
The Challenge of Raising Ethical Awareness: A Case-Based Aiding System for Use by Computing and ICT Students*

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ABSTRACT: *Students, the future Information and Communication Technology (ICT) professionals, are often perceived to have little understanding of the ethical issues associated with the use of ICTs. There is a growing recognition that the moral issues associated with the use of the new technologies should be brought to the attention of students. Furthermore, they should be encouraged to explore and think more deeply about the social and legal consequences of the use of ICTs.*

This paper describes the development of a tool designed to raise students' awareness of the social impact of ICTs. The tool offers guidance to students undertaking computing and computer-related courses when considering the social, legal and professional implications of the actions of participants in situations of ethical conflict. However, unlike previous work in this field, this tool is not based on an artificial intelligence paradigm. Aspects of the theoretical basis for the design of the tool and the tool's practical development are discussed. Preliminary results from the testing of the tool are also discussed.

1. Introduction and Aims of the Research

Information and Communication Technology (ICT) is a comparatively new profession. The unique features of ICT, such as its speed of transmission, globalisation, anonymity, and ability to manipulate information, can create many problems for those

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who develop and use the technology. The pace of technological development has been so rapid that the new technologies have been implemented before a full consideration of the ethical issues raised by their use can be made.¹

All professional activity has social consequences.^{2 (p.215)} Professionals should be aware of the consequences of their actions and be prepared to accept responsibility for them. However, Bynum and Moor^{3 (p.5)} suggest that little progress has been made in addressing the ethical issues associated with ICT because of a lack of a clear understanding of computer ethics. Students, the future ICT professionals, are often perceived to have little understanding of the ethical issues associated with the use of ICT.^{4(p.173)} Some governments, particularly in the Western world, and most professional computing bodies, have turned their attention to the problem^{5,6} and instigated measures to include consideration of social, legal and ethical issues in undergraduate and postgraduate computer-related courses.

This research is part of a wider project to establish a theoretical basis for, and the development of, an educational courseware tool that will assist students to recognise, understand and consider more deeply the ethical issues that may arise from the use of ICTs. Rahanu's⁷ case-based reasoner was an initial output of this wider project. This particular tool builds upon that experience. It will retrieve a nearest matching case(s) to a given scenario from a library of ethically analysed real-life cases chosen to reflect the range of conflicts arising from unethical computer use.

2. The Challenge of Raising Ethical Awareness

There is considerable debate concerning the most effective way of raising students' awareness of the ethical issues that they will possibly encounter in their future careers. Munro and Munro^{8 (p.643)} have identified that, especially in the medical, engineering and computing disciplines, it is essential that students be taught to recognise ethical issues, and encouraged to consider the social and legal consequences of their actions. Woodcock and Armstrong⁹ suggest that exposing students to a variety of relevant ethical experiences can produce significant changes in students' ethical awareness. Other authors consider that the most effective approach to raising awareness is to target an individual's personal ethical code by the use of pertinent case studies.^{4(p.173),10,11(p.xii),12}

Stanoevska et al.^{13(p.23-1)} consider that classification and retrieval procedures, transforming simple data into knowledge, are required before knowledge can be reused with efficiency. They identify two categories of knowledge: tacit and explicit. Tacit knowledge is internal, personal intuition and insight. Explicit knowledge is external, codified, and available with some form of transmission medium. The two form a cyclical knowledge creation process (Figure 1) which can be mapped to the development of personal ethical values. How, then, can codified knowledge and a transmission medium be developed and deployed to target students' personal ethical codes?

Much experience, particularly in the engineering and science disciplines, has developed through the inspection and analysis of former events. This information can be incorporated into case studies. These can be used to transfer to students the experiences gleaned from detailed inspection, speeding up recognition of the issues raised. The use of case studies for examination and discussion by students is the preferred method of instruction suggested by the ImpactCS committee.^{5,14} However, the use of case studies can bring 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 factual richness that would be of benefit to students. 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. Clearly any approach using case studies needs to recognise these pitfalls.

The recent recognition by governments and the courts that unlawful use of ICT must be addressed is now beginning to produce an interesting, accessible and relevant source of teaching material. The publication of legal case transcripts on the Internet has provided ready access to those areas that were formerly the privileged domain of lawyers.¹⁵ Court transcripts, legal commentaries, and articles from reliable trade and national press sources provide case details that can be used as a library of reference material.

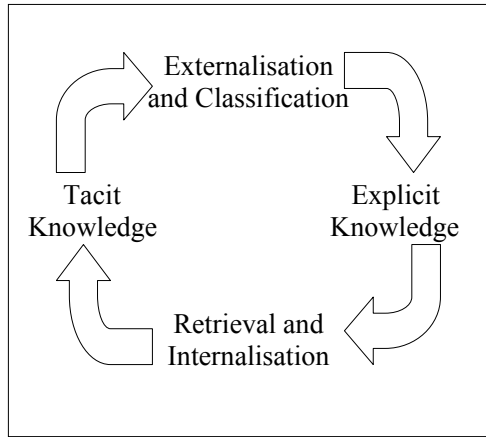
Student awareness of ethical issues can be improved by providing examples of matching, ethically interesting episodes from the library, so forming an ‘aide-memoire’ for comparison with the students’ assignment scenario. The use of current, relevant material is a stimulant to students, who are able to identify and empathise with the participants in the action, and to develop their own personal intuitions and insights.

The ubiquity of ICTs, and their use by those who are not ICT professionals (in the sense of belonging to an ICT professional organisation), raises the possibility that anyone employing the technologies has the ability to use ICT intentionally or unintentionally in unethical actions. This would suggest that all who use ICTs should be aware of, and observe, some key ethical principles.

3. Previous Work

A number of authors have developed instruments that are designed to assist in raising awareness of the ethical issues posed by the use of ICTs. Kallman and Grillo¹⁶ devised

Figure 1. *The Tacit-Explicit Knowledge Cycle (Adapted from Stanoevska et al. (1998))*



a system for ethical analysis and decision making. Maner¹⁷ developed a web-based interactive survey tool using scenarios to compare one's own ethical views with those of a world-wide audience. Rahanu's⁷ tool uses artificial intelligence (AI) techniques to retrieve cases from a library of ethically analysed case studies addressing the issue of professional malpractice in failed information systems.

While in some ways useful, the retrieval vectors for Rahanu's system are not applicable to a range of ethical issues wider than those involved in failed information systems. Rahanu's case library, however, provided a useful resource. Analysis of the Rahanu cases suggests that most involve failure to keep promises. Rahanu's term 'failed information systems' does not immediately convey any suggestion of unethical or unlawful behaviour. For our wider purposes, the classification might therefore more helpfully be described as 'contractual issues' rather than 'failed information systems'.

ICT has also permeated most other professions, allowing traditional wrongdoings to be perpetrated more rapidly, widely and effectively than ever before. Most enterprises become involved in contractual issues. ICT faces the same dilemmas as many other professions. Rahanu's system therefore addresses ethical, social and legal issues common to the contractual problems faced by many organisations.

Rahanu's concept has the potential for development for use within any discipline where ethical issues need to be considered, not just those arising from failed information systems. It should be possible to develop a set of vectors for use in a retrieval process that will address a range of ethical issues common to most professions. Examination of the codes of conduct and practice for other professions reveal that they follow closely the principles adopted by ICT professional bodies. The case library developed as part of this research draws heavily on ICT case law. Other professions also generate their own volume of case law that may be used to assemble similar libraries for use by students in those areas. The concept therefore has the potential to be transferred to other professions.

The following sections suggest how the Rahanu concept may be generalised to address unethical actions within any sector of ICT.

4. The Basis for a Retrieval Engine

The selection of a 'similar' matching case from a library of pre-analysed cases can be difficult. Some retrieval systems adopt a semantic approach, attempting to match cases through the identification of word associations. Others attempt to apply rule-based algorithms, and follow the propositional calculus format used in relational database management systems. In so doing, they attempt to apply AI techniques to mimic human intelligence.

Zeleznikow and Hunter¹⁸ discuss at length the application of AI principles to the domain of legal case retrieval, and find that the appropriateness, acceptability and usefulness of AI systems are a question of degree. The greater the need for human reflection, intuition and judgement then the less appropriate is an AI system that is closed, self-sustaining and incapable of human intervention. For this reason, the type of AI techniques used and the manner in which they are used are most important. Systems

that replace human activity are likely to be closed and use rigorous techniques to emulate the human performance. Systems acting as support or guidance for human activity are more likely to have multiple intervention points and simpler techniques.

Moor^{19 (p.221)} notes that it is of concern to many critics of artificial intelligence that the activities of computers are matters of calculation, and not judgement. Computers process information dispassionately. Dreyfus^{20 (p.199)} states that a computer has no built-in pre-understanding of how our world is organised. Before a computer can undertake AI actions, it needs to be primed with human knowledge and judgement.^{19 (p.217)}

Ethical concepts do not lend themselves to semantic or logic-based retrieval as the many important nuances present in ethical scenarios are ignored. 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 ever likely to be set in exactly the same context. Consequently, the reduction of the potential range of actions available to the human operators to a simple rule-based algorithm is impossible to achieve.

While rule-based systems may be confounded if they attempt to obtain a precise match on all fields, other systems may use AI techniques that are closed, self sustaining and incapable of human intervention. Neither technique is what is required for the stimulation of students' deeper thinking processes. An exact match will not encourage discussion and reflection of ethical issues. Wiener^{21(p.21)} suggests that the more probable the message, the less information it conveys. Similarly, the more exact the match, the less the student will need to think about the relationships between the scenario and the matching case presented by the retrieval tool. Students' imaginations must be stimulated to recognise and explore the nuances and differences between cases, 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 not provide stimulation either. 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'.

4.1 The Development of a Retrieval Algorithm

The retrieval of ethical analyses from the case library presents many challenges if suitable similar cases are to be identified and presented to students. Kolodner^{22 (p.31)} suggests that cases are contextualised pieces of knowledge representing an experience. These do not lend themselves to the application of rule-based systems for several reasons:^{22 (pp.93-94)}

- 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 a mechanism rather than addressing 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.

Kolodner discusses the opportunities presented for the retrieval of cases using case-based reasoning techniques. She notes that these can range from a fully repairing, predictive system to a simple retrieval system that transfers reasoning from the computer to the user.^{22(p.540)} The proposed retrieval tool does not require a fully-fledged case-based reasoner. The predictive and repairing facilities are inappropriate when dealing with ethical issues, a domain often not fully understood by the students. Students need to retain ownership of the reasoning (thinking) process. There should be no student passivity with the retrieval or interpretation of the case. The input of data for use in the retrieval paradigm is part of the reasoning process. If the tool is allowed to usurp the human elements of the reasoning process, it will block student thinking.

Thagard^{23(p.49)} believes that much in artificial intelligence research is not concerned with modelling human thought processes. It is focused towards the construction of algorithms designed to perform well on complex tasks, regardless of whether the algorithms correspond to human thinking. The proposed retrieval tool is required to act simply as a 'reminding' system, guiding and supporting the human-centred thinking process to reach a suitably similar case. Kolodner^{22(pp.60-71)} describes such retrieval-only and advisory systems. Furthermore, the systems described are not required to include any complex computer code. Any system that guides a user through a retrieval process may be included under the generic heading of case-based reasoning. The degree of interactivity and artificial intelligence is entirely within the control of the designer.^{22(pp.540-543)} It is therefore acceptable for a system to be developed that merely assists the user to navigate successfully through a series of questions. Such systems are classified by Kolodner as case-based aiding systems.

4.2 Case-Based Aiding

From the above it can be seen that it should be possible to develop a case-based aiding system that:

- Follows many of the principles of case-based reasoning systems, but does not involve the mechanistic application of rule-based algorithms for retrieval.
- Describes cases in terms of neutral, dispassionate vectors.
- Allows students to retain control of the reasoning process.
- Presents suitable similar cases, but allows the user mentally to adapt and merge information from several cases where appropriate in order to arrive at a suitable evaluation of an ethical action.
- Does not attempt to process input data to give a computationally interpreted or adapted result.

- Guides students' navigation through the system, suggesting relevant questions that will lead to a suitably similar case(s) within the case library.

This suggests the use of a 'conversational' interface, interacting with the students in a natural, sensible manner.^{22(pp.556-561)} Such systems are particularly useful for inexperienced students, and adopt the metaphor of a novice in conversation with an expert. The system guides the novice through a sequence of questions based upon the experience of the designer concerning what the novice might reasonably be expected to ask next. This raises the question of how the conversational elements of the interaction may be modelled.

4.3 The Retrieval Tool Paradigm

Moor^{19 (p.226)} suggests that the conversational responses can be modelled as nodes of a decision tree. He recognises that, during a normal conversation, the possible choice of sensible response strings that might be used in a conversation is huge. However, if the conversation is contextualised, the number of choices can be reduced so that the number of nodes is restricted to a manageable level.

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 navigational direction is entirely under the control of the user.

Schweighofer²⁴ suggests 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 the navigational structure that permit navigation through the document collection to a relevant case or cases. The system thus 'walks the user through' the retrieval process.

These concepts appear to match exactly the requirements for the retrieval of ethical analyses. It therefore seems possible that a tree structure, constructed using hypertext links and posing navigational queries based on contextualised ethical principles to the user, is a fruitful area for research.

4.4 The Selection of Retrieval Vectors

There now comes the issue of what substantive queries should be asked of the user to enable them to use the case-based aiding system. Kallman and Grillo^{16 (p.9)} suggest that anyone using computers should consider the following issues when contemplating the effects of the use of the computer and making a defensible decision for their actions:

- Legal issues and limitations.
- Availability of Guidelines.
- Consequentialism,
- Rights and Duties, involving
 - Personal duties,

- The rights to know, to privacy and to property,
- Professional responsibilities.
- Kant’s Categorical Imperative.

These criteria may provide a basis for the classification and retrieval of ethically analysed cases, and be adapted to fit the requirements of a retrieval, in a way that facilitates the use of those cases in a case-based aiding system as described above.

Pattern-matching retrieval seems to offer a possible case identification system. This uses Boolean logic, asking simply whether a particular factor is present in the case, regardless of its influence upon the outcome. The responses are limited to ‘Yes’ or ‘No’, giving a simple algorithm. Cases may be ‘described’ by the presence or absence of the factors. Smyth and McKenna²⁵ (p.343) suggest that the method is most effective using a restricted range of cases. If a large case library can be partitioned using recognised classifications, the final retrieval can be successfully achieved using the Boolean responses as retrieval vectors.

Difficulty in retrieval of ‘matching’ cases is not unique to ethics. A similar problem exists in law, where semantic or logic-based models give difficulty with legal document retrieval systems.²⁴ 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 also.

Curran and Higgins⁽²⁶⁾ have investigated this system for retrieval of legal documents. The pattern of the Boolean responses may be matched to similar patterns for other cases contained within the case library as in Figure 2. Curran and Higgins examined the area of company directors’ duties towards small shareholders, and found it possible to develop rudimentary retrieval vectors for this legal domain that would lend themselves to Boolean responses. The system operated successfully if an area of law could be discretely identified. This suggests that if instances of ICT ethical malpractice could be broadly

Figure 2. Factor Matching (Adapted from Curran and Higgins (2000))

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

contextualised into areas such as contractual issues or property ownership, following the concept of keywords, it should be possible to apply suitable ethically based questions as vectors to identify specific areas of ethical malpractice.

5. The Development of the Retrieval System

The retrieval tool model is that of a decision tree. 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. The tool first contextualises the case, bursting the retrieval process into a number of discrete ethical domains. It then applies Boolean logic to determine the occurrence of specific ethical principles within a case. Finally, fine-tuning is carried out by applying professional and personal moral duties to the retrieval process, allowing navigation to a suitable matching case or cases.

5.1 Contextualisation

A series of real-world ethical scenarios was researched and examined. The ethical, social and legal issues raised by the cases were identified. It became evident that the contextualisation of unethical acts requires consideration of environment, culture and jurisprudence, all related to the country in which the act arises. This vector is one of the most important for the successful retrieval of relevant cases, and is a convenient start point for the tool.

The cases were then used to test whether sub-division might be achieved within each country domain. Two areas were of interest: the main issue raised by the unethical act, and the violation of personal rights. Examination of the test cases

suggested that the main issues highlighted fell within the broad categories listed in Figure 3. These are not mutually exclusive, but usually one will be more dominant. The tool requests that the students select the issue they perceive to be the most important.

It was also found that most scenarios examined contained violations of one or more of the rights to privacy, to property and to know, recognised by Kallman and Grillo^{16(p.13)} as being of significance to ICT ethical analysis. Identification of the violations of the different rights provided a further sub-division of the case library.

The combination available from the country, main issue addressed and rights violation classifiers provides a very powerful partitioning mechanism for the case library. They provide 480 discrete areas within which Boolean responses to the presence of ethical and professional principles may be identified.

5.2 Applying Ethical and Professional Normative Principles

The test cases were checked against the criteria of Kallman and Grillo^{16(p.9)} to determine if it was possible to use these issues as retrieval tool vectors. Most issues lent themselves well to Boolean responses, and these were incorporated into the retrieval tool interface.

However, it is not necessary to apply all potential questions in the tool interface in order to retrieve a case. Some questions are irrelevant to retrieval in some contextual

Figure 3: Main Issue Raised by the Case

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

areas. 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 categories. Each group of cases was used to run a series of experiments to determine which questions were relevant for retrieval within that context. It was found that many of the decision paths within the contextual areas required submission of the questions in different sequences if a good separation of the cases was 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.

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. Cases can be separated or sub-clustered using the combinations of the professional principles shown in Figure 4. In particular clusters of cases grouped by the Boolean questions, this provides the ability to match cases into smaller groups of two or three cases according to the professional criteria identified. It presents a choice of cases for consideration and encourages exploration and evaluation of the issues raised from several viewpoints.

Finally, further sub-division may be required within the small clusters of cases provided by the 'professional duty' classifier. Kallman and Grillo ^(16, p.14) suggest that all people have personal moral duties, shown in Figure 5. Although available for inclusion in the retrieval tool, this sort mechanism has not yet been needed, but has been included in one decision path to test its effectiveness.

Figure 4: Professional Duties

No.	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

Figure 5: Personal Moral Duties

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

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.

6. The Expansion of the Case Library

At present, the environment addressed by the tool is 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.

The 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. Before the full efficacy of the tool can be realised, it will be necessary to populate further US and UK areas of the case library. Furthermore, students may have differing perceptions of the main issue addressed by a case. Cases are often not clear-cut, and may fall equally justifiably into more than one of the 'main issue' categories. Students must be able to navigate to an appropriate case regardless of which start-point is used. The construction of the tool allows this multi-standpoint approach, but will require the inclusion of a substantial number of additional cases for a fully effective retrieval operation.

The case library for this tool includes ten cases developed by Rahanu, but needed more cases for effective operation. The library was therefore expanded to contain twenty-two contractual cases from the UK. It was also necessary to include additional cases to populate a further area of the case library. The area of US privacy was selected, and thirty-three cases from this area have been included.

7. Empirical Testing

Initial testing of the tool has begun. Two areas are being investigated: the usability of the tool, and the effect of the tool upon a student's ethical awareness.

The tool has undergone a pilot assessment for usability by students within the United Kingdom. Students who have used the Rahanu tool have commented favourably upon their first impressions of the new tool. Several useful suggestions upon usability issues have been received, and modifications included in the interface.

Some informal experimentation by students who used the tool to match a case against their assignment case has demonstrated its ability to retrieve relevant cases. It has also raised the point that the retrieved cases do not always immediately appear to address the areas anticipated by the student, a point addressed in Section 4.0 of this paper. Some thought and evaluation is required on the part of the student to interpret the issues raised, a strong point in favour of the tool. Initial informal testing therefore seems to suggest that the tool is able to achieve one of its major objectives: that of stimulating deeper thought upon ethical issues raised by new scenarios.

There is an element of subjectivity in a student's performance when undertaking an ethical analysis of a given scenario which prohibits the assignment of absolute scores.¹⁰

It is therefore not feasible to reduce the assessment of change in ethical awareness to a comprehensive statistical analysis. The testing seeks only to identify trends in the change of students' ethical awareness using a simple two-stage survey technique.

Students are given a simple case study to analyse, and asked to complete a brief questionnaire seeking responses to ethical issues identified within the case study. Students are then encouraged to use the case retrieval tool to retrieve a suitable matching case and to undertake a more detailed analysis. The survey is then repeated. The comparison of the students' 'before' and 'after' responses will give an indication of the effect that the use of the tool has produced upon the students' ethical awareness of the issues raised by the case study.

The students may use the tool within a group or individual environment. However, it is important that students complete the surveys individually, without contemporaneous input from their colleagues, to determine whether their own ethical understanding has changed.

7.1 The Human Research Protocol

The research protocol used for the testing of the tool was that required by the Human Research Ethics Committee of De Montfort University, Leicester, UK. The principal points of the protocol are:

- The rights of students will be respected.
- Students are not obliged to participate in the research. Students may withdraw from the research at any time without providing any reason for doing so.
- No personal, private identifiable data is to be collected. The data collected will identify only a student's perception of their ethical understanding concerning the issues raised by the case study or the usability issues of the retrieval tool.
- Student responses to the questionnaires will be kept strictly confidential. All responses will be anonymised during processing.
- Students will be required to choose a personal identifier known only to them for entry on the 'before' and 'after' response questionnaires for the ethical awareness evaluation so that the researcher can match 'before' and 'after' responses.
- 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 the evaluation and development of the retrieval tool.
- Students have a right to place their responses in an envelope for return to the researcher without the tutor seeing their responses to the questionnaire, and to see that the envelope is sealed.
- Once received by the researcher, the questionnaire sheets will be kept within secure facilities at the home of the researcher.
- Once the paper questionnaires have been processed, they will be destroyed. No personal or private information will be disseminated to others.

7.2 Pilot Testing

Pilot testing of the tool was carried out in Malaysia in July 2003 using a UK contractual case, that of SAM v Hedley, for the assessment. More stringent testing of the tool will be carried out in the UK during the 2003/4 and 2004/5 academic years.

Additionally, it is intended that in future semesters the tool will again be used by students in Malaysia, and in the United States. This will provide an assessment of its acceptability in different ethnic and cultural environments.

8. Analysis of Ethical Awareness Pilot Test Questionnaires

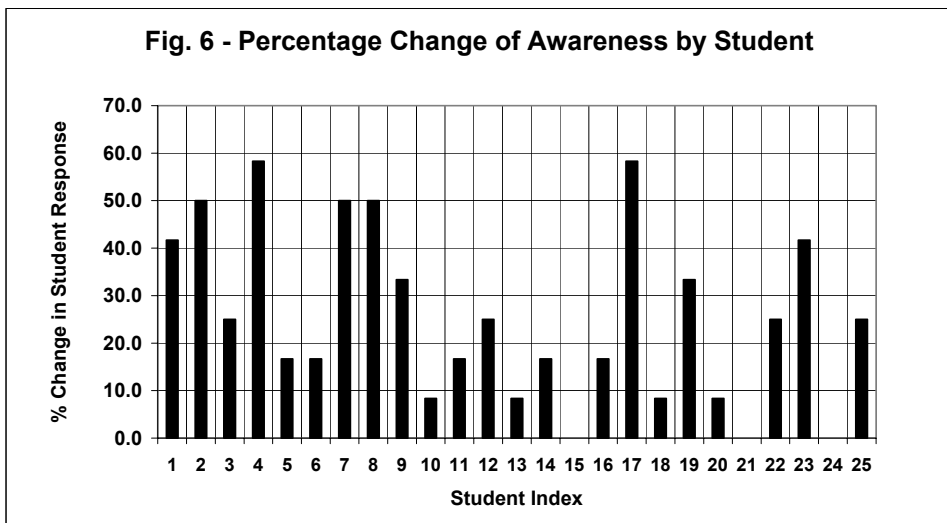
Forty-one Malaysian and Taiwanese students at university in Kuala Lumpur agreed to take part in the research. From these, twenty-five pairs of responses were found to be valid. A number of students either completed only one questionnaire, or had failed to use the same personal identifier on the 'before' and 'after' questionnaires, thus preventing the matching of the individual student's responses.

Students' responses were examined from three viewpoints:

1. the number of students who changed their responses to any of the questions after using the retrieval tool,
2. which issues were the subject to the greatest reconsideration,
3. the perceived ease of answering the questionnaire after using the retrieval tool.

8.1 The Number of Students Changing Their Responses after Using the Tool

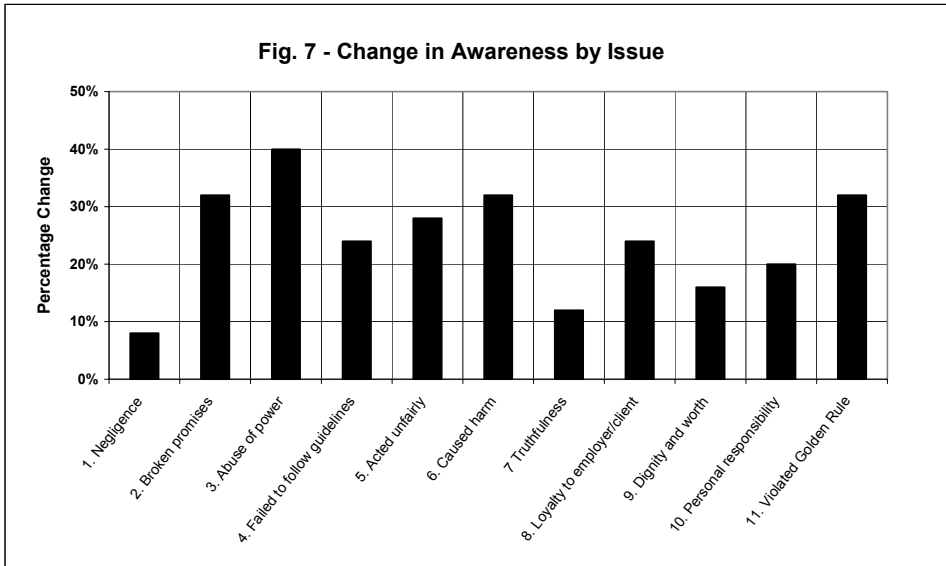
Figure 6 shows a graphical representation of the responses of students who altered their response to the questionnaire after using the tool. The plot indicates that twenty-two of the twenty-five students (88%) changed their perception of at least one issue raised by the questionnaire. Fifty-two percent changed their perception on 25% or more of the issues raised. Twenty percent of students changed 50% or more of their perceptions of the ethical issues.



Three students did not change their responses to any of the questions. The reason for this is not known. It suggests that these students held very firm ethical beliefs and that the tool did not prompt reconsideration of the issues raised by the test scenario. Alternatively, students may not have entered into the spirit of the research and simply repeated from memory the responses to the questions. However, the latter explanation is less likely as the students were not told that the test for ethical awareness was to be repeated, and had no need to memorise their ‘before’ responses.

8.2 Issues Subject to the Greatest Reconsideration

Figure 7 indicates the number of students altering their perception of each ethical issue. Two of the issues addressed by the questionnaire, broken promises and truthfulness, are qualities that are personal and internalised. The others are qualities that require the student to consider the issues from the perspective of another. It would be expected that, following theories of moral development, individuals who have developed a high degree of moral maturity would be able to ‘inhabit’ the personae of others, and to recognise the ethical dilemmas that a case study presents. The high number of changes indicated suggests that the students taking part in the research have yet to reach this degree of maturity.

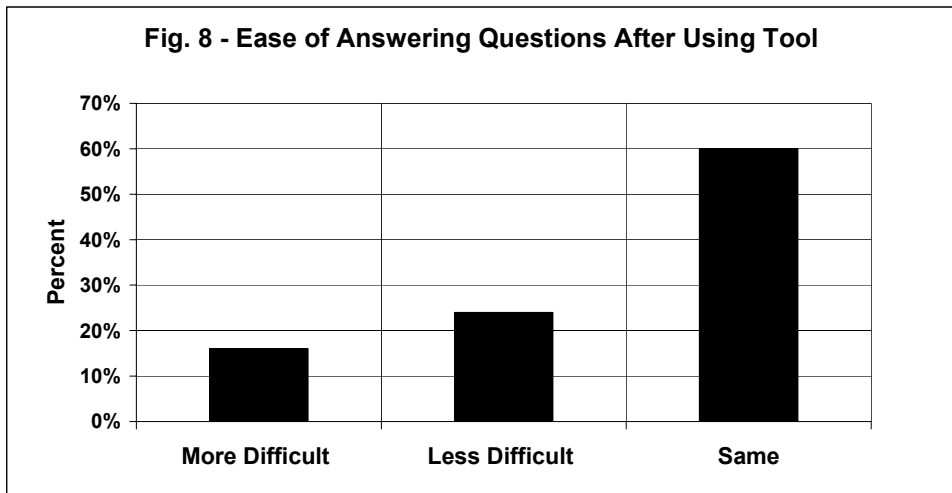


Furthermore, those issues that have attracted a change in response of more than 25%, (broken promises, abuse of power, unfair action, caused harm, and the Golden Rule), are all issues associated with contracts and the conduct of business. The case study addresses the issues of contract limitation and exclusion clauses. The responses suggest that students were not familiar with the implicit promises and conditions contained within the area of contract law. However, the level of change indicated suggests that students have an inherent attitude towards contract and promissory commitments that follows their cultural background. Hofstede^{27 (p.26)} finds that many

south-east Asian cultures have a power distance index (PDI) of 60-100. This suggests a culture where high value is placed by society on obedience and conformity, acceptance of the status quo where individuals tend not to trust one another or to disagree with one another. Business practices thus tend to be very different from those of western cultures where PDI scores are typically 35-40, suggesting a much more open, competitive society.

8.3 Ease of Answering Questions after Using the Retrieval Tool

Figure 8 indicates the change in perception of the difficulty in answering the ethical awareness questionnaire. Forty percent of students changed their responses following use of the tool. Of these, 24% found the questions easier to answer and 16% found them more difficult.



Of those who made the same response to the difficulty of answering the questions after using the tool, 44% found the questions difficult and 16% found them easy. One interpretation of these results would be that the tool facilitates the analysis of the given scenario by some students, but prompts others to recognise that the scenario may not be so simple and clear-cut as it first appears. Unfortunately, the results could also be interpreted as consistent with the tool enabling some students to short-cut ethical analysis, while confusing others. The results obtained to date can now be used as a baseline for a further series of more stringent tests to be carried out on a wider selection of students. These will help to resolve whether the changes brought about by using the tool are helpful.

9. Conclusion

The literature provides evidence of the need for the development of a tool to raise students' ethical awareness and understanding of the ethical issues inherent in the use of ICTs. Furthermore, there is a coherent ethical basis for the technological

development of the tool. The use of a hypertext decision tree linked via Boolean retrieval techniques to a library of pre-analysed ethical scenarios offers a promising way forward. This would suggest that it is possible for the tool to be developed to meet its stated objectives.

The pilot studies and informal feedback suggest that the students like using the tool, finding it easy and intuitive to use. The studies also suggest that the tool achieves its aim of promoting students' deeper thinking upon ethical issues.

The questions posed by the tool during the retrieval process seem applicable to a wide range of business and social scenarios, suggesting that the tool is transferable to other professions. However, some additions to the choices offered by the tool interface may need to be made and suitable case libraries would need to be developed.

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