice of travel

mode (Bamberg, Ajzen, and Schmidt 2003), and taking medicinal supplements (Sheeran and Orbell 1999). Both theories are acceptable for this research, and are included in this review of literature in ways commensurate with their use by the different authors cited.

The reason for the inclusion of the control beliefs, and perceived and actual behavioural control elements is explained by Ajzen (2002a). The TRA erroneously assumed that most human social behaviour is under the discretion of the person concerned, and that human social behaviour is predictable from intentions alone. Individuals could choose whether to instigate a particular action. However, other factors such as emotions may supersede rational decisions in stressful environments (Ben-Ze'ev 2002, p.503). Martinez-Miranda and Aldea (2005, p.323) observe that emotions play an important role in decision-making, and that they should be embedded within the reasoning process when attempting to model human decision-making. Furthermore, success often depends upon events beyond the control of the individual. These factors can have an effect upon the individual's assessment of the degree of difficulty in attaining a desired goal. The 'control' element of the theory addresses these issues, allowing individuals to assess how much control they have over the desired action. They may then adjust their intention to act according to the actual possibility of successfully completing the action. Humans may abandon their intention to act if they sense that they will not succeed.

The TPB suggests that individuals consider three areas that will influence the formation of an intention to carry out an act before making a decision:

- Behavioural beliefs (The Attitude Towards the Behaviour).
- Normative beliefs (The Subjective Norm).
- Control beliefs (The Perceived Behavioural Control).

For a stakeholder, the behavioural beliefs generate an assessment of whether their actions will be good or bad. Normative beliefs, drawn from the appropriate social standards, laws, codes of practice, organisational policies, or other relevant guidance, consider the social and professional pressures applied to the stakeholder. These apply a motivation to the stakeholder, who then feels a greater or lesser desire to conform to those norms. The control beliefs provide the stakeholder with a measure of behavioural importance, and of the expectation upon the

stakeholder to conform to the perceived guidelines. Attitudes themselves do not directly trigger specific actions. Societal standards strongly influence an individual's intention to carry out an action. The strength of an individual's intention then raises or lowers the possibility that that individual will carry out the action. The attitudes adopted by an individual are strongly influenced by beliefs about the consequences of acting in a particular manner, and an assessment of the possible consequences of carrying out the action.

There is considerable support for these concepts. There is a distinction between perceived control and perceived difficulty, suggesting that perceived difficulty is a better predictor of most behavioural intentions and behaviours than is perceived control (Trafimow et al 2002, p.101). Wood (2000, p.562) found that normative beliefs have many facets, exerting considerable influence over the formulation of one's decision to carry out a particular action. Loch and Conger (1996, p.83) found that attitudes and social norms have a major impact upon decisions to undertake ICT operations affecting privacy and ownership. Studies by Terry, Hogg, and White (1999, p.255), and Armitage and Connor (1999, p.52) conclude that the TPB is a good predictor of intentions and behaviour over time.

Literature upon the application of the TRA or TPB to the understanding of unethical or illegal practice involving ICT is sparse, the main work being that by Loch and Conger (1996, p.76). Loch and Conger believe that the TRA fails to consider four issues that are relevant to ICT decision-making:

- Characteristics of individuals making ethical decisions.
- Relevance of technology.
- Similarity of ethical decision-making to other decision-making processes.
- Importance of gender.

The solitude experienced by many ICT professionals engenders a feeling of anonymity and distance, causing behaviour to fall below expected norms (Loch and Conger 1996, p.83). This state, 'individuation', appears closely related to mood. They suggest its inclusion in the TRA. Mood and emotions can temporarily affect rational thought and actions (Ben-Ze'ev 2002, p.502; Armitage, Connor, and Norman 1999, p.430). Nevertheless, the basic concepts of the TRA and

TPB are accepted by Loch and Conger (1996, p.82), and can be used by students in their evaluations of their given scenarios and applied to the actions of stakeholders.

Emotions occur when positive or negative changes are observed in personal situations, or in the situations of those who are important to others (Ben-Ze'ev 2002, p.498). Ben-Ze'ev suggests that a significant emotional positive or negative change occurs when there is a significant improvement or deterioration to a smoothly flowing progression relevant to one's concerns or expectations. Ajzen and Fishbein (2000) comment that the adoption of a negative attitude by an individual towards a particular psychological phenomenon will predispose a negative attitude towards anything associated with that phenomenon, regardless of other factors.

Individuals in positive moods tend to choose activities that give pleasure or a feeling of 'goodness' (Eisenberg 2000, pp.683-684). Those experiencing negative emotional states such as sadness, anger, or distress tend to make moral decisions based upon short-term effects, disregarding the more serious long-term consequences. Ben-Ze'ev (1997) notes that emotions help people to distinguish moral features in specific contexts, stimulate moral behaviour as in moral indignation, and discourage immoral behaviour. However, investigation of affective aspects of learning, such as mood and other states that occur during computer aided learning, is a relatively recent area of research, and little literature is available (Konradt, Filip, and Hoffman 2003, p.309).

2.6.3 Personal Motivation, Expectations, and Self-Efficacy

A number of studies use the TPB as a suitable medium to investigate personal motivation, and have identified further additions and modifications that may be used to extend its applicability. Beck and Ajzen (1991) found that if the concept of 'perception of moral obligations' was added to the TPB, the theory showed a high degree of accuracy when predicting dishonest actions. Beu, Buckley, and Harvey (2003, p.89) observe that accountability, individual characteristics, culture, environment, and strength of relationships with others are all factors that have a significant influence over the direction that the decision-making process will take. Pierce and Henry (1996, p.425) found that three factors influence the individual's ethical decision-making process:

- The individual's own personal code that develops from experience or observation of others.
- Any informal code of ethical behaviour that exists in the workplace or from peer expectations.
- Exposure to formal codes of ethics.

There is evidence that an individual's own personality may also be related to the expectations that they have of themselves (Snyder and Stukas 1999, p.275), a point addressed by Bandura's (1977) Theory of Self-efficacy (TSE). An individual's own attitudes may influence their concept of possible actions, and intention to carry out an action. Loch and Conger (1996, p.76) found that self-image was an important factor in student motivation.

Theories addressing motivational beliefs, values and goals, and their effect on one's expectations and motivation, are reviewed by Eccles and Wigfield (2002). They observe that the TSE focuses upon expectations of success, and suggest that these are major determinants in goal setting and activity choice. They note that most theories of expectation assume that one should expect to succeed to the extent that one feels in control of one's successes and failures. Not knowing what caused one's success or failure is a demotivational factor.

The two areas of expectation that are invoked when considering whether to carry out an action are addressed by Bandura (1977, p.193): efficacy expectations and outcome expectations. They become effective at different points in the decision process, shown in Figure 2.5.

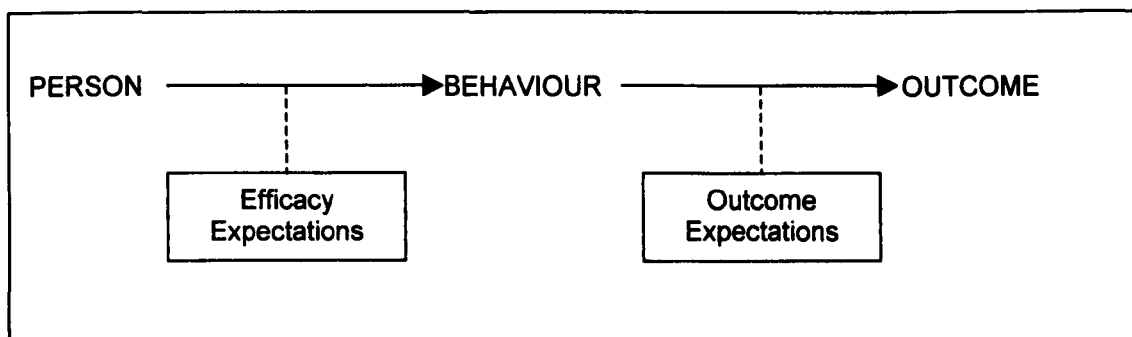


Figure 2.5 – Diagrammatic representation of the differences between efficacy expectation and outcome expectation (from Bandura 1977)

Bandura states:

“... efficacy expectations are distinguished from response-outcome expectancies..... An outcome expectancy is defined as a person's estimate that a given behavior will lead to certain outcomes. An efficacy expectation is the conviction that one can successfully execute the behavior required to produce the outcomes. Outcomes and efficacy expectations are differentiated, because individuals can believe that a particular course of action will produce certain outcomes, but if they entertain serious doubts about whether they can perform the necessary activities such information does not influence their behavior.” (Bandura 1977, p.193).

The TSE, shown in Figure 2.6, posits that behaviour is largely governed by what one expects of the results of one's actions.

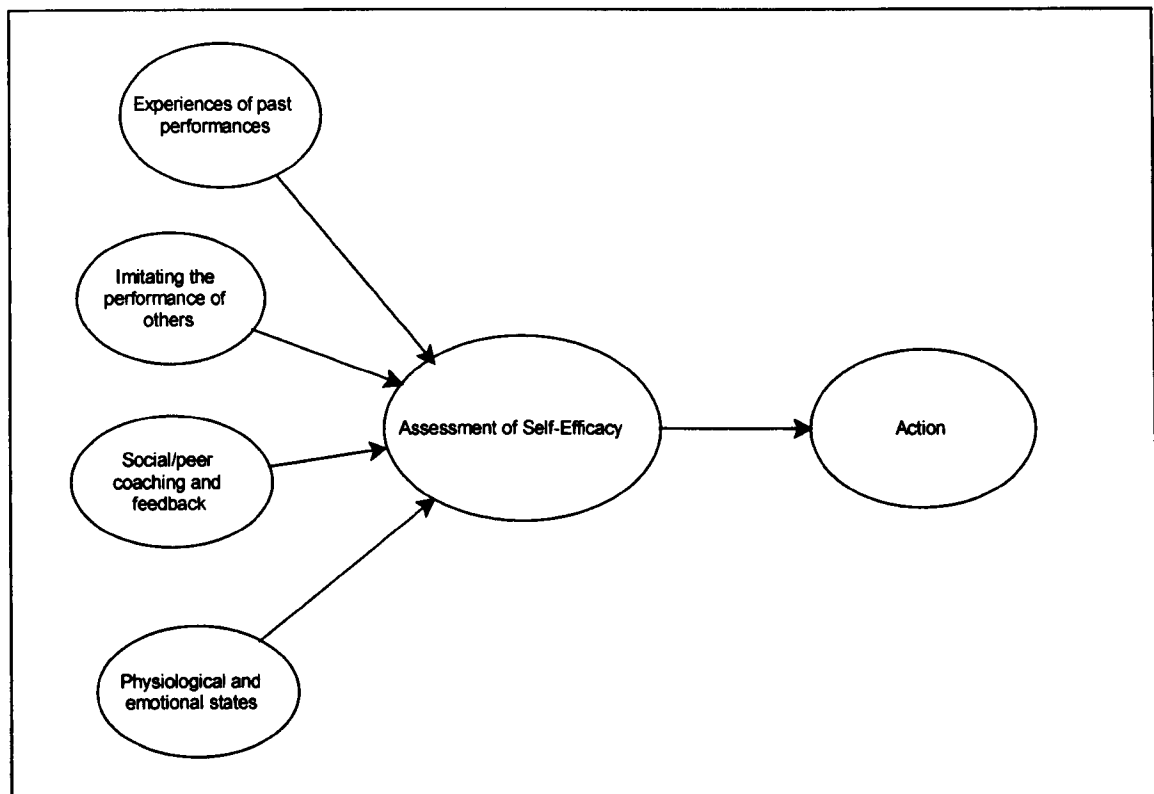


Figure 2.6. - Diagrammatic Representation of Bandura's Theory of Self-Efficacy

Expectation of success in reaching a chosen goal is affected by assessment of four factors (Bandura 1977, p.195):

- Performance accomplishments - Assessment of how well one performed similar or identical tasks in the past. Bandura notes that this source of expectation is particularly strong as it is based on one's past successes. Past failures can lower expectancy levels. Having confidence and skills to cope with stressful or novel situations undoubtedly lifts one's sense of personal efficacy. This supports the need to prepare students for the stressful and novel

situations encountered in the workplace. It encapsulates the objectives of this research to provide students with an effective mechanism for meeting such challenges.

- **Vicarious Experience** - Observation of how well others perform similar or identical tasks. This is a less persuasive source of expectation as it lacks the immediate personal experience in evaluating of one's own accomplishments. This supports the concept that experienced professionals should impart their accumulated experience to novices. It also supports the use of case studies, gathering knowledge from the experiences of others.
- **Verbal Persuasion** - the encouragement and comments provided by peers and instructors that provide reassurance upon one's capability to complete the task. This element is weaker in its effect than personal performance evaluation. Verbal encouragement to raise expectations of a successful outcome in a stressful situation can be swamped by the negative recollections of past failures.

Bandura observes that to use persuasion to raise personal expectations of competence is likely to lead to unreasonable levels of expectation, and failure to achieve one's goals, unless facilities are made available to improve performance. This has particular significance for the teaching of ethics to students. It is unreasonable to expect them to adopt high moral standards unless suitable instruction and tools are available to raise their ethical competency.

Verbal persuasion, however, tends to be more effective with children. Fisher (1995, pp.36-37) observes that there is a need to provide a stimulus, and to allow a child their sense of success. Children who receive encouragement and praise tend to perform significantly better than others who are reprovved or ignored (Child 1997, p.59). Nevertheless, Granger and Little (2001, p.244) suspect that verbal reasoning upon ethical issues is less effective once individuals reach their mid teenage years.

- **Emotional Arousal** - Stressful or taxing situations generally arouse emotions. People rely partly upon their emotions as a measure of their anxiety and vulnerability. They are more likely to have high expectations of themselves when not haunted by negative experiences.

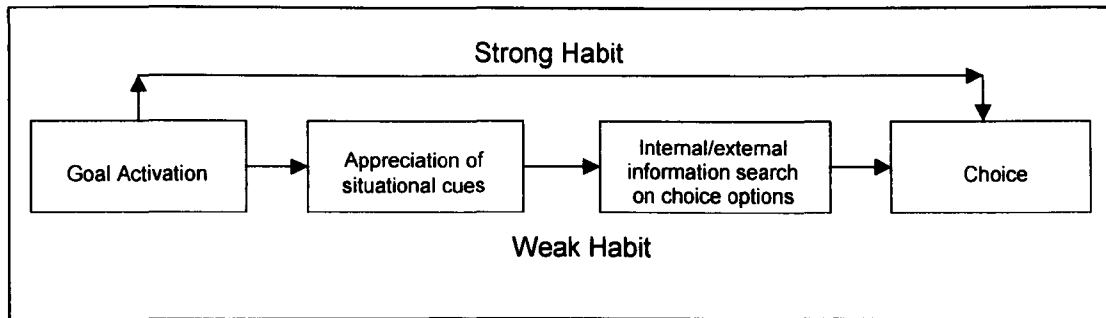
The TSE contributes greatly to the perceived behavioural control in the TPB (Ajzen 2002a, p.668). Perceived self-efficacy is the realisation of an individual's belief about their capabilities to control their own actions or events that effect their lives. Ajzen comments that self-efficacy differs from the element of perceived behavioural control which addresses one's ability to perform a particular act. Self-efficacy is one's conviction that a certain action can be successfully completed in order to achieve an expected result. This definition addresses the recognition of control over the behaviour, not the outcomes from the action. It is therefore a contributory factor to the decision-making process.

Success at a difficult task provides evidence of increased competence and strengthens self-efficacy (Bandura 1977, pp.200-203). This promotes an increase in one's confidence to address new, more demanding situations. This process also develops the individual's coping skills. New situations are then addressed, leading, if successful, to further increases in self-efficacy. The attitude of the individual becomes part of an upward spiral, encouraging a deeper involvement in attaining successful outcomes for the task in hand.

2.6.4 Habituation and Examination of Previous Events

The frequency of past events or behaviour has strong effects upon intentions, tending to overrule normal reasoned intentions (Perugini and Bagozzi 2001, p.84). Ajzen and Fishbein (2000) note that some human behaviour is often 'automatic', with reaction to an issue being stimulated by habitual beliefs or by mindlessly bypassing rational thought or reasoning. Individuals often take intuitive short cuts when making decisions or forming attitudes, and base decisions on pre-existing schemas. Repeated actions become habitual and obliterate normal reasoning processes (Aarts, Verplanken, and van Knippenberg 1997, p.2), although Ajzen (2002b, p.119) disputes some concepts underlying these findings. He agrees that humans are creatures of habit and suggests that complex behaviours, initially requiring explicit formation of intentions, can become automatic with sufficient repetition and practice, e.g. driving a vehicle. This is often accomplished in parallel with other equally demanding actions. Verplanken, Aarts, and van Knippenberg (1997, p.542) consider that the greater the repetition, the stronger is the habit. Strong habituation may overwhelm the weaker, normal reasoning processes that rely on

situational cues or internal choices. They propose the process model shown in Figure 2.7 below.



**Figure 2.7 – Model of Choice Selection by Weak and Strong Habit Individuals
(from Verplanken, Aarts, and van Knippenberg 1997, p.542)**

However, Ajzen draws a distinction between the concepts of the TRA/TPB and habituation, and the ritualised, formal responses to events suggested by Snyder and Stukas (1999, p.274). Ajzen states:

"One way to look at the process of routinization is to assume that repeated performance of a behavior produces habituation. When a habit develops, behavior is said to come under the control of stimulus cues On future occasions, presence in a similar situation is sufficient to trigger the automatic response sequence. A stable stimulus context is therefore crucial for habitual behavior to occur, and *habit* has indeed been defined as the tendency to repeat past behavior in a stable context.

Routinization of behavior, however, is also consistent with a reasoned action perspective. The Theory of Planned Behavior does not propose that individuals review their behavioral, normative, and control beliefs prior to every enactment of a frequently performed behavior. Instead, attitudes and intentions — once formed and well-established — are assumed to be activated automatically and to guide behavior without the necessity of conscious supervision (Ajzen and Fishbein, 2000). However, whereas the habituation perspective asserts that routinized behavior is under the control of stimulus cues, the reasoned action perspective postulates that such behavior is guided by automatically activated or spontaneous attitudes and intentions." (Ajzen 2002b, p.108).

Ajzen thus draws a distinction between "rote" and "deep" learning. This distinction is of particular significance to consideration of, and learning from the analysis of ethical case studies. In the retrieval of analogous cases, care must be exercised over the stimuli that are used as retrieval vectors to indicate similarity between the given and retrieved cases.

The concept of education in ethics is that comparisons are made with a data store of past experiences, and decisions upon ethically justifiable actions are based upon the previously considered case criteria. Therefore, there must be an element of repetition in the decision-

making process. This aspect follows the concepts of Moor (2001b, p.91), that ethics education is an iterative process. However, regression to rote learning suggests that the decision process has been reduced to a rule-based exercise, not necessarily providing a solution that is socially and ethically justifiable.

The concept of rote learning conflicts fundamentally with the proposals of Friedman and Phillips (2003, p.22) who believe that a commitment to self-reflective practice is an essential facet of the modern professional. Self-reflection should be an automatic response to consideration of an ethical dilemma, but the response should be a considered response, not a rote-learned one. Goldstone (1998, pp.591-596) conceives this as 'stimulus imprinting', and suggests that, if a set of stimuli can be internalised, a receptor mechanism is developed that stores specific instances. As more instances are stored, performance improves because further relevant instances are available for retrieval, and the time required for decision-making decreases. People's performance in perceptual tasks is closely tied to their experience with a particular stimulus. They become attuned to the particular instances to which they are exposed. Instance memories that are strong and quickly developed facilitate the perception of similar items. This retrieval capability is enhanced by the use of "template" models that allow instances to be recognised by comparison with stored schemata of known objects. Goldstone also finds that people imprint particular parts or features of an instance or object, or environmental irregularities between instances. Goldstone states:

"By differentiation, stimuli that were once psychologically fused together become separated. Once separated, discriminations can be made between percepts that were originally indistinguishable. As with imprinting, differentiation occurs at the level of whole stimuli and features within stimuli" (Goldstone 1998, p.596).

The detectors developed are also influenced by task requirements and strategies. Schemata that have been previously classified become available for use in a partial matching process. This has two implications for this research. Firstly, it confirms that pre-processing and decision making can be usefully undertaken, and the results recalled quickly for future use without a repetition of the evaluation process. Secondly, it does not assume that a case must match on all similarity issues for it to be useful. The first implication meets the beliefs of Ajzen (2002, p.117) that consideration and reflection are necessary for the formation of valid intentions, but previous

consideration and decisions may be used to speed the decision-making process if sufficient similarity issues exist. The second implication appears to address the concern that students will have different views or start points in their approach to ethical issues, depending upon their culture, nationality, or religion. What is morally acceptable to one student may not be so for another. Given that all students will begin their ethical assessments using the same case scenario, it is possible that many will retrieve different analogous cases for comparison. Therefore, there seems to be a basis for using similarities or recognisable differences between case studies to classify and retrieve suitable cases for comparison. However, Goldstone (1998, p.599) questions whether genuinely perceptual changes can be identified by simply reading a given scenario. The key to the effectiveness of the retrieval process that will lead to an enduring increase in self-efficacy seems to be the deeper stimulation and guidance of students' interest in the cases that are presented to them.

Lasting changes in assessment of self-efficacy and behaviour can best be achieved by participant methods using techniques initially to develop an individual's capabilities (Bandura 1977, p.202). Later, any external aids are removed to ensure the adoption of suitable personal efficacy values, leading finally to a self-directed mastery of the coping skills to strengthen high expectations of personal efficacy. The process, envisaged by Bandura, follows closely the perception of deeper learning required to raise students' ethical awareness. It seems to form an iterative cycle, tending to draw the individual deeper into the development of coping strategies to address tasks of increasing difficulty. The repeated process becomes habituated, and may be carried out by default. It would seem that the attitude of an individual who attains the state contemplated by Bandura is approaching an almost subconscious state of learning, tending towards a state of 'flow'.

2.6.5 Achieving a State of Flow

Flow Theory, developed by Csikszentmihalyi (1992, pp.15-35), suggests that intrinsic factors can create a state where an individual seems to lose touch with reality. Humans become immersed in a virtual world where decisions flow unconsciously. Flow is the state that occurs when an individual is involved in an activity for its own sake. The state is so satisfying that individuals want to repeat the activity continually. Eccles and Wigfield (2002, p.113) observe

that flow can only occur when it is felt that the opportunities presented by a situation or environment match the capability and capacity to master the challenges presented. They also observe that for flow to be effective,

both the challenges and skills must be relatively high. Flow can only occur when a task is absorbing and stimulating. Csikszentmihalyi and Csikszentmihalyi (1992, pp.254-261) describe the relationship between the challenge of the task undertaken and

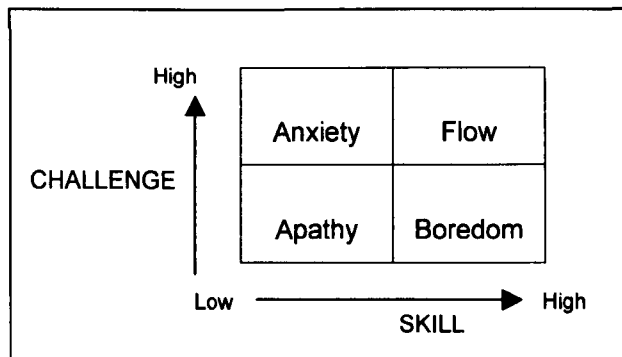


Figure 2.8. - Four Channel Flow Model (From Csikszentmihalyi & Csikszentmihalyi 1992, p.261)

the skill required accomplishing it. Only when high skills match high challenges will the state of flow be reached. This is shown in Figure 2.8.

Nine dimensions, shown in Figure 2.9, characterise flow (Csikszentmihalyi 1992, pp.32-35).

These may be grouped into antecedents (factors provoking and contributing to flow experience), experiences (the characteristics evident during a state of flow), and effects (the individual's inner experiences after entering the flow state).

Antecedents	1. Clear goals.
	2. Immediate feedback.
	3. Personal skills suited to the task.
Experiences	4. A merging of action and awareness.
	5. Focus of attention on a limited field.
	6. Lack of self-consciousness.
Effects	7. Feeling in control of one's actions.
	8. An altered sense of time.
	9. Experience that becomes autotelic.

Figure 2.9 – Csikszentmihalyi's Nine Characteristic Dimensions of Flow

The conditions necessary for a state of flow to be attained when seeking information on an Internet web site are described by Skadberg and Kimmel (2004). They believe that the development of a web site is not just about providing information – it is also about facilitating and enhancing the users' experience, including the creation of pleasurable experiences that will lead to experiential learning. This is an important issue in the creation of pedagogic web sites.

In addition, Skadberg and Kimmel (2004, p.406) propose the model shown in Figure 2.10 to illustrate the factors that affect an online user's level of interaction and contribute towards the attainment of flow. The model is divided into three phases coinciding with the findings of Csikszentmihalyi (1992, pp.32-35). When applied to online activities, the attainment of flow leads to enhanced learning and to a change in attitude (Skadberg and Kimmel 2004, pp. 407-408). The model includes elements of human-computer interaction that promote a feeling of confidence and competence. It would thus seem that the concept of high self-efficacy, and the iterative process associated with its attainment, match closely with the concept of flow. This concept will have a major impact upon the design of the case retrieval tool, and upon the selection of the case studies contained in the case library. However, external factors will also affect the internal decision-making process.

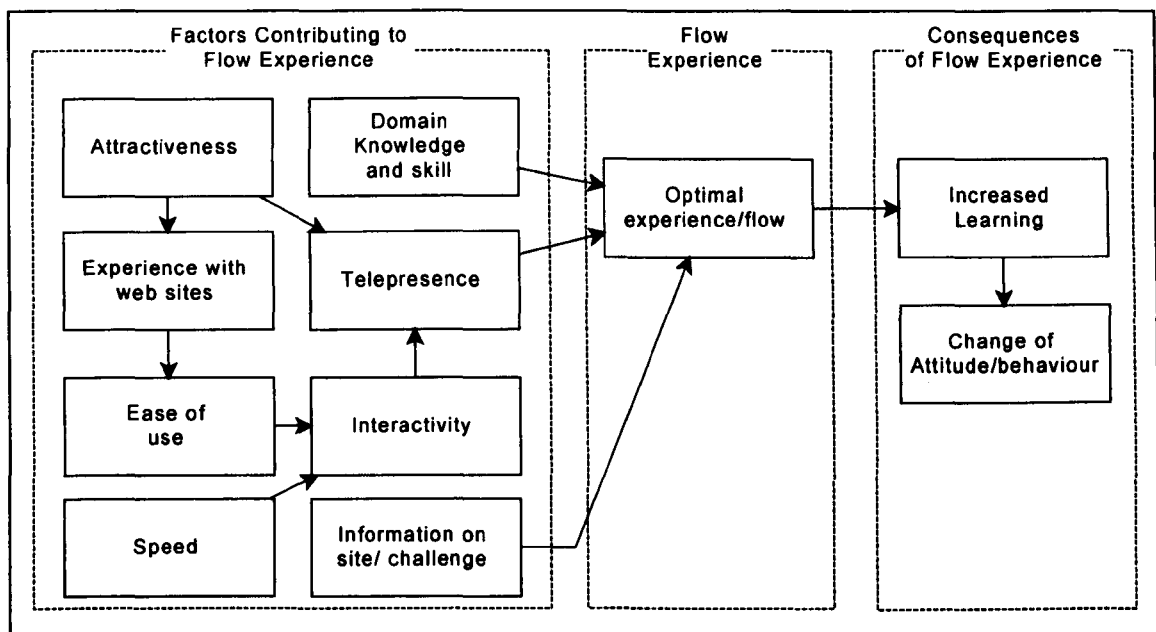


Figure 2.10 - Proposed Model of a Web Site Flow Experience (Derived from Skadberg and Kimmel 2004, p.406)

In their discussion of individuals' motivation and ethical decision-making processes, Loch and Conger (1996, p.79) suggest that ethical climate is a significant factor in forming intentions. Victor and Cullen (1988, p.101) define ethical climate in an organisation as "the prevailing perceptions of typical organisational practices and procedures that have ethical content". They found that work climates differ within organisations by position, tenure, and workgroup membership. The socio-cultural environment, organisational form, and organisation-specific

history are also significant in setting the ethical climate of an organisation. Sproull, Kiesler, and Zubrow (1994, pp.583-585) found that computing has developed its own culture and ethical environment that sometimes conflicts with accepted social norms.

2.6.6 A Model for Ethical Decision-Making

It is possible to use the factors that affect ethical climate, also inherent in many professional ethical codes, to identify the occurrence of an unethical action (Beck and Ajzen 1991). Consequently, it should be possible to combine the use of suitable ethically analysed case studies with the predictive capabilities of the TPB to raise the awareness of ICT students to ethical dilemmas. The TSE, Flow Theory, the concepts of emotions (Ben-Ze'ev 2002), and mood (Eisenberg 2000) appear to integrate well with the TPB. Together, they suggest the development of a model that could be applied to the analysis of the actions of stakeholders, and to the learning actions expected of students when using the case retrieval tool. A model, shown in Figure 2.11, was developed that includes the many factors discussed above.

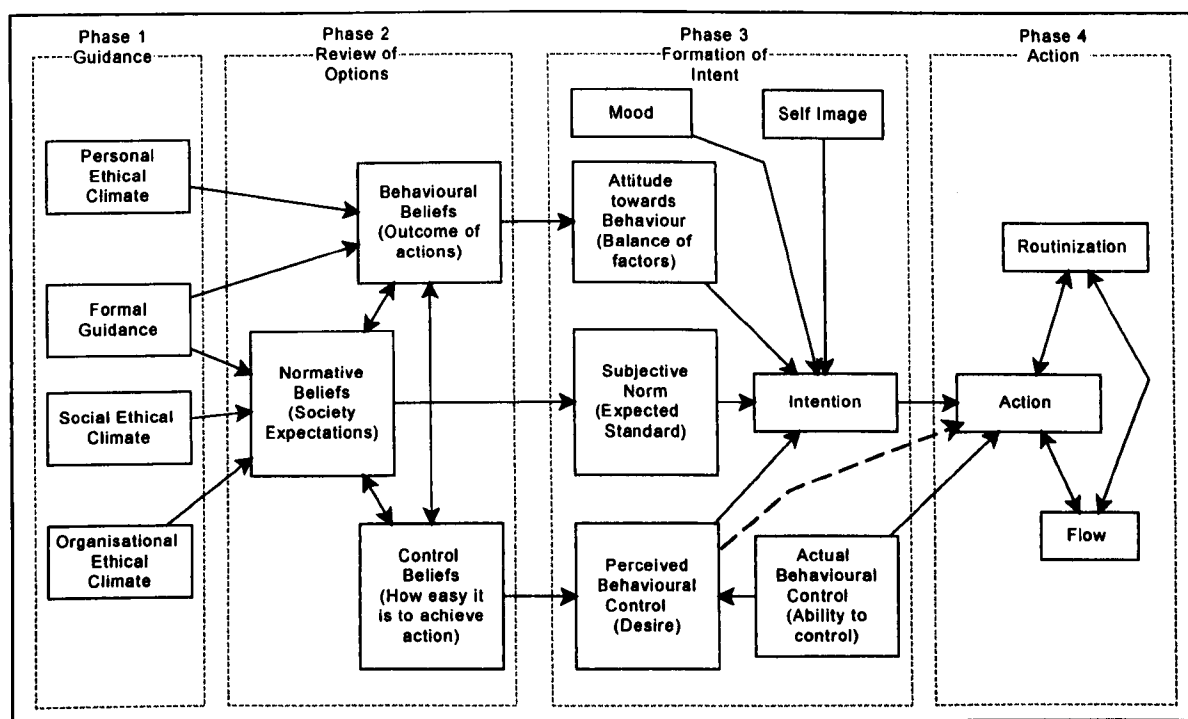


Figure 2.11 - A Model of the Process of Evaluation of Ethical Case Studies

The model has been used as the basis for the development of the retrieval tool. It is suggested that four phases occur in the ethical decision-making process. The first phase addresses the

concept that human motivation and decision-making are influenced by ethical climate. This element will include consideration of gender issues, raised by Loch and Conger (1996, p.77). As has been discussed above, ethical climates are formed from a multitude of ethical criteria, and the resulting decision and action reflect the actor's perception of the ethical issues intrinsically suggested by the relevant ethical climate. Phases two, three, and four follow closely the concept of the TPB. Additionally, phases three and four reflect the effect of mood, self-image (self-efficacy), and flow. This recognises that mood, emotions, and self-perception have a significant effect upon an individual's intention and action.

Phase three includes an input element of mood to meet the suggestion of Loch and Conger, (1996 pp.76-77) that any model of ethical decision-making addressing the use of computers should include a consideration of deindividuation. In extreme cases, mood and emotions may completely overwhelm rational consideration of the effects of an action, blocking the attainment of a flow state. Deindividuation promotes a sense of isolation and anonymity, and a change of mood leading to a relaxation of inhibitions that control the performance of unethical acts. The effects of deindividuation feed into the model through the formation of ethical attitude in stage three of the model. However, some moods such as those prompted by anger or frustration may override the reasoned process outlined in the TRA/TPB. The model proposed therefore shows how and where mood and self-image influence reasoned decision-making. It differs from the TRA/TPB in that the TRA/TPB ignores any unreasoned, emotional responses. In the TRA/TPB, Ajzen considers only the fully reasoned consideration of a formation of intent, ignoring those factors that override reason.

The model also includes an implicit element of iteration at two levels, required by the considerations noted at the beginning of this section. The revision of students' ethical values is addressed by iteration through the complete model following presentation of a novel ethical dilemma. The application of the model to the student learning process demonstrates the development of the student's intention to undertake the analysis and reflect upon the issues raised by the given case scenario. This will lead to the formation of attitudes upon the ethical issues involved. The retrieval tool poses a series of questions as it directs student navigation through the retrieval process. Each requires reflection upon the facts of the given scenario, and

formulation an attitude and opinion to the actions of each of the stakeholders. An iteration of the decision-making process is completed for each significant stakeholder, and ethical issue raised by the retrieval tool. The tool presents an appropriate sequence of questions to the student, based upon the student's previous responses. Students are expected to role-play, placing themselves in the personae of the stakeholders, and forming attitudes upon the actions that were possible or taken by the stakeholders. The responses reflect the student's ethical standards and values to the given case scenario. The repeated consideration of the ethical issues raised will inculcate the process and need for ethical consideration into the student's psyche.

Students require the assembly of a variety of ethical experiences against which they may judge the actions of stakeholders. The iterative process in phase four accommodates the requirements of Moor (2001b, p.91) that evaluation of the ethical impact of actions requires reflective, iterative consideration, and Snyder and Stukas (1999, p.274), that this process should become habitual. This differs from the concepts of Ajzen, who looks at the intention to carry out an action. Ajzen's (2002b) concept requires that students iteratively pre-process information obtained from a range of previous experiences. In this way, a wide range of ethical issues are examined and stored in readiness for recall following suitable a stimulus. Ajzen's proposals model the process of populating the memory store with cases addressing the many ethical issues that may be encountered in real life.

The need to attain a state of flow for the development of the most effective learning environment has been discussed above. This state will lead to the desire to explore alternative or additional cases, so providing a deeper understanding of the ethical issues involved. The process thus becomes routinized and habitual. Consequently, the process of considering the ethical implications of an action meets the concepts that there should be habitual iterative consideration of ethical issues. It also meets the requirements that the iterative process should consciously match cues in the given case study with the cues in the presented cases so that stability of context can be established.

The model fits well with Feuerstein's (1998, pp.10-11) concept that the beliefs and attitudes of humans can be modified by suitable internal or external stimuli. He notes that humans are not 'hard wired', but are endowed with a plasticity and flexibility that leads to individuals having a high degree of modifiability which renders the individual, their development, and their behaviour, unpredictable. Feuerstein suggests that the exposure of individuals to internal and external stimuli via a mediation process will modify individuals' attitudes and reception of the stimuli as catalysts for further modification. However, the theory suggests that for the most effective learning mediation should take place through a human mediator in a face-to-face situation. This synchronous exchange between student and mediator is not always possible in a university environment where ethics is taught to large groups of students. This is a fundamental reason for the development of the tool. Human face-to-face mediation is expensive, and it is difficult to find staff sufficiently experienced and willing to teach the application of ethical principles. To some extent, the retrieval tool takes the place of the human mediator, both interpreting the information contained in the ethical case analyses, and in stimulating the interest and learning processes of the students. It supplements face-to-face mediation in a manner acceptable to students, and is able to operate in an asynchronous mode. The tool is designed to accept the input of the students, mediate their input using pre-analysed case studies, and provide feedback based upon the mediation. As Wiener states:

"Feedback is a method of controlling a system by reinserting into it the results of its past performance. If these results are merely used as numerical data for the criticism of the system and its regulation, we have simple feedback of the control engineers. If, however, the information which proceeds backward from the performance is able to change the general method and pattern of performance, we have a process which may well be called learning." (Wiener 1954, p.61).

The tool must therefore aim to achieve those qualities that stimulate the interest of students through the study and interpretation of ethical scenarios. It must present case information and analyses that are current, relevant, interesting, and entertaining. The style of retrieval and presentation of the analyses thus becomes a critical issue in the construction of the tool. The following section addresses the approach taken to establish the students' response to the use of the case retrieval tool, to establish its efficacy in causing students to reflect upon and modify their ethical opinions.

2.7 The Implications of Culture upon the Effectiveness of the Retrieval Tool

The primary aim of the testing of the retrieval tool is to determine whether it causes the students who use it to recognise and consider more deeply the ethical issues raised by a given real-life scenario. Ethical values are personal, internalised concepts, affected by a variety of factors including cultural background, religion, peer influence, and upbringing (Simpson 2000). There appears to be a considerable difference between the ethical attitudes of the developed 'western' nations and other nations who are yet to be influenced by the progress of modern technology, or who espouse different cultures. Tedre, Kahkonen, and Kommers (2003) note that ICT is currently focussed upon western knowledge workers. Nevertheless, globalisation may be causing a homogenisation of ethical and cultural norms (Seitz 2001, p.21). The influence of the US and other developed countries has tended to dominate the implementation of ICT and its associated ethical values (Lenarcic 1999, p.204).

Our lives are now so permeated by the use of ICT that many people and organisations would find it difficult to function without it (Tavani 2001, p.98). The implementation of ICT on a global scale tends to reinforce US influence and standards (Asgary and Walle 2002, p.62). The suggestion of Moor (2001b, pp.89-90) that ICT has presented many new ethical dilemmas for all sections of society suggests that the retrieval tool must be able to address a variety of issues from differing cultures and backgrounds. It must support personal ethical views taken from students' different cultural and ethical standpoints. However, many students have little understanding of the ethical issues associated with the use of ICT (Schulze and Grodzinsky 1996, p.100; Cook 1987, p.462).

2.7.1 The Rationale for the Retrieval Tool

Personal and business ethical standards appear to be declining (Beu, Buckley, and Harvey 2003, p.88; Introna 2002, p.72; Simpson 2000), causing most students to hold misconceptions about what represents unethical behaviour (Calluzzo and Cante 2004, p.301). Many governments and professional societies have moved to improve both the recognition and consideration of ethical dilemmas raised by the development and use of ICT (IEEE-CS/ACM 2001, p.231; ACM 2001; Spinello and Tavani 2001, p.v). The wide acceptance by governments

and professional societies in the 'westernised' countries that ethics should be incorporated as a core module in the university ICT curriculum has encouraged a strong bias towards western values in these courses. Furthermore, the globalisation of university education has exacerbated the problem. Students from other cultures that incorporate different values are now exposed at universities, particularly in the UK, Australia, and the US, to 'westernised' ethical values. Migratory flows have also caused the appearance of separate cultural communities within the westernised societies. Interestingly, Rosin (2003, p.273) finds that cultural differences may be significantly reduced in the most recent generations because of globalisation. This would tend to suggest that there is a movement towards a universal ethic in ICT.

Student uncertainty about what constitutes unethical behaviour will carry over into their workplaces after graduation (Calluzzo and Cante 2004, p.301). Calluzzo and Cante observe that unethical behaviour is already present in the workplace, and cite research in the US indicating that almost half of US ICT users admit to acting unethically. They argue that this conveys a misleading message to students of all cultures about how they are expected to behave when confronted by an ethical issue. Peppas and Diskin (2001, p.347) believe that ICT students have become accustomed to seeing unethical behaviour by many who should be role models. De Ronde (1996, p.54) suggests that practical guidance should be given to students so that their actions in commerce and industry may be prevented from causing harm to anyone who uses, or is affected by the use of ICT. Ensuring that students are aware of the ethical issues that will affect them throughout their working lives (Huff and Martin 1995; Webb, Rackley, and Betts 1999; Storey and Thompson 1999) will inevitably extend to affect society in general.

Wide exposure to a variety of ICT ethical issues is most likely to come from accurate accounts and analyses of the actions of stakeholders within case studies, and can produce significant changes in students' ethical awareness (Simpson 1999). Turner and Lowry (1999, p.1050) suggest that employers are moving to a more ethical, people-based approach in the workplace. Students need to develop a variety of skills and knowledge to be successful in their chosen career (Castleman and Coulthard 1999, p.174), including good appreciation of appropriate professional conduct, working styles, and characteristics of industry in general (Orpen 2003, p.81).

This research seeks to address the lack of ethical awareness by students. However, there are two aspects of the retrieval tool that must be considered: firstly, the effect of culture on the student understanding of the ethical issues raised, and secondly, the acceptability of the tool in terms of usefulness and usability. The learning styles adopted by different cultures are expected to affect the acceptance of the retrieval tool by students from cultures other than westernised societies.

The internalised values that form an individual's ethical standards, and the criteria for acceptance of a computerised teaching tool, are subjective. The method of evaluating and testing must therefore recognise that there will be different responses to the content, operation, usability, and acceptability of the retrieval tool. In this research, the evaluation of the retrieval tool gathers information from two perspectives. Firstly, a single questionnaire obtains students' assessment of basic human-computer issues connected with the retrieval tool interface. Secondly, the change in students' awareness of ethical issues raised by a given test scenario is gathered by two surveys. The first is completed after consideration of the given case scenario but before the use of the retrieval tool, and another identical survey completed after the use of the retrieval tool. This gives the 'before' and 'after' status of the students' ethical awareness.

This research is able to target students from Wolverhampton University in the UK, which has a catchment population drawn from the spectrum of ethnic groups found within the UK West Midlands region. It is also able to target students who attended BSc courses conducted by De Montfort University in Kuala Lumpur, thus focusing upon a spectrum of students from South East Asian countries. Wolverhampton University also attracts some students from the South East Asian region in addition to students from France, Greece, and Germany. Consequently, the cultural diversity of the target populations used to test the retrieval tool is wide.

2.7.2 The Effects of Cultural Diversity

Cultural differences often cause miscommunications and conflict, and lead to an increase in 'cultural distance' (Triandis 2000, p.145). Triandis' concepts are examined in more detail in section 2.7.4. The cultural differences between the ethnic groups used to test the retrieval tool may give rise to different responses to the same ethical issues. Furthermore, the case analyses

in the case library, and the given case scenarios were written in the style suitable for a Western European male. This style may not be suitable for South East Asian students, or those drawn from some of the many immigrant groups in the UK (Asgary and Walle 2002, pp.65-67).

Globalisation and natural ethnic makeup of national populations introduce diversity in cultural mix. Constituent groups within a student cohort will tend to reflect their own individual cultural and ethnical traits (Peppas 2002, p.52). Chatterjee and Pearson (2003, p.203) observe that South East Asian cultures include Buddhism, Hinduism, and Islam, that espouse Confucian values. Malaysia has four major ethnic or religious groups: Tamils, Indians, Chinese, and Malays. In addition, there are about 40 other minor ethnic/cultural/religious groups in the country. The Kuala Lumpur cohorts could be drawn from any of these groups. The UK cohorts may include students whose cultures are rooted in those of the Indian sub-continent, or who are Afro-Caribbean, in addition to the European or indigenous UK population.

The mix of religions, ethnicity, and cultures is not a drawback for this research. Cultural characteristics are expected to have an effect upon the assessment of the effectiveness retrieval tool. The student responses to the usability questionnaire establish the acceptability of the retrieval tool to students from a wide range of backgrounds. The student responses to the ethical awareness questionnaire explore the effectiveness of the tool in causing students' deeper consideration of the ethical issues raised in real-world scenarios. The responses also allow consideration of the possible effects of students' cultural and ethnic background when using the tool. It is beyond the scope of this research to investigate in depth the cultural characteristics of potential ICT users. Nevertheless, a basic understanding of these issues is relevant here to allow consideration of the variation of responses that may be expected from students of different cultural backgrounds.

2.7.3 Hofstede's Cultural Classification Dimensions

A widely accepted body of cultural research is that of Hofstede (1982; 1994). Hofstede (1982, p.13) defines culture as "collective programming of the mind". He used data garnered from staff of IBM in more than forty countries between 1968 and 1972. The data allowed the countries to be ordered by five main dimensions that affect human thinking, organisations, and institutions:

- Power Distance - the extent to which members of a society accept that power is unequally distributed in organisations.
- Uncertainty Avoidance - the degree to which members of a society feel uncomfortable with uncertainty and ambiguity, which leads them to seek conformity.
- Individual versus Collective - the extent to which members of a society believe that individuals are supposed to take care of themselves and their family compared to a collectivist society where unquestioning loyalty is given to a larger group.
- Masculinity - the extent to which a society is achievement oriented, assertive and competitive as opposed to femininity, which is the extent that a society values relationships and caring for others.
- Long-term versus Short-term Orientation – the extent to which society values the eastern (Confucian) long-term values as opposed to the short-term western perspectives. These are shown in the Table 2.1.

Short Term Orientation	Long Term Orientation
Respect for tradition.	Adaptation of traditions to a modern context.
Respect for social and status obligations regardless of cost.	Respect for social and status obligations within limits.
Social pressure to 'keep up with the Joneses', even if it means overspending.	Thrift, being sparing with resources.
Small savings, little money for investment.	Large savings, funds available for investment.
Quick results expected.	Perseverance towards slow results.
Concern with 'face'.	Willingness to subordinate oneself for a purpose.
Concern with possessing the Truth.	Concern with respecting the demands of Virtue.

Table 2.1 – Key Differences Between Short Term and Long Term Orientation Societies (From Hofstede 1994, p.173)

Hofstede (1994, pp.13-15) suggests that, using scores on the five dimensions, countries may be grouped into cultural clusters. When combined, the factors present a five-dimensional model of differences between cultures. Each dimension can be compared with similar dimensions in other cultures. Furthermore, Hofstede suggests that examination of dimensions may be used as

a predictor of the characteristics and behaviour of nations, and can be used to compare nations or cultural groupings.

The cultural backgrounds of cohorts selected to test the retrieval tool came from countries that are very different and score very differently on Hofstede's criteria. The Malaysian students are drawn from a mainly Confucian-based culture, whereas the Wolverhampton students appear to be from a largely western culture. However, this distinction is somewhat blurred, and illustrates one of the major criticisms of the use of Hofstede's work as a basis for cultural classification. Initially, Hofstede incorrectly assumed that countries are homogeneous in their population and culture (Goeschl and Doherty 2000, p.15).

Two other criticisms of Hofstede's work suggest that it has limited application to the analysis of the test results for the retrieval tool. Firstly, the surveys carried out by Hofstede were confined to the employees of IBM. The company ethos is strongly US-based, and will inevitably bias the responses of senior managers. This may skew the data used by Hofstede in his analysis.

Secondly, the surveys carried out by Hofstede were undertaken in the late 1970s and early 1980s. Since that time, populations have become more mobile. Political and national divisions have changed. Furthermore, there has been an exponential growth of global deployment of ICT. These factors have combined to produce changes in cultural divisions throughout the world, and have created new cultural norms within existing societies. Consequently, Hofstede's scores for the countries included in his surveys have changed, and it would be unwise to use them for direct comparison without correction (Schramm-Nielsen 2000, p.3).

2.7.4 The Triandis Cultural Classification Dimensions

Despite these drawbacks, many of Hofstede's basic concepts still apply. Many of the issues that he raises are still applicable to recent cultural developments. A number of other researchers have taken Hofstede's dimensions and extended them to interpret behavioural changes that have taken place over recent years. One of the most influential in this field is Triandis, who defines culture as:

"... a shared meaning system, found among those who speak a particular language dialect, during a specific historic period, and in a definable geographic region. It functions to improve the adaptation of members of the culture to a particular ecology, and it

includes the knowledge that people need to have in order to function effectively in their social environment." (Triandis 2000, p.146)

This interpretation of culture is more far-reaching than that adopted by Hofstede. Most importantly, it does not assume that culture is static. Cultural norms are only applicable for a limited time span. Other, external influences may change the perception of what is an acceptable cultural norm or characteristic. Triandis (2003, p.486) also recognises that, with increasing globalisation, people integrate with others who have different cultural values. Peppas (2002, p.52) suggests that it is necessary to consider the differences of culture in business and social interactions. Globalisation is leading to the development of a 'common' culture in business that covers some aspects of our lives in the international sphere (Seitz 2001, p.21). Triandis recognises that cultural differences lead to miscommunications and misconceptions. People do not all perceive the same causes as being relevant when considering the reasons for behaviour. The same action can be interpreted in different ways, leading to confusion and misunderstanding. Triandis (2003, p.486) notes that the diversity in human attributes such as gender, culture, race, and ethnicity all play an important part in the perception of space, social identities, and social distance, reflecting the different backgrounds of individuals. Interestingly, Triandis includes lifestyle in his list. In this dimension, he includes the exposure of populations to ICT:

"A relatively new kind of diversity is the digital divide. Those who make use of personal computers develop a lifestyle that leaves significant segments of the population on the other side of the divide. Major segments of the population of China, India, and other developing countries now belong to the computer literate side of the divide, with incomes sometimes similar to those found in the developed world. At the same time major segments of those countries remain on the computer illiterate side of the divide....."

Another problem is that as mass communication makes the lifestyles of the developed world visible to the majority of the less developed world, the latter wish to acquire parts of these lifestyles, but this is unrealistic because these lifestyles consume resources at much higher rates than can be sustained by the known resources of the earth. Thus, cultural distance is created because some segments of the world have access to resources and other segments do not have such access." (Triandis 2003, pp.486-487).

This tends to suggest that ICT exerts a significant influence upon cultural norms and expectations of much of the world's population. Standards adopted by the developed world are emulated by undeveloped countries. Furthermore, economically active countries will adopt ICT in greater depth, expecting others who do business with them to adopt similar cultural and

ethical approaches. There is thus a tendency for the development of a common 'ICT culture' based upon the culture of the technological leaders. Those who do not conform are seen as different, and a divide tends to develop that gives rise to an 'us and them' situation (Triandis 2003, p.489). People tend to associate and co-operate with groups and people that are regarded as 'of us', and shun those who are 'of them'.

Human behaviour is affected more by the context in which it occurs than by the culture of the actor (Triandis 2000, p.145). Examination of human response to a given scenario within a context can thus be used to identify cultural distance.¹⁷

Opposing cultural attitudes are described by Triandis (2000, pp.147-151), a phenomenon he calls 'cultural syndromes', defined as "a shared pattern of beliefs, attitudes, self-definitions, norms, roles, and values organised around a theme". Most themes have two extremes, each having its proponents. Examination of the conduct of proponents at each extreme allows the assessment of a cultural distance. Triandis considers a number of cultural syndromes, shown in Appendix A, that may contribute to the identification of discrete cultures by approaching the theme from opposing poles.

The cultural syndromes identified by Triandis are not mutually exclusive, and may occur in combination. This phenomenon is most likely to occur at the junction of two major cultures, when a 'blending' of cultural syndromes may occur. This is an interesting concept, as the junction of cultures need not be geographical. It can equally be a 'virtual' adjacency, facilitated by globalisation and the deployment of ICT.

¹⁷ Triandis (2003, p.489) notes that:

"Perceived dissimilarity depends on several factors. These include a history of conflict between groups, the presence of resources that need to be divided, and cultural distance. Cultural distance is greater when members of two cultures speak very different languages, have different social structures, religions, standards of living, and values. Cultural differences such as differences in cultural complexity, tightness, individualism, collectivism, horizontality (de-emphasis on hierarchy), verticality (emphasis on hierarchy), and other kinds of contrasts on cultural syndromes create cultural distance and thus perceived dissimilarity between 'us' and 'them'."

2.7.5 Links between the Work of Hofstede and Triandis

The individualism/collectivism dimension is of particular interest and importance (Triandis 2004, p.88). Vertical/horizontal cultures have links to the individualist/collectivist model. Vertical structures tend to present a 'ladder' for the ambitious individualist to climb. Success and self-satisfaction is measured by position on the hierarchical ladder. Collectivists accept that the interests of the group should receive priority, and that individuals should not seek personal advancement in preference to group interests. The characteristics of collectivist and individualist cultures are described by Triandis (2000, pp.146-147), who suggests where such cultures may occur. A comparison of collectivist and individualist traits is shown in Table 2.2.

<u>Collectivist:</u>	<u>Individualist:</u>
Tends to focus upon the prospering of groups rather than individuals.	Tends to focus upon the advancement of individuals with little regard for the larger group environment.
<u>Found in:</u> Most Asian and Latin American cultures.	<u>Found in:</u> North and Western Europe, the US, Canada, Australia and New Zealand.
<u>Cultural Traits:</u>	
<ul style="list-style-type: none"> • Considers the collective self and the interdependence with others such as work colleagues, family, co-religionists or nationality. 	<ul style="list-style-type: none"> • Places personal preferences above the needs of the group.
<ul style="list-style-type: none"> • Prioritises the goals of the group above their own goals. 	<ul style="list-style-type: none"> • Gives priority to personal goals.
<ul style="list-style-type: none"> • Uses group norms to shape their own behaviour rather than rely on their own personal attitudes. 	<ul style="list-style-type: none"> • Employs personal attitudes much more than the norms of the cultural group.
<ul style="list-style-type: none"> • Considers the needs of others even when this is to their own disadvantage. 	<ul style="list-style-type: none"> • Fulfils their own needs and abandon personal relationships that are not optimally beneficial to them.
<ul style="list-style-type: none"> • Shows a high level of conformity to social and cultural norms. 	<ul style="list-style-type: none"> • Shows less regard for social and cultural norms.
<ul style="list-style-type: none"> • Generally occurs in societies that are relatively homogeneous 	<ul style="list-style-type: none"> • Generally occurs in disparate societies.
<ul style="list-style-type: none"> • Generally occurs where the society is not affluent. 	<ul style="list-style-type: none"> • Generally occurs in more affluent societies.
<ul style="list-style-type: none"> • Generally occurs in lower social classes and those who have not been exposed to modern mass media. 	<ul style="list-style-type: none"> • Generally occurs in higher social classes that have travelled and received a higher level of education.

Table 2.2 – Individualism vs. Collectivism (derived from Triandis 2000, pp.146-147)

Several of the cultural syndromes described suggest that the dimensions of individuality and collectivism form an important basis upon which to model cultural identity. Triandis observes that the theme of collectivism/individualism forms a common thread through most of the cultural syndromes that he identifies. Most humans have both individualist and collectivist tendencies. However, when the group to which they belong is threatened, they assess the probability of harm to the group, and adopt either collectivist (group) responses or individual action. This concept introduces the consideration of degree to which the theme of individualism/collectivism is adopted within cultures.

There is therefore much evidence to suggest that different cultural groups will behave and make decisions in different, discrete ways, but blending of cultural traits can occur. The student cohorts who took part in the testing of the retrieval tool would appear to conform to Triandis' description above. The Kuala Lumpur cohort may be taken as representing a sample from eastern culture, and the Wolverhampton cohorts representing a typical 'western' sample drawn from North West Europe. It may be argued that the Wolverhampton cohort is less extreme than, say, a sample drawn from the US where there is an even greater diversity of cultural groups. However, it is believed that if cultural differences are to be identified, the Wolverhampton cohort is sufficiently 'westernised' for these differences to be demonstrated. The research discussed above suggests that ethical criteria adopted by students from different cultural backgrounds may affect the retrieval of suitable ethically analysed case studies.

2.7.6 Expected Results from the Retrieval Tool Testing

Students are the professionals of the future, and will be expected to perform on a global stage. It is important that they not only consider their own ethical and cultural values and background, but also recognise that others could have different viewpoints that may be as soundly and intellectually based as their own. Goncalves (2002, p.302) comments that increasing use of ICT is, in many nations, now challenging the traditional concept of an hierarchical government and social administrative structure. Traditional hierarchical administration is fading, and wider recognition of human rights, together with more negotiation and participation of citizens is involved within the governance process. Goncalves (2002, p.303) also notes that the power of commerce, finance, and industry is now often greater than that of many nation states.

The inclusion of a strong element of ICT in case scenarios addressing business issues poses an interesting environment for examination of the students' responses to the ethical issues raised by the survey questionnaire. Using only Hofstede's classification, one might predict that there would be clear divisions between the responses from the Kuala Lumpur cohorts and the Wolverhampton cohorts. However, the suggestion by Triandis, that ICT is becoming a 'universal sub-culture', would tend to suggest that the responses from the two groups of cohorts would not show major differences. It also suggests that students of both cultures might experience problems with similar ethical issues.

It cannot be claimed that any change of the students' ethical understanding and views is a direct result of the use of the retrieval tool. However, the stimulation and information provided by the tool should influence the ethical perception of many students. The testing therefore looks for trends in responses rather than absolute values. Examination of students' change of ethical viewpoint should demonstrate several aspects of the effectiveness of the tool:

- Examination of individual student responses should demonstrate whether any students did not change their ethical views. Failure to make any change to one's ethical concepts after using the tool might suggest that the student has very firm ethical standards and concepts, and is unwilling to change. Alternatively, it could indicate failure to understand or recognise that an ethical issue is being presented by the test scenario. Finally, it could mean that the student has failed to respond in the spirit of the test procedure.
- Examination of cohort members' responses should demonstrate the general ethical orientation of the cohort. The work of Hofstede and Triandis suggests different projections for the outcome for the testing. Hofstede suggests that there should be distinct differences between the responses of the Kuala Lumpur and the Wolverhampton cohorts, demonstrating a divergence in cultural and ethical orientation. Alternatively, the effect of the global deployment of ICT, noted by Triandis but unavailable to Hofstede at the time of his investigative surveys, suggests that students who are exposed to ICT will generally follow western cultural and ethical tendencies. Chatterjee and Pearson (2003, pp.203-204) identified that globalisation of business, introducing primarily US corporate ethics, conflicts with South East Asian culture, but note wide variations in regional ethical standards.

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- Examination of responses by cohort will also permit the identification of any ethical issues that cause particular problems for students. These can also be identified between and within cultural groups by comparing like or dissimilar cultural group responses. Munro-Smith (2002) notes that within groups of Australian and Singaporean students, cultural differences have a marked effect upon interactions within the cultural group. He observes that the Hofstede dimensions of Power Distance, Individualism, and Uncertainty Avoidance are especially noteworthy, with Australian and Singaporean students appearing to be at the opposite ends of the continuum for each dimension. Hofstede found Australians highly individualistic, and to have both low power distance and low uncertainty avoidance scores, the antithesis of the Singaporeans. Australian characteristics bear a marked similarity to UK characteristics, and Singaporean characteristics are similar to Malaysian characteristics. Therefore, Hofstede's concepts would suggest that similar characteristic differences will also apply to the Kuala Lumpur and Wolverhampton students' ethical attitudes.
- The direction of change in individual students' responses between the surveys carried out before and after the use of the retrieval tool may be of importance. The apparent lack of ethical guidance to students in their formative years has resulted in their failure sometimes to recognise that an ethical issue exists within many scenarios (Calluzzo and Cante 2004, p.301; Kaiser 2000, p.146; Simpson 2000). The change in student response from a 'No' in the 'before' questionnaire to a 'Yes' in the 'after' questionnaire might suggest that a student has not recognised the presence of an ethical issue. The reverse direction of change would seem to suggest that the student has misconceived the implications of the issue, or has imagined an issue where none exists. It is expected that any indication of change might also follow the interpretation of Hofstede's and Triandis' work. It is possible that differing cultural and ethical approaches will lead to different directions of change. If this is so, then Hofstede's conclusions are supported. If no such difference in direction of change is identified, then this would tend to suggest that the work of Triandis is a more accurate predictor of ethicality.
- The alignment of the student responses to either Hofstede's or Triandis' work will have implications for the wider deployment of the retrieval tool. In most cases, the case analyses

are based upon interpretation of western ethics and legal systems. If the results of the testing demonstrate distinct cultural divisions, then the suggestions of Hofstede would seem to be supported. This would lead to the conclusion that a case library of analyses based upon western ideals would be less suitable for use by students from Confucian-based cultures. However, a reasonable measure of similarity between the results of the Kuala Lumpur and the Wolverhampton cohorts would suggest that the proposals of Triandis are more applicable. By implication, this would suggest that there is the tendency for the deployment of ICT to create a universal ICT ethic, based upon the ethical approach of those who develop the technology. Swigger et al. (2004, p.367) suspect that there is a homogenisation of culture, tending to suggest that the tool might be used by a wide range of cultural groups.

- Finally, the last question of the survey questionnaire addressing ethical awareness asks students whether the previous questions that addressed ethical issues were easy to answer. The responses of the survey conducted after using the retrieval tool are expected to differ from the responses of the survey conducted before using the tool. Here, the total changes recorded in both directions should indicate the effectiveness of the tool in stimulating students' awareness and interest in the application of the ethical principles to their given case scenario. The direction of change (from 'yes' to 'no', or vice versa) is not important in the responses to this question. Identification that a change has taken place will tend to indicate that the tool has had some effect upon the student's ability to recognise and consider ethical issues.

2.7.7 The Case Studies, Role Play, and Expected Difficulty with Ethical Issues

The two real-world scenarios used in the tests both addressed the failure of companies to supply bespoke software packages to clients. Therefore, both scenarios have many ethical issues that are implicit in the contractual arrangements that need to exist between developer and client when such a contract is formed. UK law has many conditions regarding duty to deliver software that does not cause harm to the user, is of suitable quality, and will be delivered within the agreed timescale and price. The law urges parties to the contract to avoid unfair practices, and to act with fairness and in good faith. As a number of contractual conditions are

implicit, this seems a suitable vehicle for the testing of students' responses and views to these issues. The initial response to the ethical awareness survey questionnaire must be drawn from within the student's own internal values. This enables a baseline to be established for the further assessment of any change prompted by use of the case retrieval tool. Many of the implicit issues raised by the scenarios are based upon ethical issues that apply to wider societal concerns. Such issues as loyalty, conduct of business, personal responsibility, fidelity, trustworthiness, and the use of personal power are all issues that have implications throughout the society in which one lives. All of these issues are addressed in UK law. An outline of the issues is included as Appendix U.

UK law also addresses the other issues raised by the remaining questions of the survey. However, the relevance of these issues to the given scenarios involving the failure to deliver satisfactory bespoke business software are not so great as the issues listed above. Nevertheless, they can relate strongly to ethical issues in other fields such as privacy, property ownership, or abuse of rights and freedoms. The 'before' and 'after' questionnaires completed by the students may thus be seen to address many of the ethical issues that might be expected not only in cases of contractual failure, but in any area of human activity. However, problems arise from the differing perceptions of students from diverse cultures concerning the interpretation of the ethical principles invoked.

There appears to be some debate upon whether any ethical principles can be regarded as universal (Blackman and Leake 2000; Peterson 2002; Simpson 2000). Chatterjee and Pearson (2003, p.203) suggest that some personal moral understandings transcend cultural boundaries, whilst others are specific to a cultural context. Calluzzo and Cante (2004, p.302) observe that the concept of ethical values appears to be changing, and that global ethical values appear to be focusing upon the western concepts of ethics. In addition, the report of the ImpactCS committee (IEEE-CS/ACM 2001) appears to base its recommendations upon the assumption that what is acceptable to western nations is universally acceptable. Gorniak-Kocikowska (2004), Lenarcic (1999), Simpson (2000), and Peterson (2002) also appear to suggest that at least some ethical principles can be 'universalised'.

One ethical principle that does seem to have an element of universality is the Golden Rule (Bruton 2004, p.180). One might therefore expect that the Golden Rule could easily be adopted by students of all cultures as a start point for the ethical analysis their given scenario. However, this is not the case. The concept of the case retrieval tool is that students are expected to engage in role-play, adopting the persona of each player in the given case in turn. Students must reflect upon the relationships and consequences of different actions. It is therefore essential that they understand the application of the Golden Rule. Students may need to use the case retrieval tool several times when responding to the characteristics and motivations of the actors within a given scenario. This may even lead to the presentation of different cases from within the case library to illustrate possible alternative ethical consequences. However, Maxwell et al. (2000, pp.5-7) note that Malaysian students have little or no idea of role-play. Asian students are fundamentally passive in their learning approach, finding it difficult to adapt to the deeper, interactive learning style. They tend to adopt a rote learning style. Consequently, the use of the case retrieval tool by Asian students may cause some difficulty when attempting role-play in response to the questions posed by the retrieval tool interface.

Initial perception of the Golden Rule might suggest that there should be uniformity in the responses made by students in response to the question in the survey addressing its violation. However, this may not be so. The predictions of Hofstede would suggest that there will be identifiable differences between the responses of the Kuala Lumpur and Wolverhampton students, based upon their cultural backgrounds. Alternatively, if the suggestions of Triandis are correct, and there is the formation of an 'ICT culture', differences may not be so pronounced, or even identifiable.

2.7.8 Usability Requirements and Cultural Attitudes

Culture influences the human-product interaction (Hoft 1996, p.41). However, it is not within the scope of this research to carry out an in-depth review of human-computer interaction factors. Nevertheless, without acceptance by the users, any software will fail in its purpose. The didactic aspects of the retrieval tool should not be masked by problems with the interface.

The interface supports the dialogue between the students and the computer, and is a crucial element in the operation of the retrieval tool. Many of Nielsen's (1993, pp.115-163) principles lend themselves well to the requirements of the retrieval tool interface. It must be simple and natural, intuitive, conveying a sense of control in use (Nielsen 1993, pp.115-116). This may be achieved by keeping the density of information on the screen to a minimum (Nielsen 1993, p.120), keeping the language simple (Nielsen 1993, p.123), and providing suitable cues or information for navigation (Dix et al. 2004, pp.204-205). The dialogue must also be understood by the user. The diverse range of users implies that the language used in the interface must be simple to understand, and avoid excessive text or large volumes of information on a single screen (Nielsen 1993, pp.120-123). Additionally, the interface must appear transparent to the user (Shneiderman 1998, pp.202-203), avoiding elements that distract or offend the cultural sensibilities of the users (Hoft 1996, p.42). Colour is an important element of design that may cause difficulties if used carelessly (Nielsen 1993, pp.117-120). Badre (2000) identifies the relationship between colour and culture, and notes the differing perception and meaning of colour between cultures. Tractinsky, Katz, and Ikar (2000, p.127) suggest that aesthetic aspects of an interface affect its perceived usability. The aesthetics of the interface must therefore address cultural issues.

Cultural attributes are also applicable to groups whose members possess specialist skills in different discrete areas (Del Galdo 1996, p.78). This tends to suggest that a 'culture' of ICT, biased towards western values, could evolve. Badre (2000, p.1) believes that interfaces can be culturally sensitive, but the targeted audience is capable of rapid change. Applying the suggestions of Del Galdo (1996, p.78), it may be possible to redefine the target audience groupings into discrete specialisms, each creating its own culture, rather than using Badre's assumption that culture is a national phenomenon.

Following a cultural change, an individual will not necessarily fully adopt all tenets of the new culture. Usually some pockets of the individual's traditional culture remain. It is therefore possible that, although ICT students and novices find themselves in an ICT culture, they will retain many of their traditional cultural values based upon their family environment and upbringing. Ito and Nakakoji (1996, p.124) state that developing an interface for multiple

cultures requires consideration of cultural dimensions. However, they also note that communities who share a common interest will develop new types of culture, e.g. those who use ICT will develop an ICT culture.

It is therefore necessary to design the retrieval tool interface so that it is acceptable to as wide a selection of students as possible. Badre (2000, pp.2-4) comments that cultural differences are important, and that colours, spatial organisation, fonts, shapes, icons, metaphors, and language affect the usability of an application. However, there is some disagreement upon how powerful is the effect of the interface.

The findings of Badre are useful where the potential users may be accurately identified. However, in this research, it is not possible to reach this ideal as the nationality and culture of most of the students is not known. The design of the retrieval tool interface will therefore need to address general usability issues identified above in addition to accommodating a broad range of cultural traits.

There is no universal interface that can be applied to any culture (Ito and Nakakoji 1996, pp.121-122). Ito and Nakakoji believe that an iterative development of a system is perhaps the best approach, having first considered the important issues in interface design. They note that explicitly represented and stored information can be used as a basis for design. However, Hoft (1996, p.69) also suggests that in some cases there are so many cultural similarities between groups that customisation to avoid cultural mistakes is generally unnecessary. This suggests that it may be possible to develop an interface that is acceptable to the diverse range of students who will use the retrieval tool, but that does not attempt the impossible task of fully satisfying all cultural requirements.

2.8 Conclusion

The previous sections of this chapter provide a basis for the development of a didactic software tool to address and influence students' ethical attitudes. Care must be exercised over the development of the tool, both in its aesthetic qualities, and in its presentation of the pedagogic materials. Cultural issues may have significant effects upon the usability and acceptability of the retrieval tool by the wide range of students who will use it, and will need to be incorporated as

an integral part of the design. The following chapter addresses the issues raised in the system development, and describes the blend of different methodologies that have been used to ensure that a successful system is created.

Chapter 3 - The Research Justification and Methodology

3.1 The Global Impact of ICT

Information management and technology are the underpinning technologies of globalisation (Strain 2003, p.12). The introduction of new technologies can have a profound effect upon the ethical principles of those who use or are affected by them (Wahlstrom and Roddick 2000). The ubiquity of ICT presents a monumental challenge to computer ethics that must be faced by much of humanity (Bynum 2000b, pp.12-13). ICT has the ability to allow the avoidance of responsibility, the concealment of actual activities, the covert implementation of unethical or illegal actions, and the creation of a false sense of trust in those affected by the actions. Strain (2003, pp.8-9) observes that there are powerful reasons for teaching ethical standards and societal expectations to students:

- Young people should be encouraged to consider and develop their own standards concerning the way that they and their employers should behave. However, Coldwell (2000) observes that students often fail to 'see' ethical issues as pressing issues without positive direction, whilst Peppas and Diskin (2001, p.349) find that students generally want ethical and moral guidance. Unfortunately, young people are not generally exposed to the concept that the use of ICT brings with it a responsibility not only to themselves but also to others affected by its use (Grodzinsky 2000, p.4).
- Business and the public expect graduates to be ethically aware. Lelewer (1994, p.253) considers that ethical, social, and economic issues raised by the application of ICT are topics of growing importance and visibility to the public. Society is generally concerned that students should develop an ethical awareness of the consequences of their work.
- Ethics can itself contribute to one's learning capability. The world's knowledge base is expanding rapidly. The synthesis of ability to manage vast amounts of knowledge and expert manipulation of that knowledge using ICT places those at the interface with immense power and responsibility. Workers in this field need to develop skills in anticipating the occurrence of an ethical issue, recognising it when it does arise, and developing appropriate methods for resolving it.

Many users of ICT assume, by default, a consequentialist approach to ethical issues (Lucas 2003, p.116). They often adopt a naïve outlook that requires less effort to derive an apparently socially acceptable resolution to even quite complex ethical dilemmas (Ansari 2001, p.113). They ignore, or do not realise the far-reaching effects that may be triggered by their decisions and actions. Ansari focuses upon engineering students, and suggests that engineering disciplines¹⁸ tend to encourage students to concentrate almost entirely on simple, non-living things. Engineering students are thus discouraged from considering the world as a living organism that is vulnerable to the adverse decisions and actions of humanity. They are not encouraged to accept responsibility for the results of their actions. Unfortunately, the anonymity that surrounds many ICT applications appears to remove the concept of responsibility from a young person's ethical makeup (Grodzinsky 2000, p.6).

3.1.1 The Lack of Personal and Global Standards

ICT has removed much of the need for face-to-face contact between organisations and their clients (Introna 2002, p.80), thereby weakening the ethical ties traditionally present in human personal interactions. Furthermore, many people believe that the general standard of ethics is deteriorating due to the overriding preoccupation by business with the generation of profit (Beu, Buckley, and Harvey 2003, p.88). Simpson (2000) suspects that the adoption by business of ICT is continually causing the public's concept of ethics to change.

The spiritual and ethical dimensions have been missing from much current business and academic decision-making (Chae et al. 2005, p.199). Hsu and Kuo (2003, p.53) consider that individuals will need to police themselves in the global world of the new wired society. However, no global police force is yet available to oversee the actions of those who use ICT. No global laws or standards are yet available to act as yardsticks against which behaviour may be measured. The influence of ICT may extend far beyond national boundaries, and prompts consideration of the ethical standards of many countries or ethnic groups (Gorniak-Kocikowska 2004, p.319). Consequently, there is a need to touch the inner personal mechanisms that cause humans, particularly young persons, to identify, evaluate, and address ethical dilemmas.

¹⁸ For the link between engineering and ICT, see section 2.3.1

3.1.2 Justification for the Development of an Instrument to Raise Ethical Awareness

Government demands upon universities to improve their teaching standards have caused most universities to provide educational programmes focussing primarily upon the facilitation of student-centred learning and reflective practice (Macfarlane 2003, p.123). Macfarlane found that there was little evidence to demonstrate that ethical considerations are included within the programmes. Programmes tended to be technician in nature, with little encouragement for lecturers to promote reflection by students upon the ethical consequences of the technical subjects delivered. This situation is now slowly changing. Professional societies such as the Royal Academy of Engineering (RAE 2005a) now urge the inclusion of ethics modules in student education. Macfarlane believes that morality is as much an art as a science, and calls for the development by lecturers of an approach which will encourage in students a versatility to understand, improvise, and respond to actual circumstances and particular situations.

The conversion of knowledge from its pure form into its more practical applications seems to be at the root of many problems experienced by society. The conversion interface must form the focus of attempts to influence students' ethical stance (Spier 2003). Spier (2003, p.137) suggests that scientists frequently adopt an isolationist view of the world, assuming that their sole purpose in the pursuit of science is to make their findings known to others. They see no link between their findings and the ethical deployment and application of their work. Lucas (2003, pp.115-116) suggests that there is a divide between the perception of moral knowledge and understanding, and its practical application. As some students will progress to the development of new technologies, a system is needed to demonstrate to them how theory can be interpreted and applied to practical everyday issues that they will encounter at work.

The apparent lack of responsibility for one's actions runs counter to the codes of most professional societies, and demonstrates a lack of professional capacity. Two major facets of personal development that demonstrate professional capability are identified by Lizzio and Wilson (2004, p.740):

- Being able confidently to take appropriate action in unfamiliar and changing circumstances.
- Being able to develop a further professional capability.

The latter point involves learning to learn, and logically to evaluate and assimilate new experiential knowledge into one's professional armoury. This point is also raised in the Report 'Higher Education and the Public Good' (CIHE 2004). The CIHE report suggests that a number of points should be addressed in the higher education of students:

- Ethical, social and moral dimensions should be built into all higher education courses. It is suggested that the inclusion of these issues will enrich students' lives and to help them to contribute ethically to society, local communities, and business. It would lead to a more just and tolerant society.
- The teaching of pure ethics is, perhaps, not the best way to proceed. Ethical realisation needs to be stimulated by dialogue between industry and academia, and will involve relating course content to the real world scenarios of the business community, industry, and society.
- In delivering their courses, universities should pay more attention to the values that shape student experience. Industry and commerce are looking for graduates with at least a baseline of ethics, and who have the personal qualities that give an individual the strength and courage to stand up for what they believe is right.

Turner and Lowry (1999, pp.1049-1050) believe that future ICT professionals must develop a wider range of non-technical skills than has previously been the case. Spier (2003, p.136) suggests that teaching ethics is not easy because it is normally considered primarily in association with philosophy rather than civics. Grodzinsky et al. (2004, p.280) find that many areas of computer ethics are frightening to both students and lecturers, with both lacking the confidence to address the underlying ethical issues. Nevertheless, Macfarlane (2003, p.124) suggests that it is essential to sensitise students to issues of computer ethics whilst strengthening their critical thinking and reflective processes.

Prominent figures in the field of ethics have traditionally used the philosophical approach to account for and justify morality (Beauchamp 2002, p.133). However, little attempt has been made to use theories of morality to solve practical problems (Golja 2003, p.203). This suggests that there has been much talk upon the subject of raising ethical awareness, but little practical progress towards the development of tools that address this deficiency. The situation is only now slowly changing. Maner (1998), Rahanu (1999), and Goldin, Ashley, and Pinkus (2001)

have developed limited systems to influence an individual's personal ethical values. However, a system that has the flexibility to address a wide range of professions and their ethical problems appears not to have been attempted. The primary aim of this research is to address that deficit.

The sources discussed above amply demonstrate that there is a need for the development of a system that will assist future ICT professionals to recognise and understand the ethical dilemmas that await them in the workplace. The question remains as to what type of system is required, and what methodology should be used for its development.

3.2 The Pedagogic Software Paradigm

The interaction between the student and the software is fundamental to the design of electronic learning systems (Pahl 2004, p.47). The relationship must be interactive if a beneficial learning experience is to be achieved. However, Aiken and Epstein (2000, p.164) warn that "Computer-based education, including AI (artificial intelligence) technology, has the potential to harm young people in various ways, including ethically, aesthetically, physically, psychologically, intellectually and socially." The learner's interactivity, behaviour patterns, preferred learning style, and learning goals will all need to be considered carefully in the design paradigm that is adopted for the development of the system. The paradigm required for the development of the case retrieval tool in this research can be viewed from a number of different perspectives.

3.2.1 The System as a Conversation

The process of learning is essentially a dialogue between student and teacher (Laurillard 2002, p.81). Laurillard (2002, p.4) comments that students' academic learning is often not derived directly from their personal experience of the world, but from the descriptions of others' perceptions of that same world. The mediation of students' perceptions of world events must therefore include an exchange of questions and answers – i.e. a conversation.

In this research, the conversation is a system-driven dialogue between the student and the computer. The conversational flow model developed by Aha, Breslow, and Munoz-Avila (2000, p.12) is illustrated in Figure 3.1 overleaf. This mode is particularly useful for novices who may not be able to understand or formulate the information needed for generation of the query required to retrieve the relevant information from the information system (IS).

Responses to the questions may be restrained within the domain to provide positive input that is required for effective retrieval (Preece et al. 1994, pp.267-268). Furthermore, the dialogue may be used to create dynamic queries (Ahlberg, Williamson, and Shneiderman 1992, p.619), allowing the system automatically to 'decompose' the problem (identifying suitable retrieval criteria) using a limited selection of responses. Most importantly, it is the responses, reflecting students' individual ethical viewpoints, which form the 'nodes' of the dynamic query.

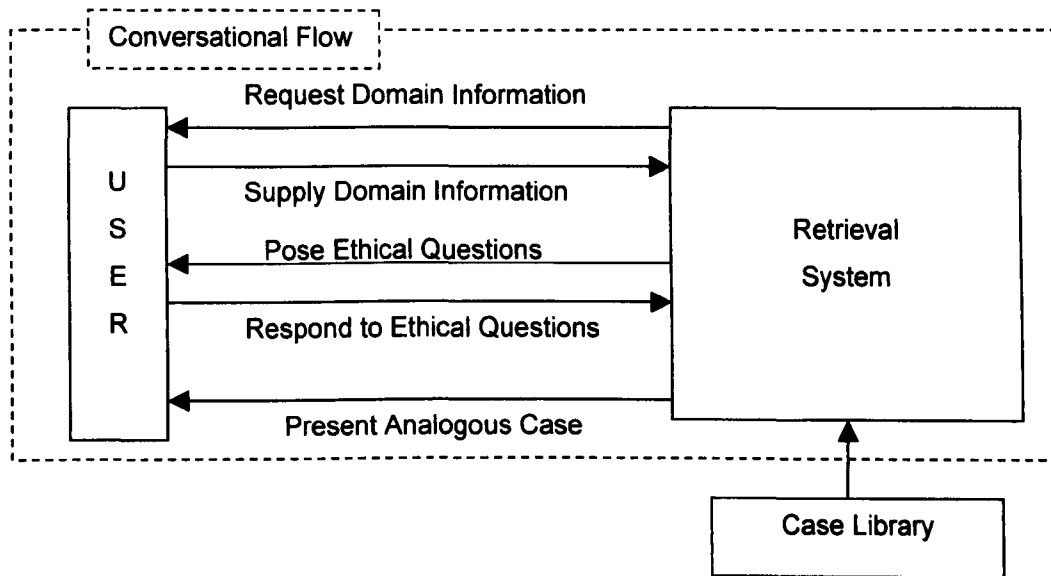


Figure 3.1 – Conversational Flow in the Retrieval Interface (Adapted from Aha, Breslow, and Munoz-Avila, 2000)

3.2.2 The System as a Story Teller

It is important when using electronic delivery for educational purposes to select a suitable narrative for the problem domain. This must fit well with the electronic medium delivering the details of the problem, and permit the appropriate interaction between the student and the data (Bearman 1997). The interaction must flow logically from the details of the problem. This suggests that a narrative describing the problem domain is a highly effective medium for the transfer of such information. Heo notes:

“Narrative is a mode of knowing and understanding that captures the richness and variety of meaning in humanity as well as a way of communicating who we are, what we do, how we feel, and why we ought to follow a certain course of action. A narrative involves facts, ideas, theories, and dreams from the perspectives and in the context of someone’s life. Individuals think, perceive, interpret, imagine, interact, and make some decisions according to the narrative elements and structures.” (Heo 2004, p.375).

Case studies are essentially real-life stories that have a particular significance for the identified problem domain. Bearman (1997) notes that stories (cases) provide a framework within which students may adopt the personae of players within the story. They:

- Enlist the interest of the student.
- Reduce the degrees of freedom of the task, e.g. restrict possible responses to a given list.
- Keep the learning process directed.
- May accentuate relevant or critical features.

The richer the narrative description, the more subjective the conclusions may be, and the greater will be the variety of interpretations that are generated (Artz 1998, p.11). In this research, students with different ethical viewpoints may interpret cases differently. The richness of the cases used will therefore be of considerable benefit in addressing the needs of students from differing cultures. Artz comments that stories are powerful tools for developing the moral sense of individuals.

The effects of lessons last longer when encased in a story (Watson 2003, p.97). However, it is essential that the correct stories are offered for a given problem domain, a phenomenon identified by Laurillard (2002, p.16) as 'situated cognition'. This criterion can best be addressed by presenting stories chosen from a suitable repository and retrieved by a reliable retrieval system – an information system (Burke and Kass 1996, pp.93-109).

3.2.3 The System as an Information System

The term 'information system' (IS) can apply to a wide range of applications (Sauer 1993, pp.10-11). They are usually computer-based business systems whose major input and output is data. Sauer's view seems to be confined to business systems, but his comments apply equally to other data storage and manipulation systems, including pedagogic systems. Electronic learning systems can be considered as a particular subset of a much wider category of systems that categorise, manage, and retrieve data from within a data store (De Pietro and Appratto 2004, p.5). The data held in the store may be in any of a number of formats, not necessarily textual or numeric. Pedagogical systems that use knowledge stores for didactic purposes are thus information systems in the most basic sense.

Similar requirements for legal systems are identified by Rissland, Ashley, and Loui (2003, p.13). They consider that almost all retrieval of information from legal databases is a learning process. Pedagogic, legal, and business information systems have similar formats. All have a repository of information or data, require the retrieval of the data to match a given query, and require a suitable algorithm for the retrieval of relevant information. In this research, the system stores and retrieves information from the repository, the case library, using the algorithm that suggests a suitable analogous case to address a specific query formulated from a student's ethical approach. The process is fundamentally similar to the operation of any IS, except that students are not required to input the permanently stored data (case analyses) into the system.

3.2.4 The System as a Decision Support System

The process of establishing which case in the case library is the most suitable for a particular student's needs is dependent upon the student's responses to a series of questions. This requires that students make a series of decisions. Such systems may be classified under the generic heading of 'decision support systems' (DSS).

It is a necessary early step in the decision-making process to recognise that one must choose between options (Edwards and Fasolo 2001, p.586). Edwards and Fasolo define a decision as:

"... an irrevocable choice of an action that has value-relevant consequences. Both the impact on values and irrevocability encourage care and thought." (Edwards and Fasolo 2001, p.582).

Angehrn and Dutta suggest that the interaction between the decision-maker and the DSS creates learning about a specific decision. A decision system for pedagogic purposes requires three components: the decision-maker, the decision support system, and the stimulus agent (Angehrn and Dutta 1998). These are shown diagrammatically in Figure 3.2 overleaf. The stimulus agent supplies the input to prompt the student's deeper consideration by presenting analogous cases that meet the retrieval criteria elicited from the student in their consideration of their given scenario.

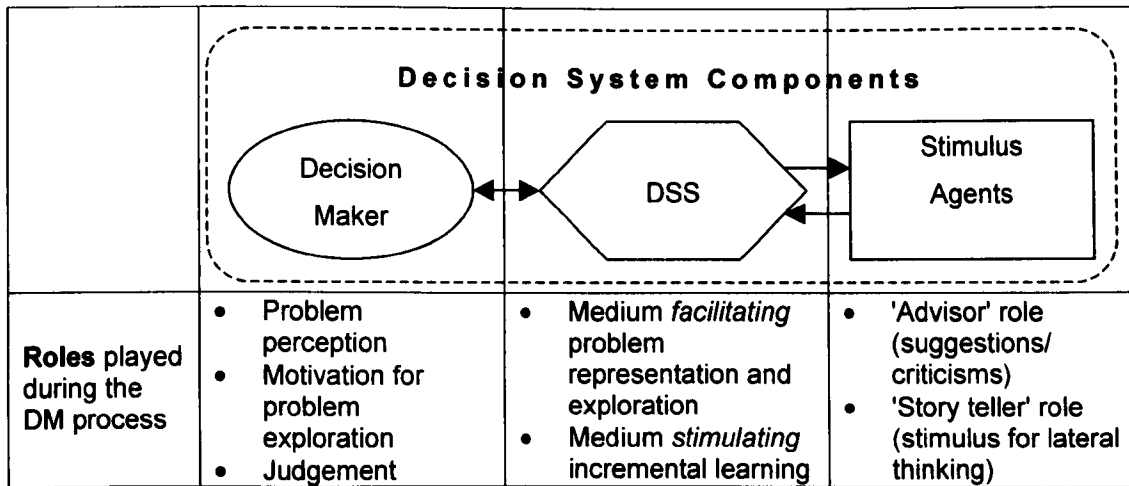


Figure 3.2 - Components and Roles of a Decision System (From Angehrn and Dutta 1998)

3.2.5 The System as a Reminding and Advisory System

Human memory is frequently unreliable when recalling past events (Chen and Lee 2003, p.150), and benefits greatly from being reminded of facts and outcomes. The types of problems that occur in real-world scenarios tend to recur. Remembering what happened on a previous occasion can facilitate addressing a similar, later occurrence. Learning using previous events or case studies relies upon remembering (Leake 1996, p.3). Although the nature of memory is still not fully understood, it is believed (Gross 1996, pp.305-311) that forgetting (and hence the need for reminding) depends upon both availability and accessibility. Gross notes that information cannot be retrieved if it has not previously been stored. Furthermore, events can fade from long-term memory with the passage of time through either trace decay or interference. Consequently, humans can either fail to recall appropriate former events or ethical principles to help them address the issues in an unethical action, or will have not previously experienced such issues.

The case retrieval system developed as part of this research addresses the issues of remembering the details of previous relevant events and the lessons that may be learned from them. The support offered by ICT to those humans who are required to make decisions has given rise to a particular genre of IS. These systems simply support or remind the human operator of significant data or facts that need to be considered during the decision-making process. They do not seek to usurp the decision-making process. They usually include facilities

that either guide the user through a retrieval process, or allow exploring or 'browsing' of the information collection. Leake (1996, pp.19-20) describes similar applications, which he calls 'case-based aiding' and 'case-based education' systems. Both inherently include the advisory and reminding elements required for enhancing students' store of real-world knowledge, and are capable of reminding students of relevant features that identify 'similar' cases.

This review of the different roles required demonstrates that the task of the case retrieval system is complex. An effective development paradigm, based upon the concept of an IS, is needed if a successful retrieval system is to be built, matching the pedagogic requirements to the possible design approaches. An understanding of the different research approaches, and an appreciation of how they might interact, is needed. The concept of the retrieval system must be that of a conversationally driven system, drawing upon user input, that combines the role of advisor, mediator and storyteller to remind users of salient points gleaned from past events. This suggests a hybrid system, drawing on a range of methodologies to form a unified paradigm.

3.2.6 A Unified System Concept

In this research, the information used to reason is either a complete case, or relevant parts of a case. Reasoning with cases is suggested by Angehrn and Dutta (1998) as an excellent method to adopt as a stimulus agent that may dynamically influence the decision-making process by adopting the dual roles of storyteller for both analogous cases and advisor. It will provide for the analogous resolution of those issues that are identified within the given scenario using information from within the retrieved cases. Angehrn and Dutta suggest that the design of such a system might follow the concepts shown in Figure 3.3 overleaf.

During its knowledge acquisition phase, the case-based reasoner (CBR) agent communicates with the human decision-maker and elicits the requirements for the identification of an analogous case from the case library. In the storyteller role, the CBR uses the decision-maker's input to prompt consideration of what issues are significant in the given scenario, and suggests how similar issues in other cases have been addressed. It stimulates lateral thinking by prompting decision-makers to associate the issues identified in the given scenario with the way

that the problems are perceived and structured. It then acts as a tutor in that it suggests to inexperienced decision-makers the reasoning behind the decisions made in the retrieved cases that have been presented as exemplars or instances of unethical actions. The retrieved case analyses contain criticisms and evaluations of the decisions made by the actors in the retrieved cases that act as a reminder to the user of the system.

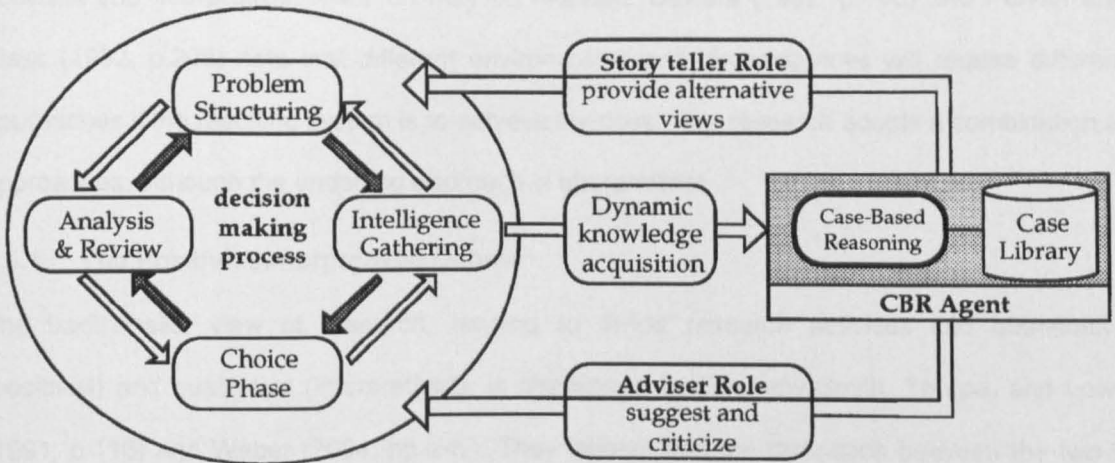


Figure 3.3 - The Integration of CBR into the Decision-Making Process
(From Angehrn and Dutta 1998)

The system only adopts a suggestive or advisory role. It does not attempt to replace the judgement of the human decision-maker. This model appears to incorporate most of the facilities that are required for raising students' awareness to ethical issues. The system proposed is thus clearly an IS, and appears to be a hybrid system combining elements of decision support, case retrieval, tutor, and the promotion of self-reflection after consideration of the analogous case(s) presented. The system design may then logically proceed following IS design methodologies. A number of approaches and techniques are available.

3.3 The Development of the Research Approach

There is much discussion and disagreement upon methodologies for IS research (Cornford and Smithson 1996, p.37). A universal approach to IS research and development is almost impossible (Galliers 1992, pp.144-145). This is not surprising given the range of uses to which information systems are being put. Research approaches appear to fall into one of two categories; scientific/empirical (this appears to correspond with positivist research approaches),

or interpretive (Cornford and Smithson 1996, pp.37-39; Galliers 1992, pp.147-149). However, that is not to say that the two categories are mutually exclusive within a single project. Both Galliers (1992, p.148) and Cornford and Smithson (1996, p.36) comment on research that involves enquiry into social phenomena, observing that many researchers consider that such research must be grounded on a positivist approach. They dissent, and accept that elements of positivist and interpretivist research may be relevant. Galliers (1992, p.145) and Pervan and Klass (1992, p.208) note that different environments and circumstances will require different approaches if the resulting system is to achieve success. This research adopts a combination of approaches, although the underlying approach is interpretivist.

3.3.1 The Positivist/Interpretivist Debate

The traditionalist view of research, tending to divide research activities into quantitative (positivist) and qualitative (interpretivist), is challenged by Easterby-Smith, Thorpe, and Lowe (1991, p.116) and Weber (2004, pp.iii-iv). They believe that the distinction between the two is not always clear, if indeed there actually is a difference. Considerable controversy exists between the proponents of each approach (Walsham 1993, pp.4-5; Fitzgerald and Howcroft 1998, p.155; Klein and Myers 1999, p.67). Positivists generally maintain that the only true research is that which is measurable and verifiable, and that claims not based upon positivist approaches are ascientific (Hirschheim 1992, p.32). Positivism relies heavily upon the use of statistical methods to 'prove' hypotheses (Easterby-Smith, Thorpe, and Lowe 1991, p.134). Interpretation of data takes little account of context, and rests upon 'factual' information (Cornford and Smithson 1996, p.41). Walsham (1993, p.4) comments that many consider positivism is based upon the view that the world exhibits objective cause/effect relationships that can be discovered, at least partially, by structured observation. The approach is therefore to collect a significant volume of data and to derive conclusions dispassionately from the statistical results.

This approach is disputed by Cornford and Smithson, and by Walsham. Cornford and Smithson (1996, p.108) believe that the increasing use of case studies in research requires a more active interpretive element than mere 'number crunching'. Interpretivists generally believe that research cannot provide meaningful results unless the context of the phenomenon under

investigation is considered. Walsham (1993, p.5) believes that, in following the interpretive tradition, there are no correct or incorrect theories. There are, however, more interesting and less interesting ways to view the world. He believes that interpretivism is concerned with understanding the reality of the world. All such knowledge is necessarily a social framework, and is therefore a subjective construction, a point endorsed by Fitzgerald and Howcroft (1998, p.163). Often, there is no precise solution to a problem, only evidence that tends to suggest a solution. This concept fits well with the approach of this research, and the expectation that students from different cultures may perceive the same ethical issue from different viewpoints.

Metatheoretical Assumptions About	Positivism	Interpretivism
Ontology	Person (researcher) and reality are separate	Person (researcher) and reality are inseparable (life-world)
Epistemology	Objective reality exists beyond the human mind	Knowledge of the world is intentionally constituted through a person's lived experience
Research Object	Research object has inherent qualities that exist independently of the researcher	Research object is interpreted in the light of meaning structure of person's (researcher's) lived experience
Method	Statistics, content analysis	Hermeneutics, phenomenology, etc.
Theory of Truth	Correspondence theory of truth: one-to-one mapping between research statements and reality	Truth as an intentional fulfilment: Interpretations of research object match lived experience of object
Validity	Certainty: data truly measures reality	Defensible knowledge claims
Reliability	Replicability: research results can be reproduced	Interpretive awareness: researchers recognise and address implications of their subjectivity

Table 3.1 – Alleged Differences Between Positivism and Interpretivism (From Weber 2004, p.iv)

The apparent clear-cut divisions between interpretivist and positivist research approaches, shown in Table 3.1, are considered by Weber (2004, p.xi), who finds that the apparent differences cannot be sustained in today's complex sociological and technological world. He dismisses the contention that real differences exist between the two research approaches. He

concludes that excellent researchers simply choose a research method, or combination of methods that fits their purposes and get on with the business of doing their research. They understand both explicitly and implicitly the criteria that their colleagues will use to evaluate their research. He comments:

"As researchers, our goal is to improve our knowledge of some phenomena. Different research methods and different data-analysis methods have different strengths and weaknesses. They provide us with different types of knowledge about the phenomena that are our focus. Moreover, different research methods have different strengths and weaknesses depending on our existing knowledge about the phenomena. obtaining this understanding is inhibited rather than facilitated by the current but longstanding positivist versus interpretive rhetoric." (Weber 2004, p.xi).

Most research will therefore probably involve elements of both positivism and interpretivism (Phillips and Pugh 1999, p.50). Cornford and Smithson (1996, p.39) believe that the two schools should not be discrete, stand-alone approaches, but should be complementary, a point echoed by Easterby-Smith, Thorpe, and Lowe (1991, p.133). Klein and Myers (1999, p.69) consider that qualitative research does not necessarily have to be interpretivist. However, for the sake of this research qualitative will be regarded as the same as interpretive. It is therefore necessary to consider the approaches that are available for research into the development of information systems.

3.4 Possible Alternative Research Approaches

The development of the case retrieval tool will need to be undertaken using a recognised research approach, and use acceptable research methodologies. Nunamaker, Chen, and Purdin (1990, p.90) consider what constitutes research in general, and cite the definition provided by Blake (1978) as a good foundation. Blake defines research as "a systematic, intensive study directed toward fuller scientific knowledge of the subject studied." Nunamaker, Chen, and Purdin (1990, pp.90-91) suggest five research categories that tend to adopt a transverse approach, cutting across the traditional positive/interpretive concept. These are shown in Appendix B.

It may be seen that with this wider range of research classifications, there is much overlap Nunamaker, Chen, and Purdin (1990, p.91). However, it is also evident that the differing classifications have intrinsic biases towards particular types of research, and their own

strengths and weaknesses. Nunamaker, Chen, and Purdin suggest that all types of the research process follow a pre-determined pattern shown in Figure 3.4.

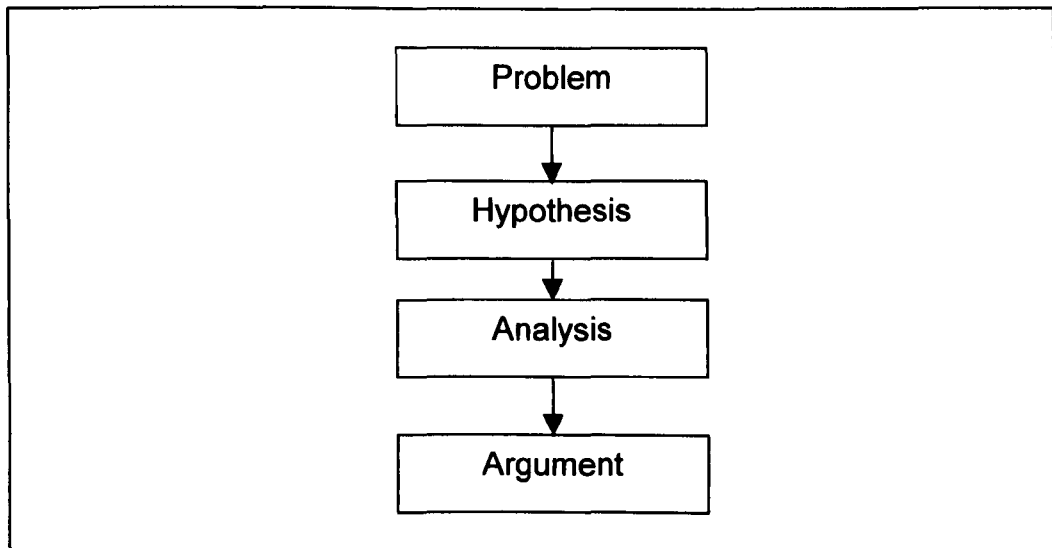


Figure 3.4 – Research Pattern (From Nunamaker, Chen, and Purdin 1990, p.91)

The results of the research become the arguments or evidence in support of the original hypothesis. Nunamaker, Chen, and Purdin (1990, p.91) believe that this view of research provides sufficient evidence, often in the form of a working system, to support the initial hypothesis or concept. Furthermore, they suggest that this may be regarded as 'proof by demonstration'. This concept appears to hold equally well for interpretive research as for positivism, as may be seen from their classifications described above. It suggests that the development may adopt an heuristic stance, since, in an interpretive investigation, the researcher is not generally trying to 'prove' a particular concept, but to investigate underlying causes for phenomena. This view of systems research appears to fit very closely with many of the concepts proposed for the present research.

All good research that uses acceptable approaches adds to the body of knowledge for a given research domain (Nunamaker, Chen, and Purdin 1990, p.91). New knowledge that has been added to the research domain allows refinement and re-definition of the research area, and stimulates new concepts for investigation. This is the classic life-cycle model for prototyping. It is particularly true of engineering research, a branch of research that includes IS. This type of research approach can be constructive in that it can produce artefacts such as models, frameworks, working applications, or, as in this research, a combination of all three. If the

constructivist approach, requiring the development of a useful artefact, is combined with the prototyping approach, the resulting paradigm would seem to be strongly oriented towards heuristic research. Interestingly, Nunamaker, Chen, and Purdin find that algebraic research used in some domains often tends to be narrow and restricted in the methods that may be employed.

No one research approach can be identified as the definitive approach for IS research. Nunamaker, Chen, and Purdin (1990, pp.94-96) suggest that a multi-methodological approach be adopted, linking together all major research approaches. This is shown in diagrammatic form in Figure 3.5.

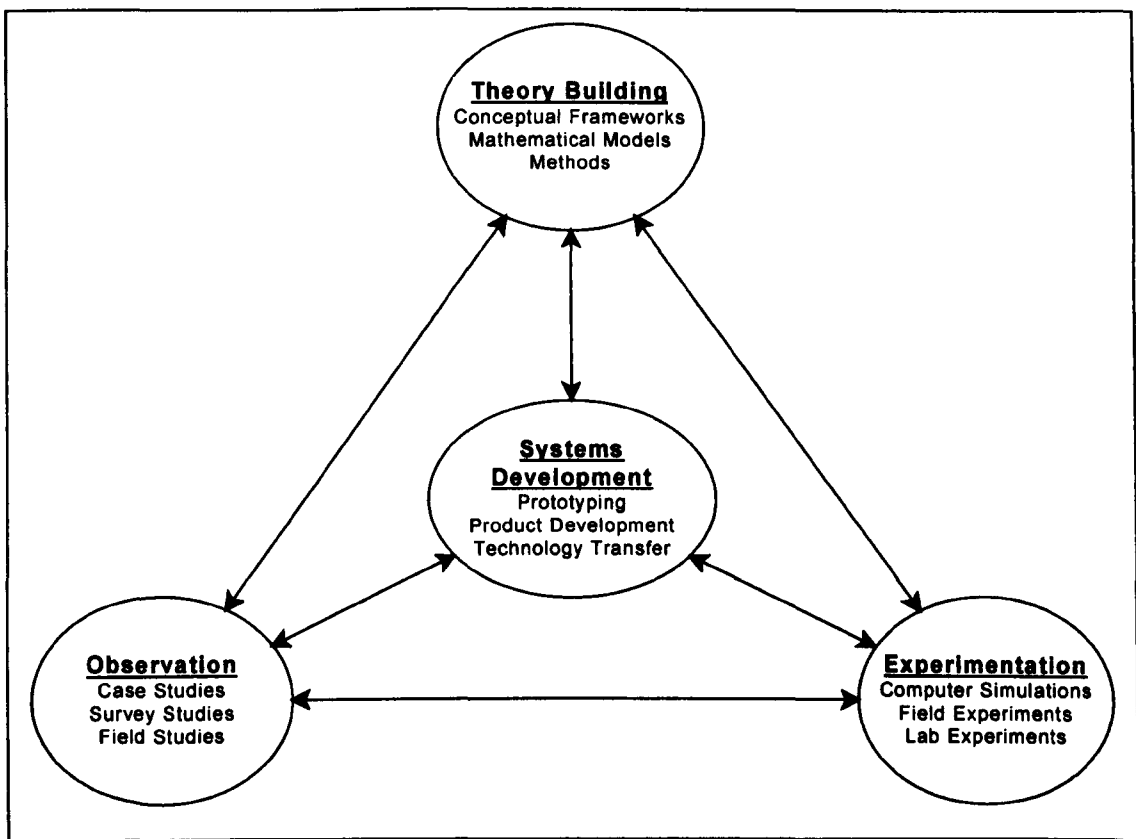


Figure 3.5. A Multimethodological Approach Model to IS Research
(From Nunamaker, Chen, and Purdin 1990, p.94)

The appropriate paradigm may be selected at the appropriate time in the research programme. Systems development is thus seen as the hub of IS research, interacting with other approaches that are applicable to allow a dynamic approach to research. No one approach is pre-eminent, and all appear to be complementary. The model also allows comparison with other research

approaches that result in the application of domain knowledge and previous research from other disciplines to new problem areas. This is particularly applicable to research that produces practical and useful artefacts.

The proposed research appears to fit well into the model. A theoretical foundation has been established as the basis of a classification and retrieval system for analysed case studies. This has drawn concepts from several research disciplines such as legal research, applied ethics, cognitive psychology, and behavioural and social science, in addition to the technical considerations drawn from the multi-faceted discipline of computer science. A system may be developed as a prototype, and may be subjected to basic interpretive evaluation. The results may be fed back into the design process to refine the system. The system will be populated with case studies that rely upon observation and interpretation of real-world events. The survey of cases may be used in the classification and retrieval algorithm to develop a schema within which the cases will fit. The details of many cases are expected to be incomplete. The retrieval engine must thus be based upon a flexible approach to case manipulation. Surveys may be conducted using students to elicit satisfaction and usefulness of the final tool.

The model also appears to meet the pedagogical requirements of the system. It supports Laurillard's (2002) concepts of a conversational style of learning that leads to an exploratory approach in student perception. Students are encouraged to draw from many disciplines, and to observe the context and actions within the case studies. They are encouraged to build their own concepts of the issues involved, and experiment by considering alternative actions that might be taken by the stakeholders in a given case. This supports Laurillard's (2002, pp.14-15) concept of situated learning.

All these approaches appear to follow the concepts of the model. Both the action of the retrieval tool and the learning processes of the students appear to be addressed by the model. It is therefore proposed that this IS approach be adopted for the conduct of the research. However, it is necessary to consider the mechanisms that will be adopted for the construction of the retrieval tool, and the effects that the tool and the case studies will have upon the students.

3.5 A Classification of Information Systems Research Approaches

Once the research approach has been determined, it is necessary to consider the way in which data will be gathered and processed. Klein and Myers (1999, p.72) attempt to derive a set of seven principles that will offer a guidance framework within which to undertake interpretive research. However, they believe that interpretive research does not require criteria to be applied in a mechanistic way. They suggest that much interpretive research rests heavily upon hermeneutics, the exploration of meaning in textual information. The fundamental principle, upon which all others rest, is that all human understanding is achieved by iterating between consideration of the independent meaning of the individual parts of a research development and its concept as a whole. This follows the requirements to stimulate in students a deeper consideration of the individual ethical issues identified by a given case study, and to consider their effect upon the case as a whole. This research follows the same paradigm. Nevertheless, Klein and Myers (1999, p.69) believe that qualitative IS research can have elements of positivism where formal propositions, hypothesis testing, and quantifiable variables are used.

Although based upon the positivist/interpretivist classification, Galliers (1992, p.149) suggests a number of approaches that might be used. These are shown in Table 3.2. However, if a generalised approach similar to that of Nunamaker, Chen, and Purdin (1990) is adopted, the use of the various research approaches can be mapped onto the proposed research.

Scientific (Quantitative/Positivist)		Interpretivist (Qualitative)	
Research Approach	Use	Research Approach	Use
Laboratory Experiments	N/A	Subjective/argumentative	*****
Field Experiments	N/A	Reviews	****
Surveys/questionnaires	*****	Action Research	*****
Case Studies	*****	Descriptive/interpretive	*****
Theorem Proof	N/A		
Forecasting	*	Futures Research	**
Simulation	*	Role/game Playing	****

Table 3.2 - Information Systems Research Approaches and Methodologies (modified from Galliers 1992, p.149)

The Galliers (1992, p.149) model has been modified to show additional columns indicating the use of the appropriate approach within this research. The extent of the usage is shown as a 'star rating', five stars indicating the highest level of employment. Interestingly, the employment of research approaches shows that, for this research at least, the contention of Phillips and Pugh (1999, p.50) and Cornford and Smithson (1996, p.39) concerning the complementary nature of the two approaches is justified. It is noticeable that of the thirteen approaches listed by Galliers, three do not find major application within the chosen research approach, and two are of lesser importance. No field or laboratory experiments are involved. No proof of a theorem is attempted. Little simulation of a scenario is undertaken, although students are urged to consider their feelings as if exposed to the actions that occur in ethical situations. Forecasting is confined to suggesting what students may expect from their given scenarios. The tool does not attempt to make firm predictions.

This leaves eight categories present in varying degrees of application. Many of these are closely inter-linked and complementary. Galliers places the approaches in pairs, each pair to a line, and suggests that they form opposing concepts supporting their appropriate research approach. It is interesting to note the 'five star match', where Galliers' apparently conflicting research approaches of surveys/questionnaires versus action research, and case studies versus descriptive/interpretive approaches are actually complementary. The following sections examine the different approaches to this research that are identified as relevant by the star ratings, particularly those with a rating of two stars or greater.

3.5.1 Case Studies

Research may use case studies in several different ways. Walsham (1993), taking the interpretivist approach, uses a single case study for an in-depth investigation into a single phenomenon. His book illustrates three examples of how single case studies can be used to analyse and interpret the issues involved in the design and implementation of an IS, and examines how the systems behave in practice. He also investigates the motives of the actors involved in the cases, drawing rich conclusions from the analysis.

Case studies may also be used simply to assemble numerical counts of similar statistical information concerning the cases in order to derive theoretical bases for hypotheses, or to prove such hypotheses. Galliers (1992, p.154) discusses the dualistic nature of case studies, and concludes that they are equally applicable to positivist and interpretive research. He comments that they can cause problems when used for empirical or scientific research. It is frequently difficult to use them collectively to gather sufficient acceptable corresponding statistical data. Interestingly, he places both case studies and surveys in the scientific category (Galliers 1992, p.150) as many researchers classify case studies as such. He does not seem to consider them as events that may form a longitudinal survey. Galliers' concept of case study research is that of a single or small number of case studies, used to describe relationships that exist in reality. Furthermore, Galliers also places reviews in the interpretive category of research approaches. However, although Galliers discusses many of the research approaches, he does not give any in-depth description of reviews. There would appear to be some overlap between case study research, surveys, and reviews, the distinction being somewhat blurred in Galliers' classification.

These concepts fit the research well. The researcher will be deeply involved in the investigation and interpretation of all the legal, social, and ethical issues within the case studies and in their presentation. The interpretation of the context of the case studies will include such factors as economic, scientific, political, and cultural issues, in addition to the legal and ethical factors. Forester and Morrison (1994, p.277) note that students should be aware of the economic, scientific, legal, political and cultural issues that have helped to shape the development of ICT. This requirement can be assisted by the use of case studies that may provide a longitudinal timeline.

This research uses case studies with elements of both modes of research. It is necessary to collect cases of differing ethical flavour in order to illustrate the dilemmas that may be experienced in real life. The precise classification of the cases for storage and retrieval is a major issue in this research.

Although there is an element of positivism in the research, no attempt is made to manipulate statistically the different attributes of the cases to form hypotheses concerning the issues. The examination of a number of case studies can more clearly identify a particular set of relationships or themes (Cornford and Smithson 1996, p.49). In this research, case studies provide a richness of information upon the application of ethical principles. Evidence of the presence of ethical attributes within the cases is necessary for storage and retrieval. Therefore, limited processing may be necessary to obtain a nearest-neighbour match. However, the main thrust in the use of cases is to analyse the ethical issues highlighted, and to use them as 'influences' in attempting to change students' underlying ethical awareness. This requires analysis and reflection, firmly in the interpretive domain.

3.5.2 Surveys and Questionnaires

The retrieval tool developed as part of this research requires the use of surveys. It is necessary to establish the acceptability of the tool. The repeatability of the satisfaction and usability results indicates the acceptability of the tool. It is therefore necessary to expose several cohorts of students to the tool, and to record their observations upon it. The analysis of the questionnaires should demonstrate the acceptability of the tool to various student categories.

The development of the tool requires the programming of an interface that poses questions addressing ethical principles. The interface itself is in the form of a questionnaire that elicits the student's ethical attitude, constructing the query for the retrieval of a suitably analysed case. The interaction between the student and the tool is itself subject to the problems and limitations of questionnaire design. Correct construction, language, semantics, and appearance are all vital to its success.

Surveys also include the concept, outlined by Cornford and Smithson (1996, p.49), that case studies themselves may be used to form a timeline to identify trends or themes in a longitudinal investigation. They consequently result in a survey mapping the evolution of the issues under investigation. This aspect has already been discussed within section 4.5.1, which addresses the overlap of concepts between case studies, reviews, and surveys.

The questionnaire method of seeking data for the formulation of retrieval queries, and for establishing student satisfaction with the usability aspects, will attract the highest star rating because of the importance of the student/tool interface.

3.5.3 Descriptive and Interpretive Approaches

Case studies provide a snapshot of a particular situation (Cornford and Smithson 1996, p.49). The use of multiple case studies can provide a timeline indicating a development of a concept or societal standard such as might be applied to ethical or legal issues. Similarly, a cluster of case studies addressing a broadly similar area can provide a stimulus for contrasting and comparing the differing treatments of similar ethical issues, and lead to a deeper understanding of the issue under exploration.

It is necessary to provide as much background information as possible within the case to promote deeper learning. This aspect may bring some disadvantages. Eastman (2003, p.19) notes the difficulties that students experience with identifying issues in textual stories. However, Harmon and Huff (2000, p.25) consider that case studies must have sufficient detail to create in students a sense of reality and belief that the study is based upon real-world criteria. Korac-Kakabadse et al. (2001) cite work by Hall (1989) finding that the context surrounding an event is critical to its meaning. Therefore, relevant information must exist before the meaning of any interaction can be examined.

The case library constructed as part of this research contains some cases with a strong legal content. Moens and de Busser (2002, p.432) find that richness of content in legal cases will provide only a subset of the overall information concerning the case. Many facts may be initially considered contextually irrelevant by the judge or the parties to the case, but the richness provides both implicit and explicit detail that can be later used for the establishment of legal precedent. Similar comments can be made concerning cases that have ethical content. Case studies are closely linked to descriptive and interpretive issues in this research.

3.5.4 Subjective and Argumentative Approaches

The subjective and argumentative elements have considerable effect upon the approach to the research. The descriptive/interpretive approach accepts that case studies may contain a

number of different viewpoints that may conflict. This may be particularly true of ethical principles such as human rights, where the safeguarding of one person's rights may infringe upon the rights of another. The analysis of case studies can be subjective, depending upon the ethical standards of the analyst. The aim of the research is to produce a tool that will stimulate students to consider alternative views of ethical and legal issues, not to dictate solutions based upon the fundamental beliefs of the analyst. However, the cultural and ethical stance of some students may cause difficulty in this respect. This issue has been addressed in Chapter 2.5.5.

There is some possibility of bias in the development of case studies, stemming from the perception of the researcher (Walsham 1995a, p.77). Walsham finds, also, that the interaction between student and teacher will affect each other's perception and judgement of the issue under discussion. Hammersley and Gomm (1997) consider that the term 'bias' is ambiguous, and that some forms of bias can be legitimate. Often, a decision must be made upon whether features are significant within a knowledge domain. The decision of the researcher upon what is salient is a valid judgement. It should not be regarded as bias. However, where there are systematic errors, or where conscious deviations from a path that will produce valid conclusions are allowed, the results will be biased. Particular care must be taken in the analysis of the studies to ensure that they are ethically neutral.

The retrieval algorithm is required to address a variety of cases. Cases may contain any combination of legal and/or ethical issues, i.e. a case can be legal and ethical, legal but not ethical, ethical but not legal, or neither ethical nor legal (Kallman and Grillo 1996, p.10). Therefore, the classification/retrieval tool interface should not focus preferentially upon any one of these options.

3.5.5 Action Research

Action research occurs when the researcher ceases to be simply an observer, and becomes involved within the actual research context. It has the advantage that the researcher is in close contact with a real-world situation, and applies this knowledge to the design and development of the system. The fundamental concept in action research is that complex social processes are best studied by examining changes in these processes and noting the subsequent effects.

Baskerville (1999, pp.2-3) considers that the method produces highly relevant research results as it is grounded in practical application of theoretical concepts. In this research, the researcher has developed a theoretical basis for the construction of a functional IS tool. This allows the researcher the opportunity to view the system from the perspective of the future users.

The researcher is required to research and analyse a considerable number of real-world case studies used to populate the case library. The process of analysis is precisely the same as that to be attempted by the students for their given scenario. Burstein and Gregor (1999) consider that when an IS is developed and evaluated by the researcher in a social context, this work can be regarded as a form of action research.

The approach to this research is rich in interpretivist elements. Without this type of approach, the case library would be weak and of little use in the stimulation of students' ethical awareness. A good range of case studies and ethical analyses are therefore crucial to the success of the research. However, the researcher has to derive the 'meaning' of the observation, in this case the observation being the information contained within the case studies. However, Walsham raises a cautionary note upon the employment of action research:

"Interpretive methods of research adopt the position that our knowledge of reality is a social construction by human actors. In this view, value-free data cannot be obtained, since the enquirer uses his or her preconceptions in order to guide the process of enquiry, and furthermore the researcher interacts with the human subjects of the enquiry, changing the perceptions of both parties. Interpretivism contrasts with positivism, where it is assumed that the 'objective' data collected by the researcher can be used to test prior hypotheses or theories." (Walsham 1995b, p.376)

This concept is taken further by Klein and Myers, who state:

"It follows from this that interpretive researchers must recognize that the participants, just as much as the researcher, can be seen as interpreters and analysts. Participants are interpreters as they alter their horizons by the appropriation of concepts used by IS researchers, consultants, vendors and other parties interacting with them, and they are analysts in so far as their actions are altered by their changed horizons. This effect is lessened if the researcher is not interacting with the participants, i.e. relies solely on historical secondary data or a concealed one-way window. Even in this case, however, the researcher's preconceptions about the participants still affect the construction, documentation and organization of the material." (Klein and Myers 1999, p.74)

In other words, the actors in an event are themselves interpreters of the actions played out by all who are part of the event. They will tend to modify their behaviour and decision-making in line with their own interpretation of the motives and actions of the other actors. This fits well with

the aim of the retrieval tool, to influence the ethical awareness of students, and links strongly with the concept that students role-play the actions of the participants in a case study.

3.5.6 Reviews

Reviews consider past events (Cornford and Smithson 1996, p.48). This research has inherent elements of review. It considers the influence of developments of other areas such as law, ethics, cognitive psychology, and social attitudes upon students' ethical awareness.

The researcher conducting a review is concerned with charting the development of an idea (Cornford and Smithson 1996, pp.48-49). A series of case studies may be tracked over a period to establish relationships between factors under investigation. This suggests that case studies may be followed as they develop upon a theme following a timeline. This research has parallel elements in that it is possible to track the changes in the development of a particular ethical or legal stance by the use of a series of case studies. Although they are separate incidents, they may illustrate changes in, say, legal interpretation upon issues of contractual obligation or privacy. Similar sequential development is often seen in the development of statute law, usually addressing a contentious or complex issue. Case studies used in this way provide a strong feeling of personal insight upon the issues investigated, and a robust framework is needed to present them (Cornford and Smithson 1996, p.49).

Students are also required to review the case presented by the case retrieval tool, and to review, contrast, and compare the information provided with the facts of their given scenario. The requirement for students to review and consider the information provided is a fundamental aspect of deeper thinking and learning – a basic aim of the research.

The review content of this research contributes strongly to the overall aims. It is inherent within the descriptive, argumentative, subjective, and interpretive elements of the research. Only by reviewing work in other disciplines have the fundamental ideas for the research evolved.

3.5.7 Futures Research

Futures research attempts to develop possible hypotheses, or to predict likely outcomes to the research exercise. In this research, it is suggested that the use of the tool will enable students to understand the implications of their actions in events that they will face in their working lives.

The aim is long-term. As such, it is not measurable. However, it may be possible partially to assess the effect of the tool upon student awareness from the results of the survey questionnaire. The research approach would thus possibly stimulate more awareness of ethical consequences. That itself is a futuristic aim.

Nevertheless, futures research has some disadvantages that will influence this research. Galliers (1992, p.151) notes several issues that affect the accuracy of predicting possible outcomes:

- a) IS research often examines many variables simultaneously that may change with the passage of time.
- b) It cannot be assumed that the context and detail of future events will replicate those used for the research.
- c) The scenarios used for student consideration may not be 'true' scenarios because of the accuracy of the scenario description.

These points emphasise the need for the careful description of the case analyses used in the case library. However, in this research, point a) can be turned to advantage. The production of a timeline, mapping the changes in societal attitude over a given period, can illustrate the development of a concept or societal standard, and may promote students to consider the direction in which an issue may develop.

3.5.8 Role/game Playing.

Game and role-playing can be linked with the descriptive/argumentative and futures approaches that are included in the interpretive research approach category (Galliers 1992, pp.156-158). Galliers suggests that role/game playing can be a structured process that promotes the development of new concepts. In this research, the researcher is attempting to build a structure that may be used by the students themselves to review their ethical opinions. This approach stimulates students to think about the deeper issues of their given scenario. It leads the student into the role of a researcher, and encourages a wider consideration of the feelings, motivations and actions of each of the participants in a case study. The role adopted differs as the student proceeds through the stages of the ethical analysis procedure. In complex cases with many

players, it may be necessary to run the case retrieval tool several times, each following the adoption of each persona from the given scenario.

Students may also be encouraged to place themselves in the role of a judge listening to the presented evidence upon the actions of the participants in a scenario, thereby adopting a supposedly unbiased opinion of the motivations and actions. This concept appears to fit well into the systems for ethical analysis proposed by Kallman and Grillo (1996, p.9).

The use of role-play to stimulate and mirror professional practice is described by Golja (2003, p.211). She finds that role-play has strong affiliation with case study research. Real-world, relevant case studies are particularly beneficial for the development of a professional ethos.

She comments:

"Implicit in this perspective is a sense that within the design of rich complex environments such as role-play simulations there are no right or wrong answers but rather a means that enable individuals (through interaction with their environment) to choose their own pathways based on their own developmental histories and where events occur in relation to what has taken place previously." (Golja 2003, p.211)

This process of student stimulation is inherent in the case retrieval tool that is an integral part of this research. Students are encouraged to take an approach to the issues raised by the scenario from multiple viewpoints. The students are drawn from many different backgrounds and cultures, and it is inevitable that their role-play will be influenced, at least initially, by their inherent ethical stance that stems from their culture and upbringing.

The element of role-play is not confined to the student. There is also an element contained within the actions of the researcher. The analysis of the case studies for inclusion in the case library also requires the actions that take place within the study to be viewed from the perspective of the other actors. The research follows the Rahanu, Davies, and Rogerson (1999, pp.3-5) five-stage analysis, and adopts the same role-play strategy expected of the students. The use of the role-play approach therefore contributes strongly to the effectiveness of the system development, and to the overall research approach.

3.6 Conclusion

IS research is still emerging as a new field of development. It has not yet achieved its own armoury of research approaches, or universal recognition as a discrete research approach (Banville and Landry 1992, pp.61-62). The wide scope of this research makes the identification of a discrete research approach difficult. The approach was required to be highly flexible. The research is investigative in the sense that it sought logically to build facilities into the theoretical basis and the working model of the retrieval tool, amalgamating additional issues as they became relevant. The selection of suitable approaches depended upon the evolving context of the research. Interestingly, several authors (Nunamaker, Chen, and Purdin 1990, pp.94-96; Galliers 1992, pp.145) suggest that no one research approach can be identified as the definitive IS research approach. Nunamaker, Chen, and Purdin (1990, pp.94-96) suggest that a multi-methodological approach be adopted, linking together all major research approaches (The Nunamaker model - see Figure 3.5). Furthermore, there is no reason why one research approach should not be used as an integral part of another approach. However, the selection and balance of the different approaches used will differ with the exploratory demands of the research. It is unlikely that a definitive mix can be identified at the outset of the research process. This suggests that a prototyping approach, implied by the Nunamaker model, is likely to be the most suitable development methodology.

The original approach to the development of IS research has been technical, but there is an increasing realisation amongst researchers that behavioural and organisational considerations must now be included. Galliers and Land (1987, p.900) note that "IS is a meta-subject that spans many disciplines in the social sciences, in business, and, only occasionally, in the natural sciences." The selection of contributory research approaches must therefore include psychological, social, and personal considerations in addition to the technical aspects of the system development. This multifaceted approach is inherent in this research, drawing upon the establishment of personal attitudes and intentions, and has resulted in an approach that is strongly interpretivist. The 'personae' adopted by the retrieval tool as storyteller, advisor, reminder and decision support agent all draw upon suitable pedagogic, attitudinal and motivational foundations in appropriate theoretical areas.

Nevertheless, the research is not exclusively interpretivist. In order to determine the effects of the retrieval tool on the students' perception of usability and ethical issues, some numerical, positivist elements are also present. This follows closely the conclusions of Webber (2004, p.iv), that it is difficult to justify the somewhat artificial division between the interpretivist and positivist concepts. Good research into psychological, social, and personal factors will almost inevitably be a blend of the two perspectives. This research adopts the 'blended' approach, albeit with a bias towards the interpretivist stance.

It is beyond the scope of this research to conduct an in-depth investigation into the psychological and social issues raised by the construction of the retrieval tool. Although the research draws upon a wide selection of research in these areas, including motivation theory, attitude assessment, cognitive science, and self-motivation, it accepts the conclusions of prior research and progresses from that point.

This research adopts the multimethodological approach suggested by the Nunamaker model that includes the standard prototyping approach to systems development. This approach allows a cautious, sequential, iterative development to the inclusion of the different research approaches. The segments of the research approach adopted can be mapped to the Nunamaker model. The theoretical basis for attitude assessment and manipulation, human motivational factors, and interactivity are addressed under the model's 'Theory Building' heading. This provides the framework for the development of a prototype retrieval tool under the 'Systems Development' heading. The case library is populated with case studies, included under the 'Observation' heading, and incorporated in the product development category under the 'Systems Development' heading. Determination of the usability and effectiveness of the tool are investigated under the 'Experimentation' heading. The results of the experimentation are fed back into the prototype. Additional issues such as culture, experience, cognitive psychology, and physiological issues are considered. The theories for these issues are incorporated, and the theoretical concepts of the tool are revised. The modifications are then built into a revised tool before re-testing. The process thus becomes an iterative development, drawing on the relevant theories at the appropriate time in the development process, but demonstrating the cohesive effect of the development.

Testing of the working model was undertaken by a pilot group of students. However, a number of psychological issues, although based upon proven theoretical principles, had not previously been applied to the development of a pedagogic retrieval tool addressing ethical dilemmas. It was therefore necessary to incorporate these issues while acknowledging that their effect upon the functioning of the tool was unclear, and would only be better understood following further investigation and use of the tool. These issues form the basis of the proposals for future work, outlined in section 7.4.

The following two chapters describe the iterations in the development of the initial investigative and revised case retrieval tools. Reasons for the failure of the investigative tool are described, and reasons advanced for the development of the revised tool.

Chapter 4 - The Development of an Investigative Retrieval Model

In Chapter three of this thesis, a case has been made for the development of a tool using case studies to assist students in identifying and addressing ethical issues that they may experience in their professional lives. Chapter three also suggests suitable research approaches for the development. Chapter two has identified a number of issues that require consideration when attempting to build the retrieval tool. The following chapter describes the initial development of the retrieval tool to incorporate the theoretical requirements for prompting memory recall of issues from previous cases into a practical, working artefact. The challenge is to use the power and precision of ICT in the design of a tool to address the uncertainty and fuzziness of ethical considerations.

4.1 Case Classification, Storage, and Retrieval

The incorporation of case studies into a computer-based didactic tool presents a number of challenges. Few case studies fully describe in dispassionate terms all the nuances of the case or incident under consideration. No one case study is identical to another. Consequently, the selection of which issues should be used to classify and retrieve an analogous case to 'match' a given scenario can present problems.

In addition, real-world cases are usually complex, and contain several issues. Students may evaluate the relative importance of issues differently. That is not to say that any one approach is 'right' and the others are 'wrong'. Differing interpretations upon the importance of issues within the scenario emanate from students' different ethnic, cultural, and religious backgrounds. Furthermore, Friedman and Phillips (2003, p.22) find that gender affects ethical judgement, with females tending to use a different interpretation of moral imperatives and values from those used by males.

Finally, the way in which humans gather, identify, store, and retrieve knowledge is not clearly understood. This chapter considers some of the theories of human memory that are widely accepted, and develops the basis for a retrieval model based upon these concepts

4.1.1 Human Collection, Identification, Storage, and Recall of Knowledge

Classification and retrieval procedures, transforming simple data into knowledge, are required before the knowledge can be efficiently reused (Stanoevska et al. 1998, p.23-1). Stanoevska et al. identify two categories of knowledge: tacit and explicit. Tacit knowledge is personal insights and intuitions, and is thus internally created from within an individual's personal memories and experiences. Tacit knowledge includes the individual's ethical stance, knowledge of the world, and of the particular problem

domain being addressed. Explicit knowledge is created from knowledge supplied by external sources or influences beyond the control of the knowledge user, but codified and made available through a transmission medium. The two form an iterative cycle, shown in diagrammatic form in

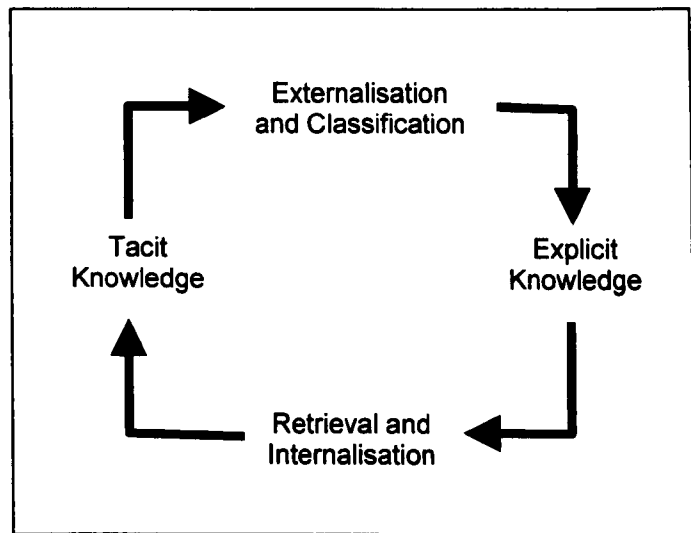


Figure 4.1, with explicit knowledge being used to expand an

**Figure 4.1 - The Tacit-Explicit Knowledge Cycle
(Adapted from Stanoevska et al. 1998)**

individual's tacit knowledge store. This research is based upon the premise that the cycle can be developed and deployed using a suitable transmission medium to target students' personal ethical codes, and consequently to develop or influence students' personal ethical values. The research seeks to develop a system that can meld a student's internal, codified knowledge of the world with that from external, real-world situations, giving the ability effectively to address novel ethical dilemmas.

Knowledge is held in an individual's long-term memory as instantiations of objects in an internal schema (Eysenck and Keane 1995, p.119). Sommerville (1996, p.190) also uses the concept of schemata for the storage of data in his discussion of the data-handling capabilities of ICT. Minsky (1988, p.244) uses a similar concept, 'frames', for the data objects, and describes them as "data structures for representing a stereotyped situation".

However, retrieval of frames or schemata from a data collection creates particular problems. Eysenck and Keane (1995, p.123) cite the work of Tulving and Thomson (1973, p.359), who state that "Only that can be retrieved that has been stored, and ... how it can be retrieved depends upon how it was stored". Tulving and Thompson's comments relate to the retrieval of information from within a human's long-term memory store, but they apply equally to a computerised data store. This point was foreseen by Bush (1945, pp.106-107) in his concept of a 'memex' for storing and retrieving information of interest to an individual. Eysenck and Keane (1995, p.124) find that the retrieval process involves a search through the mind to identify specific memories. These memories can be equated to frames or schemata. However, concepts of human memory are still vague and undefined (Springer and Deutsch 1989, p.204). Matlin (1998, p. 245) believes that memory retrieval works only by positively retrieving consistently stored material in a mental schema. He correctly notes, however, that sometimes information is retrieved because it does not match pre-defined schemata or frames. Yet, it is from within a person's internal long- and short-term memories that the foundations of ethical beliefs and behaviour originate. The recall of analogous instances from stored frames or schemata provide a powerful stimulus for the formation of new decisions when facing novel ethical dilemmas. Memories and experiences are elements within the schemata or frames that the retrieval tool, developed as part of this research, seeks to assist and to expand. They provide the explicit element in the learning process.

For this research, it would be useful if a retrieval model could be developed, based upon the generally accepted concepts of how humans store and retrieve information. However, although the research draws upon a number of established cognitive psychological and behavioural theories, the investigation of such psychological phenomena is not the aim of the research. No attempt has been made to interpret or adapt the fundamental theoretical concepts to develop further cognitive psychological issues. The theories have been used as a scaffold, each contributing and combining to support the concepts for the development and operation of the retrieval tool. The area of cognitive and behavioural development is an extensive, discrete area of research, presently under investigation by others.

4.1.2 The Incorporation of Case Studies into Pedagogic Tools

Much experience, particularly in the engineering and science disciplines, has developed through the inspection and analysis of former events and reflection upon their consequences. This information can be incorporated into case studies that can be used to transfer to students the experiences gleaned from detailed inspection of past events, accelerating recognition of the issues raised (Simpson 1999). The use of case studies is a preferred method of instruction suggested by the ImpactCS committee (Harmon and Huff, 2000, p.24; Martin et al 1996, p.81). This guidance strongly supports the concept that lessons can be learned from examination of past events. Experience is rapidly transferred to novices, or to professionals who may otherwise remain unaware of the implications arising from an event. Indeed, the basic concept of professional institutions and practice appears to have developed from examination of past disasters. Most recognised professional institutions now require constant review of projects within their particular fields.¹⁹ The use of case studies in education is thus widely accepted as a proven method of influencing students' perception of issues. Case studies act as external influences that impinge upon a student's consciousness. However, to be effective in the task of influencing a student's perception, it is necessary that suitable cases be presented for evaluation and comparison. The method of retrieval should mimic, as far as possible, the cognitive processes that are used by students when retrieving past knowledge from their own long- and short-term memories. The mechanism for 'loading' the student's internal memory schemata may be from their own personal experience, or it may be from mediated input through an instructional medium.

The development of computerised storage and retrieval systems for case studies poses considerable difficulties when attempting to stimulate deeper learning and mimic the human cognitive process. Most pedagogic systems require a retrieval system that is based upon recognisable criteria for grouping or identifying cases. Such identification criteria need to be

¹⁹ Knowledge dissemination is through a mandatory programme of Continuing Professional Development (CPD) for each of the Society's members. This develops best practice aimed at reducing the occurrence of similar, potentially catastrophic disasters. CPD also encourages the understanding of, and commitment to successful activities. It mirrors the new approaches in education that focus upon lifelong learning.

discrete, common elements, applicable to all records (or cases) within the storage medium. The use of frames or schemata tends to imply that such discrete identifiers are necessary for successful retrieval. The question is, therefore, how to classify and retrieve the analyses of ethically significant events in a format acceptable to students, and to promote deeper consideration of the issues raised.

Traditional retrieval systems tend to rely heavily upon rule-based systems. However, for incomplete cases, the unthinking application of rule-based systems can lead to poor classification and inaccurate retrieval of suitable analogous cases. In the extreme, it may not retrieve any case from a case library, a situation that defeats the didactic aims of the retrieval tool. Ethical concepts do not lend themselves well to semantic or logic-based retrieval, as the many important nuances present in ethical scenarios are ignored. Nevertheless, apparently small and insignificant nuances can change completely the ethical bias of a case. Slight changes of context or date can mean that, for a similar set of case conditions, very different courses of action may be ethically acceptable.

Case studies are a valuable source of materials for teaching and learning, but must be used with care. Furthermore, in education the use of case studies can also bring positive disadvantages. Complex cases are often précised for the sake of readability, or to emphasise a particular issue required by the curriculum, thus losing some of the real-world factual richness that would be of benefit to students. This, in turn, may reduce the influence of the chosen retrieval criteria. Students may see the précised studies as phoney, and lose interest in the analysis and discussion of the very points that the cases were designed to illustrate. Dijkstra (2001, p.120) comments that such abbreviations become 'models', and that as models fail to reflect fully the many nuances of the real world they sometimes fail to correspond to what are the important issues in a case. Consequently, the successful employment of artificial intelligence (AI) techniques in the retrieval process, and reduction of the potential range of actions available by human operators to a simple rule-based algorithm, is difficult to achieve. It is thus necessary to adopt methods for classification and retrieval that are able to accommodate these difficulties.

The concept of examination and reflection upon past events appears to integrate closely with the Theory of Planned Behaviour, the Theory of Structural Cognitive Modifiability, and the requirement for reflection upon ethical issues, a point already identified in section 2.5.1. The challenge for this research is to develop a system that draws upon the strengths of the tacit and explicit knowledge sources to modify the students' internal schemata so that students understand more readily the ethical implications of their actions. In attempting to do this, the research must encourage students to develop higher order thinking skills. Deeper engagement with the students' given scenario, and comparison with the case analyses presented by the retrieval tool, should lead to a more questioning and thorough understanding of the issues raised. Students must be encouraged to question, and investigate their own questions about the ethical issues raised by a given case study in addition to responding to those posed by the retrieval tool. This suggests that cases must be fully presented in an interesting and stimulating format, not abridged for convenience sake.

4.1.3 Issues in the Classification and Retrieval of Case Studies

An examination was made by Maner (1999) of sixty-three models from a number of disciplines and addressing several approaches to ethical analysis. He finds that many of the models are complex, tend to be procedural, and need interpretation within the context or environment in which they occur. Nevertheless, the fundamental aim of ethical analysis should not be simply to go through a procedure for the resolution of ethical dilemmas. This approach will tend to lead to an unthinking rule-based interpretation of issues.

Ethical analyses should promote and encourage ethical reflection (Friedman and Phillips 2003, p.22; Moor 1998, p.17; Baase 1997, p.34). Ethical reflection, however, is not always achievable through structured approaches. Limayem and Hirt (2003, p.71) suggest that the development of 'habit', sub-conscious or automatic structured behavioural tendencies developed from past repeated action, will tend to override one's rational consideration and motives for the conduct of an action. Habit becomes a structured activity in its own right. Notwithstanding, Maner attempts to apply procedural methods to the analytical process if only to demonstrate their shortcomings. He concludes that ethical problems cannot be solved by rule-based algorithms. Computer professionals have good procedural skills that may be used to develop systems for ethical

decision-making. He suggests that algorithmic solutions will always lead to a definitive result. However, if an heuristic, step-wise approach is adopted instead, the system becomes much more flexible, with the heuristic outcome tending to guide the analyst towards a solution. This concept, whilst following the requirement for ethical reflection, poses problems for research using case studies. If cases are to be stored and retrieved to illustrate ethical issues, a structured system is necessary for retrieval of suitable cases that illustrate the ethical issues raised by the students' given case study. The researcher thus has the dilemma of resolving how the richness of the information contained within the selected cases can be used in an heuristic analysis whilst retaining a basic structure that will readily permit the retrieval of suitably analogous cases.

The effectiveness of a case retrieval depends upon the degree of similarity between essential criteria of cases (Kolodner and Leake 1996, p.46; Burke and Cass 1996, pp.94-95). Some of the algorithms proposed for use in document retrieval systems adopt semantic aggregation or statistical techniques for 'clustering' near-matching cases. A number of retrieval algorithms have been proposed for the clustering process. These include scatter/gathering (Cutting et al. 1992), clustering (Xu and Croft 1999; Hearst and Pedersen 1996; Gibson, Kleinberg, and Raghavan 1998), concept-based retrieval (van Deursen and Kuipers 1999), context-based similarity (Jurisica 1994), and Bayesian reasoning (Gigerenzer and Hoffrage 1995). Most suffer from some disadvantages. They generally address the retrieval requirements of large data collections, often documents, focussing upon advanced retrieval techniques. The retrieval and presentation of full documents from the case library forms a major issue in this research. However, as described in section 2.6.4, a suitable case for one student may not match the ethical disposition of another, and so different students may not retrieve the same case for comparison with a given scenario.

Some systems attempt to apply a propositional calculus format used in relational database management systems, and attempt to apply AI techniques to mimic human intelligence. Retrieval takes place by applying production rules that uniquely identify each record. Provision of a matching set of criteria from a given case study is assumed to give retrieval of a 'similar' matching case from the case library. Unfortunately, cases are not consistent and uniform, and

often incomplete or inadequate. In such situations, it is difficult to apply rule-based retrieval processes.

None of these techniques fully matches the requirements for the stimulation of students' deeper thinking processes. The use of full text searching to retrieve cases is unreliable (Moens and de Busser 2002, p.430). Moens and de Busser suggest that the occurrence of a word or phrase in a passage of text is no guarantee that the text is relevant to the search request. Furthermore, Brewer (2001, p.54) importantly notes that relevance does not mean the same thing to everyone. Mauro, Natale, and Libertella (1999, p.23) note that something regarded as morally right by one person may not mean the same thing to other individuals in a diverse society. Hertzum et al. (2002, pp.579-580) crucially observe that relevance is dynamic and may change at a different position in time, a point of particular significance to ethical cases.

An exact match of the given and retrieved cases is *not* desirable. It will tend to discourage discussion and reflection of ethical issues, and inhibits the development of deep thinking. Wiener (1954, p.21) suggests that the more probable the message, the less information it conveys. Consequently, the more exact the match between the issue under investigation by the student and the information provided by the educational tool, the less the student will need to think about the relationships between the two. Cope (2003, p.136) observes that students use different strategies for learning. Those who wish simply to establish facts, and to regurgitate them as responses to assessments, fail to seek a deeper understanding of the issues involved. Those who wish to gain a deeper understanding of the issues seek stimulation to reveal the meaning associated with the content provided by the educational technology. This will lead to encouragement for students to develop their own understanding of the content, and to construct a deeper vision of the issues from further investigation. This, Cope calls 'conceptual development'. This would tend to suggest that the technique used to 'prime' the knowledge base of the retrieval tool should not provide a complete answer to a given issue. Students' imaginations must be stimulated to recognise and explore the nuances and differences between cases, as well as to recognise the similarities, and to 'bridge' between their given scenario and the retrieved case presented by the tool. However, a case that appears to the student to bear no, or minimal relevance may provide little stimulation. There needs to be a gap to bridge, but to

be useful it cannot be wider than the student's ability to build the 'bridge'. This suggests that in the retrieval process there must be an element of intentional 'fuzziness' that the retrieval tool should be address.

The design of the retrieval system poses a difficult choice. The algorithmic approach is unlikely to be the best method for raising ethical awareness but would be necessary for good retrieval. Conversely, the heuristic approach, with its suggestion and influence that will guide rather than direct, seems to be a more promising method to influence ethical values, but is difficult to implement. Maner (1999) finds that the heuristic approach has previously been used in ethical analysis to direct case studies, frame solutions, and to focus on scenarios. He therefore concludes that heuristics are at the core of applied ethics, and finds no problem with their application to teaching ethics. The challenge appears to be how to present a system for ethical analysis to ICT students. Maner notes that many ICT professionals, and presumably ICT students, are adept at procedural thinking. He therefore suggests that the development of 'procedural ethics' may be a possible solution to this challenge. His concept of procedural ethics follows the pattern developed by Pollock (2000, pp.17-21) for 'procedural epistemology', the concept of how to determine the approach one will take to direct one's own cognition. Maner's interpretation of Pollock's concept matches well the concept of the case retrieval tool. Maner (1999) identifies clearly the two issues that form the hub of the retrieval tool concept:

- The tool should formulate procedures that will guide ethical reflection, and thus lead to deeper consideration of the ethical issues.
- The development of a control structure to determine how and when the procedures can be used to best effect.

This would tend to suggest that the same procedure should not be employed endlessly for every ethical dilemma. Different issues set in different contexts will need different approaches, or at least an approach that is capable of being modified to suit the context of the issue. The ethical analysis system developed by Rahanu (1999) appears to support the first of these requirements, providing guidance upon ethical consideration of stakeholders' actions within the contexts of the case analyses contained in the case library. It poses a series of questions, and broadly follows the procedural stages outlined by Maner. However, the limited scope of the

Rahanu tool causes it to appear less able to provide the control element that allows the variation of approach. Pollock (1998, p.19) notes that epistemic cognition must be driven by the context and sense of the questions that the investigation is attempting to answer. This aspect is not immediately evident in the Rahanu model. Nevertheless, within its limitations, Rahanu's model appears to work well.

Rahanu's five-stage ethical analysis procedure is based upon the four-stage analysis model of Kallman and Grillo (1996, p.34). Rahanu includes an additional fifth stage that considers a series of informal ethical tests. Few other models investigated by Maner (1999) seem to have the clarity, simplicity, and discrete, distinctive stages of the Rahanu and Kallman and Grillo models. Maner (1999) and Rahanu, Davies, and Rogerson (1999, p.4) consider specific, identifiable ethical principles that might be used as the basis for a stable framework, and would allow successful retrieval of suitable cases. Rahanu, Davies, and Rogerson's (1999, p.5) system adopts a CBR paradigm. It does not attempt to decompose and synthesise cases to expand the case library, but uses the CBR simply as a retrieval mechanism, ignoring its more powerful AI capabilities. It also appears to use a minimum of rule-based reasoning to establish discrete domains for the application of AI techniques. However, it employs a weighting process to bias each of the issues posed in the interface of the tool. The tool therefore tends to use an element of AI in its operation.

4.1.4 Conditions for Effective Learning with Case Studies

Students are becoming more active participants in the learning process (Barak and Rafaeli 2004, p.85). Students have traditionally been taught to respond to questions, not to pose them, but are now being encouraged to adopt a more questioning attitude. Barak and Rafaeli suggest that the development of self-reflection, and consideration of peers' accomplishments, are important for learning outcomes. These might be equated to the examination of past events and cases.

Effective learning demands that cases must be well designed, and encourage the engagement of the students. Students must be immersed in a virtual world, and connect with the characters, culture, history, and ongoing story of the organisation and issues addressed in the case study

(Jacobs and Bone 2003, p.618). Carrick-Simpson and Armatas (2003, p.105) believe that the deeper learning required for students to become more ethically aware will not materialise unless students are encouraged to draw upon their previous experiences and knowledge. Carrick-Simpson and Armatas confirm that interest in, and knowledge of subject content are two major factors that influence student engagement with deeper learning and attainment of learning outcomes. Cope defines deep learning thus:

"Deep learning approaches involve an intrinsic interest in and awareness of developing an understanding of the content associated with a learning task. The bigger picture is intentionally sought, with upcoming assessments in mind but also understanding for personal interest, beyond the academic setting. A student uses preferred strategies to gain understanding. Underlying all strategies is the seeking of meaning associated with the content through relating the content to previous understanding; to the content in other learning tasks in a subject; and, in more sophisticated deep learning approaches, to the content in other subjects and in personal experiences both within and outside the academic setting." (Cope 2003, p.135)

CBR techniques have been used for the retrieval of case studies for pedagogic purposes in the field of professional healthcare (Oliver, Munn, and Pedder 2003, p.668). They note that case studies are an excellent way of encouraging students to adopt a problem-solving approach to professional issues. However, de Ronde (1996, p.56) dissents, believing that there is too much emphasis placed upon problem-solving techniques, and not enough on developing moral character. Indeed, this point forms an important issue in this research. A common criticism of ICT students is that they are taught primarily to address the technical problems of ICT with little thought for the wider ethical implications of their work. Oliver, Munn, and Pedder (2003, pp.667-668) describe their CBR system that encourages a constructivist approach to learning, and claim that it encourages self-reflection rather than rote learning. Learners are exposed to real-life situations. The system becomes a natural extension of students' ability to learn from their previous experience. It complements human reasoning and problem-solving abilities. However, although the authors comment upon the effectiveness of the system, they fail to describe the way in which the system operates to achieve successful case retrieval.

4.1.5 Retrieval of Legal Cases and its Relevance to Ethics and Learning

The retrieval of legal cases poses many similar problems to the retrieval of ethical cases. Research into legal retrieval has progressed much further than research into retrieval of ethical

cases. It is therefore possible that legal retrieval research can assist with the development of other types of retrieval systems (Schweighofer 1999), including the case retrieval tool.

Law is a very reflective intellectual discipline, constantly examining and re-examining its underlying methods and data (Ashley and Rissland 2003, p.18). Rissland, Ashley, and Loui (2003, p.15) suggest that legal concepts have an unchanging core of settled meaning, and a penumbra of subsidiary, flexible issues subject to interpretation as societal demands change. Legal issues are not static but evolve as society changes. Furthermore, cases may have more than one issue contained within them. Legal concepts become unavoidably open-textured. Rissland, Ashley, and Loui (2003, p.13) liken the interpretation of the penumbral elements in a case or statute to a form of learning. They suggest that there are interesting comparisons between learning and legal reasoning. Their comments are also highly relevant to ethical issues.

The adversarial legal systems of the UK and the US are founded upon factual investigation (Ashley and Rissland 2003, pp.17-18). However, they incorporate some interpretive reasoning to address any special circumstances or issues, in addition to fulfilling the wider goals and purposes of society. In other countries, e.g. France, the inquisitorial system of jurisprudence relies more heavily on rules and codes. Nevertheless, it is universal that rules and codes play a large part in any legal system. Similar concepts appear to be applicable to ethical issues. However, whilst legal issues have statute law to formulate rules and the courts to interpret legal issues there is no formative or interpretive body for ethical issues. Ashley and Rissland also note that legislators must accommodate ethical norms, economic and political principles, social policies, public expectations, past commitments and decisions, language related conventions, and technological advances (Ashley and Rissland 2003, p.19). Consequently, ethics and law are influenced by each other both directly and indirectly. Accordingly, it is almost impossible to consider ethical issues in isolation from legislative standards.

4.1.6 Lessons from the Application of Artificial Intelligence to Legal Case Retrieval

The application of AI principles to legal case retrieval is discussed at length by Zeleznikow and Hunter (1994). They find that the greater the need for human reflection, intuition, and

judgement, the less appropriate is an AI system that excludes human intervention. Zeleznikow and Hunter appear to suggest that AI systems are not well suited to support nuanced legal or ethical reasoning. The manner in which AI techniques are used is most important. Many critics of AI are concerned that computer processes process information dispassionately, and are matters of calculation, not judgement (Moor 2000, p.221).

Users often tend to require that the computer make all decisions, removing human control over the decision making process (Dijkstra 2001, p.119). Users are tempted to accept dispassionate advice supplied by the computer without further consideration of its relevance or implications. The system is used to decrease the effort required for decision making rather than to improve the quality of the resulting decision (Dijkstra 2001, p.122). Opdebeeck (1998, p.519) notes that modern technologies create increasingly 'simple' machines that require less skill, intelligence, and thought to operate them. This tends to encourage a lazy attitude to learning, and promotes the expectations that the computer will provide a definitive answer to any question posed. Opdebeeck observes that this is a false assumption, and that society has increasingly to concede that problems cannot be solved simply by the use of technology.²⁰

Computer development has not yet reached the stage where it is able to incorporate a 'personality', including ethical standards, in computational processes. Dreyfus (2000, p.199) states that a computer has no built-in pre-understanding of how our world is organised. It cannot supply the explicit input required for the support of deeper learning. Before a computer can undertake AI actions, it needs to be primed with human knowledge and judgement (Moor 2000, p.217). This presently remains largely under the control of the human developer.

Much in AI research is not concerned with modelling human thought processes, but upon the construction of algorithms designed to perform well on complex tasks, regardless of whether the algorithms correspond to human thinking (Thagard 2000, p.49). This suggests that it would be unwise to apply powerful AI techniques to the retrieval of sensitive ethical scenarios. An element of 'common sense' interpretation of the context and content of the cases is required if a

²⁰ See the UK Social Fund fiasco in section 1.1.3

defensible decision is to be made for a particular action. The importance of 'common sense' knowledge, accumulated by humans during their everyday activities, is stressed by Dijkstra (2001, p.120). He suggests that this should be a mediating factor in the acceptance of the information supplied by the computer, but that it cannot be modelled by the designer of the knowledge based system. These points support Barak and Rafaeli's (2004, pp.85-86) concepts that the retrieval tool should supply sufficient information to stimulate further reflection and questioning of the given ethical case, but not attempt to provide complete answers.

The claims of some developers, that computerised AI systems can replace humans, are rejected by Anderson, Grant, and Chan (2000). Human reasoning takes a form of knowing not possessed by computational reasoning. Computers attempt to reduce the multiple views used in human reasoning to a single viewpoint used by computers. Humans not only know, but also know what they know - metacognition - an attribute not available to computers. Anderson, Grant, and Chan (2000) challenge the concept of Turing (1950) that computers can act like human beings. They consider that computers are simply calculating machines using abstract symbols and notation without applying real-world meaning to the abstractions. The Turing test ignores consciousness and grasp of linguistic meaning which are integral parts of human intelligence. A computer appearing to possess the human ability to reason intelligently merely simulates the human thought process, but simulation is not replication.

Despite the limitations of rule-based systems, Zeleznikow and Hunter (1994, p.126) believe that some aspects of legal reasoning and case retrieval can be modelled using logic and production rule systems. Aikenhead (1995) suggests that this aspect of legal retrieval and interpretation is severely restrictive. He believes that this is not how law is administered in practice. It is interpreted and mediated by judges and lawyers who take into account the various influencing factors in a case, not just those that fit a particular set of issues. He suggests that research into AI techniques have only explored a few of the possible methodologies. He concludes that the use of CBR systems is more akin to the interpretive approach to the legal reasoning process. Case-based reasoners incorporate a strong element of analogous reasoning, mimicking the legal reasoning process, and overcome some of the problems of rule based systems. However, Kolodner (1993, p.93) accepts that case-based retrieval can be either interpretive or rule-based,

or may include elements of both. Therefore, it may be possible to develop a system that incorporates both elements. However, considerable care will need to be exercised over the balance of the paradigm.

4.2 The Development of the Investigative Retrieval Model

The retrieval tool is required to incorporate many of the issues discussed above. The supposed 'intelligence' input to the retrieval process must be controlled by the student, not the computer. It is partly through the consideration of responses to the retrieval tool interface questions that the student will gain experience and understanding of ethical issues. The effectiveness and success of the retrieval tool will depend upon the tool meeting a number of fundamental criteria:

- Retrieval of cases that are relevant to the student's given scenario.
- Promotion of interest and engagement with the case(s) presented by the retrieval tool.
- Immersion of students in a virtual world created by the case studies.
- Transfer to the student the experiences of others, including legal professionals.
- Provision of guidance in the formulation of search criteria for students who lack the necessary background knowledge of the domain under consideration.
- Ability to enhance students' previous experiences using the experiences of others.
- Ability to address scenarios that contain more than one ethical issue.
- Ability to process scenarios containing incomplete data.
- Avoidance of naïve interpretation of rules.

The tool also needs to be primed with sufficient relevant case analyses so that it has capacity to retrieve a suitable analogous case for consideration by the student. The format, presentation, and storage of the cases are crucial. Poorly indexed and stored cases will be almost impossible to retrieve with any degree of relevance to the student's given scenario. The cases also need to be sufficiently interesting so that the student is stimulated to explore more widely the ethical issues raised.

4.2.1 The Selection of the Retrieval System Algorithm

Algorithms used for legal case retrieval are reviewed by Aikenhead (1995). A summary of the advantages and disadvantages of these is shown in Table 4.1 overleaf.

Reasoning/ Retrieval Systems	Comments
Production Rules	<ul style="list-style-type: none"> • Based upon the paradigm "if X.(and/or Y)... then Z". • Superficial consideration of approach to problem. • Lose 'richness' and plasticity in case-based knowledge. • Ignore context in which action/case is set. • Reasoning/retrieval is constrained by modelling of rules. • No clear rule may be found/available. • Rules may conflict. • Can only be based upon deductive reasoning. • Subject to monotonicity. • Is simple in operation.
Fuzzy Logic Systems	<ul style="list-style-type: none"> • Able to deal with imprecision and partial truths. • Subject to monotonicity. • There is some doubt about its philosophical basis for reasoning.
Deontic Logic Systems	<ul style="list-style-type: none"> • Concerned with modelling normative aspects of rules. • Attempts to explore the relations between normative aspects. • No clear rule may be found/available. • Rules may conflict. • Subject to monotonicity. • Appears to ignore context.
Non-monotonic Logic systems	<ul style="list-style-type: none"> • Allows change in meaning of a previous statement or fact. • Allows exploration of richness of cases. • Considers context of cases.
Case Based Reasoners	<ul style="list-style-type: none"> • Operates with case examples rather than rules. • Breaks down stored and problem case into factors that are then 'matched'. • Appears to emulate human analogical reasoning/retrieval. • Process of similarity matching is uncertain in humans. • Only a crude approximation of analogical reasoning/retrieval. • Requires understanding of the context of the cases. • Similarity is found by testing for the presence or absence of features. • Features can be 'weighted' for relative importance.
Neural Nets	<ul style="list-style-type: none"> • Uses cases in same way as case-based reasoners. • Attempts to mimic structure of a biological nervous system. • Good for ICT tasks that confound expert systems. • Good at recognising and classifying patterns. • Work best at a low level of complexity. • Requires understanding of the context of the cases. • Similarity is found by testing for the presence or absence of features.

Table 4.1 – Comparison of Reasoning/Retrieval Systems (Adapted from Aikenhead 1995)

Modelling and emulating the processes of legal reasoning are complex (Aikenhead 1995).

Martin et al. (1996, p.82) observe that models never fully capture the reality of a situation or process. Aikenhead (1995) concludes that although the efforts of researchers in the field of legal knowledge-based systems have not been entirely successful, there is some advance in their use. He concludes that, although case-based reasoners do have some problems, they can match similar cases if these are not too complex. His comments upon legal retrieval systems strongly resemble the problems posed by the retrieval of ethical case studies.

When the context of the case is unclear, or information is incomplete or inadequate, Kolodner (1993, p.24) and Aamodt and Plaza (1994) suggest that case-based reasoning may provide a solution to case retrieval. They describe the concepts of full case-based reasoners that include the facilities for interpretation, self-learning, and adaptation. Cases may be presented at different levels of abstraction, some focusing upon an individual level, others more abstractly (Kolodner 1993, p.355). They may also be presented from differing points of view, or the features available for use in retrieval may differ in number or application.

The development of such systems tends to employ AI techniques for the semantic interpretation of case content. There are areas of legal case retrieval where interpretation and derivation of new solutions are not desirable, or where rule-based systems are not always reliable (Aikenhead 1995). Systems that attempt word identification techniques, or semantic interpretation of the text in an attempt to justify the presentation of retrieved information would be inappropriate for the requirements of this research. They would apply unnecessary complexity and false interpretations to issues that are unable to tolerate artificial decomposition or synthesis. Nevertheless, as this research does not attempt to decompose or synthesise case information, simple, non-interpretive case-based reasoning may be considered as a possible basis for the retrieval algorithm. The retrieval of ethical case analyses does not require the tool to attempt interpretation and development of new cases and solutions, as would a full CBR system. It seeks to promote human consideration of the existing facts and data. The observation and comments of Aikenhead seem to resemble the requirement for the retrieval of ethical cases addressed in this research.

Research in the legal retrieval field has achieved, at best, limited success. Nevertheless, because of the many similarities between legal and ethical issues, the research into legal case retrieval may provide some pointers to the successful development of a system for the retrieval of ethical case analyses. For the purposes of this research, a model amenable to a rapid prototyping approach was needed. Aikenhead (1995) suggests that the use of production rule systems can only incorporate an approach based on deductive reasoning. Deductive reasoning limits the ability of the model to emulate human reasoning. However, he does not claim that systems using deductive reasoning prevent any form of reasoning model. Examination of the factors identified in Figure 4.1 above suggests that it might be possible to adapt a standard database engine. This might use a rule-based approach to retrieve nearest matching cases if suitably phrased questions, that include an element of fuzziness, could be devised. It was decided to undertake an investigation to determine if such a system was viable.

4.2.2 Selection of Suitable Retrieval Vectors

The identification of suitable features that may be used for the classification and retrieval of real-world cases can be difficult. Conditions and personalities are usually different, as are culture, societal norms, and personal ethical climates. In particular, students' own ethical climate and beliefs will determine the approach that they take towards the assessment of ethical issues (Huff and Martin 1995, p.79). A retrieved case that appears to match the ideals and standards of one student may fail to meet the perceptions of a student from a different ethical or cultural background. Rissland, Ashley, and Loui (2003, p.3) observe that similarity is not static. It can depend upon one's viewpoint or desired outcome. Conventional 'matching' techniques are not applicable to the retrieval of ethical case analyses. A system is required that will respect the differing opinions of students from varying cultures and beliefs, and provide cases that are suitable for consideration by individual students. This leads to the concept of a 'suitable' retrieved case rather than a 'matching' case that is often used for conventional document retrieval systems.

It is essential to identify indices that are useful and generally applicable to the cases in the case library (Kolodner 1993, p.115). Sixty-two models of ethical decision-making were identified by Maner (1999) to establish common themes that might be suitable for use as indices. The

models were seen to be drawn from a general consideration of ethics and a wide a wide range of professions. Most models dissected the analytical methodology into a series of stages. All models either stated or implied that three primary aspects are needed for analysis:

- Recognition of appropriate guidelines.
- Determination of the parties' intentions.
- Examination of the parties' actions.

Several of the models identified were directly applicable to ICT, but those for other professions were found to be broadly similar in their approach to the analytical process. Several models specifically suggested additional aspects to be considered. These included:

- The context in which the action takes place.
- The power relationships between parties.
- Religious requirements.
- Human dignity and worth.
- Exceptions to normal ethical rules and guidance.
- Relationships with the local business environment.
- Human rights.

All posed questions for consideration upon how such influences would affect the intentions and actions of the parties to the case under investigation. The aspects listed above conform well to the concepts of the Theory of Planned Behaviour, discussed more fully in section 2.6. They all may be integrated to reflect the ethical climate in which an intention is formed and an action takes place. Ethical climates are strongly influenced by culture. Chatterjee and Pearson (2003, p.203) link ethical beliefs to philosophical and religious roots, and suggest that some moral understandings are specific to local cultural norms whilst others transcend national and cultural boundaries. Kankanhalli et al. (2004, p.184) note that Hofstede asserts that there are shared values, beliefs, and norms that are culture specific. These factors can predict a wide range of human behaviour and practices. They might be used in the classification process required for case storage and retrieval.

The research outlined above suggests that it should be possible to apply ethical criteria, at least in part, in the classification and retrieval of ethically analysed case studies focusing upon the actions of the stakeholders of the cases. A classification and retrieval model was developed, illustrated in Figure 4.2, incorporating many of the criteria discussed above.

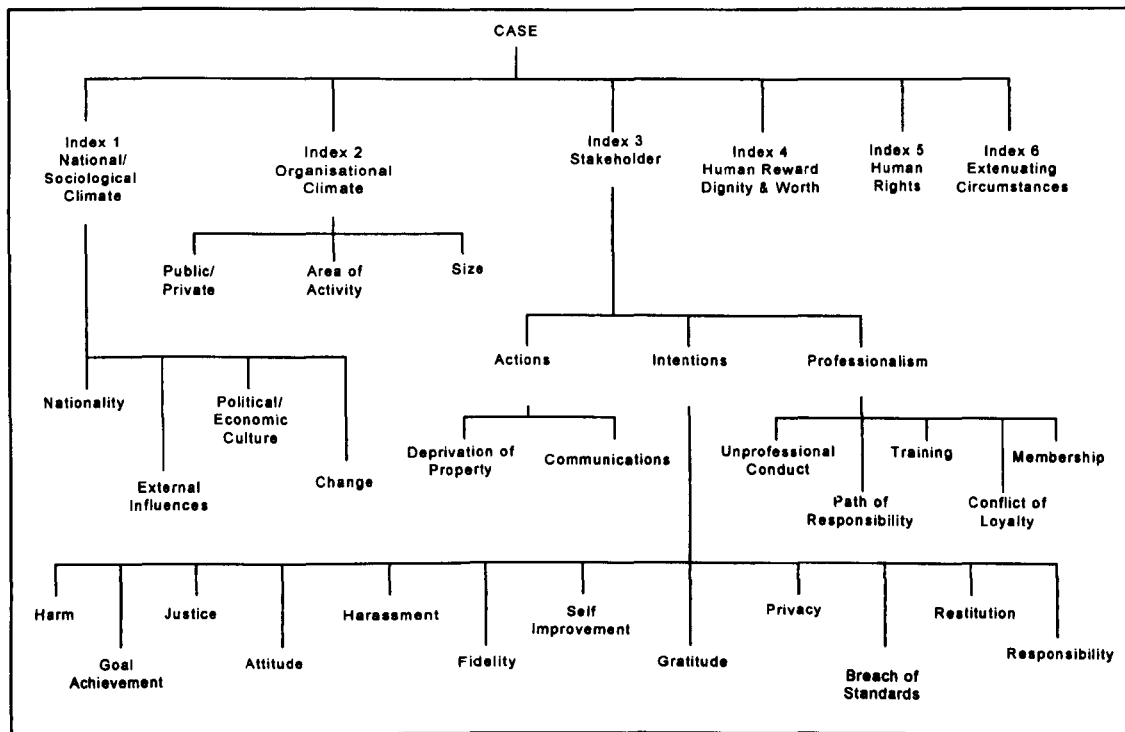


Figure 4.2 – Model of the Retrieval Tool Indices

Seventy-two case studies addressing ethical dilemmas were researched and analysed. The cases, drawn from several countries, were chosen to address as wide a range of ethical issues as possible. A schedule of cases used for identification of the ethical issues is included as Appendix C. Six main indices were identified that might be used for the determination of the presence of ethical issues within the analysed case studies. Three of the indices were divided into sub-indices, each addressing a specific area within the main index. Each index or sub-index in the model was then further divided to identify discrete issues addressing the ethical climate. Each issue acted as a retrieval vector in the classification and retrieval of the case analyses, and formed the basis for a question on the retrieval tool interface. This provided twenty-nine questions requiring responses from the students. The indices were selected for the following reasons:

- **Index 1 – National/Sociological Climate.**

This considered the factors affecting ethical climate within the nation, the nation's political attitude, and any supranational factors that might be relevant (Kamano 1999, p.2). It also considered whether any significant changes had occurred at national level that might disturb the equilibrium of the prevailing climate, such as a war or recent change of government (Chepaitis 1997, p.195). The 'ethical climate' is taken to be the attitude of the society in which the action takes place (Kusuma, Armstrong and Sweeney 1999). Political culture may range from totalitarianism to anarchy. Style of leadership is significant in shaping the attitude of our society (Aycan et al. 2000, p.196; Brakel 2000, p.99). Nationalistic pride can cloud attitudes towards other nations. Political factors may influence the fundamental culture adopted by the citizens of a country. This in turn may affect the social and economic conditions (Daley 1993). This index gave rise to four retrieval vectors.

- **Index 2 – Organisational Climate.**

This index considered the factors affecting ethical climate within the organisation, examining the area of activity, the location of the organisation in either the public or private sector, and the organisation's size. The ethos of an organisation may influence the individual behaviour and performance of staff (Kenyon 1998, p.220). The area of endeavour in which an activity takes place can influence the ethical stance of the organisation or the individual (Victor and Cullen 1988, p.105). This index gave rise to three retrieval vectors.

- **Index 3 – Stakeholder Influences.**

This index attempted to establish whether the stakeholder intentions and actions flowed logically from the requirements placed upon the individual by professional codes and by societal ethical standards. This draws upon the five-stage analysis developed by Rahanu, Davies, and Rogerson (1999, pp.3-5), including the deontological considerations derived by Ross (1930, p.21). This index gave rise to nineteen retrieval vectors.

- **Index 4 – Human Reward, Dignity, and Worth**

This single index sought information, based upon Kantian ethics, upon how personal dignity and worth were recognised and rewarded. This index gave only a single retrieval vector.

- **Index 5 – Human Rights**

In this single index, the United Nations Universal Declaration of Human Rights was selected as a basis to identify the fundamental rights of human beings, and to determine whether any have been violated. This index gave only a single retrieval vector.

- **Index 6 – Extenuating Circumstances**

This single index addressed the issues raised by Ben-Ze'ev (1997). It considered whether external factors beyond the normal control of the stakeholder have been invoked. This index gave only a single retrieval vector.

Responses to each question in the interface were pre-programmed using a limited menu of responses that could be made by students. Some menus offered a choice of specific criteria, e.g. the country in which the action took place. Others offered a Boolean response set, including 'Not applicable' and 'Don't Know' responses. The questions and possible responses are shown in Appendix D.

4.2.3 The Application of Weighting Factors

Retrieval vectors may be weighted to improve retrieval performance of the CBR (Kolodner 1993, pp.349-352). However, Kolodner provides few details upon the methodology to be applied. It was decided to attempt to use weightings to give a measure of nearest-neighbour match but to allow an element of fuzziness in the matching process. The concept behind this decision was that possible answers to the retrieval vector questions might be 'clustered' in accordance with information obtained from research and observation.

The responses to the questions may all be regarded as a continuum. Cases having a high degree of similarity would be clustered closely on the continuum. For example, it might be expected that the ethical climates in former British Commonwealth countries might closely resemble the ethical climate in the UK. Hence, if a case took place in, say, Australia, and there

was no matching Australian case for retrieval from the CBR library, then the CBR would determine the closest match from other Commonwealth countries. All Commonwealth countries would have weightings that were closely clustered. This is illustrated in Figure 4.3. The cultural climates in Canada, Australia, and New Zealand were given scores close to that of the UK. The US was given a score slightly less than the Commonwealth countries, allowing for its federal/state structure that promotes a core of federal legislation and standards, but allows a penumbra of state interpretation of other issues. China and the former USSR were given scores much less than the UK to reflect the totalitarian culture prevalent in those countries. Weighting factors were similarly applied to other questions posed by the retrieval tool.

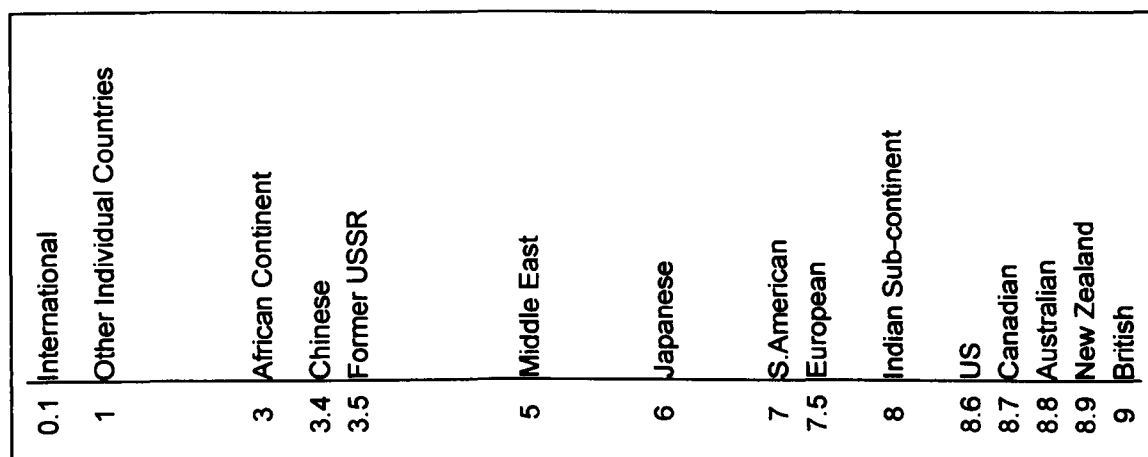


Figure 4.3 – The Continuum Clustering Concept.

It is important to note that the weightings that were applied to the retrieval vectors were intended to reflect the position value of the feature on the question continuum. They were to be used only in the retrieval process as proximity indicators. They were not an attempt to rank ethically the issues addressed by the questions.

The weighting differential between similar retrieval vectors on the test case and the retrieved case provides a measure of case similarity for that particular vector. The values shown in Appendix D represent a first attempt to apply such weightings. However, no research literature could be found that provided a suitable basis upon which to establish the weighting values. Those shown in Appendix D were intuitive values. It was not until much later, when further clarification of the operation of weighting factors became available, that the application of weightings in this manner was revealed as a misconception of Kolodner's intentions.

Nevertheless, at the time of its development, it was expected that the classification and retrieval system would provide the following facilities:

- Data for each stored case study would be held in the memory of the database as a profile formed from the presence and weighting of the retrieval features in a case. The profiles would thus be simple data structures.
- An identical data structure was to be assembled for the submitted case as the user entered the details of the given case scenario.
- Case retrieval would depend upon matching successfully the profile of the submitted case to the profile(s) of one or more of the stored cases.
- The search routine became a sequential search of an array of structures.
- The case data structure would store a link to the stored cases. The identification and presentation of the nearest matching case would include this address, and access to the stored case would be by hypertext link.
- Addition of a new case to the library required the new case to be submitted to the standard retrieval interface. This would assemble the structure profile necessary for inclusion within the record structure for the case, and would add it to the array of case descriptions.
- Maintenance of the case library would be through the same interface that was used for case retrieval.

4.3 Testing of the Retrieval Tool

A working model of the system was constructed, based upon the Microsoft Access database engine. The cases in the Rahanu, Davies, and Rogerson (1999, p.10) case library were analysed using the weighting system described above and the values stored in the database. The engine accessed a revised case library of the existing fourteen Rahanu cases. The database was configured so that it posed the twenty-nine questions in Appendix D to the user, comparing the users' responses with the indexed table of weighted features contained within the database.

Four additional case studies were selected for their similarity to cases already included in the case library. The cases were submitted to the retrieval tool to establish if it would retrieve the cases from the library known to be similar to each of the four test cases.

The prototype model had very limited success. It was found that many alterations to the questions of the interface and to the vector weightings were required. The algorithm for the retrieval of the nearest matching case produced links to cases that were obviously incorrect. This was caused in part by the incorrect 'best guess' weightings that had been applied to the retrieval vectors within the tool. Furthermore, it was found that the complexity of linking the retrieval tool to the cases in the case library through the weighted vectors was a major task, not one that lent itself easily to a rapid prototyping approach.

4.4 Reflections upon the Effectiveness of the Retrieval Tool

Several issues were raised by the performance of the investigative model.

- No consistent retrieval of case was obtained. The wide scope and semantic interpretation of the questions asked did not permit a repeatable set of 'hits' to be obtained. The semantic interpretation of the questions needed adjustment to provide a more 'fuzzy' interpretation of the ethical principles if a better consistency for retrieval was to be achieved.
- The number of questions posed by the retrieval tool interface was excessive. It should be possible to classify and retrieve analogous cases successfully with fewer questions.
- The concept of weighting the retrieval vectors was easily misinterpreted. This led to considerable confusion. It erroneously appeared as an attempt to rank ethical principles.
- The use of discrete questions about ethical climates was inappropriate. Further research had revealed that there is doubt about the consistency of ethical climates over the longer term. The work by Hofstede (1982; 1994) was carried out upon surveys made in 1968 and 1972. However, the data was ageing and no longer relevant to today's political and economic climates. The change in perception of ethical climate was, therefore, to be expected.

In addition, the natural changes that take place in democratic societies because of government elections or shifts in societal norms can change the political climate of a

country overnight. This may result in change in ethical climate within a country that would have a profound change upon the case retrieved from the case library. Similar changes are experienced in totalitarian regimes if the populace overthrow the central government.²¹

- It was found that the concept of clustering nations that might be expected to have similar ethical climates, such as Commonwealth countries, was invalid. This is seen in the former African colonies such as Uganda or Zimbabwe. Both, at some stage since independence, have taken a totalitarian approach to their governance, and the concepts of democracy and freedom have diminished for a time. Other Commonwealth countries, such as Canada Australia, do not have a homogeneous mix of population, or have a federal system of government.
- The issue of the degree of difference in retrieval vector weightings between the submitted case and the nearest analogous case in the case library caused problems. There comes a point when the difference between the two weightings becomes such that the retrieved case can no longer be regarded as being 'similar' to the submitted case. This cut-off point is highly subjective, and no justification could be provided from the research literature for any values inserted into the retrieval tool.
- It proved difficult to incorporate several of the practical aspects that would assist students in the promotion of deeper learning. The principal disadvantage stemmed from the ability to enter only one set of retrieval criteria for the retrieval query. Students were unable to retrace their steps and to re-submit their query with slightly different criteria. An exploratory approach to resolving student misunderstandings of ethical issues was not possible. Changes to any retrieval vector in the retrieval set did not involve any stepwise refinement of the query, but required the query to be re-formulated from scratch. Consequently, the stimulus for student exploration and review of their personal ethical values was reduced, and the encouragement to try different ethical approaches was removed.

The realisation that two major flaws in the concept for the classification and retrieval of cases had been included in the retrieval algorithm prompted a reconsideration of the retrieval

²¹ This is particularly evident in the fragmentation of the former USSR.

paradigm. Further development of this model was halted, and alternative models of retrieval using a reduced set of retrieval vectors were investigated.

This apparent setback was not entirely unexpected. It is rare for a project of such complexity to be successful in its aims at its first incarnation. Brooks (1995) warns of problems with project development, and states:

“In most projects, the first system built is barely usable. It may be too slow, too big, awkward to use, or all three. There is no alternative but to start again, smarting but smarter, and to build a redesigned version in which these problems are solved. all large-system experience shows that it will be done. Where a new system concept or new technology is used, one has to build a system to throw away, for even the best planning is not so omniscient as to get it right the first time..... Hence plan to throw one away; you will, anyhow.” (Brooks 1995, p.116).

Brooks discusses the realisation that there is no ‘silver bullet’ that will compensate for the mistakes made in project development, and notes that conceptual complexity is an integral property of software, not an accidental one (Brooks 1995, p.183). Brooks (1995, p.199) is firmly of the opinion that the hardest part of building a software system is deciding precisely what to build. The true task is often only revealed following iterative extraction and refinement of the product requirements.

4.5 Conclusion

This research breaks new ground in attempting to classify and retrieve suitable analogous, ethically analysed case studies from a library containing cases addressing a wide selection of ethical issues. The most acceptable way forward when faced with a task of such innovation and uncertainty is to adopt a prototyping approach. This enables the developer to consider, in an iterative cycle, the emerging issues in the tool development. This process leads inevitably towards the rejection of early prototypes of the product and the development of a more refined model. This research must therefore re-define the concepts of the retrieval tool to include the lessons learned from the initial model before proceeding to construct and test an improved tool. The following chapter describes the revision of the theoretical basis for the retrieval tool, and then considers the construction of a revised, simpler retrieval tool. Chapter 6 then evaluates its effect upon the ethical awareness of the students who have used it.

Chapter 5 - A Revised Case Retrieval Tool

5.1 The Way Forward

The development of the initial unsuccessful investigative retrieval model, described in chapter four, used the Microsoft Access database engine as a basis for the retrieval tool. This placed some restrictions upon the developer. The tool adopted the 'look and feel' of a Microsoft application. The Access retrieval algorithm required reconfiguration with complex code to reduce the rigidity imposed by the rule-based paradigm used by the database engine. The abandonment of the initial design allowed reconsideration of the requirements and operational processes for the retrieval of suitable cases, unencumbered by any restrictions imposed by proprietary software.

5.2 A Revised Theoretical Basis for the Retrieval Paradigm

The case retrieval tool algorithm was re-examined in the light of experience gained from the development of the initial model, identified in section 4.4. The review of the model suggested that the following issues should be incorporated in a revised retrieval tool:

- The adoption of a 'conversational' style of interface to encourage interaction with the retrieval tool, and to assemble a 'dynamic' query for case identification and retrieval.
- The use of a stepwise algorithm to develop the retrieval query, rather than the 'big bang' approach used by the database engine. This allows the student to consider each question posed by the tool interface in isolation, and stimulates a constructivist approach to consideration of the ethical issues raised in, or absent from the case.
- The inclusion of a 'step back' facility, encouraging students to reconsider, and possibly change their initial responses to the retrieval tool questions, thus promoting an exploratory, reflective approach to the use of the tool.
- Reduction in the number of retrieval vectors used to identify and retrieve cases.
- Development of a more appropriate set of retrieval vectors, allowing application to a wider range of ethical issues.

- Removal of weighting factors on the retrieval vectors. These simply confused students, and led to an assumption that the tool attempted to prioritise ethical issues.

Incorporation of these issues requires revision of the theoretical basis for the retrieval tool algorithm. Didactic software must be guided by educational theory (Soloway et al. 1996). Most didactic systems now attempt to maintain and stimulate user motivation through interactivity. Soloway et al. (1996) describe the stimulation and supportive process as 'scaffolding', supporting learners to strive for goals not previously achieved. This facility is introduced into the cognitive process by the use of narrative to expand and elaborate the questions and the information provided. The informational aspects often involve the use of case studies. The software must encourage and support users in three areas:

- a) Growth - the user must be able to learn whilst engaged in the operation of the software, not passively carry out automated tasks.
- b) Motivation - the software must be attractive to learners, and should lead and inspire the cognitive process. The learner's continuing motivation cannot be assumed. Facilities must be included in didactic systems to maintain and stimulate motivation.
- c) Diversity - developmental, cultural and gender differences must be taken into consideration in the design of the software.

Issues a) and b) strongly suggest that the ideal is the development of a state of mind where the student becomes deeply absorbed into the educational task through interactivity in a virtual environment – attaining a state of 'flow'.

However, scaffolding can create its own problems. The effective design and use of didactic software is limited by the capacity of the human information-processing system (Byrne 1996). Miller (1956) suggests that seven, plus or minus two, chunks of information presented to human short-term memory is all that a normal individual can effectively process at any one time. If the system is not designed gradually to introduce the additional information streams, the additional cognitive load introduced by scaffolding can reduce the apparent learning effect. These practical issues will significantly affect the design of the retrieval tool.

5.2.1 Promoting User Control and Involvement

Section 4.1.3 identifies the issues that arise in the design of the retrieval algorithm. Rule-based algorithms tend to assume that students understand the substance of the problem before formulating a query. Belkin (2000, p.58) observes that it is difficult to create queries needed for retrieval of suitable case studies if the searcher has insufficient domain knowledge of the topic upon which information is sought. Once submitted to the database engine no further revision or exploration could be undertaken unless the query was re-entered into the interface. The large number of questions posed by the initial, unsuccessful interface made this an almost impossible task.

The limitations of AI techniques have been discussed in section 4.1.6. Nevertheless, it is necessary to elicit the student's personal values and judgements if a suitable analogous case is to be retrieved. A certain level of interaction between the computer and student is therefore necessary, prompting and guiding the student to respond in a valid and meaningful way. However, the level of interaction required should not be of sufficient complexity to qualify for the epithet 'artificial intelligence'. Control and progress of the retrieval process should remain primarily under the direction of the student.

As any user of a retrieval system is unlikely to begin an interaction with a perfect query, Belkin (2000, p.59) suggests that the formulation of the query in the retrieval process should be an iterative and stepwise refinement. This implies that questions used to generate the query form an integral part of the learning process, and that suitable retrieval criteria need not be static, fixed issues. They may vary according to context. Belkin seems to be suggesting dynamic querying of the case analysis library. Ahlberg, Williamson, and Shneiderman (1992) describe such a system, but use 'widget sliders' to alter parameters affecting the retrieval algorithm, and use numeric data within the search query. However, if a similar principle is applied to textual data, a very powerful and flexible retrieval mechanism can be developed that appears to meet many of the demands for this research. The concept of a dynamic iterative retrieval process raises a number of useful leads for further development.

- A stepwise query-building process has an implicit element of consideration and reflection upon what responses to make to the questions posed by the retrieval tool.
- Reformulation of the query can easily be undertaken.
- Any reformulation of the query can be made by stepping back through previously answered questions, and selecting alternative responses to create a new path to a possible alternative retrieved case analysis.
- Reformulation of queries allows the investigation of alternative cultural, gender, or other alternative viewpoints, stimulating reflection and re-evaluation of one's own stance upon an issue.
- Forward progression through the questions posed by the retrieval interface can be guided by the algorithm for the retrieval mechanism, based upon the user's previous responses.
- The sequence and connections between questions posed by the interface in response to the user's replies will themselves contribute to the learning process, guiding the user in which issues need to be considered for a given problem domain.
- The sequence of the questions can be adjusted within the retrieval process to give greater sensitivity when retrieving cases addressing specific issues.

The human-computer interaction must therefore be dynamic and continuous – a conversation. The use of conversations through technology to encourage learning is addressed at length by Laurillard (2002). She considers five major technological paradigms for the use of educational media.²²

Although all are discussed discretely, it is difficult in practice to separate the differing concepts. Many teaching programs include a narrative element, outlining a problem or scenario, and subsequently provide guidance to the student upon possible solutions. They will almost certainly contain interaction, with the program prompting an action from the student. This will include the generation of a desire to explore more deeply the concepts framed within the problem domain. There will probably be an adaptive element, with the program responding to the input by the student. The program will require communication, the student providing input into the program,

²² Narrative, interactive, adaptive, communicative, and productive.

and the program providing feedback and guidance to the student. Finally, the program will aim for productivity, when the student retains the knowledge of the problem and its resolution, building on past experience and knowledge. Interestingly, Laurillard does not seem to dismiss the use of AI techniques to stimulate interaction. The use of AI is acceptable for the stimulation process, but should be avoided for the processing of facts leading to the presentation of solutions.

A conversational interface would seem to offer a new retrieval tool paradigm. However, before the case retrieval tool can influence a student's inner values, it needs to progress through a retrieval process to establish what those values are. Consequently, the style of the interaction used is of great importance. A conversation, shown diagrammatically in Figure 3.1, requires a duplex communication mode. The interaction between the student and the retrieval tool must necessarily be a 'question and answer' (Q&A) model. The challenge, therefore, is to create a dialogue in the form of a Q&A interaction, but that stimulates interest, flow, and promotes deeper learning. The responses must be used by a retrieval mechanism that does not rely upon AI techniques for automated interpretation of the elicited facts.

5.2.2 Retrieval Tool Interactivity and Query Formulation

The style of interaction can have a strong impact upon the student's motivation to learn (Davis and Wiederbeck 2001, p.550). Laurillard (2002, pp.81-174) believes that a conversational approach to learning is an effective teaching strategy. Quinn and Reid (2003) extend this concept further, suggesting that a questionnaire or 'quiz' type of interface containing intrinsic feedback can greatly assist learning. Laurillard agrees, stating:

"Intrinsic feedback is extremely valuable to the learner. It enables them to know how close they are to a good performance, and what more they need to do. It is individualised, private, formative feedback, which helps to build their understanding of the internal relations between theory and practice" (Laurillard 2002, p.127).

Laurillard appears to confine her comments on feedback to evaluations of a student's performance ('good', 'could do better', etc). However, feedback that accepts a student response as valid should itself convey implicit approbation to the student in the form of encouragement and suggestion for further avenues for progression, rather than simply providing explicit approval. Acceptance of student input, and the offer of additional actions that would thus lead to

deeper understanding of the problem domain, is a form of extrinsic feedback. This, in turn, will promote the intrinsic realisation that the student's action was of an acceptable standard. Some adaptation of this principle is required for the consideration of ethical issues. One cannot say, in most cases, that a decision by a student is 'wrong'. Decisions are subjective, depending upon a student's ethical standards. The whole point of the retrieval tool is to illustrate to the student areas and issues where the student's responses, reflecting their ethical principles, become difficult to defend, thus causing a realisation that some modification of those principles is required. The student is thus encouraged to discover the unacceptability of their ethical approach for themselves. Dijkstra (2001, p.126) notes that support systems must not make the decision, but simply support the human actor in making it. However, student input will be affected by the style of the questions posed.

The mode of interaction is that of a 'question and answer' (Q&A) interface (Dix et al. 2004, pp. 139-140; Preece et al. 1994, pp.267-268). Interestingly, Shneiderman (1998, p.268) does not recognise the Q&A mode of interaction, preferring to consider it as a 'dialogue box', a combination of 'menu selection' and 'form fill-in' interactions. This is a valid point, particularly in the present research. Shneiderman (1998, p.74) suggests that blending several styles of interaction is acceptable when the required tasks and users are diverse. Age, ethnicity, culture, knowledge, and skills will all vary considerably across the range of potential users. Furthermore, these attributes may change over time (Shneiderman 1998, p.68). Dix et al. (2004, p.139) suggests that Q&A interfaces are easy to learn and use, but are limited in functionality and power. Q&A interfaces are appropriate for restricted knowledge domains (Dix et al. 1998, p.139). However, this does not exclude their application to more complex tasks. In the present research, the students must have read and understood a complex case study. Therefore, the interface will need to cope with a diverse range of issues, many of them requiring in-depth consideration, before an answer is made.

The interface of the initial retrieval tool followed accepted questionnaire practice. The questions were kept short, succinct, and focussed (Salant and Dillman 1994, p.91; Hague 1993, p.66; Oppenheim 1992, p.125). They sought to provide closure by presenting a menu of choices (Shneiderman 1998, p.75). The menus were restricted, using 'combo' boxes, confining users to

a given set of responses. However, this procedure unfortunately failed to promote learning and deeper thinking.

The issues discussed above tend to suggest that the rigidity of a rule-based database paradigm or the insensitivity of an AI application will, in isolation, not address the needs of the retrieval tool. A system is required that:

- Allows for the user's initial lack of knowledge.
- Accommodates the difficulties posed by unclear or incomplete cases.
- Accepts different ethical approaches by the user to a given ethical dilemma.
- Encourages exploration and learning.
- Promotes the development of the 'ethical self'.

5.2.3 The Influence of Cased-Based Reasoners and Aiding Systems

Many real-world ethical dilemmas are often unclear, incomplete, or have several possible ethically defensible explanations. Slight changes of context or date can mean that, for a similar set of case conditions, very different courses of action may be ethical. No two ethical dilemmas are likely ever to be set in exactly the same context. Consequently, reduction of the potential range of actions available to the human operators to a simple rule-based algorithm is impossible to achieve, and the application of pure AI-based techniques can lead to blind, unfeeling application of ethical principles. Kolodner (1993, p.70) suggests that CBR systems can assist novice problem-solvers by providing them with experiences that they have not experienced for themselves, and can draw upon the knowledge of experts as a basis for their own self-development. The use of CBR techniques has already been raised in sections 4.1 and 4.2 of this thesis when considering the development of the first retrieval tool. Kolodner (1993, p.31) suggests that cases are contextualised pieces of knowledge representing an experience, and do not lend themselves to the application of rule-based systems for reasons shown in Table 5.1 overleaf. A CBR system, if suitably modified, seems to offer a practical alternative to rule-based or AI systems.

The proposed retrieval tool does not require fully-fledged CBR. The predictive and repairing facilities are inappropriate when dealing with ethical issues. Users should be actively involved with the retrieval and interpretation of the case, retaining ownership of the reasoning process. If the tool is allowed to usurp the human elements of the reasoning process, it will block student thinking.

Rules	Cases
Rules in a rule-based system look for patterns.	Cases in a case library are constants that may not contain any definable or repeatable patterns but will contain certain vectors that can be discretely identified.
Rule-based systems require an exact match for retrieval.	Cases are retrieved usually on partial matching.
Rules are applied iteratively on a cycle of microevents.	Cases are retrieved first in their entirety, presenting an entire solution immediately, which may then be refined and adapted to provide a final answer.
Rules are small, usually independent, pieces of domain information.	Cases are large chunks of domain knowledge, much of which may be redundant.
Rules are based on process.	Cases address content.
Rule-based systems are more applicable when the domain is well understood.	Case-based systems are more applicable to domains where the underlying model is not clearly understood.

Table 5.1 – Comparison of Rules and Cases (From Kolodner 1993, pp.93-94)

The use of a CBR as a 'reminding' system is described by Kolodner (1993, pp.60-71). It is therefore acceptable for a CBR system to be developed that merely assists the user to navigate successfully through a series of questions. The level of interactivity and artificial intelligence is entirely within the control of the designer (Kolodner 1993, pp.540-543). Kolodner describes these as 'case-based aiding systems'.

The use of CBR systems to retrieve stories suitable for educational purposes is discussed by Burke and Cass (1996), an application that they call 'a case-based teacher'. They note that a system for use by novices, or those with little knowledge or understanding of the retrieval topic, will need actively to support and guide the learner in the formulation of retrieval queries. For

effectiveness, the teaching tool must be more than a passive information retriever. The system must:

- Retrieve and present relevant and suitable case analyses.
- Inform and educate students through the process of query formulation itself.

Cases used for teaching involve different kinds of judgements from those found in more conventional similarity comparisons (Burke and Cass 1996, pp.97-99). In conventional case retrieval, a suitable case must be retrieved and presented. However, in teaching, student attitudes may differ from what might normally be expected, and there may be no analogous case to retrieve. As the CBR is not expected to adapt or blend cases to give novel solutions for offer to the student, it can only retrieve closely relevant cases. In this respect, the CBR will guide the student's learning processes, and will highlight any erroneous approaches to the student's understanding of the case. This effect may be improved somewhat by including within the case library a wide selection of suitable cases. Burke and Cass also note that often no one case is available to provide a 'right' answer. There may well be cases in the case library that have the same context, but take a different viewpoint, often triggered by changes in societal attitude or passage of time. These 'analogous' cases will need to be presented to the student so that a balanced perspective may be offered. Burke and Cass compare the requirements of an educational retrieval system and a conventional problem-solving system. The main issues are illustrated in Table 5.2.

Issue	Standard Problem-Solving	Educational Case Retrieval
Cue Composition	Before Retrieval	Incremental
Retrieval Criteria	Solves a similar problem	Makes an educational point
Case Structure	Represents a problem solution	Highlights case issues
Mandatory Retrieval	Yes	No
Case Evaluation	Yes	No
Between-case Competition	Yes	No

Table 5.2 - Differences between case retrieval in problem-solving and educational retrieval (Adapted from Burke and Cass 1996, p.98)

A CBR system can also be used for creative reasoning (Leake 1996, p.20). This may be equated to exploratory learning. Reasoners may have their search criteria modified quickly to reflect changing content or context. Consequently, as students can be exposed to a wide range of 'similar but different' cases and scenarios, reasoners are useful as educational tools. This technique is effective in highlighting novel correspondences between cases. The system can be used to predict the likely outcome or solution to hypothetical cases or actions, and reflects the consequences of actions or solutions to previous cases.

Mark, Simoudis, and Hinkle. (1996, p.270) suggest that CBR may usefully combined with other classification and retrieval techniques. They suggest that CBR might be used to focus on important issues within a problem, and other methods might be used to solve sub-problems. This approach fits well with the concept of the presentation of the cases. Most real-world cases have more than one issue. If a case addressing contractual failings is being evaluated as part of the learning process, several legal issues may arise in addition to a number of ethical principles. A CBR system can identify analogous cases, but it may be necessary to apply some rule-based analysis to some parts of the investigative process.

There is ample evidence that techniques and methodologies exist for the development of a case-based retrieval system suitable for retrieving ethical case analyses. A hybrid system incorporating case-based reasoning, minimal AI, and rule-based algorithms might prove to be an acceptable and successful solution.

The retrieval tool interface forms the essential bridge between the ethical perceptions of the student and the issues addressed by the case analyses contained in the case library. Retrieval of suitable analogous cases will depend upon the matching of the student's perception of relevant issues in both the given scenario and the issues identified by the case analysis. A central part of this research is to establish what factors may be used as retrieval vectors for the identification of ethical issues. The identification and presentation of suitable retrieval vectors is thus crucial to the success of the retrieval tool.

5.3 The Bridging Function of the Retrieval Tool Interface

Difficulty in retrieval of suitably analogous cases is not unique to ethics. For example, similar problems exist in law, where semantic or logic-based models give difficulty with legal document retrieval systems (Schweighofer and Merkl 1999, p.156). It is therefore possible that progress made in research upon the retrieval of legal cases can offer potential solutions for the retrieval of ethical cases. Curran and Higgins (2000) describe a system for retrieval of legal documents using factor matching, that simply asks whether a particular factor is present in the case being investigated, regardless of its influence upon the outcome. The responses are limited to simple Boolean ('Yes' or 'No') option. Cases may be 'described' by the presence or absence of the factors, providing a pattern or footprint of the case. The pattern of the Boolean responses may be matched to similar patterns for other cases contained within the case library as in Figure 5.1. This follows the 'footprint' retrieval paradigm of Smyth and McKenna (1999)

Stored Case	Problem Situation
Factor 1	
Factor 2	Factor 2
Factor 3	
Factor 4	Factor 4
Factor 5	Factor 5
Factor N	

Figure 5.1 - Factor Matching (Adapted from Curran and Higgins 2000)

Retrieval can be made considerably easier if the case-base is reduced (Smyth and McKenna 1999, p.344). Curran and Higgins followed the suggestion of Smyth and McKenna, restricting the problem domain and focussing their system on the area of company directors' duties towards small shareholders. They found it possible to develop rudimentary retrieval vectors for this legal domain that would lend themselves to Boolean responses. This suggests that if instances of ICT unethical practice could be broadly similarly contextualised into areas such as contractual issues, or property ownership, suitable ethically based questions might be developed as vectors to identify specific areas of ethical impropriety. The effectiveness of this concept will depend upon the identification and selection of suitable retrieval vectors. However, ethics has the same problems as law – there is no universal classification of illegal or unethical practice. Such classifications as exist are heavily dependent upon context.

5.3.1 Contextualisation and Determination of Relevant Retrieval Vectors

The initial retrieval tool used a generalised case library, and attempted to address ethical issues regardless of the context in which they occurred, matching cases simply upon selected ethical criteria. It became evident that this was impracticable. The contextualisation of unethical acts required consideration of environment, culture, and jurisprudence, all related to the country in which the act arises. Different nationalities, cultures, and legal systems interpret similar ethical or legal issues differently. Cases in the case library would have to be identified by country to establish a discrete context for the legal or ethical environment. This would allow issues identified within cases to be interpreted according to precedent set within that national/cultural environment. Separation of cases by country provided an instant sub-division of the case library, and conformed to the concept that retrieval should be focussed on a reduced range of case analyses. However, further reduction was required before the retrieval system could work effectively.

The same cases of ethical impropriety may be seen by different individuals from very different perspectives. Furthermore, cases frequently contain more than one ethical issue. Prioritisation of ethical issues is an intimate, personal matter. It would be impossible for the retrieval tool to confine each case in the case library to only one ethical issue. The retrieval mechanism must therefore be capable of allowing a diversity of approaches and opinions by students.

Several authors have suggested partial classifications of unethical practice (Moor 1998; Birrer 2001, p.92; Spinello and Tavani 2001, p.515; Mason 1986, p.5; Rahanu, Davies, and Rogerson 1999, p.8). Others do so in a complete volume (Ayres 1999; Langford 1999). Most disregard the differing national, legal and cultural aspects associated with ethical decision-making. Furthermore, there appears to be no definitive schedule of possible unethical practice in ICT. Nevertheless, some form of identification must be adopted if a system is to be developed that allows classification and retrieval of case analyses, permitting students to approach ethical issues from within their own ethical persona. It seems that the most realistic approach to a possible classification of potential ethical issues would be to examine a suitable selection of cases to identify the major issues within each case.

A series of real-world ethical scenarios, shown in Appendix C, was researched and examined. The ethical, social and legal issues raised by the cases were identified. Examination of the cases suggested that the main issues could be contained within the broad categories listed in Table 5.3. Barnard et al. (2003, p.267) note that new concerns are rapidly emerging in computer ethics. Flexibility is required in the retrieval paradigm to address them. The scope of

No.	Class
1.	Promises/contracts
2.	Personal rights/freedoms
3.	Harm
4.	Computer misuse
5.	Information use
6.	Property ownership

Table 5.3 - Main Issue Raised by the Case

the categories was intentionally kept broad so that complex issues raised by the students' given case scenario could quickly and easily be fitted into a category. The categories described above provide flexibility to accept a wide range of unethical practices. Addition of further elements to the classification is unlikely. The elements in the classification are not mutually exclusive, but usually one will be relatively dominant within an unethical action.

Having identified broad areas of unethical practice, it was necessary to sub-divide them further.

Maner (1999) lists seven issues derived from Moor's (1985) assertion that computer ethics is unique, the last being the fact that computers may accentuate the attention given to certain types of rights. Maner (1999) concludes that the rights of access, privacy, and intellectual property are emphasised when real-world issues are subject to computer manipulation. Violation of rights is also identified by several other authors (Mason 1986; Fairweather 2004, p.147). Kallman and Grillo (1996, p.13) incorporate the violation of rights in their model of ethical analysis. They suggest that anyone

	Issues
1.	Legal issues and limitations.
2.	Availability of Guidelines.
3.	Consequentialism,
4	Rights and Duties, involving - Personal duties, - The rights to know, to privacy and to property, - Professional responsibilities.
5.	Kant's Categorical Imperative.

Table 5.4 – Ethical Issues to be Considered When Using ICT (From Kallman & Grillo 1996, p.9)

using computers should consider the issues shown in Table 5.4 when contemplating the effects

of computer use, and in making a defensible decision for their actions. A further explanation of these issues is included in Appendix E.

It was found that most scenarios examined contained violations of one or more of the rights to privacy, to property, and to know.²³ Consequently, identification of rights violations provided a further sub-division of the case library. The combination available from the country (ten elements), main issue addressed (six elements), and rights violation (eight elements) classifiers provides a very powerful partitioning mechanism for the case library. Together they providing 48 discrete areas for each country where the retrieval tool can search for the presence of further ethical and professional principles. It is necessary to determine what these other principles may be.

The issues identified in Table 5.5 include consideration of professional responsibilities. Kallman and Grillo (1996, p.9) identify specifically items 1 to 4 as being relevant to ICT ethical decision-making. However, other authors and professional codes (Gotterbarn, Miller, and Rogerson 1999) also identify items 5 to 7 as being important to professional integrity. The issues in Table 5.5 may be applied to the case clusters identified by the 'country/main issue/rights violated' mechanism, providing additional divisions of the case base, narrowing the focus of the retrieval tool still further.

No.	Professional Duty
1.	Maintain Confidentiality
2.	Maintain Impartiality
3.	Maintain Professional Relationships
4.	Maintain Efficacy
5.	Duty of Care to Others
6.	Competence
7.	Avoid Inducements and Bribes

Table 5.5 - Professional Duties

Cases frequently involve more than one ethical issue. Case clusters may have some cases with common ethical issues, and others with issues making a particular case unique. Furthermore, the different perceptions of an ethical issue by different students can be accommodated by allowing students to decide for themselves what constitutes the main issue in a given case. Therefore, the matching process needs to be able to present a case or cases to students that

²³ These are identified by Kallman and Grillo as being particularly important to the users of ICT.

are meaningful within the context of the student responses to the retrieval tool questions. This suggests that although entering different main issues, selected from within the criteria identified within Table 5.5, different students may ultimately be presented with the same case. Students may see that cases can be multi-faceted, and that ethical issues often interact with each other.

Finally, further sub-division may be achieved by the application of the 'personal moral duty' classifiers shown in Table 5.6. Kallman and Grillo (1996, p.14) suggest that all people have these personal moral duties. These issues are taken from the work of Ross (1930), reflecting personal moral attributes that many regard as contributing to the basis for a universal ethic, and that are implicit in most professional codes.

No.	Personal Duty
1.	Trust
2.	Integrity
3.	Truthfulness
4.	Justice
5.	Beneficence/Nonmaleficence
6.	Self-Improvement
7.	Gratitude/ Reparation

Table 5.6 - Personal Moral Duties

The concept of the stepwise refinement of the issues addressed serves two purposes:

- It presents the student with a valid selection of responses to the question posed by the interface.
- It encourages the student to consider the issue posed by each question, reflecting upon the relevance to student's given scenario, and prompting the student to develop their personal range of experiences. The sequence and substance of the questions should prompt within the student a realisation of the issues that are important within the discrete ethical domain in which the issue arises.

This follows the suggestion of Eastman (2003) that one must identify the facts of a problem before one can begin to consider how it may be resolved. The process described above does not assume that the student has prior knowledge and experience, enabling determination of relevant questions to ask to ensure correct resolution. Eastman (2003, p.19) recognises that it is necessary to include contextual information in a case study to set the context and carry the story line. It can be difficult to separate this from the facts needed to address the underlying problem. The retrieval tool interface provides a structured approach to the establishment of relevant facts. However, the understanding of the facts will depend upon the questions posed.

5.3.2 Question Format and Boolean Responses

Presentation of questions simply to establish the presence of a particular issue in the case under consideration (Curran and Higgins 2000) requires some modification for efficacy within this research. The need for contextualisation has been discussed in the previous section. The contextualisation element is addressed by offering the student a menu of possible alternative responses (e.g. the selection of a country from a given list). Similar selection techniques are used to offer a choice of main issue addressed by the given scenario, and for the violation of rights. In the latter case, it is necessary to consider combinations of rights, or their complete absence. However, the questions addressing professional and personal moral issues are subjective and much less clear. Some uncertainty may exist on the part of the respondent.

Questionnaire theory suggests that although 'Yes' and 'No' responses are always valid, 'Don't Know' (DK) and 'Not Applicable' (NA) responses should be included whenever possible or relevant (Oppenheim 1992, pp.128-129). In this research, the NA response is not valid as the questions address specific ethical issues. The DK response is more problematic. If the questions are clear in their intention, and the case scenario is written clearly, then there should be no problem with a suitable response, and the DK option should not be required. However, little literature could be found upon the use and validity of DK responses.

The design of the retrieval tool algorithm is affected by the options permitted in response to the interface questions. A DK response might also present a temptation to the user to take the lazy path through the retrieval procedure, avoiding consideration of the issues raised. Additional research was undertaken to establish the need for the inclusion of the DK option. This is described in Appendix F. A separate test case was prepared, shown in Appendix F1. Two groups of students were selected to undertake the testing. One group was permitted to use the 'Yes, No, DK' responses, and the other was restricted to only the 'Yes and No' responses. It was found that the same percentage of students in each group answered 'Yes' to the same questions. This suggests that those who answered DK would have answered 'No' if the DK option had not been offered. It was therefore concluded that it was unnecessary to include a DK option in the possible responses.

The omission of the DK option allowed the users to create a clear and precise footprint for reflecting their perception of the presence of ethical issues in their given scenario. In turn, this allowed the development of a simple question for each ethical issue derived from the criteria identified in Tables 5.4, 5.5, and 5.6. The system was able effectively to address the problem of incomplete or unclear elements in the case scenario, an element that would defeat a rule-based system.

The sequential application of the country, main issue, violation of rights, professional duties, and personal ethical duties identifiers provided a broad scope for the classification and retrieval of cases. This presented the challenge of developing a system that would accommodate a stepwise application of the retrieval vectors to retrieve a suitably analogous case.

5.3.3 Development of a Decision Tree Structure through Hyperlinking

Conversational exchanges can be modelled as nodes of a decision tree (Moor 2000, p.226). Moor recognises that, during a normal conversation, the possible choice of sensible response strings that might be used is huge. However, if the conversation is contextualised, the number of choices can be reduced so that the choice of nodes is restricted to a manageable level. In this respect, Moor follows the recommendations of Schweighofer and Merkl (1999), and Curran and Higgins (2000). Moor also believes that following a conversational tree is not AI. So long as the computer follows a path of sensible responses supplied by the designer, selected in sequence by the user, the machine will have the appearance of a Turing machine, but will simply be an inert tool. No inherent reasoning, adaptation, or merging need take place. The conversation's navigational direction is entirely under the control of the user. These concepts appear to match exactly the requirements for the retrieval of ethical analyses. It therefore seems possible that a tree structure, posing to the user queries based on contextualised ethical principles, is a fruitful area for research. The design of the retrieval mechanism therefore needs to focus upon how nodes in a conversation can be modelled as a decision-making process.

The contribution of Vannevar Bush to the concepts of information storage and retrieval is noted by Laurillard (2002, pp.107-125). Bush (1954, p.102) states that "A record, if it is to be useful to science, must be continuously extended, it must be stored, and above all it must be consulted."

Bush (1945, pp.105-106) observes that although the range of information available is immense, we are not able to consult it. This, he claims, is due to the artificiality of our indexing systems. These do not follow the workings of the human mind, which operates by association. The mind creates a 'trail', associating one item of information with one or more others. Bush claims that although humans cannot hope to duplicate this mechanism artificially, they ought to be able to learn from it. He suggests that selection is the most important issue in information retrieval. It might be automated to use selection by association rather than selection through indexing. Bush (1945, p.108) describes his concept, a 'memex', focussing upon the areas of law and medicine, which is strikingly similar to modern hypertext. Although described in the technologies of the 1940s, it predicts the modern uses of hypertext as a 'reminding' system. Laurillard (2002, pp. 107-125) discusses the implications for this form of technology in teaching. She appears to advocate its use in a similar manner to the concepts of Bush, as a reminding system to augment human memory, and to assist in the formation of links and trails.

Bush also relates this concept to the storage and manipulation of data beyond simple statistical or arithmetic information:

"The repetitive processes of thought are not confined, however, to matters of arithmetic and statistics. In fact, every time one combines and records facts in accordance with established logical processes, the creative process of thinking is concerned only with the selection of the data and the process to be employed, and the manipulation thereafter is repetitive in nature and hence a matter to be relegated to machines. (Bush 1945, p.104)

The principle of hypertext links to retrieve information has already been proposed. Schweighofer (1999) notes that hypertext links can form the basis for the representation of a structure allowing the indexation and classification of a document collection. The nodes of the hypertext system form the basis for a structure that permits navigation through the document collection to a relevant case or cases. The system thus 'walks the user through' the retrieval process.

The retrieval tool may therefore be modelled as a decision tree, constructed using hypertext links. Each node in the tree addresses an ethical issue. For a decision tree to work effectively, it is necessary to split the analysis process quickly into discrete paths. This concept mirrors the contextualisation needed for the retrieval of the ethical analyses using the techniques described in section 5.3.1. The tool first contextualises the case, bursting the retrieval process into a

number of discrete ethical domains. It may then be apply Boolean logic to determine the occurrence of specific ethical principles within a case. Finally, fine-tuning may be carried out by including professional and personal moral duties in the retrieval process, allowing navigation to a suitable matching case or cases.

The basic principle of a decision tree is that it functions best when a large number of cases are included. A reduced case base restricts the scope and efficiency of retrieval. However, the case retrieval tool requires a minimum critical mass of cases within each category of unethical practice before it may function effectively. This suggests that a large number of cases will be required to allow such sub-division. Consequently, before the full efficacy of the tool can be realised, it is necessary to populate the case library with additional cases.

5.4 Development of the Case Library

The capacity of the algorithm for the retrieval system is such that several millions of cases may be stored and retrieved. Obviously, the scope of this research does not permit the identification and analysis of such a large number of cases. However, the principle of operation may be demonstrated by concentrating upon a few discrete areas of unethical practice. It was decided to use ten cases developed by Rahanu, Davies, and Rogerson (1999, p.10) that addressed UK contractual issues. The library was expanded to include a further twelve contractual cases from the UK, giving twenty-two cases in total for this ethical domain. It was also necessary to include additional cases to populate a different area of the case library so that the effectiveness of the retrieval tool in other areas of unethical practice might be demonstrated. The area of US privacy was selected, and thirty-three cases for this area have been included. Therefore, the environment addressed by the tool is presently limited to that of British or North American culture and jurisprudence examining the area of unethical computer use. However, the tool is capable of including cases from other cultures and problem domains as suitable cases arise.

Analyses of the UK cases in the Rahanu, Davies, and Rogerson (1999) case library adopted a linked hypertext model. The presentation used a 'core' web page containing links identifying ethical criteria that linked to child pages examining the ethical issue in more detail. The analysis of the case was thus split over a number of pages, causing navigational difficulties for students.

The procedure for ethical analysis adopted by Rahanu, Davies, and Rogerson (1999, p.4) is shown in Appendix G. Each child page adopted this format. Some of the more detailed analyses required yet further pages to complete the analysis. The resulting case analysis structure was therefore somewhat fragmented. It was disliked by students who found difficulty in reassembling the fragments into a complete whole. This was an important issue in the acceptance of the Rahanu, Davies, and Rogerson tool. It was therefore necessary to develop an alternative model of presentation.

5.4.1 Case Analysis Presentation Style

The Westlaw legal database in the US uses Microsoft Word as a reporting medium, utilising the hyperlink capability to include links to footnotes within the document. This system appears to work well. It is also capable of accommodating the second order level of external analyses that is sometimes required. The system also adopts a template style for the case report and opinion. External hyperlinks to other documents are only used to refer to US statutes or the Constitution, opinion, or to precedent cases held within the master Westlaw database. This model appeared to address most of the issues required for case analysis and presentation within this research. The hyperlinks within the case analyses developed for this research allow the user to jump from the detailed description of the case to the appropriate footnote, and to return to the same position in the detailed description. Each footnote uses the ethical analysis procedure shown in Appendix G, drawing upon the appropriate sections as necessary. The template developed to present the analyses of the particular ethical issue identified in the case details has several benefits:

- It enables the adoption of precise screen style. A change of screen style usually demonstrates to the user a change of screen function.
- Colours and layout become familiar to the user.
- Navigation through the retrieval tool becomes automatic, and the interface becomes transparent.
- The standardised layout makes it easier to undertake the comparison of cases when more than one case is presented by the retrieval tool for consideration by the user.

External links from the footnote analyses are sometimes required to clarify legal issues, provide additional information on such issues as statute law, or to explain how specific statutes have been interpreted by the courts. The issues addressed are generally generic issues that apply to a particular genre of ethical conduct. The ability of the retrieval tool to provide the user with links to additional information was designed to meet the pedagogic requirement to raise the user's awareness of these issues. However, the full efficacy of the tool is only realised if students find the tool useful and usable. It must be capable of carrying out the tasks required by the users quickly and efficiently, retrieving cases without appearing to add to the user's mental load. To achieve these aims requires careful blending of the retrieval algorithm, and the interaction between the retrieval tool and the user.

5.5 Putting It All Together

The issues discussed above suggest that a system may be developed, based upon the paradigm of a decision tree, using hypertext links to ethical issues as nodes within the decision tree. This section describes the development of the theoretical retrieval model and the practical aspects of the retrieval tool construction.

5.5.1 A Revised Retrieval Model

The application of the sequential series of the 'country/main issue/rights violation/professional duty/personal moral duties' identifier provides the basis for a powerful stepwise procedure to concentrate the focus of the retrieval process. The process may be divided into three distinct stages. The first of these, the 'splitting' stage, shown in Figure 5.2 overleaf, splits the case library into discrete categories of ethical domain.

Ten countries were included as possible areas within the classification, although it is recognised that many more may be added as cases become available in sufficient numbers. The six main issues identified as general areas of unethical practice may then be applied to each country. Already, the case library may be split into sixty discrete domains. The eight 'violation of rights' identifiers may now be applied to each 'country/main issue' category, giving a further subdivision of the case library into four hundred and eighty discrete categories. The employment of a multiple-choice response to the initial sequence of questions in the retrieval tool interface

allows a very rapid focus upon discrete areas of unethical practice. Figure 5.2 shows the path through the splitter process identifying a UK case addressing contractual issues, with violation of a stakeholder's right to property. The violation of the right to property then moves the user into the area of Boolean responses to single ethical principles.

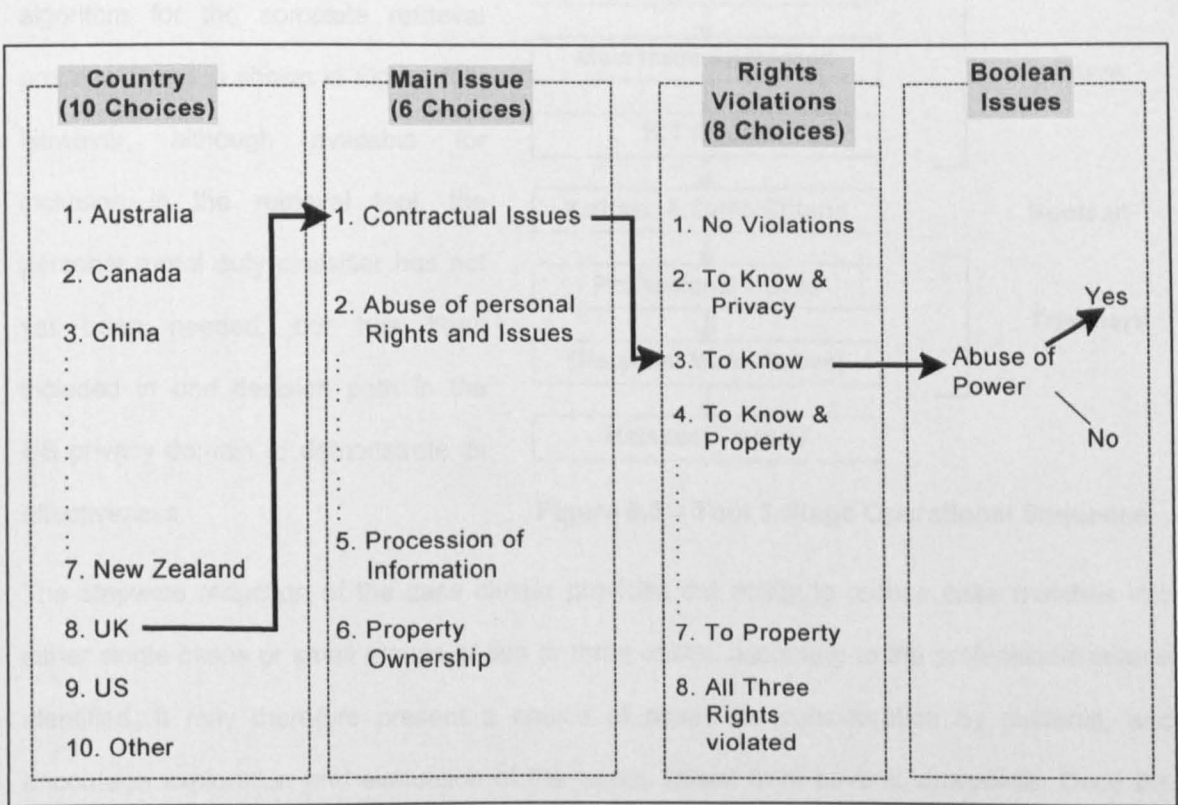


Figure 5.2 – The Splitter Mechanism (With Example Showing the Path Followed for a ‘UK Contractual Issues with Violation of the Right To Know’ Scenario)

Two further stages complete the retrieval paradigm. The application of Boolean responses to the presence or absence of ethical principles within a case, derived from the suggestions of Kallman and Grillo (1996, p.9), generates a footprint or profile of the case as seen by the student. This guides the student through the retrieval process, offering questions concerning the refinement of the query for analogous case retrieval in a measured, reflective approach. As each Boolean question is answered, and the retrieval tool moves to pose the next question, the potential case cluster of possible analogous cases is halved – a form of ‘binary chop’ algorithm.

Further concentration of focus, to trim the final retrieval of case or cases, is achieved by posing the multiple-choice responses to the issues of professional and personal moral duties addressed in Tables 5.5 and 5.6. These may be used as 'trimmers' to refine the search for suitably analogous cases. The algorithm for the complete retrieval process model is shown in Figure 5.3. However, although available for inclusion in the retrieval tool, the personal moral duty classifier has not yet been needed, but has been included in one decision path in the US privacy domain to demonstrate its effectiveness.

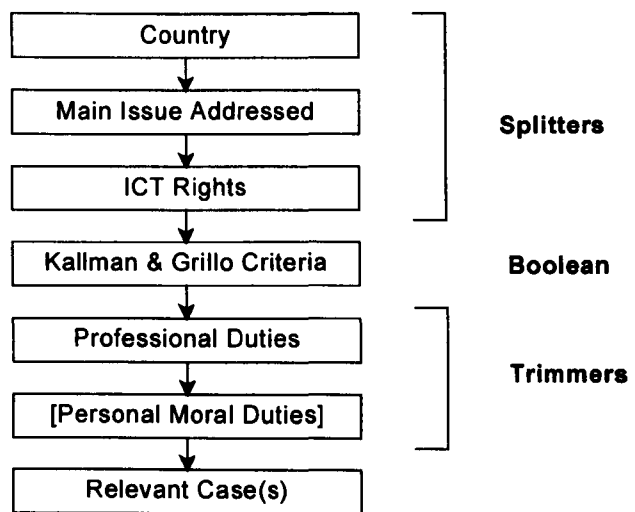


Figure 5.3 – Tool 3-Stage Operational Sequence

The stepwise reduction of the case cluster provides the ability to reduce case matches into either single cases or small groups of two or three cases, according to the professional criteria identified. It may therefore present a choice of cases for consideration by students, and encourage exploration and evaluation of the issues raised from several viewpoints. Once the retrieval process has been completed, the tool presents the user with a brief description of the case or cases. Hypertext links then lead the user to the full ethical analysis of each case.

The stepwise algorithm for reduction of the potential retrievable cases as the student progressed through the retrieval procedure allowed a considerable reduction in the questions posed when compared with the retrieval questions posed by the unsuccessful retrieval tool. The tool thus became very powerful and flexible with a reduced number of questions. The question set used in the first retrieval tool tended to be esoteric, and contained an excessive number of questions. This problem was also identified by Rahanu, Davies, and Rogerson (1999, p.6), who found that many cases were insufficiently rich in detail to supply answers to a large question set. Mladenic and Grobelnik (2003, p.46) note that a high number of retrieval vectors may simply slow down the retrieval process whilst giving similar results to that obtained using a much smaller vector subset. Furthermore, a large number of questions is not perceived as user-

friendly by the students using the tool. Huberman et al. (1998, pp.95-96) found that a user's interest in information retrieval decreases exponentially with the number of mouse clicks required for the task.

Sixteen questions, shown in Appendix H, were derived from Tables 5.4, 5.5, and 5.6 giving the potential to identify almost 6.3 million cases within the case library for each country – far more than would normally be required. The framework, therefore, has the capability to hold a huge number of cases, and to retrieve them with responses to no more than sixteen questions. In practice, sixteen questions are unlikely ever to be used, but suitable combinations of up to six to eight questions that focus upon the specific problem domain, identified by empirical investigation, appear to work quite adequately. This presents the realisation, useful from the user's viewpoint, that the paths for the decision-making process are not of similar length. They can vary according to the complexity of the ethical problem domain and the number of case analyses in the library addressing the identified ethical area. The retrieval tool is therefore able to retrieve analogous cases for many ethical problem domains with very few questions.

The theoretical basis for the revised retrieval tool appears to be based soundly on ethical principles, is flexible, and potentially user-friendly. However, the revised model raises a number of practical issues in its construction.

5.5.2 The Practical Application of the Revised Retrieval Model

Decision trees are useful for two conditions

- Where a process is accomplished in stages.
- Where the logic of the decision-making process is asymmetric.

They are flexible in that trees can spawn branches, and the order of the conditional nodes need not be identical for each branch. The creation of branches is evident in the algorithm of the retrieval tool. Branches occur at the division of the case base into countries. They occur again at the selection of the main issue, and the selection of rights violation. To follow the arborescent metaphor, the Boolean questions, followed by the trimmers addressing professional and personal duties, might be regarded as the twigs that hold the fruit – the proffered case analyses.

Not all branches and twigs are identical. Such is the case with the paradigm for the retrieval tool.

This suggests that it is not always desirable or possible to submit all the available questions for the retrieval of a suitable case analysis. Some questions are irrelevant to case retrieval in some contextual areas. Consequently, two issues required resolution before an effective retrieval system could be constructed:

- Which questions were relevant for each ethical problem domain?
- In what order should the relevant questions be posed?

The test cases shown in Appendix C were analysed and checked against the criteria shown in Table 5.4, 5.5, and 5.6 to determine whether the issues might be used as retrieval tool vectors. A database was set up containing a full set of data from the responses to all questions relating to each of the library cases, including the categorisation data and null responses where the question was irrelevant to retrieval. The cases were sorted into their appropriate 'country/main issue/rights violation' categories. Each group of cases was then run in a series of experiments, using the ordering facilities of Microsoft Excel, to determine which Boolean and trimmer questions were relevant for retrieval, and which could be discarded.

It was found that many of the decision paths within the discrete contextual areas required submission of the questions in different sequences if a good separation of the case analyses were to be achieved. Those questions in each contextual area that did not contribute to the retrieval process were removed. It was possible, using the shortened decision paths, to separate the cases into discrete cases, or alternatively into small clusters of cases addressing similar ethical principles. This method had the benefit for the researcher that the printout of the sort routines from Excel provided hard copy of the data that could be plotted for the different branches of the decision tree. The empirical determination of question sequence demonstrates the importance of specific ethical issues for retrieval within that branch of the decision tree only. It does not pretend to rank ethical principles.

The decision tree was constructed using Hypertext Markup Language. Template pages were produced for each node, and reproduced as required by the different decision paths. Hypertext

links were then created between the nodes, allowing the creation of a network that could be traversed by the user, reflecting the responses to the questions upon ethical issues.

At the end of the decision path, the user is presented with a screen that gives a brief synopsis of the case or cases that are suggested by the retrieval tool as analogous with the student's given scenario. If more than one case is suitable, a synopsis for each case is given, encouraging the student to examine each for similarities with the given scenario. Links are provided from each synopsis to the appropriate case analysis.

The time limitation on this research, and the availability of suitable cases prevents the full population of the two chosen branches of the decision tree. Some of the nodes have only one path for further traversing of the decision tree. It is intended that the dead links will be activated, and the decision paths completed when suitable cases occur. New cases may be included by registering their details in the design database, and processing these in the manner described above. The resultant Excel printout indicates where in the decision tree the links to new case should be inserted.

The interface of the retrieval tool is the bridge between the user and the computer. It is therefore essential that the system is simple and intuitive to use. The algorithm for retrieval is simple, but the system must encourage close interaction between the user and the computer. It must therefore follow recognised human-computer design guidelines.

5.6 Human – Computer Interaction Issues

In its present form, the retrieval tool should not be regarded as a finished product. It is intended to demonstrate the principle that an ethical framework can be used to classify and retrieve suitable case analyses. Time limitations on the duration of this research mean that the tool can only be regarded as a 'quick and dirty' prototype that will need further development before any claims can be made that it is a commercial product. Nevertheless, it will need to meet certain standards of acceptability and usability if it is to be used by students.

The retrieval tool adopts the role of an advisory or exploratory system. Shneiderman (1998, p.18) comments that it is difficult to construct such systems. The retrieval tool is designed for

use by a wide spectrum of students. It is impossible to identify the precise characteristics of each student or group of students who will use it. Yet, Shneiderman (1998, p.10) suggests that developers should strive to identify and accommodate the requirements of the users, and “have a thorough understanding of the diverse community of users and the tasks that must be accomplished”. Shneiderman (1998, pp.18-27) identifies a number of issues that will affect the usability and acceptability of a computer application, and makes special mention of personality, and of cultural and international diversity. Nielsen (1993, p.xi) comments that all systems used by humans should be subjected to some form of usability investigation to remove as many of the inherent usability problems as possible. However, Nielsen (1993, pp.17-20) recognises that the result will always be a compromise between functionality, acceptability, and user satisfaction. He suggests ten principles²⁴ be followed for successful software design.

A short brief for the retrieval tool interface, Appendix I, was assembled to identify clearly the main issues required in the interface. It takes the main recommendations of Nielsen and Shneiderman as a basis for the design, and considers the application of these principles to an interface that will be used by a diverse range of students. However, the construction of the tool identified a number of issues that required further consideration.

5.6.1 Colours.

Little information is available upon the effects of culture upon the design of web pages. Doubtless, many cultures prefer specific colours, and adopt their chosen colour with enthusiasm. The interpretation of colour meaning is complex, and a universal colour design is unlikely to be achieved. The final design is reduced to the selection of colours that cause least offence to the users, yet stimulate feelings of satisfaction by rendering the interface transparent to the user.

Colour is also used to identify issues of high importance. Differing cultural interpretations of colour would suggest that there is no universal convention for this task. However, the

²⁴ (a) Use simple, natural dialogue; (b) Speak the user’s language; (c) Minimise the user’s memory load; (d) Maintain consistency; (e) Provide feedback; (f) Provide clearly marked exits; (g) Provide shortcuts; (h) Provide good error messages; (i) Prevent Errors; (j) Provide help and documentation.

suggestion that a global ICT culture is emerging provides the designer with the opportunity to adopt a colour scheme that is not based upon any religious, cultural, or national convention. The focus then shifts to other considerations such as disabilities.

The final colours chosen were selected upon the basis that they provided reasonable visual contrast, enabling the partially sighted and visually impaired to read the text on the web pages without difficulty or discomfort. All pages were created with a background of pale yellow, and text was generally created using a dark maroon. Hypertext links followed the usual convention of blue for unvisited and purple for visited links. In the case analyses, dark green was selected for the section headings. Red was only used to urge users to use the 'Back' button to return to the previous page.

The choice of page format and colour raised the issue of consistency. The Boolean pages were all of similar layout, and appeared to change little as the user progressed with the retrieval. It was necessary to use a series of colours as the background to the 'Yes/No' response choices to avoid 'over-consistency' and indicate when an action had been completed by the computer.

The colours chosen offered a reasonable compromise, avoiding any identifiable preference towards particular culture or religion, yet meeting the requirements for a clear, easy-to-read presentation of information.

5.6.2 Screen Data Density and User Orientation

Several of the multi-choice screens contain a confusing number of choices, particularly the 'main issues' and 'professional duties' screens. The constraint of responses to several of the retrieval questions is achieved by the use of a menu, albeit permanently displayed within a table. Jiang and Klein (2000, p.470) suggest that menu systems can affect the user response to the options, with users tending to select the first or last menu options. Ordering of the options and clarification upon the options are essential for successful retrieval. However, inclusion of the information on the page caused unacceptable information density. It was necessary to provide supplemental 'pop-up' information boxes, activated by information buttons, to provide the required guidance. This still presented a 'fussy' screen, but further refinement is difficult.

Furthermore, the supplemental information is not needed once the user becomes familiar with the use of the tool.

It was also decided to provide a 'Decisions taken to reach this point' button to remind users of decisions made to reach that point in the retrieval process. Navigation through the retrieval tool is complex, particularly at the junction of the retrieval tool and the case analysis

5.6.3 Program Compilation, Distribution, and Restriction of Facilities

Research by Oxford University and the Universities and Colleges Admissions Service (UCAS) indicates that students tend to copy, cut and paste text unthinkingly when obtaining information from web pages (Shepherd 2006b), defeating the purpose of the retrieval tool. It was decided that cut, copy, and paste facilities should not be available to students.

The posting of unprotected web pages onto the Internet leaves them open to hacking and abuse. The data in the case analyses, and the retrieval system itself could be open to interference by unauthorised persons, and cause harm to students who use the retrieval tool. Furthermore, users of the system might not wish to spend long periods on line, and would find it convenient to download a single executable file containing the complete retrieval tool and library.

The complete application was thus compiled into a single executable file, mounted on the Centre for Computing and Social Responsibility server. Students may use the system on-line, or download a copy onto their own computer for later use. The compiler was able to disable the cut, copy, and paste functions. It also included the facility to change the size of the fonts used in the retrieval tool screens, a significant benefit to those users who suffer from visual impairment.

The use of the compiler placed some limitations upon the use of the retrieval tool. The compiled system will only run on computers using the Windows 95 or later operating system, and requires the computer to have installed the Microsoft Internet Explorer browser, Version 4 or later. However, these limitations did not seem too onerous for what is essentially a research project, with most students finding them acceptable. The use of an alternative compiler would address this issue.

5.7 Conclusions

This chapter demonstrates a sound foundation for the development of a revised retrieval paradigm, and the construction of an acceptable retrieval tool. It is inevitably a compromise, as some of the requirements appear to conflict. However, pilot testing suggests that the retrieval tool addresses the issues required of an effective pedagogic system to be used by a diverse range of students. It appears to create in the student a state of flow. It seems relatively easy to use. It uses relevant real-world cases in an interesting manner, stimulating reflection and prompting discussion by students.

There is now a requirement to undertake in-depth testing of the tool. The following chapter describes the formal testing, and evaluates its effectiveness and its acceptability to students.

Chapter 6 - Evaluation of the Case Retrieval Tool

The case retrieval tool must meet a number of criteria if it is to be considered successful.

Nielsen defines the acceptability of a software application as:

“...a question of whether the system is good enough to satisfy all the needs and requirements of users and other potential stakeholders, such as the users, clients or managers. The overall acceptability of a computer system is again a combination of its social acceptability and its practical acceptability.” (Nielsen 1993, p.24).

It is therefore necessary to consider what elements should be used to test for acceptability and usability.

6.1 The Selection of Suitable Testing Criteria

Nielsen comments upon the most important elements that contribute to overall acceptability: social acceptability, practical acceptability, usefulness, utility, and usability. The interaction of these issues he identifies in the model shown in Figure 6.1.

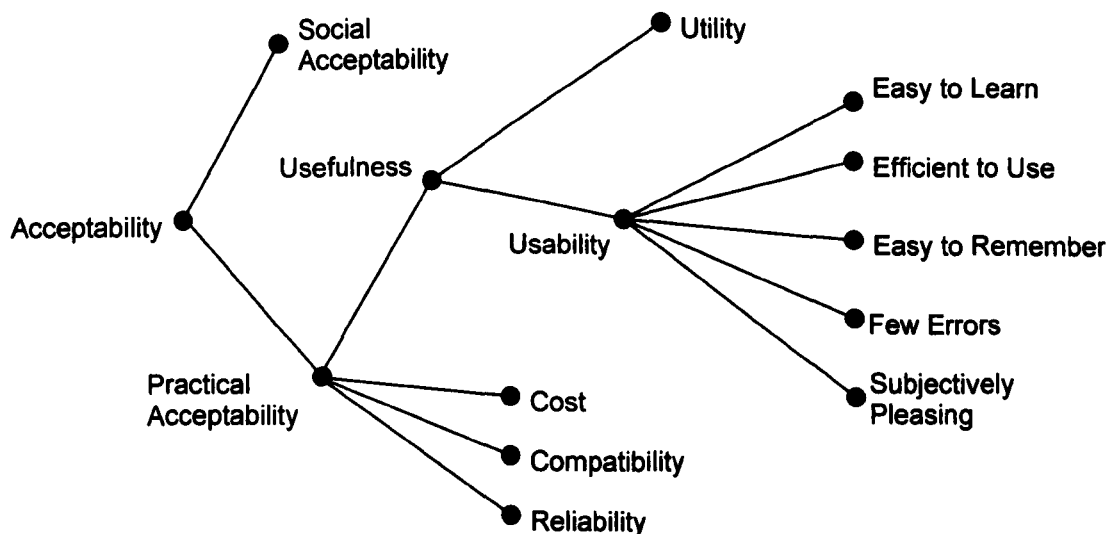


Figure. 6.1 – A Model of the Attributes of System Acceptability (adapted from Nielsen 1993, p.25)

All the issues listed by Nielsen are of importance to this research. Without social and functional acceptance by the students, the tool will be rejected and cease to have any lasting effect upon students' ethical awareness. The two key questions are:

- Does it do its intended job effectively and efficiently?
- Does it do the job in a manner that is acceptable to the widest range of users?

Nielsen notes that human factors and ergonomics have a wider scope than simple human-computer interaction. Furthermore, social acceptability goes beyond simply addressing the social sensibilities of one culture. The retrieval tool must be flexible enough to accommodate multiple cultures and user viewpoints. Nielsen (1993, p.24) notes that one's perception of social acceptability may depend upon the effects that the system may have on one's well-being. From the students' standpoint, the content of the tool will need to be matched to their previous knowledge and social understanding if it is to achieve credibility. The tool must be socially acceptable, based upon practical cases that students may encounter in their future careers.

Practical acceptance is also an essential element. Students expect to expend little cost or effort when using the tool. They also expect it to be useful and reliable to them when evaluating a given test scenario. It must help them to identify and address the ethical issues posed by the given scenario (the utility aspect), and must be easily usable by a wide section of its target users (the usability aspect). It is important that the tool is subjectively pleasing, that it becomes fun to use, and that the interface becomes 'transparent' (Shneiderman 1998, p.18), leading to the creation of an autotelic state (Csikszentmihalyi 1992, p.29). Nielsen (1993, p.25) also comments that pedagogic software has a high utility if students learn from using it. Consequently, there are many strong links between Nielsen's model and the requirements of the retrieval tool.

The five usability issues listed by Nielsen are also identified by Shneiderman (1998, p.15) as issues that can be measured for the evaluation of the effectiveness of the software application. Subjective satisfaction seems to be strongly influenced by the preceding four issues (ease of learning, efficiency of performance, few errors by users, and retention over time). Nielsen (1993, p.33) suggests that the entertainment value of the system may be greater than the need for speed. The retrieval tool developed as part of this research requires an element of 'edutainment' (Nielsen 1993, p.25), to hold the user's attention, and to stimulate consideration of the whole gamut of ethical issues. The effectiveness of the tool will depend upon users' assessment of its attractiveness and usefulness (Tractinsky, Katz, and Ikar 2000). Both

Shneiderman (1998, p.15) and Nielsen (1993, p.34) suggest that subjective satisfaction may be measured by simply asking users for their opinion. The evaluation of the tool developed as part of this research uses such an approach.

6.2 Flexibility in the Research Evaluation Approach

The attainment of 'subjective satisfaction' suggests that the research should be based heavily upon interpretivist approaches. The flexibility in this approach has been used in this research. The ability to investigate and re-focus the research as circumstances change has been of particular benefit. The initial aim of the research was to establish whether it is possible to construct a retrieval tool that will raise students' ethical awareness. This led to the consideration of the effects of AI upon the retrieval process. It prompted the approach that sought to avoid AI-based retrieval, and to promote a deeper thinking approach in students to the retrieval and case analysis. The unexpected additional opportunity arose to test the retrieval tool in a different, Malaysian, cultural environment. This raised the issue of whether the case library, created by a western European male, would stimulate ethical awareness in South East Asian students. Such flexibility to explore is not an inherent part of traditional positivist, quantitative research.

The fluidity of the research approach thus tends to militate against the more rigid hypothesis testing required for positivist or quantitative research methods. No data variables are pre-selected for investigation. No data manipulation takes place other than counting of occurrences and a simple processing to obtain a profile for a given cohort of students. The criteria used to establish the effectiveness and usability of the tool are nominal descriptors, and not suitable for processing other than by counting simple occurrences (Pervan and Klass 1992, pp.212-213). They are not ordinal criteria that may be measured in absolute quantity, ranked, and subjected to statistical analysis.

Examination of many past research projects has identified that they do not involve the collection of quantitative data, and have little need for the use of statistical analysis (Pervan and Klass 1992, p.210). This is the situation pertaining to this research. Huff and Martin (1995, p.75) observe that questions requiring personal judgement cannot be answered in precise mathematical terms. The retrieval tool is an exploratory environment (Shneiderman 1998, pp.

17-18) used by students, linked via a conversational interface (Laurillard 2002) to a pedagogical database containing ethically analysed cases. The exploratory element of the learning process tends to suggest that a positivist approach to evaluation is unsuitable for this research. The responses from students are subjective. Responses will depend upon many factors including students' gender, age, skill level, ethnicity, and religion (Hofstede 1994, pp.15-18). Consequently, the differing cultural backgrounds of the students who were engaged in the testing of the retrieval tool might be expected to influence their perception of the ethical issues raised by their given case scenarios. There may be many acceptable answers to the issues raised by the case scenarios, depending on students' ethical and cultural backgrounds. The strong subjective element inherent in the students' responses makes it almost impossible to predict and hypothesise upon the outcomes of the research questionnaires, or upon the responses to the questions in the retrieval tool interface.

The adoption of a positivist approach would assume that results would reflect the methods of science, and the belief that they may be applicable to all spheres of enquiry (Cornford and Smithson 1996, p.38). In this research, this approach is invalid. The research seeks to identify and explain the differences between student cohort pairs, not simply to establish a correlation between cohorts. The issues causing difficulties to each cohort are of interest, both as discrete issues and as clusters. The research seeks to identify trends in the change of awareness by identifying the differences between two sets of responses. It also seeks to identify which issues raised by the questionnaire give rise to the greatest change, and therefore to the greatest difficulty for the students.

Nevertheless, the inclusion of a strong element of ICT in scenarios addressing business issues poses an interesting environment for examination of the students' responses to the ethical issues raised by the survey questionnaire. Using only Hofstede's classification, one might predict that there would be clear divisions between the responses by the Kuala Lumpur and Wolverhampton cohorts to the questionnaire. However, Triandis' suggestion²⁵ tends to imply that the responses from the two groups of cohorts would not show major differences. It would

²⁵ That ICT is becoming a 'universal' sub-culture.

also imply that perhaps students of both cultures might find difficulty with the same ethical issues. Analysis of the student responses examines these concepts. The remaining sections of this chapter describe the ethical protocol developed for this research, and examine students' subjective responses upon the usability and usefulness of the retrieval tool.

6.3 Formulation of an Ethical Testing Protocol

Difficulties arose in this research over the assembly of suitable sample groups to undertake the research. Nielsen (1996, p.5) suggests that testing of software applications should be undertaken by using 'real' users to complete 'real' tasks. Here, 'real' users are the students who will use the retrieval tool. However, under the conditions for this research,²⁶ ethical requirements for research with human subjects allow students to reject requests from researchers to take part in research activities. Additionally, students may refrain from answering any questions that they find unacceptable. They may also withdraw from research activities at any time during the research without providing any justification. This presents the researcher with considerable difficulty in assembling suitable numbers of students to assist in the research, and even more difficulties in obtaining a full set of valid responses to survey questionnaires. It becomes most difficult to gain sufficient information from students to pair them for comparison, or to investigate their age, gender, racial, social, or cultural backgrounds. Written agreement was required from all students that the researcher might use their survey responses in the research. A Human Research Ethics protocol, shown in Appendix J, was therefore drafted and submitted for approval by the Human Ethics Research Committee of the University.

6.4 The Selection and Participation of Research Subjects

Four student cohorts were used for the final testing of the retrieval tool. Two cohorts were drawn from the students taking the Social, Legal and Professional Aspects of Computing Course at Wolverhampton University. The first cohort used the retrieval tool in October/November 2003 (the W1 cohort) and the second in March/April 2004 (the W2 cohort). The responses of students

²⁶ The research instruments were administered to students by their lecturers. This had the advantage of ease of access to data subjects, but the disadvantage of raising ethical issues which required the restrictions outlined here to ensure ethical acceptability.

from a different culture and ethnic background were considered useful to determine if their responses to the issues raised by unethical actions in the use of ICT differed from those of the Wolverhampton cohorts. De Montfort University delivered BSc courses to students in Malaysia that included the final module 'Computer Ethics', delivered intensively over two weeks. Two cohorts were therefore drawn from cohorts taught in Kuala Lumpur in August/September 2003 (the KL1 cohort) and August/September 2004 (the KL2 cohort).

Not all students within a cohort agreed to take part in the testing of the tool. Several who agreed to take part failed to complete the questionnaire forms correctly.

Table 6.1 shows the responses obtained from the students in each cohort to the ethical awareness questionnaire. Some failed to complete the 'after' iteration of the form. Some failed to place a unique, anonymous identifier on the forms. Some failed to place the

Cohort	KL1	W1	KL2	W2
Pre-Tool Use Survey Forms Returned	42	77	50	71
Post-Tool Use Survey Forms Returned	36	52	45	69
Matches Obtained	25	44	40	29
Percentage Useful and Valid Returns	60%	57%	80%	41%

Table 6.1 – Student Responses to the Ethical Analysis Questionnaires

same identifier on both the 'before' and 'after' iterations of the form, preventing the 'pairing' of forms to demonstrate changes in a student's responses. The Kuala Lumpur cohorts can be seen as generally more accepting than the Wolverhampton cohorts of the need for responses to the survey questionnaires.

Responses to the usability questionnaire were numerically very similar to the ethical awareness responses. However, as the usability survey was completed only once, matching to give a 'before' and 'after' snapshot was not required. Table 6.2 shows the responses from each

Cohort	KL1	W1	KL2	W2
Usability Survey Forms Returned	40	50	47	68

Table 6.2 – Student Responses to the Usability Questionnaire

cohort to the usability survey. All responses in this survey were fully completed by students who agreed to take part, and were regarded as valid data.

6.5 The Cultural Diversity of the Test Cohorts

The cohorts selected to test the retrieval tool came from countries that score very differently on Hofstede's criteria, outlined in section 2.7.3. Their cultural backgrounds are very different. The Malaysian students were drawn from a mainly Confucian-based culture, whereas the Wolverhampton students appeared to be from a largely western culture. However, this distinction is somewhat blurred, and illustrates one of the major criticisms of the use of Hofstede's work as a basis for cultural classification. Hofstede initially assumed that countries are homogeneous in their population and culture. This is not so (Groeschl and Doherty 2000, p.15). Globalisation, as well as natural ethnic makeup of countries, introduces an element of diversity in cultural mix that Hofstede does not address. Constituent groups within a student cohort tend to reflect their own individual cultural and ethnic traits (Peppas 2002, p.43).

The UK population is not homogeneous, but is a mix of ethnic groups, many comparatively recent immigrants to the country. Both Wolverhampton cohorts contained students from Indian and Afro-Caribbean cultures, in addition to the indigenous UK population. Increasing international co-operation in education has also introduced a transitory group of students who stay in the UK only to complete their education, but who form an identifiable element of the UK student population. However, this is not a drawback for this research, since the tool is intended for use with such a range of students. The constituent mix of religions, ethnicity, and culture will provide an indication of the broad acceptability of the case retrieval tool.

The two Kuala Lumpur cohorts were drawn from ethnic groups representing the South East Asian region. Malaysia is not a homogeneous nation (Fontaine and Richardson 2003, p.81). Malaysia has four major ethnic or religious groups: Tamils, Indians, Chinese, and Malays. In addition, there are about 40 other minor ethnic/cultural/religious groups in the country. Students could be drawn from any of these groups. The population is approximately 22 million. Approximately 60% of the population are Malay, 27% Chinese and 7% Indian. The KL2 cohort included a greater proportion of Chinese students than the KL1 cohort. However, Hofstede's criteria suggest that many cultural norms for the Malaysian and Chinese students are very similar. Both cultures strongly espouse Confucian principles.

Evidence has already been presented in section 2.7.5 suggesting that that different cultural groups will behave and make decisions in different and discrete ways, but blending of cultural traits can occur. It is therefore not possible to categorise the students required to test the retrieval tool into discrete identifiable ethnic groups. It is against this background that the two sets of investigations were carried out. The following sections describe and discuss the responses of the pairs of cohorts to the usability of the retrieval tool, and of its effectiveness in influencing students' ethical awareness.

6.6 Usability Testing and Results

The retrieval tool is intended simply to prove the principle that a system can be constructed for retrieval and presentation of case analyses that will promote deeper consideration of ethical issues. It does not aim to produce a commercially acceptable application. It should therefore be regarded as a low fidelity prototype that will have to undergo further development before it might be used commercially. However, this should not prevent the adoption of recognised human-computer usability principles.

6.6.1 The Usability Questionnaire

The questionnaire addressing the usability of the tool, shown in Appendix J Part B, asks students to respond by indicating their evaluation of twelve issues applicable to the interface. Students are required to allocate a value from a four-part Likert scale showing the level of students' agreement with the statements in the questionnaire. A 'Don't Know' option is not offered, as responses were required that were clearly in favour or against the issue under consideration. It was also felt that students might use the 'Don't Know' option as an easy way to complete the questionnaire, without considering their responses (Oppenheim 1992, pp.128-129). The levels offered are:

1. Strongly agree – scoring 1.
2. Moderately agree – scoring 2.
3. Moderately disagree – scoring 3.
4. Strongly disagree – scoring 4.

This would suggest that students would fall into either an 'positive' category, containing scores of 1 or 2, or an 'unacceptable' category scoring 3 or 4. However, it is unlikely that any interface will meet with universal acceptance. Some features will inevitably cause some concern for some users, but not to the extent that users find real difficulty in using the interface. Consequently, that group who scored 3 might be re-classified as 'tolerable'. This permitted the assembly of a group combining categories 1, 2, and 3 to give a satisfaction category that is 'tolerable or better'.

6.6.2 Development of the Interface

Preliminary testing of the interface was undertaken by a small pilot group of Wolverhampton students. Figure 6.2 shows the responses of the pilot group to each usability issue of the interface illustrating areas of concern. The pilot group used the initial version of the interface, and it would therefore be unwise to use these for direct comparison purposes with later cohorts using the revised interface. They are, however, included in the charts for illustrative purposes.

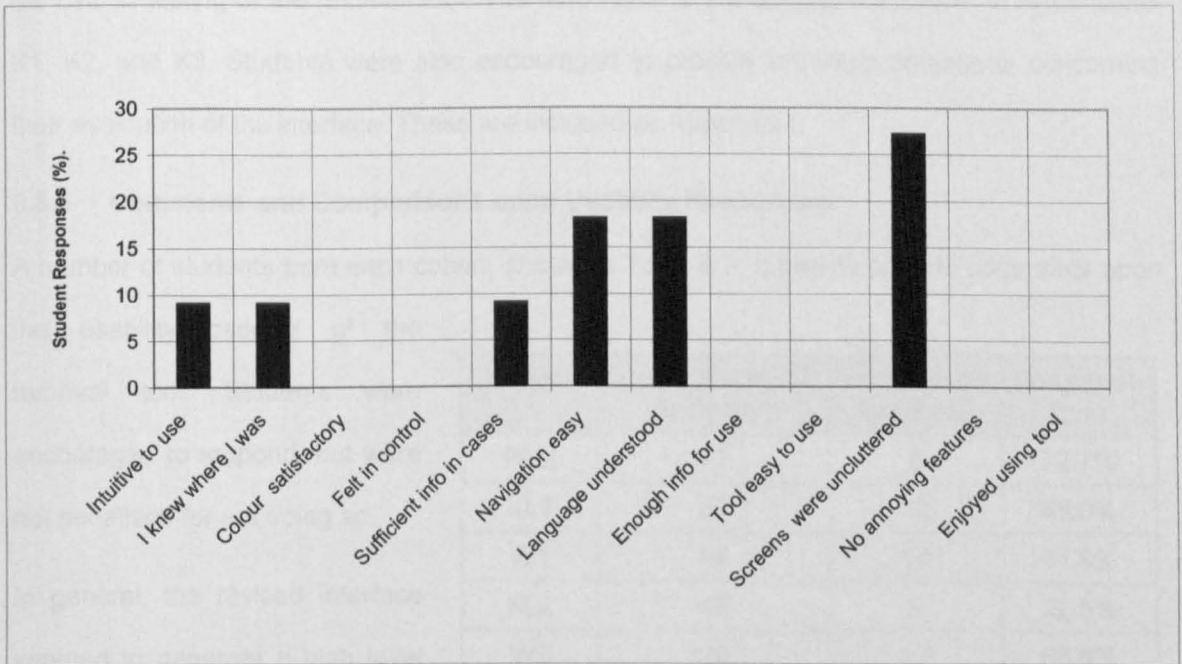


Figure 6.2 - Issues of Concern Raised by Pilot Testing (8 Students)

Specific issues identified by the pilot cohort as causing difficulty to two or more students were:

- Navigational issues (2 students).
- Use of language (2 students).
- Amount of information contained on the screens of the retrieval tool (3 students).

The following alterations were made to the interface to address the issues raised by the pilot group:

- Additional navigational aids were incorporated indicating the decisions made to reach that point in the retrieval process.
- Some minor amendments were made to the language of the questions posed.
- The number of colours used in the interface was reduced and standardised.
- The format of the case analyses was modified to follow more closely a template style of presentation.
- A number of lengthy, explanatory textual passages on the retrieval tool screens were hidden so that they could be recalled when necessary by clicking on appropriate 'help' buttons.

The interface was then submitted to the two pairs (W1/KL1 and W2/KL2) of cohorts as part of the overall testing of the retrieval tool. The responses of the cohorts are shown in Appendices K1, K2, and K3. Students were also encouraged to provide individual comments concerning their evaluation of the interface. These are included as Appendix L.

6.6.3 Comments and Comparisons upon Usability Responses

A number of students from each cohort, shown in Table 6.3, chose to provide comments upon the usability aspects of the retrieval tool. Students were encouraged to respond, but were not penalised for not doing so.

In general, the revised interface seemed to generate a high level of acceptance. As shown in Appendix K1, the 'positive'

Cohort	No of Students in Cohort	Responses Received	Response Rate
Pilot	11	8	72.7%
KL1	25	12	48.0%
W1	44	14	31.8%
KL2	40	9	22.5%
W2	29	17	58.6%

Table 6.3 - Percentage Student Cohort Response to Usability Questionnaire

category, shows that for most issues, the pilot group returned higher satisfaction scores than the later cohorts. This is interesting, as the pilot cohort used the unmodified interface. In general, the two Kuala Lumpur cohorts were less satisfied than the two Wolverhampton cohorts.

The W1 cohort showed a 'flatter' profile than other groups, which could be interpreted as showing a generally more mature view of the interface.

Three issues showed low satisfaction scores:

- Enthusiasm for the use of the tool.

The responses for the KL1 cohort show a very low satisfaction score (22%) for the enjoyment in the use of the tool, although the other cohorts returned a much higher (60%) satisfaction score. Examination of the KL1 student comments shows that they would have preferred the interface to have more interaction and brighter colours. These comments run counter to those of the pilot group.

- Clutter of the retrieval tool screens.

This is difficult to address as the screens subject to the criticism were those that presented multiple-choice selections such as 'country' or 'perceived main issue'. The KL1 cohort returned a lower score for the revised interface than the pilot group for the unmodified interface, but other cohorts returned marginally better scores than the pilot group.

- The amount of information contained in the case analyses.

The issue of sufficient information within the cases in the case library shows a lower acceptance level for the KL1 and KL2 cohorts. This could be because students expect a precise answer from the retrieved case. This is not the aim of the tool. Students are expected to interpret the solution retrieved from the library in the light of the case that they are asked to analyse. In South East Asian cultures, student learning styles tend not to promote a deeper thinking approach (Maxwell et al. 2000, pp.5-7).

The 'tolerable or better' category is shown in Appendix K2. The general level of acceptability increased markedly for many issues. Only the KL1 cohort returned scores of less than 85% satisfaction on any issue. However, this cohort returned scores of 100% for the intuitiveness of the interface, and an impressive increase from 22.5% to 95% for enjoyment in using the tool. Furthermore, despite not using English as their first language, the Malaysian cohorts coped equally well with the language used in the interface and case studies as the UK cohorts. All returned satisfaction scores of 95% or greater for this issue.

Two notable usability issues that were unacceptable to students are highlighted in Appendix K3, both identified mainly by the KL1 cohort: lack of sufficient information in the case studies and cluttering of the screens. It is suspected that the students indicating dissatisfaction with the information provided in the cases expected a precise explanation to be provided that mapped directly to their given case scenario. However, the principle of the tool is that students will need to identify for themselves the relationships between the presented analogous case and their given scenario case.

Some screens of the retrieval tool offer a multiple-choice response to the question posed. The clutter appears because of the explanations offered by the tool to guide student use. Without this help, students could have difficulty in interpreting the meaning of some of the questions or choices offered. It was also noted that the KL1 cohort expressed some dissatisfaction with the colours used in the interface. This dissatisfaction is not reflected in the high satisfaction scores recorded by the other cohorts. No satisfactory explanation can be offered for this phenomenon.

6.6.4 Response to Student Usability Comments

The comments made by the students on usability aspects of the interface are shown in Appendix L. Generally, the comments made tended to fall into one of five main categories:

- **Interactivity.**

The interface is an interactive hypertext decision tree, but without any intentional animation. Several students, particularly the KL1 cohort, requested more interaction or brighter colours. This suggests that students wished to see an element of fun in the interface, an approach often taken by students in their perception of the suitability of software. Hassenzahl et al. (2000, p.201) support this approach to some extent, citing work by Carroll and Thomas (1988), who suggested that the concepts *easy to use* and *fun to use* should not be confused when talking about software quality. They argue that ease of use implies simplicity, which may be incompatible with fun. Making something as simple as possible can also make it boring. Fun requires a subtle balance of simplicity and challenge. Conversely, Gonzalez (1996, p.27) notes that the conventional concept that animation makes interfaces easier to use, more enjoyable, and improves human performance, is not supported by research. Very little is known about the design and effective use of animation in user interfaces. Morrison and

Tversky (2001, p.378) found that animation did not enhance learning in most students, showing only minimal effect to those students with low spatial ability. Furthermore, they found that:

"Each type of presentation format, text, graphic, and animation, has its own strengths in conveying information. Language is ideal for conveying causal and conditional relations as these are difficult to depict. Additionally, language can convey concrete concepts that are easy to visualize without external aids....."

Animations are claimed to have an advantage over text and static graphics in showing change in time. This can be literal, in that animation can use motion to convey motion. It can be metaphoric in using change in graphics to show change in processes. Thus, animation may be the most congruent way to convey conceptual information about motion or change." (Morrison and Tversky 2001, p.377).

The retrieval tool does not intentionally display a change over time. Students are encouraged to explore for themselves the effects of time upon the development of ethical norms.

Despite the generally held belief that interactivity through animation enhances learning, these findings would tend to suggest that there is much doubt about its efficacy. Furthermore, the inclusion of animation adds to the complexity of the program code and reduces accessibility for those students who run the program on lower powered equipment over the Internet.

- **Colour.**

Some students wished to see more colours used in the interface. The number of colours used was rationalised and reduced following comments from the pilot cohort. The use of colour needs to be addressed with care (Shneiderman 1998, pp.398-403). Excessive use of colour can lead to colour pollution, making the interpretation of the information contained on the page more difficult and confusing (Preece et al. 1994, p.89). There is also evidence that some colours have specific connotations within given cultures (Barber and Badre 1998). Certain medical conditions are also affected by colour, e.g. different types of colour blindness can cause difficulties for those using computer equipment (Preece et al.1994, p.240). Similarly, those with Meares-Irlen Syndrome (Scotopic Sensitivity Syndrome) (Evans 2005, pp.363-364) can experience severe distress and learning difficulties.

The students appear to have adopted an egoistic view, and disregarded these limitations on the use of colour that may affect other students.

- Cut, paste, and print.

Several students commented adversely upon the inability to cut, copy, and paste text from the case analyses into their own written submissions. These facilities were intentionally disabled by the researcher. Students are required to translate the information offered by the case analyses using their own words, to understand and interpret the information presented, and not simply copy sections of the retrieved case analyses verbatim.

- Information, case numbers, and feeling of control.

Several students felt that they were not in control of the progress through the retrieval process, and requested that the retrieval tool contain more cases so that all links could be active. If fully populated, the case library has the potential to store case numbers running into millions. Time precluded the preparation of so many cases. The tool is a prototype, testing the principle of ethical case retrieval. Students did not appear to understand this.

Navigation through a hypertext site is often difficult (McDonald and Stevenson 1996, pp.61-62). Mental models of the site are easily confused. The system was designed to rely heavily on the 'Back' button enabling students to adopt a more exploratory style of use. Cockburn, McKenzie, and JasonSmith (2002, p.397) note that few ICT users appear to understand the action of the 'Back' button. The retrieval tool was later modified to include a 'Return to previous page' option. Paradoxically, this also may create difficulties by adding to the complexity of the browsing algorithm.

- Intuitiveness and instructional documentation.

A number of students requested printed documentation for the use of the tool. This was surprising, as the tool is simply a linked hypertext decision tree. Most Internet sites follow the same pattern, but do not have any form of user instruction. The tool was designed as a 'walk-up and use' system. It should not require extensive documentation for its use.

Despite the adverse comments made by some students, others found the system intuitive, easy to use, and helpful in their own scenario evaluation.

6.6.5 The Retrieval Tool Acceptability

Observations of Appendices K2 and K3 suggest that the interface has successfully reduced to reasonable limits the usability concerns of students. Generally, most elements of the tool seem to be acceptable to students. Many issues obtained a 90% or higher satisfaction level following the revision of the interface. Some issues attained a 100% satisfaction score from the two Kuala Lumpur cohorts and the W1 cohort. Only the W2 cohort did not return a maximum satisfaction score on any issue, but its responses were in a narrow band between the limits of 89-99%.

The issue of screen clutter, aimed mainly at the multiple-choice screens, was much reduced by the modifications carried out to the interface. However, it still shows a slightly lower acceptance than most of the other factors in the usability evaluation. This is a difficult problem to overcome whilst still keeping the operation of the interface simple.

Students will not use the tool unless they find it intuitive and enjoyable. These criteria were given satisfaction scores of 90% or higher by all groups. These two criteria can thus be used as the primary measure for success of the interface. Other factors measured highlight issues that are of concern to students, but are of a lower level of importance.

It is difficult to increase the levels of acceptability to students to levels beyond those achieved by the revisions already made. The different preferences of individual students will always have some influence on satisfaction levels that will be impossible to eliminate. Furthermore, the global mobility of students makes it impossible to forecast the ethnic mix of students using the tool. The tool is thus considered acceptable in its existing format to investigate the change in ethical perceptions of a wide range of students.

6.7 The Apparent Effects of the Retrieval Tool on Students' Ethical Awareness

The ethical awareness questionnaire seeks 'Yes' or 'No' responses to questions concerning the student's attitude to the given case study. The KL1 and W1 cohorts both used the same case

study for assessment and evaluation. The W2 and KL2 cohorts used a different case study,²⁷ very similar in content, but with a slightly different emphasis on some of the issues raised. It is expected that, because of the similarity of the case studies, there will be some general agreement in the ethical responses to the questionnaire. However, the differences in the case studies preclude direct comparisons of the cohorts having the same cultural background.

Comparison of the student's 'before' and 'after' responses indicates whether any change has taken place in perception of the ethical issues raised by the given case study. It cannot be claimed that all changes in students' ethical values are exclusively the result of the use of the retrieval tool. However, the aim of the tool is to stimulate discussion amongst the students, and to allow them to reflect and review their previously held ethical convictions. Consequently, the general trend of any changes may be attributed, either directly or indirectly, to the influence of the retrieval tool. The following observations address the issues raised by the approach described above.

6.7.1 Students Who Changed Their Ethical Viewpoint

Appendices M and N show in tabular form the change in responses of all the cohorts using the revised case retrieval tool. Appendices O, P, Q and R show graphically the percentage of change in responses to all the questions for each student in the cohort following the use of the retrieval tool.

- Appendix O illustrates that three KL1 respondents (12%) did not change any of their initial responses after using the case retrieval tool. A further three changed less than 10% of their initial judgements. Thus, six from 25 students (24%) showed a high degree of consistency when subjected to a re-test of their ethical perceptions.
- Appendix P illustrates that one student in the W1 cohort (2.3%) did not change any responses. A further five students (11.3%) changed less than 10% of their responses.

²⁷ Different cases were used for two reasons: firstly to eliminate any temptation towards plagiarism, and secondly, to test and demonstrate the retrieval tool effectiveness and acceptability in cases that were broadly similar but had slightly different emphasis on some of the ethical issues raised.

- Appendix Q illustrates that one of the KL2 cohort (2.5%) made no change in any response. Two further students (5%) changed less than 10% of their responses.
- Appendix R illustrates that all students in the W2 cohort changed some of their responses. Five students (17.2%) changed less than 10% of their responses.

The number of students changing some of their responses was thus very high. One hundred and thirteen students from a total of one hundred and eighteen (95.76%) changed some of their ethical opinions during the test.

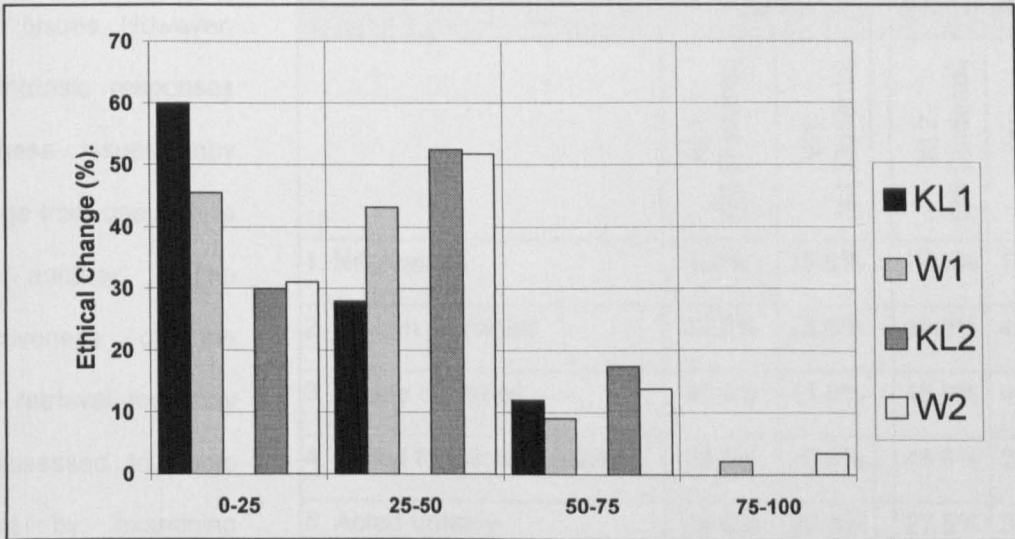


Figure 6.3 - Quartile Response Analysis

The responses of student cohorts by quartile bands are shown in Figure 6.3. Most students made the most changes in the lower quartile bands. Only students in W1 and W2 cohorts made changes of more than 75% of their responses. This suggests that the UK cohorts were more influenced by extrinsic factors when identifying and considering ethical issues. The Malaysian students appear to resist influences that attempt to change their intrinsic ethical values. This would tend to support the evidence of Hofstede (1984). Asian cultures tend to resist influences that seek to change the established order or destroy a recognised social, family or team hierarchy, reflecting Hofstede's power distance and uncertainty avoidance dimension values.

6.7.2 Issues Causing Most Change in Ethical Viewpoint

The issues of promises, agreements, trust, fairness, and loyalty are common to most human-human exchanges. The case scenarios, shown in Appendix S, and Appendix T, raise very similar ethical issues of business transactions that depend heavily upon ethical principles. A discussion and summary of the main principles involved appears in Appendix U. The questions

in the interface of the retrieval tool reflect these issues. However, the intrinsic responses to these issues may change from one culture to another. The effectiveness of the case retrieval tool may be assessed to some extent by examining how much the responses to the interface questions change upon comparison of the responses of students before and after the use

of the tool. The higher the score, the greater is the change in ethical perception. Table 6.4 illustrates the total changes in responses for all cohorts.

Appendices V1 and V2 show graphically the levels of change in student perception of ethical issues created by comparison of the responses before and after the use of the tool.

	Sam Business Systems v Hedley		Metcalf Assessors v Wharnecliffe	
	KL1 (25 Students)	W1 (44 Students)	KL2 (40 Students)	W2 (29 Students)
1. Negligence	8.0%	15.9%	17.5%	17.2%
2. Broken promises	32.0%	25.0%	35.0%	41.4%
3. Abuse of power	40.0%	31.8%	45.0%	44.8%
4. Failed to follow guidelines	28.0%	29.5%	45.0%	27.6%
5. Acted unfairly	24.0%	29.5%	27.5%	34.5%
6. Caused harm	32.0%	34.1%	32.5%	37.9%
7 Truthfulness	32.0%	43.2%	45.0%	44.8%
8. Loyalty to employer/client	20.0%	27.3%	35.0%	48.3%
9. Dignity and worth	16.0%	27.3%	47.5%	27.6%
10. Personal responsibility	20.0%	38.6%	57.5%	44.8%
11. Violated Golden Rule	32.0%	29.5%	32.5%	37.9%

Table 6.4 – Student Cohort Total Percentage Change in Attitude

Interestingly, the plots show a broadly similar shape for each cohort, but several issues seem to cause difficulties for some students. However, the same difficulties were not always experienced by all cohorts. Table 6.5 summarises the extent to which the groups changed their ethical responses, and shows that levels of difficulty were not similar between cohorts using the same case scenario. The general level of difficulty experienced by the KL1/W1 group was generally lower than that experienced by the KL2/W2 group.

Test Group	Scores > 30%	Scores > 40%	Scores > 50%
KL1/W1	9	2	0
KL2/W2	17	10	1

Table 6.5 – Test Groups’ Levels of Change in Ethical Responses

This would tend to suggest that the KL2/W2 group were more influenced by the use of the retrieval tool, and were less firm in their original ethical opinions. However, it might also be argued that the marked difference between the two groups’ results might be due to the different case scenarios used. This is unlikely as the scenarios were chosen for their similarity.

The areas of greatest change in each test group appeared to be the issues of fidelity, abuse of power, truthfulness, and personal responsibility. These issues are closely related to Hofstede’s concept of power distance. It would be expected that the Malaysian students might experience a different perspective on these issues, and that the retrieval tool would exert greater influence upon their perceptions than upon the opinions of the UK cohorts. However, this does not appear to be the case. Students from both cultures appear to experience uncertainty about the same issues. This would tend to suggest that Hofstede’s hypotheses upon national and cultural traits are not well founded for these groups. The suggestions of Triandis, that there is a trend towards a universal ethic, may be more appropriate in this context.

The general level of change recorded would also tend to suggest that the use of the retrieval tool has affected the perceptions of all students. The lowest level of change recorded for any cohort was 8% (KL1 for negligence), and the highest was 57% (KL2 for personal responsibility). Twenty-six cohort scores from a possible forty-four exceeded a change value of 30%. This would appear to confirm the findings of Calluzzo and Cante (2004, p.301) that many students have misconceptions about, or fail to recognise what represents ethical and unethical

behaviour. Students presumably would only later change their views if they were open to the possibility that they had initial misconceptions.

6.8 The Direction of Change in Response

Examination of the student responses to the survey questionnaire allowed the determination of the direction of change in the student's ethical opinion. Some change in student response might be natural random variation and inconsistency, resulting in random errors (Greenfield 1996, p.228). It is unlikely that students would repeat exactly the responses, even for a short questionnaire, if re-tested soon afterwards. It is difficult to eliminate this error from the survey results. However, for this research, a large change in either direction of response (i.e. 'Yes' to 'No', or vice versa) was taken to mean that students had given further thought to the ethical issue posed by the questionnaire. Furthermore, the direction of change was also of interest.

6.8.1 Responses Changing From 'No' to 'Yes' (By Case Scenario)

The response changing from 'No' to 'Yes' might reveal the fact that a student had failed upon initial consideration of the scenario to recognise that an ethical issue was being presented. Appendices W1 and W2 illustrate the responses of students in each cohort who changed from 'No' to 'Yes'.

The values of change levels are shown for the KL1/W1 group in tabular form in Table 6.6, and graphically in Appendix W1. Despite some 'crossover', the general shapes of the plots are very similar. This

No to Yes	KL1 (25 Students)	W1 (44 Students)	KL1/W1 Difference
1. Negligence	4%	9%	5%
2. Broken promises	28%	25%	3%
3. Abuse of power	28%	25%	3%
4. Failed to follow guidelines	20%	18%	2%
5. Acted unfairly	12%	16%	4%
6. Caused harm	8%	18%	10%
7 Truthfulness	24%	25%	1%
8. Loyalty to employer/client	20%	23%	3%
9. Dignity and worth	12%	20%	8%
10. Personal responsibility	16%	11%	5%
11. Violated Golden Rule	8%	20%	12%

Table 6.6 – 'No' to 'Yes' Variation Between Cohorts by Ethical Issue (Scenario One)

tends to suggest that the ethical stance of each cohort was similar, and that they found problems on, or were influenced in their ethical perception by the many of the same issues. Eight of the eleven issues addressed by the KL1 and the W1 cohorts were within a 5% difference limit. In addition, the level of the scores is important. Both cohorts changed their views on the identification of broken promises, abuse of power, truthfulness, and loyalty to employer or client. The absolute scores for these issues were all above 20%, suggesting that some students did not fully recognise the presence of ethical issues before using the retrieval tool. The issues addressed are important points in the formation and fulfilment of a contract, and are to be expected for a case scenario addressing contractual disputes. These are discussed in more detail in Appendix U. This suggests that these issues are difficult to recognise for around a quarter of each cohort when presented in an ethical scenario, regardless of students' cultural background.

Divergence between cohorts was most evident in the issues of causing harm, dignity and worth, and violation of the Golden Rule. The divergence upon the issue of harm might be attributable to the more rigid power distance approach to be expected of the KL1 and KL2 cohorts. Indeed, this issue was one of the three upon which they made least change. The W1 cohort, however, appeared much more malleable to this issue. A similar situation exists for the issue of violation of the Golden Rule, and to dignity and worth. The KL1 and KL2 cohorts might be expected to apply the Confucian principles to these issues, and thus accept that one's position in society may result in unfavourable treatment.

The issue of negligence showed both a low absolute score and low difference. This might indicate that the students who took part feel that they understand the concept and implications of negligence.

A similar comparison for the KL2/W2 group, using of the second scenario, is shown in Appendix W2. This shows some measure of similarity for each cohort, but is not so close as the W1/KL1 plot. Table 6.7 overleaf shows those issues that display close (up to 5% difference) agreement between cohorts. These include broken promises, abuse of power, acting unfairly, truthfulness, and personal responsibility. The absolute scores for each of these issues are high, all being

greater than 20% in each cohort. There thus appears to be an agreement between the cohorts using the different scenarios that broken promises, abuse of power, and truthfulness are areas that cause uncertainty, and that similar percentages of students in each cohort found difficulty with them.

In the W2/KL2 pair, the focus has changed in that the issue of loyalty to employer/client no longer causes problems for the KL2 cohort, but seems a problem for the W2 cohort. Acting unfairly, and personal responsibility are included as additional issues of concern by the W2/KL2 group perhaps due to the different nature of the cases that they were studying.

Those issues causing the most divergence between the KL2 and W2

cohorts are causing harm, loyalty to employer/client and violation of the Golden Rule. These differ by up to 24%. In each case, the W2 cohort appeared to have more difficulty in recognising that there was an issue in the case scenario affected by these ethical principles.

Negligence appears to be the issue that causes least problems for all cohorts. Dignity and worth causes problems for some students, and appears to affect the same percentage of each cohort.

Appendices W1, W2, and Tables 6.6 and 6.7 illustrate that the levels of change for several issues were very similar between cohorts. The scores for each pair of cohorts for each case scenario showed considerable similarity for broken promises, abuse of power, and truthfulness, all showing absolute values of between 23% and 34%. These results tend to cast some doubt upon the suggestions of Hofstede that differences can be identified between members of

No to Yes	KL2 (40 Students)	W2 (29 Students)	KL2/W2 Difference
1. Negligence	13%	3%	9%
2. Broken promises	23%	28%	5%
3. Abuse of power	30%	34%	4%
4. Failed to follow guidelines	18%	10%	7%
5. Acted unfairly	23%	21%	2%
6. Caused harm	15%	28%	13%
7 Truthfulness	25%	21%	4%
8. Loyalty to employer/client	8%	31%	24%
9. Dignity and worth	17%	17%	0%
10. Personal responsibility	25%	28%	3%
11. Violated Golden Rule	3%	21%	18%

Table 6.7 – 'No' to 'Yes' Variation Between Cohorts by Ethical Issue (Scenario Two)

different cultures when addressing similar social scenarios perhaps for the reasons given by Triandis.

6.8.2 Responses Changing from 'Yes' to 'No' (By Case Scenario)

A change from 'Yes' to 'No' suggests that students changed their perception of the ethical issue following consideration of the analogous case. This direction of change would suggest either that the ethical issue under consideration was misconceived, or the student has chosen to change his or her opinion in the light of the information presented by the analogous case.

Table 6.8 displays the data values of each issue for the KL1/W1 group. Appendix X1 shows that there is a very similar shape to the plot for each cohort using the same case study. Seven of the eleven issues showed close agreement between the cohorts in absolute scores. Most of the absolute values were low, indicating that few students changed their responses in the 'Yes' to 'No' direction. This might suggest

Yes to No	KL1 (25 Students)	W1 (44 Students)	KL1/W1 Difference
1. Negligence	4%	7%	3%
2. Broken promises	4%	0%	4%
3. Abuse of power	12%	7%	5%
4. Failed to follow guidelines	8%	11%	3%
5. Acted unfairly	12%	14%	2%
6. Caused harm	24%	16%	8%
7 Truthfulness	8%	18%	10%
8. Loyalty to employer/client	0%	5%	5%
9. Dignity and worth	4%	7%	3%
10. Personal responsibility	4%	27%	23%
11. Violated Golden Rule	24%	9%	15%

Table 6.8 - 'Yes' to 'No' Variation Between Cohorts by Ethical Issue (Scenario One)

that they felt they had correctly identified that an issue existed, and had adequately addressed the issue without the need for additional input from the case retrieval tool.

However, four issues were outside the 5% similarity limit. Of these, harm, and violation of the Golden Rule showed KL1 student responses indicating changes of 20% or more. The W1 cohort, however, showed a change of 27% in their response to the issue of personal responsibility. This tends to support the suggestion of Calluzzo and Cante (2004, p.301) that

students have difficulty in determining what is acceptable behaviour in the workplace, and need guidance to clarify their ethical perceptions and awareness.

Table 6.9 displays the data values of each issue for the KL2/W2 group. Appendix X2 displays the plot for the KL2/W2 cohorts. The pattern displayed does not show any high degree of similarity between the responses of the two cohorts. Several points have similar absolute values for each cohort, but these are far fewer in number than for the KL1/W1 cohorts.

Five of the ethical issues, following guidelines (loyalty to employer/client, dignity and worth, personal responsibility, and violation of the Golden Rule) show absolute values of more than 28% change in responses.

Yes to No	KL2 (40 Students)	W2 (29 Students)	KL2/W2 Difference
1. Negligence	5%	14%	9%
2. Broken promises	13%	14%	1%
3. Abuse of power	15%	10%	5%
4. Failed to follow guidelines	28%	17%	10%
5. Acted unfairly	5%	14%	9%
6. Caused harm	18%	10%	7%
7 Truthfulness	20%	24%	4%
8. Loyalty to employer/client	28%	17%	10%
9. Dignity and worth	30%	10%	20%
10. Personal responsibility	33%	17%	15%
11. Violated Golden Rule	30%	17%	13%

Table 6.9 - 'Yes' to 'No' Variation Between Cohorts by Ethical Issue (Scenario Two)

Furthermore, all the high scores are made by KL2 students. This would tend to indicate that the KL2 cohort was unsure of the ethical implications of these issues in their given case scenario. This tends to support the suggestion of Grodzinsky (2000, p.4) that the inexperience of young people causes difficulty in understanding that the application of information and computing technology brings with it a personal responsibility. However, Peppas (2002, p.48) notes that in some cultures, there appears to be a significant relationship between ethical standards and work experience. Furthermore, cultures may prioritise similar values differently (Peppas 2002, p.44).

In summary, there appears to be no conclusive evidence to support either the suggestions of Triandis or Hofstede. The issues that caused students to change their ethical viewpoint were not consistent. The levels of change varied between cohorts and by case scenario. While a

certain amount of random change might be expected, it is evident that in all cohorts there is a substantial change in students' ethical opinions. The retrieval tool therefore appears to be stimulating discussion and reconsideration of the issues posed by the retrieval tool and the case analyses, and thus appears to be meeting its primary objective.

6.8.3 Difficulty in Analysis of Scenarios after Using the Retrieval Tool

The final question of the ethical awareness survey asked students whether the first eleven questions were easy to answer. This question was posed for both the pre- and post- retrieval tool use. The change in response provides an indication of the effectiveness of the retrieval tool in changing student ethical awareness.

Appendix Y shows graphically the results of the student responses addressing the ease of answering the questions in the ethical analysis questionnaire. The responses from all cohorts suggest that, for the KL1, KL2, and W1 cohorts, the retrieval tool has made it generally easier for more students to address the ethical issues raised by the test scenario. The W1 cohort change was particularly striking, showing a 50% move towards the 'easier to answer' category compared to a 2% move towards the 'more difficult' category.

The 'No change' category shows that the W1 cohort, using the first test case, appear to be influenced by 22 percentage points more than the corresponding KL1 cohort by the use of the tool. However, the tool appears to prompt a change in ethical awareness of 28% or more in all cohorts, making the questions appear either harder or easier to answer.

The reason for the influence being exerted over the students is unclear. The figures in Table 6.10 indicate student responses changing in both directions. Consequently, some students found the questions easier to answer ('No' responses changed to 'Yes') following use of the case retrieval tool whilst others found the questions more difficult ('Yes' responses changed to 'No'). Several reasons might be advanced for the change.

Cohort	Easier	Harder	No Change
KL1	24%	16%	60%
W1	50%	2%	48%
KL2	15%	13%	72%
W2	14%	21%	65%

Table 6.10: Difficulty in Responding to Questionnaire After Using Retrieval Tool

- A change from 'No' to 'Yes' could indicate that the tool genuinely helped with the understanding and interpretation of the ethical issues involved.
- A change from 'Yes' to 'No' might indicate a realisation that the case was more complex and difficult than had at first been perceived.
- A change from 'Yes' to 'No' might indicate that the ethical concepts themselves appeared more complex after the use of the case retrieval tool had explained the implications of the issues for the suitable analogous case from the case library.
- A change from 'Yes' to 'No' might indicate that the tool had merely confused the students. However, this is not confirmed by students' comments relating to the use of the tool.
- The higher level of change by the Kuala Lumpur students could be due to Malaysian culture and learning style. The presentation of a model for ethical analysis would approach the Malaysian students' expectation of being given a 'correct' answer. They might subsequently be able to reproduce many of the points made in the analysis of the analogous case for their own scenario analysis. However, it is interesting to note that the 'cut', 'paste' and 'print' facilities in the case retrieval tool were disabled, but the adverse comments about this did not arise from the Kuala Lumpur students.

It must be emphasised that there is no obligation for a student to change his or her ethical views. If students do have strong ethical beliefs, and/or have carried out the initial analysis of the test scenario well, it is possible that no change will be necessary. In such a situation, the case retrieval tool should support the ethical stance of the student. It may have made the issues being addressed more understandable and empathetic with the issues raised in the test scenario.

6.9 Conclusions upon the Apparent Effects of the Case Retrieval Tool

Ethics is a dynamic, problematic concept, ill-defined, and constantly evolving to meet the new challenges presented by the changes in world order (Simpson 2000). This will inevitably generate new, hitherto unsolved problems and dilemmas. Furthermore, there is no universal concept of what is 'good' ethics, although some ethical principles appear to assume a trans-national or trans-cultural status, making them almost universal (Blackman and Leake 2000).

However, none can claim to be fully accepted by all sections of human society. Students will inevitably differ in some nuances of their ethical views.

Equally, there is no universal model for human-computer interaction. It was suspected that the issues, identified in Figure 6.1, that impinge on ethical and cultural views might markedly affect students' perception of the usefulness and usability of the retrieval tool. Tractinsky, Katz, and Ikar (2000) note that what is beautiful is usable.²⁸ However, beauty is subjective, and depends strongly upon one's personal perception and culture. Tractinsky, Katz, and Ikar comment that accentuating an artefact's form may serve to promote the social (and perhaps the cultural) needs of the user. Yet, there is little literature upon the aesthetic requirements for interface design. Tractinsky, Katz, and Ikar (2000, p.128) observe that

“..the field of human-computer interaction appears to stress the prominence of usability over aesthetics..... Even when classical elements of aesthetics - such as screen design and graphics - are dealt with, they are mostly analyzed in terms of their effects on human information processing rather than on human affect and experience.”

The retrieval tool has shown that it can retrieve from the case library a case, based on the information provided by the student, that provides useful support. It is quite likely that different students will cause the tool to retrieve different 'analogous' cases for the same test case. It is understandable that some students who have been brought up in an environment of strong ethical values will attempt to cling to those values that they understand and cherish. It is almost inevitable that they will resist attempts to move their ethical awareness into fuzzy, uncertain areas.

Literature suggests that the Kuala Lumpur cohorts might be expected to adopt a different ethical and cultural stance from the Wolverhampton cohorts who were more heavily exposed to western culture and ethical influences. The results suggest that:

- The effects of culture appear to be present in the students' responses, but the effect appears to be limited.

²⁸ A long-held maxim within the engineering profession also states that “If it *looks* right, and it *feels* right, it probably *is* right.”

- There appears to be a tendency for a blending of cultures, particularly in the Kuala Lumpur cohorts.
- There is possibly some development towards a trans-national ICT culture.
- There is greater agreement between the Asian and Western cohorts on the 'contractual' issues posed by the survey, and less on the 'internalised' values.

Although the case library is populated with US and the UK cases, analysed from a western ethical viewpoint, the retrieval tool appears to promote deeper ethical consideration of the issues raised by students' case scenarios. The cultural mismatch does not appear to inhibit the deeper learning of the Kuala Lumpur-based students.

This tends to suggest that either the direct effect of the tool, or its indirect effect on inter-student discussion following the use of the retrieval tool, stimulates deeper consideration of the ethical issues presented by the given scenarios. This would also tend to suggest that the ethical understanding (or lack of it) in the students from different cultural backgrounds is a general problem and not limited by cultural differences. There appears to be a tendency for the adoption of an international ICT culture that will affect most people who use ICT. The case retrieval tool appears to be able to assist in addressing these issues.

Chapter 7 - Review of the Research and Conclusions

In their everyday work, those who develop and use ICT face a continuing and increasing stream of new ethical dilemmas. ICT users and professionals are constantly required to exercise judgement that cannot be identified and measured in precise mathematical terms (Huff and Martin 1995, p.75). Yet, many users fail to recognise or fully understand the implications of the ethical issues generated by ICT. The educational preparation of those who develop and use the technology requires an understanding of social, ethical and professional interactions between society and ICT. This research demonstrates a basis for the design and development of an effective system for the education of ICT users and developers so that they may be more aware of the consequences resulting from their actions.

The main aims of the research, defined in Chapter 1, were:

- The establishment of a theoretical basis for the development of a system that can address ethical scenarios involving a wide range of unethical practice in ICT.
- The design, construction, and testing of a tool, founded upon the theoretical principles developed above, to enable computing novices to assimilate knowledge drawn from a set of ethically analysed case studies contained within the retrieval tool case library.

The results achieved from the testing of the retrieval tool suggest that it is successful in its aims of raising student awareness of existing and potential ethical issues in the application of ICT to everyday tasks. It is possible to blend the precision of ICT with the fuzziness of ethics.

7.1 Contribution of the Research to the Corpus of Knowledge

The research builds on and generalises the work begun by Rahanu (1999). Rahanu's work was limited to consideration of cases of professional neglect in failed information systems projects. The retrieval tool developed by Rahanu was limited to the retrieval of appropriate analogous cases from a library of fourteen case analyses. The system was useful for retrieval within the limits of failed information systems, but was unsuitable for use within the wider gamut of ICT. The retrieval mechanism relied upon the identification of issues that were at times unclear in their relevance, and caused some confusion to the users of his retrieval tool. Furthermore,

many of the issues addressed by the retrieval vectors were specific to the success of IS projects.

The retrieval system developed as a part of this research accepts Rahanu's premise that the ICT industry has a very poor record and public perception, and should strive for higher standards of conduct and quality. It should be seeking recognised professional status, and should address ways of correcting its tarnished image. A strong contributory factor towards this aim is the examination of previous incidents, and integration of others' experiences into one's personal ethical and professional standards. Rahanu demonstrated in his research that presentation of suitable case analyses can usefully assist students in their comprehension and decision-making when facing questions of ethics associated with failed information systems. This concept may be expanded to the wider range of potential issues that might arise from the unethical deployment of ICT throughout society. A new retrieval algorithm and a revised question set necessary to formulate retrieval queries for any aspect of ICT ethics were developed as part of this research.

7.1.1 The Melding of Motivational and Ethical Theory

The effectiveness of a retrieval algorithm will depend upon the relevance of the retrieval vectors, and the ability of the user to bridge between the given scenario and the retrieved case. The use of deontological and utilitarian-based questions in the retrieval tool interface allows the tool inherently to include an element of ethics. Furthermore, the multi-faceted aspect of most ethical scenarios demands an iterative approach to the ethical analysis of a given scenario.

The model of ethical decision-making, shown in Fig. 2.11, was developed as an innovative combination of motivational and ethical theory. It combines the use of suitable ethically analysed case studies with the predictive capabilities of the Theory of Planned Behaviour (TPB) (Ajzen 1991) and the habituation effect (Ajzen 2002b) to raise the awareness of computing science students to ethical dilemmas. The Theory of Self-efficacy (Bandura 1977), Flow Theory (Csikszentmihalyi 1992), the concepts of the effects of mood from Ben-Ze'ev (2002) and Eisenberg (2000) integrate well with the TPB. Together, they provide the basis for the development of a model that can be applied to the analysis of the actions of stakeholders, and

to the learning actions expected of students when using the case retrieval tool. The model also draws upon the framework for ethical analysis developed by Kallman and Grillo (1996), and applies the principles of simplified case-based retrieval suggested by Kolodner (1993) to the interactive conversational style of learning suggested by Laurillard (2002). It thus provides the reflective element of learning identified by Moor (1985, p.268), and which is an essential part of professional practice (Friedman and Phillips 2003, p.22).

The research also demonstrates that a simple logical, largely Boolean, question set in the retrieval tool interface can effectively retrieve case analyses that are relevant to the views of students using the tool. The tool provides a stimulating and interesting environment in which learning may occur. The varying ethical standpoints from which students from diverse backgrounds and cultures approach the analysis of a given scenario are successfully addressed. It thus demonstrates sufficient flexibility to incorporate the differing cultural and social nuances of the students, and is able to incorporate additional case analyses from other cultures into the retrieval process.

7.1.2 Effective Retrieval without Using Artificial Intelligence

Most approaches to retrieving information from external sources depend on a lexical match between words in a user's query and the documents searched (Dumais 2003, p.492). Many rely upon an inherent ability to 'interpret' the information used in the retrieval process (Kolodner 1993), apply weightings to the discrete retrieval vectors (Rahanu, Davies, and Rogerson 1999, pp.5-8), or apply probabilistic techniques in the retrieval algorithm (Dumais 2003). Such techniques are questionable when retrieving ethical or legal information from a document collection. Rule-based systems frequently adopt a similar approach. Full case-based reasoner systems (Kolodner 1993) introduce an element of fuzziness, but attempt to dissect and synthesise the information contained in the case studies using AI techniques.

The use of AI techniques tends to suggest that there may be definitive solutions for the input queries to the system. These techniques, particularly when allied to CBR techniques, often attempt to 'manufacture' a precise response. The retrieval tool resulting from this research

avoids the use of artificial intelligence. It relies upon the thoughts, ethical standpoint, and learning processes of the user to establish the retrieval query.

Furthermore, the user is encouraged to explore the selected ethical domain using the browsing capabilities of the hypertext paradigm. The dynamism of the paradigm allows the formulation of dynamic queries by users that adjust the question set posed, so guiding the users through the different sequence and issues raised by the retrieval tool. By this means, the user is encouraged to reflect upon why the sequence of questions has developed, and to learn from this information.

This concept is outlined in a paper that was presented at a conference (Sherratt, Rogerson, and Fairweather 2003, pp.35-43). It was later expanded, peer reviewed, and published in a respected journal (Sherratt, Rogerson, and Fairweather 2004, pp.299-315), thus gaining general acceptance within the wider community concerned with the teaching of ethics.

7.2 The Effectiveness of the Retrieval Tool

The effectiveness of the retrieval tool can be measured by comparison with the requirements for the education of computer science students, enumerated in the ACM/IEEE-CS Joint Curriculum Task Force²⁹ recommendations (Huff and Martin 1995). The research follows closely many of the ImpactCS recommendations.

7.2.1 Adopts a Real-world, Computer Science Perspective

The tool:

- Approaches issues raised by cases from the perspective of a computer scientist, not a philosopher, or social scientist.
- Is multi-disciplinary in approach, identifying input from ethicists, historians, psychologists, and anthropologists in addition to the skills of the computer scientist and software engineer.
- Addresses practical, real life issues in computer ethics with which computer professionals and students can empathise. These are drawn from real life situations.
- Includes the detail, complexity, and multi-dimensionalism found in real world cases.

²⁹ The ImpactCS Project.

- Takes the details of the case scenarios from reliable sources.

7.2.2 Based Upon Recognised Ethical Principles

- Is founded on deontological and utilitarian ethical principles.
- Allows for different cultural perspectives and personal variations in ethical understanding.
- Is based upon widely accepted ethical and professional values – individual and professional responsibility, quality of life, abuse of power, risks and reliability, rights, privacy, equity and access, and honesty.
- Examines the social and technical content within case studies.
- Does not 'predict' or 'manufacture' a 'right' or 'acceptable' answer by analysis of cases followed by synthesis of the parts to form a 'new', custom-built case addressing hypothetical issues. This is the approach adopted by many CBR applications for other tasks and environments. However, theoretical understanding of ethics has shown that it is unsuitable for the identification and explanation of ethical issues.

7.2.3 Personal Development through Stimulation of Ethical Awareness

- Scaffolds the development of students' ethical and professional development.
- Encourages rational/logical consideration of ethical issues and illustrates the fallacy of some 'easy' approaches to ethical decision-making.
- Recognises that users' and developers' actions are not ethically value-neutral, and encourages the understanding that all who use computer technology have a personal responsibility for the way in which it is used.
- Includes ethics, social science and technology issues and recognises limitations in all areas.

7.2.4 Based Upon Accepted Psychological and Pedagogic Principles.

- Adopts a conversational approach to the elicitation of students' ethical values. It does not attempt to impose standards upon them, simply asking for factual responses from students following their study of the given case scenario.
- Stimulates self-motivated exploration, and thus supports the constructivist scaffolding concept whereby students are encouraged to conduct their own additional research into both the retrieved and presented cases.

- Encourages self-confidence and self-development.
- Recognises personal and societal motivational factors in decision making.

7.2.5 A Sound Basis for Professional Development

- Provides an expandable repository of ethically analysed case studies that address professional issues for discussion by aspiring computer professionals.
- Encourages continuing consideration and development of personal ethical awareness as required by professional institutions in their requirements for continuing professional development.
- Can handle the rapid changes in technology and social standards from the aspect of a professional computer scientist or student.

7.3 Limitations of the Retrieval Tool

In its present state of development, the retrieval tool has a number of limitations. Some can be addressed by further research and development of the tool. Others are inherent in the concept of the tool.

7.3.1 The Use of Cases and Case Analyses

The use of case studies to transfer knowledge and raise awareness is dependent upon both the supply of suitable cases and the interpretation of the cases for inclusion in the case library. Cases take considerable time to research. Furthermore, details are often difficult to ascertain, and much additional work is required to provide a full contextual background that will provide real-world realism and veracity. To address any possible deficiencies in this area, and to pre-empt any challenges to the accuracy of the information given in the case analyses, a disclaimer has been included in the tool inviting objectors to provide justification for relevant changes.

The system contains case analyses that focus primarily upon 'bad' ethical practice. Few cases are readily available that celebrate success. The researcher is thus constrained by the availability of case details. Nevertheless, in an attempt to provide balance, the analyses seek out and comment upon 'good' ethical practice. The classifications of 'good' or 'bad' practice are naturally subjective, with students from different cultural backgrounds interpreting the facts in different ways. The primary classification of the cases into good and bad relies upon the

concept of ethical hypernorms (Conger and Loch 2001, p.60). The inclusion of exemplars addressing good ethical practice is desirable if they are available. Huff and Rogerson (2005) have begun to address the issue of exemplars, but have confined their consideration to individuals rather than complete cases.

The case analyses rely upon the skill of the analyst. It is inevitable that there will be some bias in the case analyses towards the ethical standpoint of the analyst. This might be overcome to some extent by including comments by analysts from different cultures and social backgrounds.

7.3.2 System Development

The retrieval system has been designed so that the user navigates through a complex network of hypertext nodes, each containing links offering the user a choice to progress through the system. The range of choice is governed by the user's previous answers, and the issues that have been found by empirical evaluation to be relevant to the problem domain under investigation. Such a system is difficult to maintain or expand. The retrieval system constructed as part of this research is hand-built. However, it attempts to use a minimum number of nodes or questions to retrieve suitable case analyses.

Although the physical construction of the hypertext pages and nodes is reasonably simple, the paths through them are complex. The system requires careful planning and documentation if it is to be effectively expanded. Currently, the 'roadmap' design documentation is held on an Access database combined with an Excel spreadsheet, giving both progression paths and node/page numbers. However, the translation from this repository to a hypertext system is laborious and time-consuming.

The ability of hypertext systems to 'jump' from one retrieval path to another is a strength, but as the size and complexity of the case library expands it is probable that the need for cross-linking will arise. This would allow the comparison of, say, cases addressing similar ethical issues in both the US, and UK or Europe but against different legal or social backgrounds. For example, Microsoft has been subject to ethical and legal investigation in both the US and Europe. Such cross-linking will require careful consideration of the structure of the hypertext retrieval algorithm.

7.3.3 Pedagogic Issues

Not all students learn effectively from hypertext tools (Laurillard 2002, pp.118-120). The asynchronicity of the retrieval tool does not always fit well with reflective, adaptive discourse with the lecturer. The tool attempts to adopt the role of mediator, but can only do so in a passive mode. It cannot respond to all the questions raised by students. Nevertheless, this is not the aim of the tool. It seeks to stimulate discussion and self-motivated discovery. It should not attempt to replace the discursive element supplied by other human input to the learning and reflective process. It should be regarded as a catalyst or aiding system rather than a full pedagogic tool.

The tool is designed to be used by student groups, where individuals are encouraged to iterate with others in their group their consideration of the ethical issues raised by their given scenario and the retrieved case analyses. However, the tool has no intrinsic computer supported collaborative work facilities, such as e-mail or 'chat' capabilities. Students must use alternative, external means of communication with each other if the tool is to be used online.

7.3.4 Cultural Issues

The retrieval tool was developed using the English language, and draws upon ethical cases from the English-speaking world. English is a rich but complex language. Some students have difficulty with the expressions and the semanticity of some of the language used. The language used in the retrieval tool interface was revised following the comments of the pilot group. Some textual information on the retrieval screens was modified to make it more comprehensible to those students who did not have English as their first language. Interestingly, few students who took part in the final testing of the tool reported difficulty with the use of English. However, most students who used the tool already have a reasonable grasp of English, promoted by the strong US influence in ICT throughout the world. However, those who do not have this advantage could find some difficulty with the use of the interface.

Similar comments can be made concerning the case analyses. It is necessary to provide enough background information to imbue the cases with sufficient richness to make them interesting, and to demonstrate their relevance to the issues that the students may experience

in their workplace. However, students still have to identify the salient issues, and map them to their own experiences. This is always difficult in a foreign tongue. The case analyses are limited to areas where 'western' laws and societal norms prevail. Perhaps this facet is a difficult area for foreign students to comprehend, although this issue was not raised by students in their usability comments.

7.4 Opportunities for Further Research and Development

Good research frequently poses more questions than it answers. It is rare for a research investigation to reach full closure. Such is the situation with this research. The retrieval tool is intended to prove the principle that a system can be developed that will stimulate students in their consideration of ethical issues within given cases of unethical and illegal practice. In its present form, it is not intended to be a commercially available product. It requires much further work to improve some of the issues identified in 7.3 above, and the expansion of the issues that it can address. Some interesting and relevant areas for further research are described below.

7.4.1 Development of the Retrieval Tool to Run on Other Platforms

The retrieval tool and its case library have been developed using Hypertext Markup Language (HTML). This provided a 'quick and dirty' method to develop screens, and to link them in an integrated system. It allowed changes to be incorporated accurately and rapidly as the system evolved. For convenience of distribution to students, the system was compiled into one executable file, available for either downloading onto students' own computers or for direct access over an Internet connection. However, operation over the Internet is slow. Furthermore, the executable file requires Microsoft Windows 95 or later, and Internet Explorer 4 or later to be available on students' machines before the executable can be run. The system should be ported to an alternative platform that will allow it to function under other operating systems.

7.4.2 Expansion of the Case Library

A major restriction in the usefulness of the retrieval tool is the present size and scope of the case library. The legal reporting systems, and the freedom of the news media to report ethical violations provide a rich source of cases in the more liberal nations of the Western world. However, sources are more limited in many of the totalitarian, restrictive regimes throughout the

world. The case library and retrieval system have been designed so that they can be expanded to accept and retrieve case data from any source. Furthermore, the system needs a critical mass of cases within any discrete problem domain before it will function effectively. For full effectiveness, the critical mass must consist of cases from both a specific country and the identified ethical issue. The paucity of reports upon legal or ethical issues from some countries means that the tool will never adequately address ethical issues in all nations. However, this should not preclude the development of the case library for those nations whose ethical standards can be assessed, and who openly report violations of them.

In their evaluation of the retrieval tool, several students suggested that the number of cases in the case library should be increased so that the decision tree for all the identified ethical issues should be populated with cases. They also suggested that the branches of the decision tree for each ethical issue should be fully populated. Their sentiments are supported, but two issues have precluded the fulfilment of these suggestions.

- The time needed to research, draft, analyse, and include the case details in the case library is significant. Major cases in the 'contractual issues' strand of the case library can take months to research and draft. Verification of sources is often difficult, and many sources such as newspapers or journals charge for access to their archives.
- As described above, a critical mass of cases is required before the system functions effectively. However, sufficient cases are not always available for inclusion in the case library. Some branches of the decision tree will inevitably remain unfilled until suitable cases occur to meet the criteria necessary for inclusion in the decision tree.

7.4.3 Greater Internationalisation

Literature reveals that there is some uncertainty concerning whether cultural identities have any effect upon students' perception of software usability. Little research has been done on, for example, the use of colour. The main work upon this issue that appears relevant to this research is that by Barber and Badre (1998) and Badre (2001). However, their work is general in application, and fails to focus in sufficient detail on individual cultural preferences. Colour is a

particularly difficult issue to address. It is often assumed that colour conventions³⁰ are universally accepted. This is not so. Dix et al. (2004, p.392) note that, in addition to representing danger in the Anglo-US culture, red can represent life in Indian cultures, happiness in China, and royalty in France. Similar diversity of meaning is evident for other culture/colour combinations.

The effect of surveying a wide diversity of students using questionnaires is also an area of some uncertainty. Although the language of the question set in the retrieval tool interface was selected to be as clear as possible, there will undoubtedly be some difference of semantic interpretation by students of differing cultural and ethnic backgrounds. It is possible that further investigation of linguistic issues could improve the overall effectiveness of the retrieval tool.

There also appears to be some evidence that there is a 'levelling out' of cultures for the use of ICT across the world (De Vijver and Phalet 2004, pp.216-217), and that a 'culture within a culture' phenomenon is being created. The economic power of the US and its global corporations appears to form the basis for this development. Del Galdo (1996, p.81) pointedly observes that the US educational system follows the national trait, and pays scant attention to the standards of other nations.

Societies seem to recognise the need for cross-cultural consideration in business and commerce. The evidence from this research tends to support this view, but it should be investigated in greater depth. This will require a greater volume of personal detail to be gathered from those students who take part in the research so that a full profile³¹ can be created for each. This presents problems with the present UK approach to research on human subjects, especially where the research instrument is administered by lecturers on data subjects who are their students.³²

³⁰ E.g. red representing danger, or green representing safety.

³¹ Culture, religion, educational level, age, gender, etc.

³² See section 6.3 and footnote 26.

The lack of universal coverage, and paucity of cases from regimes that are less open in the information and freedom of their citizens, appears at first to be a severe limitation to the use of the tool by students from the more closed regimes. However, experience with the tool, even in its present state of development, suggests that the use of 'Western' case scenarios and analyses still provokes much thought and discussion even amongst students from less open regimes. Students' ethical awareness is stimulated regardless of their cultural and ethnic background. This is perhaps the result of the use of ICT being driven by the present economic might of the United States, and the desire of other states to share in the prosperity that attachment to the US model brings. The overall effect of the tool on students from these regimes would be an interesting area for further investigation.

Expansion of the case library to include analyses from different cultural viewpoints would add greatly to the richness and acceptability of the tool. Hoft (1996, pp.41-72) notes the need to be aware of cultural differences and requirements when designing software interfaces. Similar requirements apply to the contents of the case library in this research. Many apparently homogeneous societies are, in fact, often multi-cultural, multi-religious, or multi-ethnic in their composition. This phenomenon was noted in both the Malaysian and UK cohorts in this research.

The case library includes a discrete branch that addresses privacy issues in the US. A further avenue of research might be to subject a cohort from the US, where there is possibly an even greater mix of ethnic and cultural groups, to the retrieval tool. Comparison of test results from those students with results obtained from the UK and Malaysian cohorts could provide further data upon the efficacy of the retrieval tool.

The use of the retrieval tool by the transient population of students in today's world will bring it into direct contact with many cultural and ethnic groups, each having its own ethical, legal and sociological viewpoints. The development of a tool that will affect an individual's perception and attitude towards an ethical dilemma will doubtless require consideration of the various psychological phenomena that make up an individual's personality. Many psychological

phenomena are discrete research areas in their own right, and are yet not clearly understood. They have been incorporated in the theoretical design and construction of the retrieval tool because they appeared to show a degree of support for the principles and functioning of the tool. Although several of these issues are still under active investigation by others, this does not preclude their investigation as an extension to this research. Several of these are outlined in the following sections.

7.4.4 Possible Development of the Retrieval Tool as an E-learning System.

The expansion of higher education in the UK has caused difficulties in addressing the problems raised by the numbers of students who need to receive instruction and guidance from a limited number of available lecturers. Human face-to-face mediation between student and lecturer is expensive, and, whilst most desirable, is not always possible. It is difficult to find staff sufficiently experienced and willing to teach the application of ethical principles. The retrieval tool in its present form seeks to supplement face-to-face mediation in a manner acceptable to students, and is able to operate in an asynchronous mode. However, the introduction of the asynchronous mode through the individual's use of the tool, combined with supplemental input from peers and lecturer, still imposes a substantial burden on the lecturer.

It is possible, therefore, that the tool might be further developed to allow students to study with a minimum of input from lecturers. However, this development would be approaching the mediation of ethical awareness from an e-learning standpoint. There is some doubt about the ability of students to modify their ethical views when working in total isolation. Most e-learning systems retain an element of human mediation. For example, the UK Open University requires students to attend tutorials with lecturers on a regular, usually monthly, basis. E-learning is a vibrant and evolving area of research. However, at present little guidance is available for the development of effective e-learning systems, particularly those that seek to affect an individual's personal ethical awareness.

Development of the tool as an e-learning system would provide a number of benefits. Most importantly, it would reduce the demand upon the university in terms of lecturers' time and costs. It would also encourage the possibility that cases and case analyses could be researched

and analysed by a number of lecturers/researchers working as a team. The development effort is then pooled. Cases can be gathered from differing cultural and ethnic backgrounds, and can be used by all students, thus increasing students' awareness of other cultural and ethnic viewpoints. It also provides more flexibility for students to plan their use of the tool at a time and place of their choosing. However, the possible development of the tool as an e-learning system will require the resolution of a number of issues.

At present, the tool does not include any instruction on basic ethical theory. It assumes that students will obtain this from other sources. If the tool is to be used as a discrete ethics teaching tool, basic ethical theory will need to be embedded within the tool, and made available to students as required. It may also be necessary to reconsider the template used for the analysis of the cases, and the content of the analyses themselves. Furthermore, ethical theory is often complex, contradictory, and difficult to understand. However, that is not a reason to prevent research being carried out into a development that will allow discrete student study. Nevertheless, it will require a firm commitment on the part of the student to undertake additional personal research and contemplation on issues presently covered by lecturer input. Careful consideration will be required of the personal psychological phenomena that prompt student consideration and deeper learning, and that lead to a state of flow.

7.4.5 Attaining Flow.

Flow seems to belong naturally in the field of psychology, integrating almost seamlessly into daily life. Education was one of the first areas identified where flow theory was thought to be useful in explaining students' engagement with their pedagogic tasks (Csikszentmihalyi 1988, p.11-12). The emergence of online education presents the challenge of designing learning tasks to engage and to keep students' attention throughout the duration of their assignments (Pearce, Ainley, and Howard 2005, p.745). It can also have a marked effect upon students' sense of self-esteem and happiness (Csikszentmihalyi 1988, p.10).

A person in a state of flow should be able to function at their best (Larson 1988, p.150). Chen (2004 p.223) cites work by Maslow (1968, 1971) suggesting that flow may lead to peak performance and self-actualisation. It might therefore be expected that more learning

motivation, positive learning behaviour, creativity, and self-esteem would be evident in a person who frequently experiences flow symptoms. Chen (2004, p.221) comments that users experiencing a state of flow in their on line activities achieve positive feelings and greater self-efficacy.

Flow is a phenomenon that is not easily achieved. Furthermore, Finneran and Zhang (2003, p.476) argue that computer-mediated environments such as teaching programs present a unique context and add a level of complexity to a person's on-line activity. Flow theory should be carefully re-assessed before it is directly adopted.

These observations would suggest that the attainment of a state of flow is highly desirable in a pedagogic program if students are to achieve their maximum learning potential. Nevertheless, care should be exercised in the construction and content of the program. Importantly, Hedman and Sharafi (2004, p.144) suggest that hedonic elements contribute to the attainment of flow.

Hassenzahl et al. (2000, p.2002) raise a similar concept and state:

"What is needed is an expanded concept of usability which adopts enjoyment and satisfaction of the user as the major design goal. Obviously, in a work context designing for efficiency and effectiveness (i.e. traditional usability) will be still a valuable way to reach the goal. Nevertheless, something should be added which makes the software system interesting, novel, surprising etc. Being both usable and interesting, a software system might be regarded as appealing and as a consequence the user may enjoy using it. Such an expanded perspective on usability would take us a step further toward designing *user experiences* instead of merely making a software usable."

The comments of Hassenzahl et al. seem to imply a strong leaning towards the achievement of a state of flow. It would therefore seem relevant to establish whether students using the case retrieval tool were successful in reaching a state of flow, and whether any issues can be identified that might prompt and enhance the attainment of this state.

It would also be of considerable interest, both from the development of a discrete personal learning program and from an ethical standpoint, to establish whether the state of flow, if achieved, was affected by the isolation experienced by the student. Ethics develops from interactions with others. Loch and Conger (1996, pp.76-77) suggest that the solitary computer user may enter a state of deindividuation. This phenomenon may lead to a sense of being estranged from others, creating a belief that one does not necessarily have to follow social conventions or established norms of behaviour under these circumstances. This aspect mirrors

the suggestion of Bandura (2001, p.1), that self-reflectiveness about one's capabilities, quality of functioning, and the meaning and purpose of one's life pursuits are important elements in assessing ones' attitude towards life's goals.

Deindividuation can distort one's perspective of the world, causing one to accept the temptation to commit unethical actions. This reveals itself in the stereotypical concept of the 'computer geek', who is often regarded as a societal outcast because of unacceptable habits, attitudes, and behaviour (see section 2.5.7).

The responses obtained from students upon flow attainment might present a succession of further issues for research that depend upon the psychological issues embodied in the retrieval tool.

7.4.6 Psychological Phenomena Affecting the Efficacy of the Retrieval Tool.

A major aim of the retrieval tool is to stimulate students' identification of and reflection on real-world issues involving ethical dilemmas. Responses from the students who tested the tool tend to suggest that these goals have been largely achieved. However, it is important that this recognition and self-reflection should become an inherent part of an individual's persona. It is expected that the attainment of a state of flow will lead to an increase in a sense of self-efficacy. This should prompt the student to reach a high level of confidence in recognising and assessing actions of dubious ethicality. The recognition of and reflection upon ethical issues should become habitual. The habituation is then carried over into students' lives, particularly at work. Although many students reported that they enjoyed using the retrieval tool, there is no direct evidence that either a state of flow has been reached, that self-efficacy has improved, or that the identification and reflective process has become habitual. Csikszentmihalyi (1988, p.34) notes that " This tendency to repeat the flow experience is the emergent teleonomy of the self....Those activities and experiences that are most enjoyable will have a greater chance of being remembered and built into the memory-storage of the culture." Consequently, there appears to be a link between the attainment of flow and culture. There is a need to investigate these issues further.

The 'teleonomy of the self' appears to have strong similarity to the 'ethical self' described in section 2.5.1. This suggests that individuals will develop a personalised approach to issues upon which they feel strongly, and which are perhaps not adequately covered within their own cultural standards. They create their own 'mini culture' to address only these discrete issues (De Vijver and Phalet 2004, pp.216-217). This also appears to correspond closely with the suggestions of Triandis (2003, pp.486-487) and Seitz (2001, p.21), that there is some 'levelling out' of cultural norms to accommodate the integration of ICT within local cultures. Triandis (2003, p.486) recognises that, with increasing globalisation, people integrate with others who have different cultural values, but that the integration may be within groupings that do not conform to pre-existing criteria. The development of the retrieval tool would seem to be a good vehicle to carry forward this area of research.

7.4.7 Extension of the Retrieval Tool Principle to Other Professional Areas.

Information and communications technology has now developed to a level where it affects almost all areas of life. However, the effects of ICT are not confined to ICT *per se*. The use of ICT in other professions raises the same issues over its deployment as the generic issues created by the development of ICT itself. For example, most professions become involved in contractual issues, or issues of confidentiality. All professions face a phalanx of generic problems that are created by the deployment of ICT. All professionals, therefore, need to be made aware of the effects of ICT on themselves, their clients, their employers, and the public at large. The need to raise awareness of ethical issues created by the deployment of ICT suggests that it would be useful to extend the scope of the retrieval tool for use in the training of other professionals. This, however, raises several issues.

The wide deployment of ICT generates many cases of unethical action in the use of ICT. This ubiquity of ethical issues is not reflected in foundations of most other professions. Superficially, this suggests that discrete case libraries are needed for each profession. However, the infiltration of ICT into other professions raises the question of whether cases founded only in those disciplines are required. The main aim of the case retrieval tool in the present research is to raise ethical awareness in ICT students. However, it is an essential element in the development of computer applications that the developer understands the requirements and

limitations of the client. ICT developers therefore need to have an understanding of the issues that face other professionals, and that will have a bearing upon the development of programs for use in those professions. A simple extension of the case library to include cases from other professions may therefore be a possibility. Input from members of other professions, and the use of the retrieval tool using the existing case library but using test case scenarios from other professions, would demonstrate whether the existing case analyses echo the ethical concerns of other professions. Success in the use of the existing case analyses might provide a welcome addition to the repository of materials for the stimulation of ethical awareness in other professional arenas.

7.4.8 Conclusion

The opportunities for further research presented in this section are but 'tasters' for the wide range of issues affecting the development of a successful and effective retrieval tool that will encourage deeper reflection and review of personal ethical standards. The list is not exhaustive. Without doubt, many more issues will arise as the research progresses. Many of the issues raised above interact, and will present further issues for investigation. The present status of the research is but one milestone towards the understanding and development of a fully functioning and effective pedagogic system.

7.5 Reflection and Self Evaluation

The process of undertaking research has a reflexive effect upon the researcher. Besides adding to the corpus of universal knowledge, research activity enriches the experience of the researcher. It will inevitably raise questions upon personal performance, the validity of the research concepts and methodology, possible alternative approaches or errors, and the general feeling of satisfaction. A reflective evaluation is an essential part of the research exercise.

7.5.1 Effectiveness of the Research Methodology

Section 3.3 identifies the dilemma that faces the researcher when researching information systems. This research adopts the approach of Galliers (1992, pp.144-145) who considers that it is almost impossible to separate interpretivist and positivist research. In this research, both elements are included, but the interpretivist element carries by far the heavier weighting. The

research approach is that of a voyage of discovery, applicable equally to the researcher and the students. The concepts of classification and retrieval of ethically analysed cases without resorting to the use of AI techniques, and using the students' own intelligence in assembling a view of a given case study, breaks new ground. No firm predictions upon students' actions can be made, and hence no positivist hypotheses can be formulated. The research is thus biased heavily towards an interpretivist, phenomenographic approach as described by Laurillard (2002, p.69).

The use of case studies to create a change in ethical awareness illustrates the problem identified by Galliers (1992, p.154) of the dualistic nature of case studies. He comments that they can raise problems when used for empirical or scientific research as it is frequently difficult to use them collectively to gather sufficient acceptable corresponding statistical data. The fact that there may be many acceptable ethical viewpoints to a given ethical scenario effectively rules out the use of ethical case studies to generate numeric data that can be subjected to statistical techniques. Consequently, the use of advanced statistical techniques appears to be neither relevant nor meaningfully possible in this research. However, sufficient numeric data can be obtained upon trends to determine if the use of the retrieval tool is affecting student awareness.

The divergent requirements for this research prompted the researcher to adopt the suggestion of Nunamaker (1990, pp.94-96) that a multi-methodological approach should be adopted. Nunamaker (1990, p.91) suggests that no single approach is likely to be successful in information systems research. The multi-methodological approach adopted for the research, blending elements of evaluative and developmental research, research and development, and formulative and verificational research, fitted well into the prototyping research style. The system encouraged the introduction of appropriate paradigms at the relevant stages in the research. The flexibility of this approach contributed greatly to the ability of the researcher to respond to and meet the challenges that arose during the research process. The iterative, prototyping development is conducive to constructivist learning, allowing later research challenges to be solved using knowledge gained from earlier research activities.

The multi-methodological approach used to gather and stimulate the production of data appeared also to be successful. The use of case studies appears to be a particular success. Indeed, the students appear to like them, and even ask for more. This would suggest that they find this form of instruction acceptable, and that it achieves a major aim of the tool – to engage and stimulate students to contrast and compare case analyses, thereby increasing their own ethical awareness and experiences. Furthermore, following a little encouragement, South East Asian students also appeared to accept the concept of role-play necessary for successful implementation of the tool. The surveys and questionnaires also achieved their objectives. The questions developed for the interface appeared to be comprehensible to students, and were not too difficult to answer. The usability and ethical awareness questionnaires completed by the students provided sufficient evidence of the acceptability and efficacy of the retrieval tool. The case studies promoted the role/game playing stance required of students to place themselves in the position of the stakeholders in a scenario, and subjectively to assess and review the ethical issues that motivated the stakeholders' actions. The futures research element prompted students subconsciously to include in their ethical opinions the experiences and knowledge gained from the use of their given scenario and the presented cases, in readiness for future use.

7.5.2 What Worked Well, and What Did Not

The use of a multi-methodological approach to the research allowed considerable flexibility in the evolution of concepts and the development of the retrieval tool. Some were successful, but some were not. Several of the more interesting features are discussed below.

- The retrieval algorithm.

The initial concept, that a standard database might be modified so that the rule-based retrieval algorithm included an element of fuzziness needed to address the uncertainty of ethical opinions, was not successful. However, failure of this system allowed reconsideration of the concept, and led to the evolution of a simpler, more flexible paradigm – the hypertext decision tree. This permitted dynamic querying to be applied to the retrieval process, which, in turn, stimulated the students to adopt an exploratory use of the tool.

Students were able to 'step back' through their previous responses to the questions posed by the tool interface, and perhaps further explore some of their initial responses. This mimicked the 'conversational' style of interaction suggested by Laurillard (2002), a facility that was not available in the first incarnation of the retrieval tool using the modified database engine.

The initial question set developed for the retrieval tool included twenty-nine questions, each having a choice of possible responses. This attempted to include many sociological issues, and to incorporate a temporal element. Many questions were found irrelevant to some ethical issues, or were misleading and unable to accommodate the changing legal, sociological, or political views of society. When coupled with the database engine to form the retrieval mechanism, the complexity of the questions rendered it most difficult to use. The difficulties experienced in the development and use of the interface allowed reflection upon the ethical analysis framework proposed by Kallman and Grillo (1996). The question set was revised to address the ethical issues identified by Kallman and Grillo. This led to a drastic reduction in the number of questions required within the interface for the retrieval of suitable cases from a fixed twenty-nine to a maximum of sixteen.

Not all sixteen questions were necessary for consideration of any given scenario. This suggested that some ethical dilemmas might be identified with fewer questions than others, do not require the same questions, or even the presentation of the questions in the same sequence. Furthermore, many of the questions required only Boolean responses, thus simplifying the development of the retrieval algorithm.

Development of the master document detailing the decision paths and nodes for each ethical issue was accomplished using a combination of the Microsoft Access relational database and Excel spreadsheet programs. This allowed empirical investigations to determine the most appropriate questions set and question sequence required for each ethical issue, in addition to providing essential design documentation for the technical construction of the retrieval tool.

Furthermore, discrete branches of the decision tree can be extended with more specific, ethically based bespoke 'trimmer' questions if required. This facilitates the isolation of individual or small groups of cases if it is found that the present question set does not provide sufficient classification power. This would be difficult with the more rigid rule-based approach of a database management system (DBMS).

- Selection, use, and inclusion of relevant case studies.

The initial approach to the development of the retrieval tool anticipated that, from the start, it would address a wide range of cases involving ethical uncertainty. Details of several hundred cases were assembled, and attempts were made to use the modified DBMS to retrieve suitable cases. This approach was soon found impractical. The requirement for a critical mass of cases was quickly identified, and the number of cases required would have run to many thousands for suitable matching with any given scenario. Two branches of the decision tree were therefore selected, UK contractual cases and US privacy cases, and a concentrated search was undertaken to identify a suitable number of cases for each branch.

The effort expended on the initial trawl for cases was not wasted. Many were used to identify empirically the ethical issues that occurred most frequently. These issues were then matched against the suggestions of Kallman and Grillo (1996) and used as the basis for the questions used in the revised interface. The cases relevant to the two branches of the decision tree chosen for development form the basis of the critical mass of cases for other 'twigs' as they develop with the occurrence of suitable new ethically dubious incidents.

- Control of the development process.

During the initial phases of the research, it was recognised that research and identification of many ethical incidents would be necessary for the creation of a suitable case library. This needed to be undertaken contemporaneously with the design and construction of the retrieval engine, and would place considerable pressure upon the researcher. The programming of the retrieval engine, the modification of the Access DBMS to accept a weighting capability, was delegated to an undergraduate student. The student, not under

the direct control of the researcher, was studying for a BSc in computer science, and the programming modifications were to be undertaken as a final year project.

It was natural that the student placed more emphasis upon the completion of his report than upon the research project. Problems in availability for meetings between the researcher and student, misinterpretation of some of the concepts of the retrieval tool, and time pressures on the student made this part of the research difficult. Little documentation was produced by the student upon the technical aspects of the DBMS programming, making further development difficult once the student had completed his course and left the University.

This situation had all the elements of a disaster. However, a critical review of the student's work was used to identify where and why failure had occurred. The research was re-directed towards a more fruitful direction. More thought and investigation were devoted to establishment of what the interface was actually required to do. Emphasis changed from retrieval of an accurate match between the student's given case scenario and the case(s) presented by the retrieval tool to one of retrieving suitable analogous case(s) that would stimulate deeper thinking. The two aspects are not identical. The reconsideration of the pedagogic aspects of the retrieval tool prompted the adoption of a more interactive, exploratory style of interface using a hypertext system.

7.5.3 Personal Reflections

A complex research project requires a clear concept of what the research should address and how it should be undertaken. It is expected that a programme be prepared identifying the progressive stages of the research, and attempting to allocate suitable timescales to each stage. However, investigative research that draws heavily upon exploratory, interpretive methods does not lend itself well to such rigid programming.

Such was the case in this research. At the beginning of the research, a vision was required of the research stages and of the final product - the retrieval tool. However, as the research progressed, a number of factors, many described elsewhere in this thesis, caused that vision to change. The final product is very different from the concept of the retrieval tool held at the beginning of the research. The grandiose concept of a tool that would retrieve cases upon any

ethical issue from a case library was soon recognised as being too complex for completion within the time available. The scope of the research had to be reduced to concentrate on just two areas of unethical practice. Yet, an algorithm was required that was capable of retrieving cases concerning other issues not addressed, so that the use of the tool could eventually be extended to these areas also. The research effort was thus re-focussed and concentrated into a much narrower arena than that anticipated at the outset of the research.

It soon became evident that the experience of the researcher would be a major factor in the achieving a successful outcome. The selection, analysis, and integration of suitable case studies into the retrieval tool, and the mapping of the professional and ethical issues raised, required a broad experience of the real world. The ability to translate the experiences gained over a lifetime into analyses of real-world incidents with which students might empathise, and a keen interest in professional development, was a strength that was invaluable in undertaking the research. Experience in the areas of commerce, industry, and the public service provided insights into the cases that elicited support and empathy from students, especially those who had personal experiences of the workplace. This provided an infectious curiosity and interest amongst the other younger, less experienced students, provoking much intense discussion of the issues raised. Informal discussions with students revealed the relevance of many of the points raised in the case analyses to their real-world workplaces.

However, personal experience gained over an extended period can lead to the formation of entrenched values, and produce a biased, restricted understanding of issues. It is also possible that one's entrenched views will result in an oversimplification of an issue. The researcher was no exception to this phenomenon. The research was approached with a somewhat preconceived idea of the form that the retrieval engine would take, and of how the algorithm might incorporate a wide selection of sociological, ethical, legal, and cultural issues to retrieve case analyses. Although disheartening at the time, questioning and pertinent criticism from the supervisory team prompted a re-examination of long-held views. Many issues assumed to be suitable for retrieval vectors were discovered to be fallible, and were excluded from the retrieval paradigm. Consequently, a more questioning and lateral approach to many of the issues raised by the research was adopted as the development of the retrieval tool proceeded.

A more tolerant and multi-faceted approach proved to be most useful when considering the need to raise students' awareness of the ethical issues identified in the cases selected for the assembly of the case library. The differing cultural, legal, and sociological approaches required to reflect the diverse views of the students from many different cultures was not recognised at the outset of the research. However, these issues were instrumental in gaining a general acceptance from a wide range of students. Despite personal experiences in the design, development, and particularly the human-computer interaction aspects of software acceptability, the research further raised the researcher's own awareness of the software requirements for students from other ethical and cultural backgrounds.

The responses of the students to the retrieval tool are encouraging. However, this enthusiasm is not always reflected by other members of society. Modern business tends to treat ICT as a support function, placing it below organisational or business aims. In particular, commerce demands that an organisation generate profits in order to remain viable. Ethics becomes either value neutral, something to be ignored completely when it is not able to offer competitive advantage, or is trumpeted when it promotes success. Unfortunately, this attitude sometimes reveals itself amongst even those who teach ICT and business courses. Technical issues predominate on many university courses,³³ yet society demands that those who wield the power inherent in computers use it in a wise and compassionate manner. Much rhetoric is spoken about the need for ethical business practice, but it is rarely at the top of the business agenda.

The comments of some ICT students, and of some professionals concerned with the teaching of ethics, are encouraging. They see the benefits that the greater understanding and practice of ethical conduct will bring. It is a more difficult task to gain acceptance of those who are under pressure to demonstrate business success by increasing profit margins. It is believed that the development of this tool adds to the armoury of those who wish to encourage a more ethically aware society.

³³ Some ICT educators tend to adopt the stance that "computing is programming", and that human issues are not the concern of ICT personnel.

At the beginning of the research, the workload appeared formidable. However, in practice it has been simultaneously interesting, stimulating, frustrating, demanding, inspiring, and amusing, but always satisfying and enlightening. It has inevitably changed the attitude and perceptions of the researcher, hopefully for the better, and will perhaps contribute to the creation of a new, more ethically aware wave of ICT professionals.

7.6 Conclusion

Evidence from the testing of the retrieval tool tends to suggest that the research was successful. It appears to have met its primary aims, declared in Chapter 1:

- To establish a theoretical basis for the development of a system that can address ethical scenarios involving a wide range of unethical practice in ICT.
- To devise, construct and test a tool, founded upon the theoretical principles developed above, to enable computing novices to assimilate knowledge drawn from a set of ethically analysed case studies contained within the retrieval tool case library.

The retrieval tool is able to use the precision of computers, combined with the students' own internal thought processes and experiences, to address the fuzziness of ethical issues. The tool paradigm is based upon recognised ethical, motivational, and pedagogic theory. It is able to address cases from a wide range of ethical domains, and appears sufficiently flexible and adaptable to be able to address any future, unforeseen dubious ethical practices.

The resulting tool, based upon the theoretical foundation described above, appears to exert considerable influence over students' awareness of ethical issues within scenarios that they are asked to analyse. It cannot be claimed that the retrieval tool is a direct antecedent to all the changes occurring in students' ethical awareness. Nevertheless, results tend to suggest that the stimulation offered by the tool addresses both misconceptions and non-recognition of ethical issues, and prompts students to discuss, reconsider, and adjust their concepts of ethical practice.

The initial concept of the tool development was that it would be tested in only the UK environment. However, an unexpected bonus occurred in that it became possible to test the retrieval tool using a group of students drawn from South East Asian nations. This presented

the opportunity to examine the wider effects of the tool upon the ethical awareness of students brought up in a Confucian-based ethical environment, and to assess the effectiveness of the retrieval tool for these students. Despite the cultural differences, the retrieval tool continued to stimulate consideration of ethical views, albeit from a different cultural perspective.

Many students found the tool useful and informative, and were enthusiastic over the use of case studies. The case studies chosen for inclusion in the case library appealed to many students. Several read all analyses contained in the case library from a sense of fascination and curiosity, and were keen to see an expansion of the case library with a greater variety of cases addressing other ethical issues. The tool therefore seems to have both the support and potential for further expansion and development.

Support also appears to have come from the academic community. The concepts of the tool were accepted by the community through a refereed paper published in a major journal in the field of engineering ethics. This paper has now been included in a published handbook on the teaching of ethics. Nonetheless, the support of the academic community for the tool will not cause immediate change to the general perception or use of ICT. It will require long-term commitment by business, government, and professional societies before a new era of ethical understanding and responsibility can be created.

Violation of highly sensitive military computer systems, Internet banking scams, the promulgation of terrorist threats, and many other instances of ICT misuse occur frequently. Governments themselves are not immune from this criticism. Inadequate consideration of the effects of ill-conceived ICT projects has been a hallmark of many government departments. In the UK, computerisation of the UK Social Fund, the Libra System for Magistrates Courts, and the Child Support Agency System demonstrate this trend. Other flawed developments directly affect individuals' safety (the National Air Traffic Control System), health (the NHS National Programme for IT), and liberty and freedom (the establishment of the Criminal Records Bureau). In the US, uncaring application of the federal Sex Offenders' Registration Act (Megan's Law) by some States has resulted in apparently unjustified victimisation of many registrants. The planting of a software 'time bomb' by Timothy Lloyd on the central file server of Omega, a major

supplier of equipment to the US government, caused a financial loss of more than \$10 million and jeopardised national security. These and other misuses of ICT emphatically underline the need for deeper consideration of the responsibility that goes hand-in-hand with the power of ICT. The case retrieval tool developed as part of this research binds that power with responsibility through the medium of thinking. Only by thinking more deeply about the ethical consequences of our actions can we reduce the potentially irreparable damage to our future global society.

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Appendix A: Triandis' Cultural Syndromes

- **Complex/Simple Cultures**

Primitive cultures are usually relatively simple.

Other cultures, particularly those that are information-rich, are usually relatively complex. Consequently, complexity of the culture can provide a measure of cultural difference.

- **Tight/Loose Cultures**

Loose cultures tend to have fewer rules and norms, and people are tolerant of deviations from accepted behaviours.

Tight cultures tend to have many rules and norms that govern what is correct behaviour. Failure to follow the norms of the society is likely to cause antagonism and unrest.

- **Active-Passive Cultures**

Members of passive cultures tend to follow a collectivist approach, accepting that they must change themselves to fit into the environment (Utilitarianism). They are more co-operative, and focus on the experience of living.

Individuals in active cultures place their own interest first (Egoism), trying change the environment to fit around their own desires and needs. They tend to be more competitive, action-oriented, and intent on attaining success. Usually, active cultures tend to follow individualist approach.

- **Universalism/Particularism**

Universalist cultures try to treat others based on a set of universal criteria, ignoring personal traits or characteristics, tending to favour individualists.

Particularist cultures treat others based upon their assessment of who the other person is rather than judging them against a set of common criteria. Particularist cultures tend to favour collectivists.

- **Instrumental/Expressive Cultures**

Instrumentalists tend to focus upon the action of making progress, and become irritated when delays occur. In general, individualists are more instrumental.

Expressivists tend to focus more upon the social relationships involved in their interactions with others. Collectivists tend to be more expressive in their cultural traits.

- **Emotional Expression or Suppression**

Emotions such as anger may be freely displayed regardless of consequences, or they may be controlled or suppressed. Collectivists, seeking harmony in their relationships, tend to control such emotions and hide their true feelings from others.

Individualists, who seek personal advancement and self-satisfaction, tend to display uncontrolled emotion. Anger, frustration, greed, or other negative emotions arouse negative responses in others, causing them to withdraw from the relationship, 'surrendering' to the individualist who then achieves dominance.

- **Vertical and Horizontal Cultures**

Vertical cultures tend to recognise and accept inherent hierarchical structures within a culture. Members tend to 'know their place', and to avoid any action to either rise or fall within the hierarchy.

Horizontal cultures assume that everyone is 'naturally' equal and resources are allocated equitably. Everyone has the opportunity to rise or fall within the hierarchy, depending upon ability or influence.

Appendix B: Nunamaker et al's Research Categories

- **Basic and applied research**

Basic research is prompted by a researcher's fundamental interests rather than to address a practical application. Applied research requires the use of fundamental theoretical concepts to resolve a practical problem.

- **Scientific and engineering research**

Nunamaker, Chen, and Purdin (1990, p.90) suggest that there is no difference in the approaches used by engineers and those used by scientists. Both groups will formulate predictions, and their approaches will simply attempt to verify these predictions. The scale of their work and motives distinguishes them from each other. Engineers generally adopt a creative approach that provides a useful artefact.

- **Evaluative and developmental research**

This classification recognises two types of research that can be used to solve problems. Developmental research strives progressively to develop solutions to problems or to provide a better course of action. Evaluative research requires developmental research as a precursor. It is an area that has had little attention as a research approach, yet it is in common use in most innovative environments as prototyping.

- **Research and development**

This type of research is prevalent in industry where existing knowledge, often gleaned from other research approaches, is used to develop products, systems, and materials, usually in a production environment. Nunamaker, Chen, and Purdin (1990, pp.90) cite the work of Hitch and McKean (1960) who suggest that development work can be divided into sub-classifications of exploratory, advanced, engineering, and operational.

- **Formulative and verificational research.**

Formulative, or exploratory, research seeks to highlight problem areas, and to refine their definition so that intensive research can be undertaken into the problem area. It also serves to gain greater understanding of the scope of a problem, or to assist in the development of initial hypotheses. Conversely, verificational research attempts to confirm or refute statistical or hypothetical research results.

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Appendix C: Cases Used to Determine Retrieval Vectors

No.	Country	Case Name
1	UK	Northumberland Police Authority GIS
2	UK	Dept. of the Environment (NI) v EDS
3	Australia	Madeley v Touche Ross
4	UK	Wessex Regional Hospital Authority Regional Information Systems Plan
5	UK	London Ambulance Service Computer-Aided Dispatch System
6	US	State of Florida v EDS
7	US	CONFIRM Computerised Reservation System
8	UK	Boffin v Readyco
9	UK	The Department of Social Security Analytical Services Statistical Information System (ASSIST)
10	UK	Performing Rights On-Line Membership System (PROM)
11	UK	Salvage Association v .CAP Financial Services
12	UK	St Alban's City and District Council v. International Computers Limited
13	UK	London Stock Exchange TAURUS System Failure
14	UK	Tiptree Company Warehousing System Failure
15	Australia	Westsub Pty Ltd v IDAPS Australia Ltd
16	US	US v Mitnick
17	US	US v Levin
18	International	European Space Agency Ariane 5 Launcher Failure
19	US	Denver International Airport Baggage Handling System Failure
20	UK	South West Water v ICL
21	UK	Croeso
22	UK	Cantor Fitzgerald International and another v Tradition (UK) Ltd
23	UK	Ibcos Computers Ltd v Barclays Mercantile Highland Finance
24	US	Federal Trade Commission v Intel
25	UK	Amstrad v Seagate
26	UK	Stephenson Blake v Streets Heaver
27	US	Lotus v Borland
28	US	Feist v Rural Telephone
29	UK	Dept. of Employment Field System
30	UK	DHSS Hospital Information Support System
31	US	Bourke v Nissan
32	UK	R. v Brown
33	UK	R. v Sinha
34	US	Vega-Rodriguez v Puerto Rico Telephone Company
35	International	R. v Thompson
36	UK	Morse v Future Reality
37	US	Roeslin v District of Columbia
38	UK	Saphena Computing Ltd v Allied Collection Agencies Ltd
39	UK	Tindall Riley v Unisys & DSL
40	UK	Shetland Times v Jonathan Wills
41	UK	Franxhi v Focus
42	International	The Therac-25 Failures

43	Australia	Data Access v Powerflex
44	UK	R. v Fellows
45	UK	R. v Cropp
46	UK	Morgans v Director of Public Prosecutions
47	US	Planned Parenthood of the Columbia/Williamette v American Coalition of Life Activists
48	UK	Director of Public Prosecutions v Murdoch
49	UK	R. v Bow St Metropolitan Stipendiary Magistrate
50	UK	Western Provident Association v Norwich Union Healthcare
51	US	US v Torricelli
52	US	US v Smith (Melissa Virus)
53	US	US v Baker
54	US	Turner v Acme Rent-A-Car
55	US	Steve Jackson Games v US Secret Service
56	US	Stac Electronics v Microsoft
57	US	Shoars v Epson
58	US	Sega v Accolade
59	UK	R. v DoH & Source Informatics
60	US	Omega v Lloyd
61	US	McVeigh v US Navy
62	UK	McDonalds v Steele and Morris
63	UK	Anglo Group v Winther Brown and BML
64	UK	Halford v UK
65	UK	Grant v Procurator Fiscal
66	UK	Godfrey v Demon Internet
67	UK	Duffield v Transco
68	UK	Data Protection Registrar v British Gas
69	UK	British Horseracing Board v William Hill
70	US	Blumenthal v Drudge and America On Line
71	US	Brown v DSC
72	US	Justin J. Boucher v School Board of the School District of Greenfield.

Appendix D: Retrieval Tool: Suggested Weighting for Interface Questions

A. Identification of the Case Environment

Question	Sub-section	Score/Weight
<p>1.</p> <p>Please indicate which one of the following is the most appropriate description of the stakeholder's national culture.</p>	• British	9.0
	• Australian	8.9
	• New Zealand	8.8
	• Canadian	8.7
	• Indian Sub-continent	8.1
	• European	7.5
	• United States	8.6
	• Former USSR	3.5
	• Japanese	6.0
	• Chinese	3.4
	• Middle East	5.0
	• S. American	2.0
	• African Continent	3.0
	• Other Individual Countries	1.0
• International	0.1	
<p>2.</p> <p>Please indicate if any one of the following factors has a major external influence on the case.</p>	• Nationalistic Issues	4.0
	• Political Issues	3.9
	• Financial/economic Issues	3.5
	• Business Issues	3.4
	• Cultural Issues	2.5
	• Religious Issues	2.4
	• Gender Issues	1.5
	• Professional Issues	1.0
	• Traditions	2.6
	• None Known	0
<p>3.</p> <p>What is the predominant bias in the political/economic culture?</p>	• Totalitarianism	6.0
	• Communism	5.5
	• Benevolent Dictatorship	3.5
	• Democracy	3.0
	• Capitalism	2.9
	• Anarchy	1.0

	• Chaos	0.7
	• Not Relevant	0.3
	• Not Known	0.1
4.	• Yes	1.0
Have there been any abrupt changes of any operational, political, cultural or traditional factors in the recent past in the environment in which the case occurred?	• No	0.5
	• Not Relevant	0.3
	• Not Known	0.1

B. Organisational & Business Environment

5.	• Public	2.0
Is the stakeholder a private organisation or is it in the public sector?	• Private	1.0
	• Other	0.5
	• Not Relevant	0.1
	6.	• Local/national Government
What is the stakeholder's main area of operation? Please indicate one choice that best describes the stakeholder's activities.	• Military	6.9
	• Public Utility	6.8
	• Legal	6.5
	• Medical	6.4
	• Financial	6.3
	• Educational	6.2
	• Business	5.5
	• Charity	5.1
	• Social	5.4
	• Religious	5.2
	• Research	3.0
	• Professional	6.1
	• Environmental	4.9
	• Health & Safety	4.8
	• Project Management	5.7
	• Other	2.0
• No Major Occupation	1.0	
7.	• A large international organisation?	1.0
Is the stakeholder	• A large national organisation?	0.8
	• A national government?	0.9
	• A large regional/state organisation?	0.5

	• A small regional/state organisation?	0.3
	• A large local organisation?	0.4
	• A small local organisation?	0.2
	• A very small organisation or one person?	0.1

C. Human Rights

8. Were any of the following human rights violated by the actions of the stakeholder? Please indicate the one most significant right.	• Right to Liberty	4.7
	• Right to Security of Person	4.8
	• Right to Justice	4.9
	• Right to Freedom of Expression	3.2
	• Right to Freedom of Religion	3.1
	• Right to Freedom of Thought	3.0
	• Right to Freedom of Choice	2.9
	• Right to Health and Well-Being	2.0
	• Right to Property	4.1
	• Right to Life	5.0
	• Right to Work	2.1
	• Right to Family Life	2.2
	• Other	1.0
	• None	0.1

D. Stakeholder

D1 Actions

9. Please indicate if there is there evidence of:	• a deliberate lack of communication	3.0
	• a deliberate concealment of information	4.0
	• a deliberate misrepresentation of facts or information	5.0
	• Unintentional Misrepresentation	2.0
	• Unintentional Hiding	1.5
	• No concealment or distortion of information	1.0
	• Not Relevant	0.1
10. Has there been any attempt to deprive anyone of, or to destroy, any of the following categories of property? Please indicate the one most significant.	• Intellectual	4.2
	• Contractual	3.0
	• Environmental	3.5
	• Material	3.9
	• Financial	4.0
	• Spiritual	4.5

	• Cultural Inheritance	5.0
	• Other	1.0
	• None	0.5

D2 Stakeholder's Intentions

11. Please indicate the description that best reflects the stakeholder's attitude.	• Not known	0.1
	• Timid	0.2
	• Trusting	0.4
	• Naive	0.5
	• Incompetent	0.6
	• Bombastic	0.7
	• Altruistic	1
	• Philanthropic	1.1
	• Obligatory	1.2
	• Businesslike	1.3
	• Cavalier	1.4
	• Uncaring	1.5
	• Resentful	1.6
	• Secretive	1.7
	• Devious	1.8
• Manipulative	1.9	
• Predatory	2	
12. Did the stakeholder's actions breach any of the following? Please indicate the one most significant.	• Law	3.0
	• Statutory Guidance	2.8
	• Code of conduct/practice	2.7
	• Accepted Business Standards	2.0
	• Accepted Social Standards	2.6
	• None	1.0
	• Not Known	0.1
13. If anyone has been harmed by the stakeholder's action, was it:	• Intentional?	4.0
	• Unintentional?	2.0
	• No harm caused	1.0
	• None	0.5
	• Not Known	0.1
14. Is there evidence of intention of any type of harassment or discrimination? Please indicate the one most significant.	• Political	3
	• Racial	2
	• Religious	1.9
	• Sexual	1.6

	• Physical	1.5
	• Gender	1.4
	• Workplace	1.3
	• Mental stress	1.2
	• Ageism	1.1
	• None	1
	• Other	0.5
15.	• Yes	4.0
Did the stakeholder attempt to keep promises and obligations made to others?	• No	2.0
	• Not Relevant	1.0
	• Not Known	0.1
16.	• Yes	2.0
Was any attempt made to give compensation or right the wrongs caused to those who suffered loss as a result of the action?	• No	1.0
	• Not Known	0.1
17.	• Yes	3.0
Did the stakeholder attempt to distribute assets/goods/rewards fairly, with no evidence of bribery or corruption?	• No	2.0
	• Not Known	0.1
	• Not Relevant	1.0
18.	• Yes	1.0
Did the stakeholder demonstrate gratitude for the beneficial actions of others?	• No	0.5
	• Not Known	0.2
	• Not Relevant	0.1
19.	• Yes	4.0
Does the stakeholder display a sense of responsibility towards others affected by his/her actions?	• No	1.0
20.	• Yes	4.0
Did the stakeholder learn from his/her past experiences?	• No	1.0
	• Not Known	0.1
21.	• Yes	4.0
Is there any evidence of an attempt to breach the privacy of any of the participants in the action?	• No	1.0
22.	• Yes	1.0
Was the stakeholder successful in attaining his/her goals?	• No	0.5

D3 Professional issues/conduct

23. Is the stakeholder a member of a professional organisation, recognising and adhering to professional standards?	• Yes	3.0
	• No	1.0
	• Not Known	0.1
24. Is stakeholder's path of responsibility/loyalty clear?	• Yes	2.0
	• No	1.0
	• Not Known	0.1
	• Not Relevant	0.5
25. Is there evidence of conflict of loyalty?	• Yes	5.0
	• No	2.0
	• Not Known	0.1
	• Not Relevant	1.0
26. Has stakeholder suitable training/experience/competence to undertake the tasks and duties required?	• Yes	1.0
	• No	0.5
	• Not Known	0.1
	• Not Relevant	0.3
27. Was there any lack of integrity or breach of any of the following areas? Please indicate the one most significant.	• Contractual Obligations	3.0
	• Property Ownership	2.0
	• Commercial Confidence	2.9
	• Privacy Issues	1.5
	• Care Towards Others	2.8
	• None Known	0.1

E. Dignity/worth of People

28. How is personal dignity and worth of people recognised and rewarded by the stakeholder? Please indicate the one most significant.	• Praise	3.5
	• Promotion	4.0
	• Increase of Power	5.0
	• Increase of Responsibility	4.9
	• Financial Reward	3.9
	• Other Material Reward	3.8
	• Social Influence	4.8
	• Not Recognised	1.1
	• Not Known	0.1
	• Not Relevant	1.0

F. Emotive Issues/ Mitigating Circumstances

<p>29.</p> <p>Was the stakeholder affected by any of the following emotions/ factors? Please indicate the one most significant.</p>	• Anger	2.4
	• Frustration	2.3
	• Revenge	2.2
	• Pride	1.4
	• Arrogance	2.0
	• Self Enhancement	1.8
	• Sloth	1.1
	• Envy	1.7
	• Greed	1.6
	• Lust	1.5
	• Personal Material Reward	1.9
	• Power	2.1
	• Compassion	1.3
	• Fear of Reprisal	2.8
	• Fear of Financial Penalties	2.7
	• Fear of Legal Action	2.6
	• Fear of Social Criticism	2.5
	• Panic	2.9
	• Prejudice	1.2
	• Need for Self-preservation	3.0
• Mental or physical illness that affected the stakeholder's actions	1.0	
• None of the Above	0.5	
• Not Known	0.1	

Appendix H: Retrieval Tool Interface Questions

1. Country

Please select the country in which your case study occurred.

1. Australia
2. Canada
3. China
4. Former USSR
5. Germany
6. International
7. New Zealand
8. United Kingdom
9. United States of America
10. Other

2. Main Issues

Please select the main issue that you consider the most important raised by your case study

- Contractual Issues
- Abuse of personal rights and freedoms
- Harm to others
- Computer Misuse
- Processing of information
- Property Ownership

3. Personal Duties

Please click on the most important duty that you believe was not met by a stakeholder in your case study.

- Beneficence
- Gratitude
- Integrity
- Justice
- Reparation
- Self-improvement
- Trust
- Truthfulness

4. Rights Violations

Three rights have been identified as causing significant problems for computer users: the rights to property, to privacy and to know.

Please select the appropriate link in the table below to identify which, if any, combination of Rights that you consider has been violated in your case study.

- No Rights violated
- To Know and to Privacy
- To Know
- To Know and to Property

- To Privacy
- To Privacy and to Property
- To Property
- All three Rights violated

5. Legal Action Taken

Computing and information technology are very recent innovations in society, and little experience or precedent has yet developed in their use. Many disputes over the use of computers and computer technology resort to the legal process, either as full court actions, or as appeals to specialist tribunals dealing particularly with employment issues. Have any stakeholders in your case study resorted to legal action over issues where there was a breach of the existing law, or where the law was unclear and the participants to the dispute wished to have an independent arbitrator?

6. Policy or Guidelines Available

Many organisations and companies have developed informal or formal policies and guidelines that they expect their staff to follow. Has any stakeholder in your case study developed such guidelines that would in any way be applicable to the issues addressed in the case study?

7. Policy or Guidelines Violation

Did any stakeholder disregard or violate any policy or guideline, either formal or informal, at any point described within the case study?

8. Intentional Violation of Policy or Guidelines

Did any stakeholder act intentionally to disregard or violate any policy or guideline, either formal or informal, at any point described within the case study?

9. Professional Duties Not Met

Please click on the most significant professional duty not met by any stakeholder within your case study.

- Maintain confidentiality
- Maintain impartiality
- Maintain professional relationships
- Maintaining efficacy
- Exercise duty of care to others
- Competence
- Accept inducements
- None

10. Golden Rule Violated

The 'Golden Rule' tells us that we should treat others as we ourselves would wish to be treated. Have any stakeholders in your case study violated this rule by failing to consider what they would feel if they were the recipient of the action that they are about to commit?

11. Negligence

Negligence can occur when due care is not taken over something. It can be intentional or unintentional. Have any stakeholders in your case study failed, intentionally or unintentionally, to

do something that they should have done to prevent harm or damage? Alternatively, have any stakeholders done something that they should not have done, consequently causing harm or damage?

12. Harm

Most ethical theories suggest that we should conduct ourselves in ways that protect the health, safety and well-being of others. Have any stakeholders in your case study used computers or computer technology in a way that will endanger other stakeholders? Alternatively, have they failed to act in ways that will ensure the safety, health and welfare of others?

13. Conflict of Interest

A situation sometimes arises where a computer professional may be able to take any one of a number of actions, but these may conflict between the interests of, say, loyalty to an employer and duty to society. Has any stakeholder in your case study found themselves in a situation where they face such a dilemma?

14. Dignity and Worth

Kant tells us that we should treat others with dignity, and that we should not try to use them as a means to further the interests of ourselves or others in a disrespectful manner. Is there any evidence in the case study that any stakeholder has carried out such actions?

15. Abuse of Power

Those who use computers often exercise considerable power over the well-being of others. Have any stakeholders in the case study used their computer skills to exercise unjust control over the activities of other stakeholders? Alternatively, have any stakeholders abused the power of the information that they receive from computers or computerised equipment to manipulate others unlawfully or unjustly?

16. Success

If your case study involves the management of a project, production of a piece of software or other activity, was that activity brought to a successful conclusion either at the end of the project or soon afterwards?

Appendix J: Ethical Protocol and Documentation

An Ethical Protocol for the Testing of a Case Based Retrieval Tool to Retrieve Ethically Analysed Case Studies from a Case Library.

**For submission to
De Montfort University Ethical Committee**

**Author
Don Sherratt
(Student No. P00156246)**

**Given Chairman's Approval
14 April 2003**

Part A - An Ethical Protocol for the Testing of a Case Based Retrieval Tool to Retrieve Ethically Analysed Case Studies from a Case Library.

1. The Research Background

The increasing intrusion of computers into all areas of everyday life brings particular problems for those who design, build and use computer systems and software (Sproull, Kiesler and Zubrow 1994). This research seeks to meld the traditional concepts of ethics, human social interaction and learning with the recent developments in information technology (IT). Students who graduate from the University do so in the expectation that they will be accepted as professionals within their chosen career. The use of the power of modern computers to create good or evil will be at the discretion of students who graduate with computing-related degrees. It is therefore necessary to imbue these students with a sense of ethical principles, and an awareness of the responsibilities that flow from the exercise of such power. Moor defines computer ethics as:

“The analysis of the nature and social impact of computer technology and the corresponding formulation and justification of policies for the ethical use of such technologies” Moor (1995, p.7)

Several authors (Kallman and Grillo 1996; Langford 1995; Maner 1999; Rogerson and Bynum 1995; Spinello 1997) have considered how the wide-ranging implications of the deployment of computers in modern society affect the values of societal and personal ethics. Bynum and Moor (2000, p.v) suggest that the increasing use of computing power raises important ethical issues of property ownership, privacy, power and professional responsibility. Rogerson and Bynum (1995) suggest that ethical, social and legal problems will arise from such technological developments if the moral issues raised are ignored.

Some governments, particularly governments of the Western world, together with a number of professional computing bodies, have turned their attention to the problem (Gotterbarn, Miller, and Rogerson. 1999, ACM 2001; Spinello and Tavani 2001, p.v). They have instigated measures to ensure that students, the future computer professionals, are aware of the ethical issues that will affect them throughout their working lives (Huff and Martin 1995; Webb, Rackley and Betts 1999), and that will inevitably spill over to affect society in general. A number of authors (Kallman and Grillo 1996; Maner 1999; Rahanu 1999; Spinello 1997) have developed instruments that are designed to assist in raising awareness of the ethical issues posed by the ubiquitous use of computers. Maner (1998) has also developed an instrument that prompts computer professionals to reflect upon their own personal ethical values. Rahanu (1999) has taken this concept further, and has developed a five-stage system of ethical analysis, linked to a case-based reasoner (CBR) system. The CBR system was designed for use by undergraduate and postgraduate computer science students to address social, legal and professional aspects of computing.

2. The Aims of the Research

The research outlined in this report is a continuation of the strand of research begun by Maner (1998) and Rahanu (1999). It seeks to generalise the work carried out so far, and is part of a longitudinal study of the effect of computers in society. The research aims to address the issues raised by the generalisation of the Rahanu (1999) model. Its main aims are

- To establish a theoretical basis for the development of a system that can address ethical scenarios involving any area of unethical practice.
- To devise a tool, founded upon theoretical principles, to enable novices to assimilate knowledge drawn from a set of ethically analysed case studies contained within the CBR case library.

Before a generalised tool can be developed, it has been necessary to establish an algorithm for the classification, identification and retrieval of cases so that students can retrieve suitably matching cases to the case studies that they themselves will be required to analyse as part of their course. The testing of the tool, both in terms of its acceptability and usability, and its effectiveness in influencing student perceptions of the ethical issues raised, require the formulation of this protocol.

3. Evaluation Methodology

The evaluation of the tool is required from two perspectives. Both employ qualitative assessment. Both are seeking trends, and a statistical analysis is not required in either case.

- **Human Computer Interaction**

It is necessary that the tool is intuitive to use, and that the questions posed for the identification of ethical principles are immediately obvious and clear to students who will use the tool. A questionnaire (Part B) has been developed to seek student perceptions upon the usability of the interface.

This aspect of the tool development focuses simply upon the usability of the tool, and will be used to modify and improve the interface between the student and the tool. It will be submitted once to one group of students only. This restriction is necessary as repeated changes to the interface could affect the results obtained to the student ethical awareness survey when results are compared between different cohorts.

- **Modification of Students' Ethical Awareness**

A person's ethical orientation is a highly personal issue. Ethical awareness will vary over time, context and experience. It is not expected that all students will display the same change in ethical awareness in response to any given stimulus. However, it is hoped to capture the trend in change of ethical awareness in students by the application of questionnaires linked to a simple case study. The study and questionnaire need to be submitted to students before they are exposed to the case retrieval tool, and again following the use of the retrieval tool for completion of an assignment to analyse a suitable ethical scenario. A sample case study and questionnaire are appended as Parts C and D.

It is recognised that care must be taken over the conclusions drawn from a 'before and after' survey. It is always possible that discussion between students, prompted by the problems raised by the assignment case, will result in a change of perception without the application of the case retrieval tool (Oppenheim 1992). However, the objective of the assignment is to raise student awareness of ethical issues. The questionnaire requests responses upon the student's perception of issues raised by the retrieval tool. That in itself ensures that the tool will be considered by the student, and thus that the tool will have played a notable part in any subsequent discussions.

Analysis will be undertaken of the questionnaires obtained from both topics, firstly to establish areas of difficulty in the understanding and use of the tool, and secondly to establish trends in the change of ethical orientation of the students.

4. Target Population

The retrieval tool is designed to be used by as wide a selection of students as possible. The characteristics of potential users cannot be accurately defined. In this study, the target population is those students who are studying computer-related courses. The tool is designed so that any computer studies students within the further and higher education sector may use the tool to study the ethical implications of real-world computing scenarios. The scope of the study to investigate the effectiveness of the tool, and the target population of computing science students who may ultimately use the tool is therefore broad. There is no limitation upon, gender, ethnic or cultural background, or level of computing expertise. The only limitation upon age is that they are students, and have thus normally reached the age of 18 years. Consequently, they are generally towards the younger end of adulthood although there may be many exceptions to this criterion.

The sample of students used to test the tool will be drawn from those students presently within the University who are undertaking studies in computer-related courses. As the student population is drawn from a wide range of ethnic and cultural backgrounds, from both genders, and of varying ages, it will not be feasible to restrict the sample to a limited, standardised group. In addition, the questionnaire will be submitted to students attending University courses abroad, initially in Malaysia, and possibly later in the United States and/or other countries. The study is an ongoing study spanning several years, involving several cohorts of students. The potential

student target population from which a test sample can be drawn can thus be seen as a highly variable, fluid pool of subjects.

The sample sizes are dependent upon the number of students presenting themselves for courses in computer-related subjects where the social, legal and professional aspects of computing are considered. Year class sizes are variable. However, it is suspected that between 150 and 200 student responses might be obtained for each cohort taking part in the research. This would equate to approximately 300 - 400 students per year. The study is programmed to run over two years.

The work of Huff and Martin (1995) suggests that questions requiring professional or ethical judgement cannot be answered in precise mathematical terms. The limitations outlined above present considerable difficulties in identifying a consistent, statistically valid sample for analysis. Furthermore, the establishment of suitable, quantifiable parameters to assess student deeper thinking and learning will add yet further to the difficulty of the research. The identification of such a group for a statistical analysis would not be possible within the facilities and time available to the researcher. It is proposed, therefore, that the research will seek trends in the change of ethical stance rather than to mount a full, but flawed statistical analysis. Identification of trends will demonstrate whether the use of the retrieval tool has prompted any change in the ethical stance of the students.

5. Implementation of the Surveys

No personal, private data is to be collected. The data to be collected will identify only a student's perception of either the usability issues of the interface to the retrieval tool, or the student's ethical understanding of the issues raised by the case study supplied in conjunction with the questionnaire. Nevertheless, such responses are items that will be kept confidential.

The questionnaire addressing the usability issues of the interface need be completed only once by any single student. It will not therefore be necessary to include a unique identifier on any of the usability questionnaire sheets.

The survey addressing the student's ethical attitude to the issues raised will need to be conducted twice, once before the use of the case retrieval tool, and again after its use. There is therefore a need to match the 'before' and 'after' responses for a particular student. The researcher does not have ready access to the unique student identifier allocated to all students upon admission to the University. It is therefore proposed that students use their own individual identifier, but omit their name from any questionnaire forms. This will allow matching of student responses by the researcher whilst retaining student anonymity. Alternatively, students will be allowed to use an identifier or pseudonym of their own choice.

It is hoped that the questionnaires can be submitted for student consideration during classes or tutorials. The questionnaire sheets may be distributed and collected by the class tutor (see next section), and returned to the researcher for processing. Once received by the researcher, the questionnaire sheets will be kept within secure facilities at the home of the researcher. No record of the cross match between the student unique identifier and student name will be sought or kept by the researcher.

The information obtained from the questionnaires will be used for research purposes only. The information obtained from the usability survey will be used only for the improvements to the interface. The data obtained from the ethical attitude questionnaire will be used simply to examine any change in the student's perception or understanding of the ethical issues. No further action will result from the processing of the information. When the questionnaires are received, the data contained will be transferred to a database using an auto-number facility to provide the unique identifier that the database requires to accept an individual student record. Thus the unique student identifier allocated by the University at student enrolment will not be used in the database, but rather the number from the auto-number facility provided by the database management system will provide the required anonymity. The action of entering a student's responses to the questionnaire will thus automatically anonymise the record.

As soon as an assessment of change in attitude has been made, the change will be represented simply as a 'score', and will be aggregated with all other scores for that cohort,

presenting an impersonal summation of the data. Once the questionnaires have been processed, they will be destroyed. Thus, no personal or private information will be available for dissemination to others.

6. Application Issues

It is possible that the conduct of the surveys may cause some difficulty in the area of confidentiality, although this will probably not be of a serious nature. Two areas suggest themselves for consideration.

The requirement for matching of anonymous scripts for the 'before' and 'after' questionnaires poses problems with the matching process. It will be necessary for some form of unique student identifier to be used. This will need to be one that is easily remembered by students as there could be a gap of several weeks between the submission of the 'before' and 'after' questionnaires. It is possible that students will forget the identifier that has been assigned to them unless it is one that is easy to remember. The use of the student's University admission number would be an identifier that would be easily remembered by the student, but that could be used to identify an individual student's work by an observer who had access to the University student database. However, if students agreed to this identifier being used, it would provide a means of matching appropriate scripts. Students could be asked if they would permit the use of their student identifier number to be used for this purpose, with the researcher promising not to use the identifier for any other purpose.

The other area of concern is the return of scripts from the tutor to the researcher. However, this might be overcome if the scripts were placed by individual students in an envelope that could be sealed as soon as the questionnaire has been completed by the student. Tutors will also be instructed that they should refrain from perusing the student's responses to the questionnaire. The scripts for the class are thus completely confidential, and contained within a sealed enclosure which is opened only by the researcher. This issue is of particular significance if scripts are returned from sites abroad.

7. The Requirements for Pilot Studies

Pilot studies are required for both questionnaires. The questionnaires developed for the usability survey and the ethical attitude survey will need to be assessed for comprehension and usability by the students. It is intended that pilot studies for both questionnaires will be submitted to two or three tutorial groups (possibly 60 to 70 students) for comment and feedback. Similar confidentiality conditions will apply to the pilot studies as have been proposed for the full surveys.

The ethical attitude questionnaire will use a case study similar to that used in the corresponding student assignment. The fundamental ethical principles will be as close as possible in the questionnaire case study and in the assignment case. The initial assignment case study, and hence ethical attitude questionnaire case study, will address issues raised by the application of UK law to failed information systems projects in the UK. However, in order to test a second area of ethical concern, that of privacy in the United States, a second case study will be developed to assess the trends in student ethical awareness in this area, for use with cohorts in the second year of the study. The same question set will be used. It should not, therefore, be necessary to seek ethical approval for this second case study and questionnaire, or to carry out further pilot studies.

8. Student/Researcher Communications

The rights of students will be respected. The following points will be included in a letter to students (Part E), seeking their participation in the survey:

- Students are not obliged to participate in the survey.
- Students may withdraw from the research at any time without the requirement to provide any reason for doing so.
- Student responses to the questionnaires will be kept strictly confidential.

- No attempt will be made by the researcher to identify individuals taking part in the survey from their chosen identifier.
- The data obtained from the responses will be used only for assessment purposes in connection with the development of the retrieval tool.
- Students have a right to place their responses in an envelope without the tutor seeing their responses to the questionnaire, and to see that the envelope is sealed.

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Part B - Usability of the Case Retrieval Tool

Could you please help the developer of this tool to make it even better by answering the following questions. The questionnaire consists of a number of statements. After each of the statements, there are four possible responses. Please circle:

- 1 - if you strongly agree with the statement.
- 2 - if you moderately agree with the statement.
- 3 - if you moderately disagree with the statement.
- 4 - if you strongly disagree with the statement.

PLEASE READ THE STATEMENTS CAREFULLY BEFORE GIVING YOUR ANSWER.

1.	The tool was intuitive to use.	1	2	3	4
2.	I felt that I knew where I was in the tool when I was using it.	1	2	3	4
3.	The choices of colour made the tool difficult to use.	1	2	3	4
4.	I felt in control of the tool when I was using it.	1	2	3	4
5.	The tool did not provide enough information to make selection of responses clear and easy	1	2	3	4
6.	The navigation forward and backward through the tool was easy.	1	2	3	4
7.	The language used in the tool was difficult to understand.	1	2	3	4
8.	There was sufficient information in the tool for me to understand how to use it	1	2	3	4
9.	The tool was easy to use.	1	2	3	4
10.	Some screens seemed cluttered with too much information.	1	2	3	4
11.	The tool has some annoying features	1	2	3	4
12.	I enjoyed using the tool.	1	2	3	4

Are there any other constructive and helpful comments that you would like to make about the tool? Please continue overleaf if necessary.

.....

.....

.....

.....

Many thanks for your help.

Part C – Case Study: Sam Business Systems Ltd v Hedley & Co.

Please Note

The case study, Sam Business Systems Ltd v Hedley & Co, was also used in the final detailed testing by the Wolverhampton and Kuala Lumpur student cohorts. To prevent duplication, it is shown in Appendix S of this thesis. Please refer to Appendix S for further information.

Part D - Ethical Awareness Questionnaire

Please enter your chosen form of identification

(Can be your student number or other personal keyword that you choose, but needs to be one that you can easily remember).

.....

DATE:.....

Please answer the following questions by circling the response that reflects your views.

- | | | | |
|-----|--|-----|----|
| 1. | Is there any evidence of negligence by any of the stakeholders? | Yes | No |
| 2. | Is there any evidence that any stakeholder has broken a promise? | Yes | No |
| 3. | Is there any evidence that a stakeholder has abused his or her power to cause disadvantage to another? | Yes | No |
| 4. | Is there any evidence that a stakeholder did not follow any guidelines? | Yes | No |
| 5. | Is there any evidence that any stakeholder acted unfairly? | Yes | No |
| 6. | Was anyone actually harmed by the action of another stakeholder? | Yes | No |
| 7. | Did any stakeholder not tell the truth? | Yes | No |
| 8. | Is there any evidence that any stakeholder did not honour his or her responsibility to their employer or client? | Yes | No |
| 9. | Did any stakeholder fail to respect the dignity and worth of others? | Yes | No |
| 10. | Is there any evidence that any stakeholder did not accept responsibility for his or her own actions? | Yes | No |
| 11. | Did any stakeholder violate the 'Golden Rule'? | Yes | No |
| 12. | Did you find these questions easy to answer? | Yes | No |

Thank you for your help in this research by completing the questionnaire.

Part E - Letter of Agreement

Dear Student,

I am conducting supervised research at the University into ways of improving teaching and learning. I would like to ask for your help with the research and the development of a proposed on-line teaching tool that addresses students' understanding of ethical issues. The research is closely linked with an assignment that you will be required to complete as part of your course.

You are asked to read a short case study, and to answer two short questionnaires.

The first questionnaire asks you to answer some questions about the issues raised by the case study. A second questionnaire, completed when you have used the on-line tool, asks you to assess how easy the tool is to use. The questions are designed so that you have only to circle the answer that you feel best reflects your views. Your answers will help me to identify how we can improve our teaching by the use of the on-line teaching tool.

You are not asked to reveal your personal identity on the questionnaire scripts. Your responses to the questions are kept completely anonymous and confidential by the researcher. Once the required data has been extracted from the questionnaire script, the script will be destroyed. No attempt will be made to match the questionnaire scripts to identifiable students. You will have the right to see the responses to the questionnaires placed in envelopes, and the envelopes sealed before onward transmission to the researcher.

You are not obliged to complete the questionnaires. If you decide not to take part in the survey, you will not be penalised in any way. However, if you do agree to take part, you will be helping us to help future students.

You may withdraw from the research at any time without having to give a reason for doing so. Furthermore, you will at no time be asked to provide a reason.

If you are willing to take part, could you please sign the agreement below and return the complete document to your lecturer or tutor.

Yours sincerely,

D.Sherratt

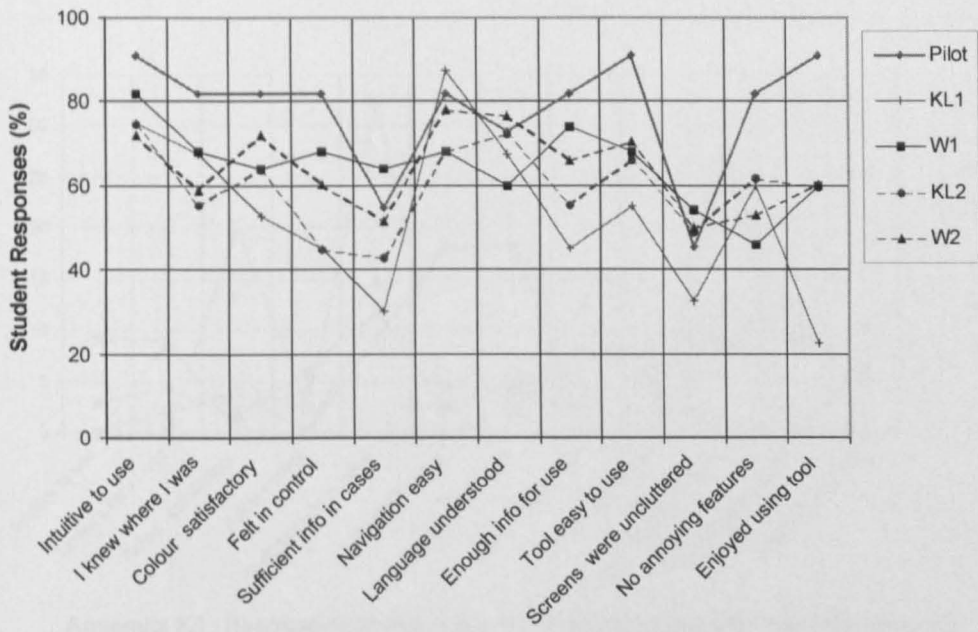
AGREEMENT

Please sign this agreement if you are prepared to take part in the research.

- I confirm that I am prepared to take part in the research outlined above.
- I agree to the responses that I give being used to further this research.
- I understand that the data that I give will be held in strictest confidence, and that the questionnaire script will be destroyed following the processing of the data that I have supplied. No publications resulting from the research will identify me as an individual.

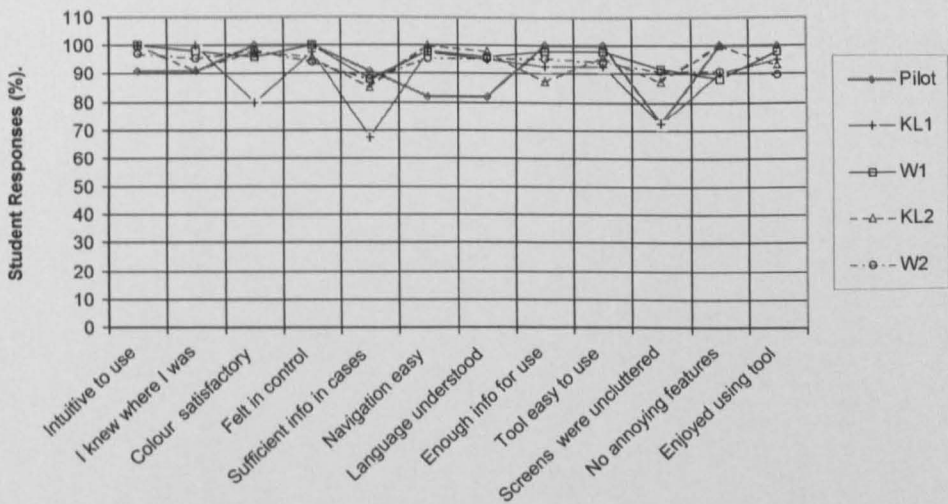
Signed Date:

Appendix K1: Usability Responses Showing Satisfaction as Positive



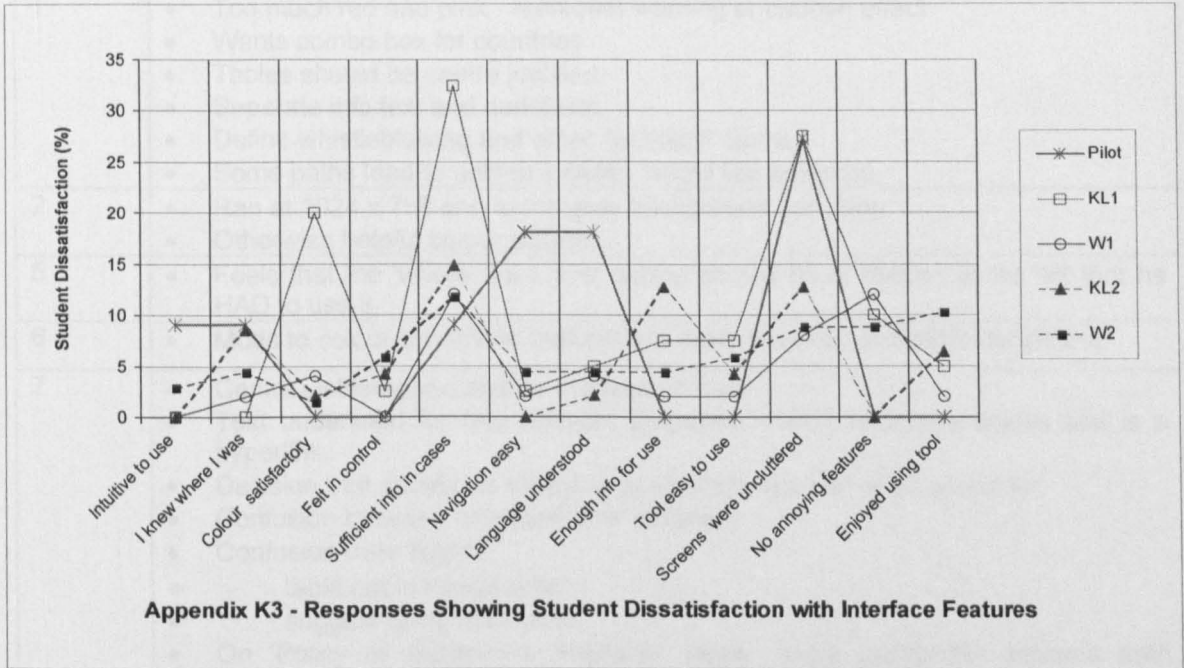
Appendix K1 - Usability Responses Showing Satisfaction as Positive

Appendix K2: Usability Responses Showing Satisfaction as Tolerable or Better



Appendix K2 - Usability Responses Showing Satisfaction as Tolerable or Better

Appendix K3: Responses Showing Student Dissatisfaction with Interface Features



Appendix L: All Comments Received on Retrieval Tool Usability

Wolverhampton Pilot

Student Index	Comments
1	<ul style="list-style-type: none"> • Too much red and pink - represent warning or caution effect. • Wants combo box for countries. • Tables should be centre justified. • Separate info text and questions. • Define whistleblowing and other 'technical' terms. • Some paths lead to only one case - would like selection.
2	<ul style="list-style-type: none"> • Ran at 1024 x 768 and found grey background annoying. • Otherwise helpful colour scheme.
5	<ul style="list-style-type: none"> • Feels that the 'where am I now' button should be at bottom as he felt that he HAD to use it.
6	<ul style="list-style-type: none"> • Mods to colour scheme to make it less multi-coloured and more consistent.
7	<ul style="list-style-type: none"> • Centre justifying text makes it difficult to read . • Text underlined for two different purposes - don't underline unless text is a hyperlink. • Decision tree should be available at all times, not just when asked for. • Confusion between 'infringed' and 'violated'. • Confusion over 'Rights'. <ul style="list-style-type: none"> - table not in logical order. - suggest using tick boxes. • On 'Policy or Guidelines Available' page, single paragraph contains both statement and question - these should be separated.
9	<ul style="list-style-type: none"> • Suggested another colour scheme to allow students a choice.
10	<ul style="list-style-type: none"> • Rights pages had too much info - maybe split screen into two. • Easy navigation. • Relaxing colour. • Return link from 'Country' page should be to Title page.
11	<ul style="list-style-type: none"> • Colours too bright. • Too much info on screen making it cluttered (does not say which screen).

Kuala Lumpur - September 2003 (KL1 Cohort)*(Comments recorded verbatim)*

Student Index	Comments
14	<ul style="list-style-type: none">• More interaction.• More lively colour.
16	<ul style="list-style-type: none">• Additional web interactive.
18	<ul style="list-style-type: none">• Under contractual issues when we select no rights violated when cannot proceed any further than policy or guidelines available.
23	<ul style="list-style-type: none">• Graphic interface have to improve.
25	<ul style="list-style-type: none">• The retrieval tool was very much helpful but need a more specific - I mean the question was nearly the same.
26	<ul style="list-style-type: none">• The case tools have repetition of questions.
27	<ul style="list-style-type: none">• The tool is easier to use if the internet connection is fast, otherwise it is not useful at all.• The page is extremely slow while loading. I hope that this page will be made offline so that other students will enjoy themselves reading it offline.• Thank you.
37	<ul style="list-style-type: none">• Confuse to use the tool. Mostly don't know what have to answer.• Some of the button have to double click. Suggest click one time can be enter.
39	<ul style="list-style-type: none">• The background or the screens seem dull and that is not so attractive to be use.• The information given is OK but some didn't, or lack of information (some links).• Overall OK to be use.
41	<ul style="list-style-type: none">• Make a clear definition on how to use the tools.• Improve the function of the buttons.
45	<ul style="list-style-type: none">• More interactive.
46	<ul style="list-style-type: none">• Need better indication to inform the user where are they currently (which stage).• Use more image and buttons instead of words and hyperlinks.

Wolverhampton 2003/4 Semester 1(W1 Cohort)*(Comments recorded verbatim)*

Student Index	Comments
54	<ul style="list-style-type: none">• Overall, this is a really good tool for me to understand the second assessment and this module on the legal side.
55	<ul style="list-style-type: none">• I didn't like the way the 'cut and paste' facility was disabled. It meant that I couldn't print the cases off in the format of my choice.
58	<ul style="list-style-type: none">• Present more than one case, give feedback, e.g. how close the case matches the answers given in the questions so one case could match the answers by 51% or 99 to 100%. However there is a difference between the two, this would save time for students.
61	<ul style="list-style-type: none">• The tool is very good at picking appropriate cases based on the questions asked. I think the major area for improvement should be the user experience and the GUI.
62	<ul style="list-style-type: none">• The tool was very informative and useful for other modules other than SLAPA.• Some interesting cases.
70	<ul style="list-style-type: none">• Some screens did not allow options (Yes/No) to be selected, i.e. sometimes only one response was allowed. This led to a feeling of a loss of control. I suspect the reason for this was that there were no cases on the system with the relevant characteristics, and this was the implied conclusion that I drew when using the software.
72	<ul style="list-style-type: none">• Wasn't made very clear how to use it.
74	<ul style="list-style-type: none">• It wasn't very clear.
75	<ul style="list-style-type: none">• Ability to copy and paste from the documents would have been useful.
80	<ul style="list-style-type: none">• Perhaps too much information in some cases.
85	<ul style="list-style-type: none">• It was difficult to work out which statements apply to the case study.
92	<ul style="list-style-type: none">• The tool was easy to use and helped a great deal to cover any questions I needed to use.• The results provided me with a superb outcome.
95	<ul style="list-style-type: none">• It was good to use but I think it could be made a little more user friendly.
100	<ul style="list-style-type: none">• It was just as easy to look at the list of cases and skim read them to use the selection.

Kuala Lumpur - September 2004 (KL2 Cohort)

(Comments recorded verbatim)

Student Index	Comments
171	<ul style="list-style-type: none">• The template needed to be filled in contain much criteria and difficult terms that may be confusing.• Other than that the tool is easy to be used.
172	<ul style="list-style-type: none">• The guide never shows on how to use the tool causing much confusion and difficulties using the tool.
173	<ul style="list-style-type: none">• A better guide or user manual should be provided to the user, especially for the Janus case tool.• Also a brief explanation on each of the different criterias which were made available, for example, right and act criterias which were in the Janus tool.
174	<ul style="list-style-type: none">• A hard copy of the Powerpoint should be given to students as references.• Lack of hard copy resources caused student didn't pay attention in the class.
175	<ul style="list-style-type: none">• A better well defined user manual would make the user's understandability increase.• The tool must be simplified in terms of design, interface design but maintain the contents.• A comprehensive search engine would make the tool more fun to be used.• More information could be added to increase the capacity of the tool.
176	<ul style="list-style-type: none">• No major comment about the tool because I couldn't find or discover any better tool than this one.
177	<ul style="list-style-type: none">• Easy to use tool but case study is hard to find, too many sub-directory and broken links.• Too many information on one page.
178	<ul style="list-style-type: none">• The tool should be more user friendly.• Need some more advantages for user.• Interface should more attractive.
191	<ul style="list-style-type: none">• The tool is very supportive documentation and it enable the student to understand more details.

Wolverhampton 2003/4 Semester 2 (W2 Cohort)*(Comments recorded verbatim)*

Student Index	Comments
102	<ul style="list-style-type: none">As the tool was used for assessment 2 and grades are dependant from it, I plead with peers to remove it as it is not a user friendly tool and student grades can suffer severely from it. It should never have passed the HCI standards to be on the SCIT web site.
106	<ul style="list-style-type: none">I did not really feel in control of the program i.e. the pathway or location of the screen in relation to the whole program. It also seemed inconsistent and incomplete.
110	<ul style="list-style-type: none">Difficult to use. Navigation to where I am in the structure was difficult to work out. Had randomly to click buttons to see what would happen and what features were on the software. Would recommend a better structure layout.
119	<ul style="list-style-type: none">Need to be explained more and more useful instructions.
123	<ul style="list-style-type: none">Got mixed up between cases sometimes.
131	<ul style="list-style-type: none">Lack of feedback on tool.
132	<ul style="list-style-type: none">Questions were too vague to apply to the case in general. I felt that all of the options could have been applied to the case.
133	<ul style="list-style-type: none">More data i.e. more cases therefore leading to more specific answers to what the user is looking for.
134	<ul style="list-style-type: none">It would be better if all the first criteria were selectable - not all options could be clicked on, making it seem limited and incomplete.
136	<ul style="list-style-type: none">Use more comprehensive language in the tool on the screens asking for questions to be answered to select a case study.
138	<ul style="list-style-type: none">Some of the links on the pages did not work. i.e. highlighted as a blue link but did not work.
139	<ul style="list-style-type: none">Should eradicate a full list as you select the criteria to narrow them down.
140	<ul style="list-style-type: none">Copy and paste to be simplified.Greater depth and increased cases.
141	<ul style="list-style-type: none">Copy and paste would help (can work round but takes time and effort).Some lines of enquiry gave no results.
143	<ul style="list-style-type: none">Couldn't copy and paste information.
157	<ul style="list-style-type: none">More cases should be used and also cases should be updated via a professional solicitor firms who perhaps should update and provide case information: real life cases.
160	<ul style="list-style-type: none">At times it felt as if the tool was leading the user to choose particular answers. But other than that it was OK.

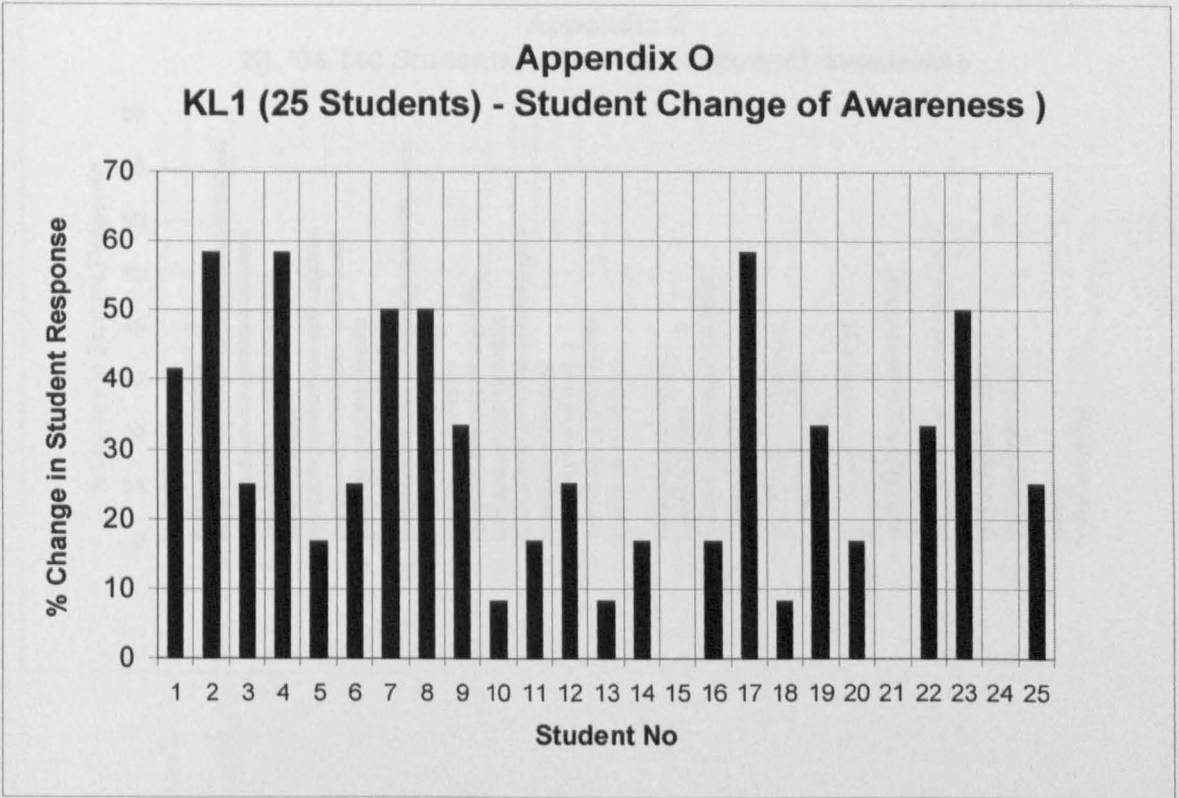
Appendix M: Ethical Awareness Responses – KL1/W1 Group

	KL1 (25 Students)				W1 (44 Students)			
	Changes in Attitude	No to Yes	Yes to No	No Change	Changes in Attitude	No to Yes	Yes to No	No Change
1. Negligence	8%	4%	4%	92%	16%	9%	7%	84%
2. Broken promises	32%	28%	4%	68%	25%	25%	0%	75%
3. Abuse of power	40%	28%	12%	60%	32%	25%	7%	68%
4. Failed to follow guidelines	28%	20%	8%	72%	30%	18%	11%	70%
5. Acted unfairly	24%	12%	12%	76%	30%	16%	14%	70%
6. Caused harm	32%	8%	24%	68%	34%	18%	16%	66%
7 Truthfulness	32%	24%	8%	68%	43%	25%	18%	57%
8. Loyalty to employer/client	20%	20%	0%	80%	27%	23%	5%	73%
9. Dignity and worth	16%	12%	4%	84%	27%	20%	7%	73%
10. Personal responsibility	20%	16%	4%	80%	39%	11%	27%	61%
11. Violated Golden Rule	32%	8%	24%	68%	30%	20%	9%	70%
12. Questions easy to answer	40%	24%	16%	60%	52%	50%	2%	48%
Difficulty in Answering								
Harder	16%				2%			
Easier	24%				50%			
Same	60%				48%			

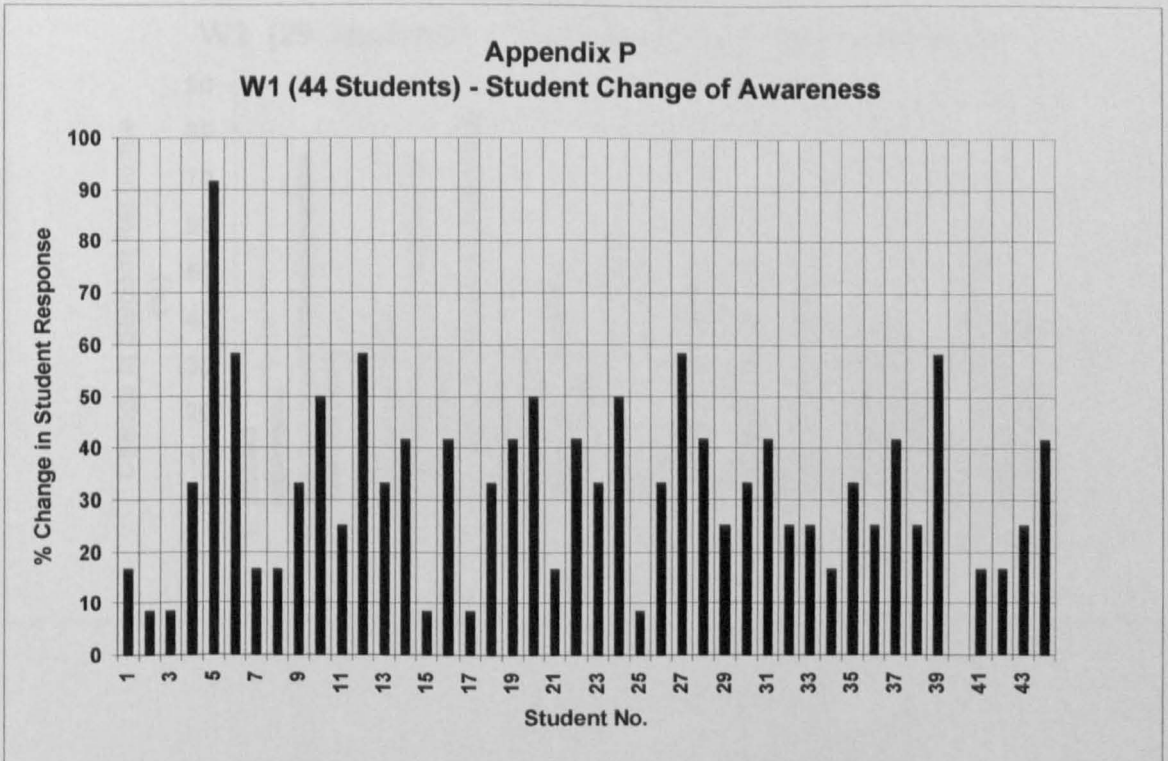
Appendix N: Ethical Awareness Responses – KL2/W2 Group

	W2 (29 students)				KL2 (40 Students)			
	Changes in Attitude	No to Yes	Yes to No	No Change	Changes in Attitude	No to Yes	Yes to No	No Change
1. Negligence	17%	3%	14%	83%	18%	13%	5%	83%
2. Broken promises	41%	28%	14%	59%	35%	23%	13%	65%
3. Abuse of power	45%	34%	10%	55%	45%	30%	15%	55%
4. Failed to follow guidelines	28%	10%	17%	72%	45%	18%	28%	55%
5. Acted unfairly	34%	21%	14%	66%	28%	23%	5%	73%
6. Caused harm	38%	28%	10%	62%	33%	15%	18%	68%
7 Truthfulness	45%	21%	24%	55%	45%	25%	20%	55%
8. Loyalty to employer/client	48%	31%	17%	52%	35%	8%	28%	65%
9. Dignity and worth	28%	17%	10%	72%	48%	18%	30%	53%
10. Personal responsibility	45%	28%	17%	55%	58%	25%	33%	43%
11. Violated Golden Rule	38%	21%	17%	62%	33%	3%	30%	68%
12. Questions easy to answer	34%	14%	21%	66%	28%	15%	13%	73%
Difficulty in Answering								
Harder	21%				13%			
Easier	14%				15%			
Same	66%				73%			

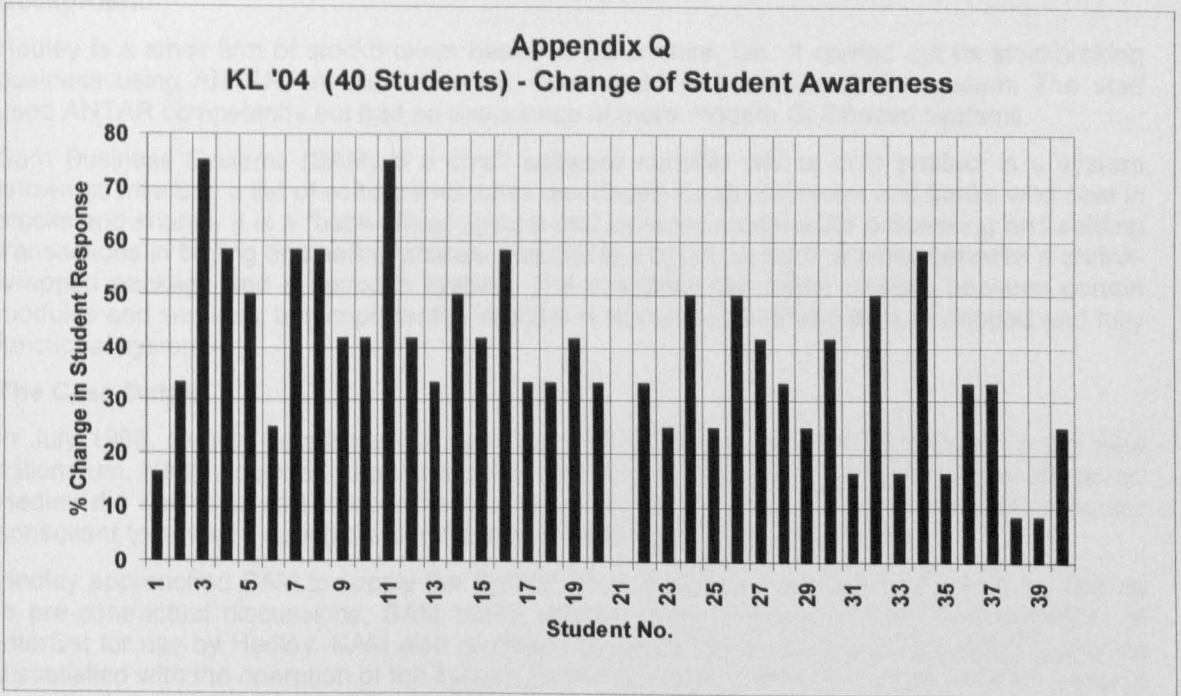
Appendix O: KL1 Students - Change of Awareness



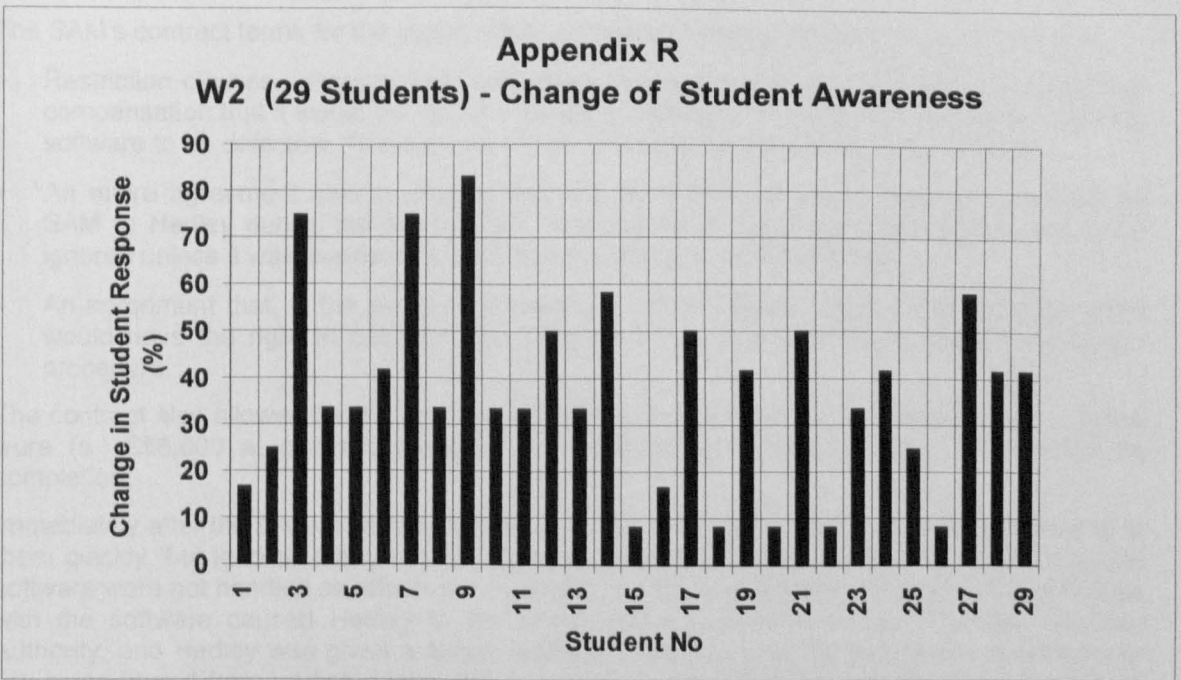
Appendix P: W1 Students - Change of Awareness



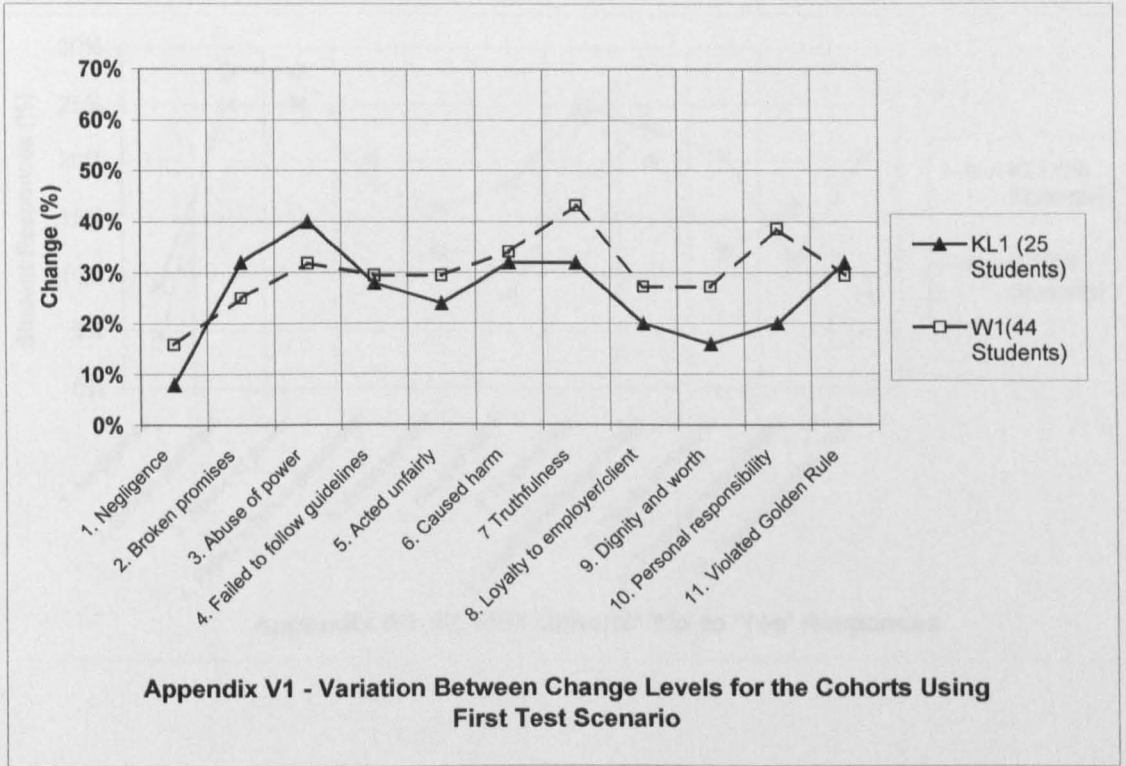
Appendix Q: KL2 Students – Change of Awareness



Appendix R: W2 Students – Change of Awareness

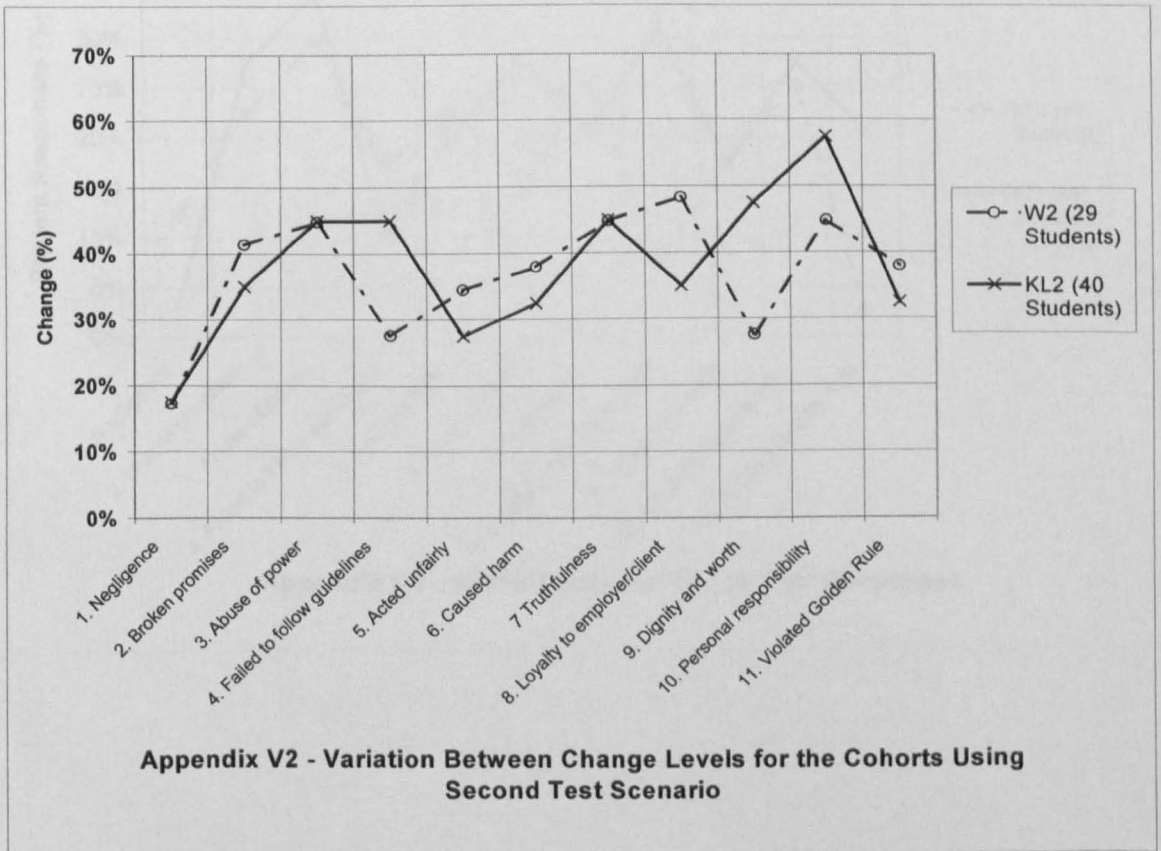


Appendix V1: Variation Between Change Levels (Scenario 1)

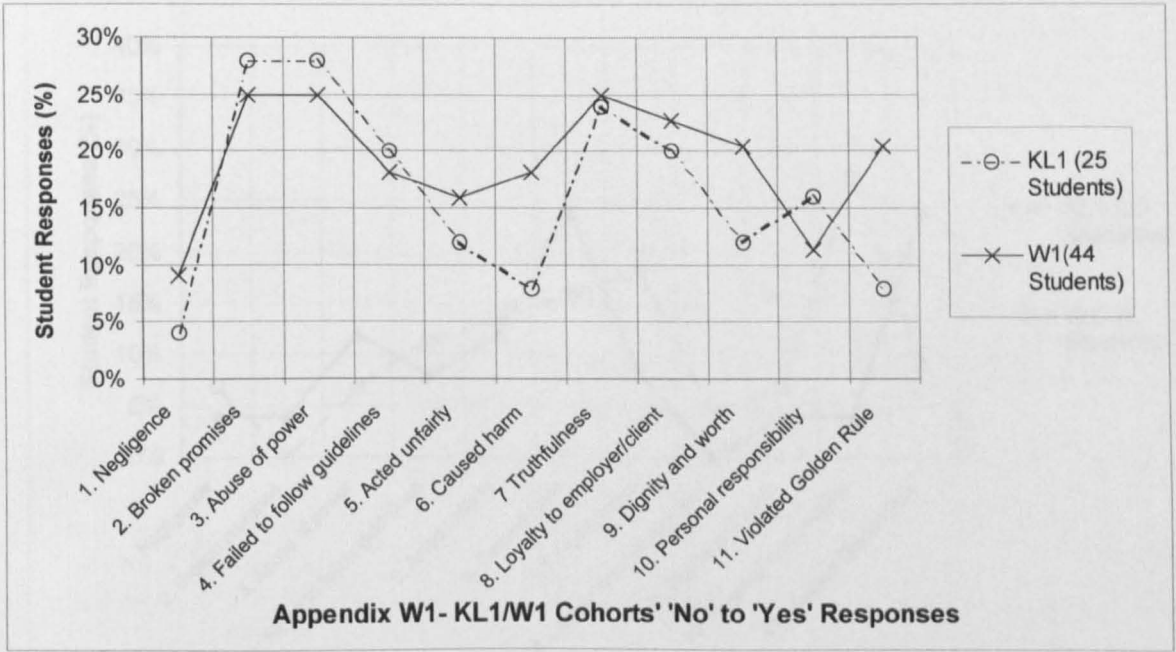


Appendix V2: Variation Between Change Levels (Scenario 2)

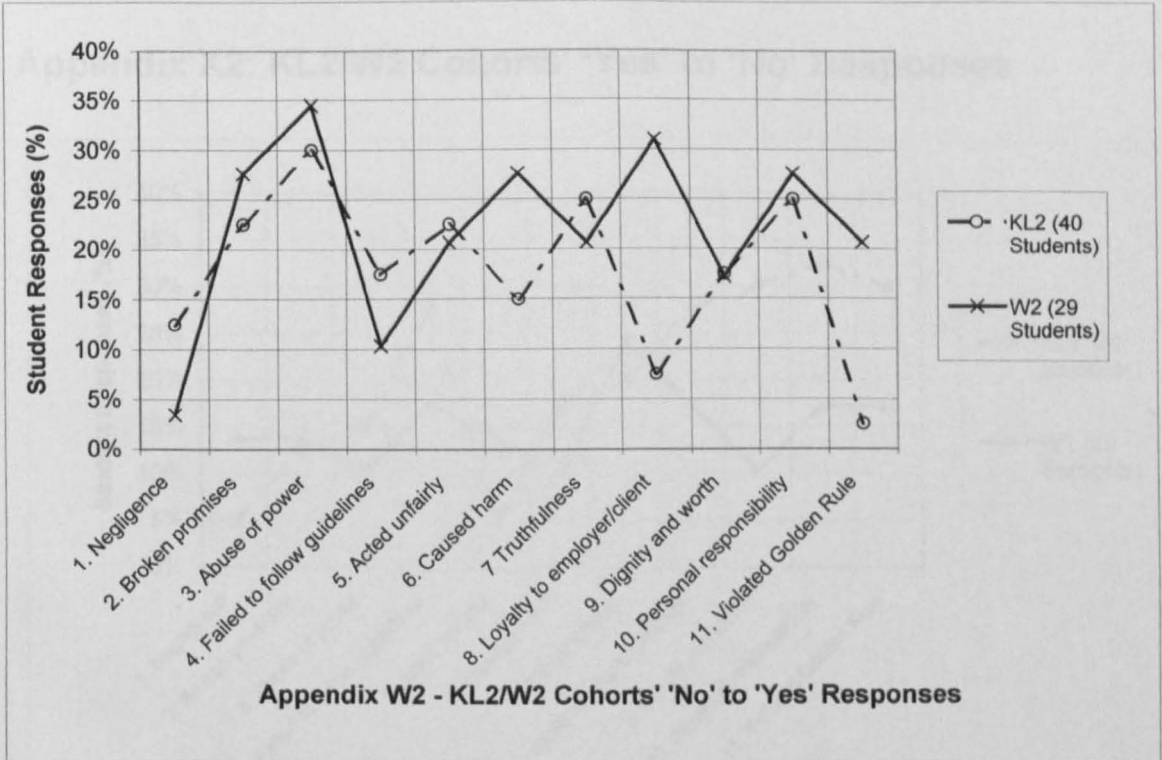
Appendix V2: Variation Between Change Levels (Scenario 2)



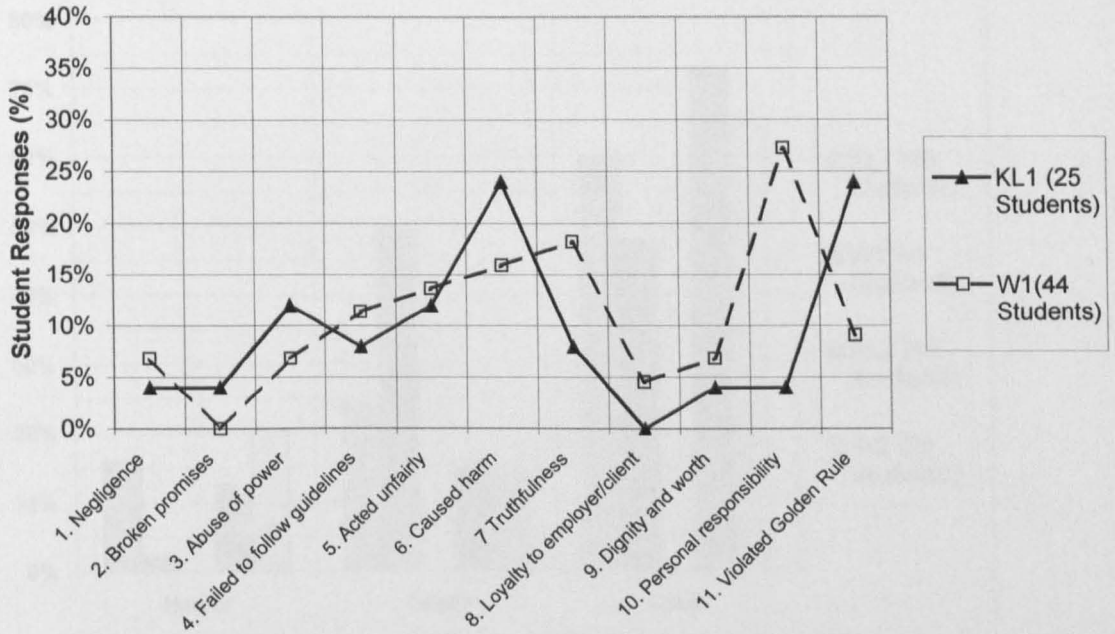
Appendix W1: KL1/W1 Cohorts' 'No' to 'Yes' Responses



Appendix W2: KL2/W2 Cohorts' 'No' to 'Yes' Responses

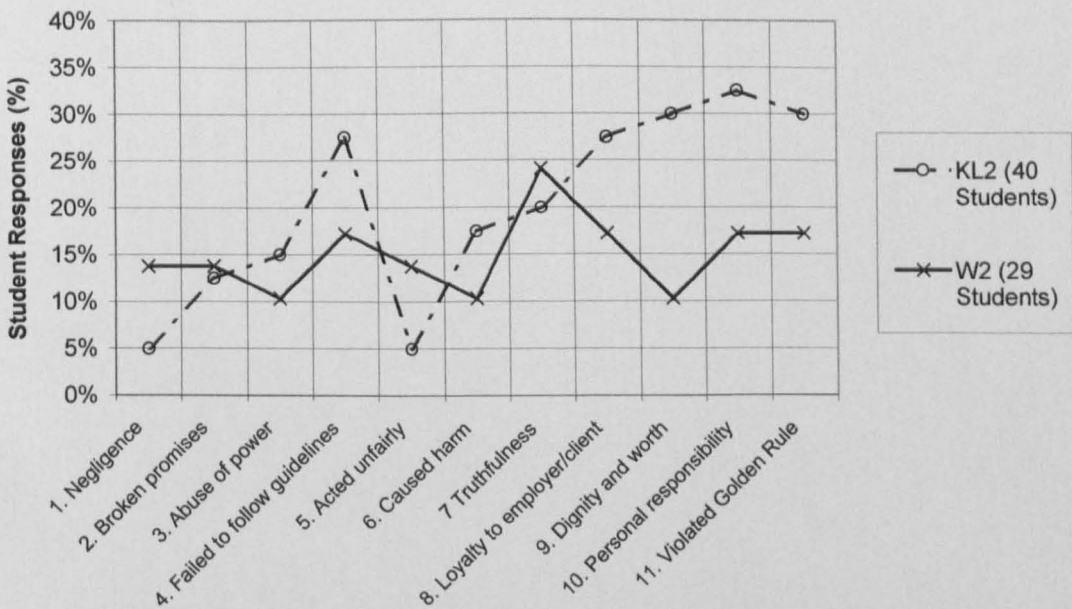


Appendix X1: KL1/W1 Cohorts' 'Yes' to 'No' Responses



Appendix X1 - KL1/W1 Cohorts' 'Yes' to 'No' Responses

Appendix X2: KL2/W2 Cohorts' 'Yes' to 'No' Responses



Appendix X2 - KL2/W2 Cohorts' 'Yes' to 'No' Responses

Appendix Y: Difficulty in Responding to Questions

