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Providing developmental feedback to individuals from different ethnic minority groups using expert systems

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Providing personal development feedback to individuals from an ethnic minority: the design and commercial use of FRED

ABSTRACT

The following paper is an account of a commercially successful and viable expert system entitled FRED (Feedback Reporter Evaluating Development). Expert systems offer a consistent approach to providing feedback to individuals that people with personal biases and emotions may find difficult to achieve. The text used in the expert system is sensitive and carefully worded by a team of skilled professionals, many of whom were from ethnic and cultural minorities. This is especially important when dealing with internal applicants from ethnic minorities as feedback given is consistent, fair, non-judgemental and devoid of possible ethnic prejudices and emotional statements. FRED offers a sensitive, comprehensive and cost-effective method of producing feedback reports for individuals from an ethnic minority and the paper details FRED's design, use and evaluation in an organizational setting. Future research was recommended in utilising expert systems to provide feedback in assessment and development settings.

Key words: ethnic minorities, personal development, applicant reactions to selection

Introduction

The use of commercial expert systems has come under considerable debate recently with several authors demonstrating their limited use (Abdullah, Kimble, Benest & Paige, 2006; Sagheb-Tehrani, 2006; Shaw and Gaines, 2005). Nevertheless, in Industrial/Organizational Psychology, expert systems have continued from strength to strength predominantly in the field of interpreting psychometric tests (Bushnell, Paltiel & Young, 1998). Many of the UK test publishers include an expert system interpretation package along with their online or pencil and paper test. These expert systems write a variety of reports from basic interpretations through to complicated in-depth analyses linking the psychometric test taken with other well-known tests.

Expert systems have also had some success in the assessment centre field. Wilson (1998) described how an expert system used in the London Fire Brigade detailed performance ratings as part of a Promotion Centre to applicant managers. The reports specifically produced by the system interpreted the performance ratings of assessors on various exercises and competencies (Wilson, 1998). Potential managers would thus be able to see which exercises they performed poorly on and more importantly which competencies they needed to develop.

This paper expands the use of expert systems further into the initial application phase of the selection process. Expert system technology, as this paper will demonstrate, can be used to report on the performance of applicants early on in the selection process. It can also be used to link consistencies of underperformance together to generate personal development feedback specific to the individual. Feedback to applicants on why their application was not successful may lessen the negative impact of being rejected as some research has suggested (e.g., Gilliland, Groth, Baker, Dew, Polly & Langdon, 2001).

Research method and questions

This study examines in detail the design processes, commercial application and evaluation of an expert system designed specifically to give feedback to individuals from an ethnic minority. The methodology is based around a case study for which one of the authors was the project manager, assessment specialist and program designer. This paper specifically seeks to answer the following research questions:

- What was the situation that meant feedback to rejected applicants was necessary?
- Why expert systems were better than humans in providing sensitive development feedback?
- How the knowledge elicitation phase generated information from two expert teams?
- How the expert system was designed, programmed and tested?
- How did the expert system operate in a commercial context?
- What were the main organisational constraints that almost stopped the system from being developed?

The Situation

Improving the representation of individuals in managerial positions from minority groups has been made a priority in UK Public Sector organizations (Auluck, 2001). On this basis, a UK Government department (the client) with over 130,000 employees instigated a Personal Improvement Programme (PIP) aimed to develop employees in specific racial groups who were under-represented at managerial level. PIP operated within UK legislation under the provision of the Race Relations Act 1976 and the Race Relations Amendment Act 2003 that allowed special access to training and development to individuals from an ethnic minority (Auluck, 2001). The focus of PIP was on supported but self-initiated development and as such, selection for the programme was based on the motivation of the individual to improve, learn and to develop.

Selecting individuals who are keen to learn and develop is somewhat problematic especially when language and cultural barriers are taken into account (Fox, 2005; Hufton & Elliott, 2000). Addressing this issue, the client had already developed a competency framework that assessed a number of behaviours. Two of these competencies that related specifically to learning and development consisted of:

1. Developing People (DP): Continuously seeking and analysing feedback and reviewing own and others' development needs as a basis for identifying and pursuing experiences to maximise learning and development. Promoting and supporting the learning and development of others, welcoming diversity, encouraging and assisting them to gain development opportunities, monitoring the impact of development and providing constructive feedback and coaching.

2. Improving and Learning (IL): Seeking and responding to feedback, consistently alert to possibilities for applying own and others' knowledge and experience to improve the way things are done. Open to new ideas, taking calculated risks and learning from problems and implementing new ways of doing things.

Participants that applied for PIP were assessed in two stages consisting of a competency based application form and an assessment centre. Stage One assessment was conducted through a competency based application form, which has shown some success as a selection method (Lamsdale, Wood, & Mulrooney, 1999; Patterson, Ferguson, Norfolk, & Lane, 2005). Typically, organizations would make their initial selection procedure based on the application form (Lamsdale, et al, 1999). Those individuals that passed would then proceed to the next stage of the selection process, which in this case was an assessment centre. Nevertheless, for the unsuccessful applicants typically they receive a rejection letter that gives little feedback on why their application was not successful which may lower self esteem (Borman, Hanson & Hedge, 1997; Gilliland, et al., 2001; Martin, Bassey & Biggs, 2005). The client was particularly concerned about this as the individuals applying for the scheme were internal applicants employed by the organization. These individuals were also from ethnic minorities which the client was keen to retain, given the civil service's aims to improve diversity (Auluck, 2001). Feedback was thus to be provided to unsuccessful applicants on their

competency based application form as it was important that individuals knew precisely why they had not been successful and how they could develop in the future.

Providing feedback on the basis of sensitivity, wording and cost

The assessment and the multicultural teams, both of which had individuals from ethnic minorities, considered a number of different approaches for providing feedback, ranging from telephone advice through to experts writing detailed reports on each of the failed applicants. Studies have shown that feedback given through these methods can produce favourable results in personal development (Alvero, Bucklin, & Austin, 2001). It was decided that the decision on the provision of feedback would be based on sensitivity, wording and cost for which the expert system approach was most suited.

Sensitivity within the report process was considered an essential aspect that must carefully convey information to the applicants (Bartram, 1995; Roberson & Stewart, 2006). This was especially the case with PIP applicants who had typically remained within the organization for some length of time, in comparatively low paid jobs. Intuitively, a computer, with its structured programming and lack of human emotion, would not appear to be the best tool in which to portray sensitivity. However, it has been shown that expert systems have been used to give individuals advice on a range of sensitive issues, including: psychiatric disorders (Lu, Liu, Zhang & Tian, 2001; Seong-in, Hyun-Jung, Jun-Oh & Marie Seong-Hak, 2006; Wagman, 1988), emotional intelligence (Dulewicz & Higgs, 2004) and sexual practices (Ochs & Binik, 1998). Arguably, expert systems may be better than humans in providing sensitive advice as they are consistent in the advice that they give (Martinez-Miranda & Aldea, 2005; Ochs & Binik, 1998).

Wording was also considered to be important within the system design as certain ethnic minorities may put an emphasis on a particular word or phrase that a predominantly white

middle-class person may not be aware of the impact of that expression (Herbst, 1997; Honeyford, 2003). For instance, an assessor stating an English phrase such as "could try harder" may be unaware of the consequences of labelling particular personal attributes within certain communities. Wording used by the expert system needs to be carefully chosen and selected by a team of individuals representing a cross-section of the community avoiding conditional judgements (Giarratano & Riley, 2004; Jackson, 1999). Expert systems therefore allow a more considered choice of phrase and thus greater sensitivity and accuracy to individuals from an ethnic minority. Additionally, the sheer volume of reports may lead to assessor tiredness and therefore inconsistency in wording. If more assessors are employed to alleviate this, problems of inter-rater consistency increase (Ballantyne & Povah, 2004). Furthermore, machines do not tire and always produce unbiased consistent results (Giarratano & Riley, 2004; Seong-in, et al., 2006).

Time was also a crucial aspect as feedback reports were considered to be more effective and had a quicker turnaround the closer they were to the actual date of application (Epstein & Brosvic, 2002). A team of assessors may take weeks if not months to produce a large number of feedback reports especially if they all have to be trained to improve inter-rater consistency (Ballantyne & Povah, 2004). In addition, time saving has been frequently cited as an advantage of expert systems (Giarratano & Riley, 2004; Knotts, 1999) and in this instance, the expert system could provide a considerable time saving over traditional methods of personal feedback producing a report in a matter of seconds as opposed to hours.

Cost was also considered to be an issue as traditionally telephone advice or report production would take an assessor over an hour to conduct or write. The client had over 130,000 employees and approximately 11% of these employees were from an ethnic minority. Thus, a possible 13,300 individuals could apply for PIP and receive feedback. Assessors receive anything from $100 an hour to $400 an hour depending on their employment status. Thus, if

10% of these individuals applied and were rejected providing feedback in a traditional manner would cost anything from $133,000 to $532,000. In comparison, the development, testing and use of an expert system would cost a fraction of this amount providing a considerable advantage as shown by other authors (Giarratano & Riley, 2004; Knotts, 1999).

The development of FRED

The advantages for developing an expert system in comparison to the more traditional forms of feedback were clear when considering sensitivity, wording and cost. On this basis, the Feedback Reporter Evaluating Development (FRED) was developed to produce feedback reports on application forms for all unsuccessful applicants. The FRED expert system was developed in three distinct phases: knowledge elicitation, programming and testing.

Knowledge elicitation

The knowledge elicitation phase obtained knowledge in two distinct areas that would form two separate modules in the final FRED program consisting of: the Report Generator and the Development Needs Generator. Knowledge from two sources was obtained for both of these modules from the subject matter experts who were in this case the assessment team and the multi-cultural team who consisted of different individuals with a variety of cultural, ethnic and religious backgrounds. The multicultural team was selected by the director responsible for cultural awareness on the basis of their expertise of ethnic and cultural minority issues and consisted of nominated officials and practitioners of diversity. Figure 1 illustrates the knowledge elicitation phase and demonstrates how each of the two teams contributed to the final coding responses of the expert system.

INSERT FIGURE 1 HERE

Feedback generated was highly dependent on the questions used to assess applicants. Questions such as the following were used: *Please give an example of a difficult or challenging situation that you have faced in the past. What did you learn from the experience? How have you been able to apply that learning?* In their application form, applicants would write essay type answers of no more than 250 words to each of the four questions. Each question, with the exception of one, was then rated on two competencies of Developing People and Improving and Learning. Each competency was then broken down to nine behavioural indicators for which the evidence from the answer was either present or not.

Once the questions and behavioural indicators had been confirmed as suitable assessment by the multicultural team, the assessment team developed the coding frame for the Report Generator (RG). The RG would produce the first third of the report which detailed the four questions and how the applicant responded to each question. Once the coding frame had been developed, all the possible responses that FRED would give were further evaluated and amended by both the assessment team and the multicultural team as shown in Figure 1.

The coding frame for the Development Needs Generator (DNG) was then developed providing overall feedback on the entire application, producing the second and last third of the report given to rejected applicants. The second third of the report listed the areas of repeated omissions suggesting to applicants that in order to maximise their own personal development they should concentrate on the suggested areas of omission Areas of omission were then bulleted in a list and included behavioural indicators from the Developing People and Improving and Learning competencies that were required.

The last part of the report detailed generic feedback to applicants but altered this again by the evidence FRED found in the answers for each of the four questions. For instance, if an applicant repeatedly omitted how they received feedback in all four questions the following sentence would be generated in the last section of the report:

After your next task/project at work or outside of work ask for feedback from the people involved. Try to find out what went well with the task(s) and what could have been improved. Try to identify what you could have done differently (if anything) to achieve a better or more successful outcome. Put this learning in to practise the next time you do something similar.

All the possible combination of responses were again considered in the coding frame and assessed and the wording was adapted by both the assessment and multicultural teams to ensure no cultural biases in the report.

Programming

The FRED expert system was developed in a BASIC environment with three distinct modules common in programmes of this nature (Awad, 1996; Kaula & Lander, 1995) and had 1050 lines of code. The first module was the input section, whereby the name of the person was entered as a string variable which named the data file and was used to name the person throughout the feedback report. The user interface of FRED concentrated on functionality as it was to be used purely by the assessment team and not the client (See Figure 2). Each competency was assessed with nine behavioural indicators for which a binary value was given indicating if the evidence was present or not. Three of the questions assessed both competencies but one of the questions only assessed one competency meaning a total of 63 binary variables were generated.

INSERT FIGURE 2 HERE

The second module programmed was the Report Generator which developed the bulk of the feedback report. This indicated where applicants had provided sufficient evidence and where there was an absence of evidence on a question by question basis producing similar performance feedback to other report based systems (Wilson, 1998). Text was automatically written to a data file, which this module initiated and automatically named. The knowledge base consisted of a total of 553 rules, 25% of which generated knowledge and the remaining

concerned grammatical structure in the generated reports. Feedback was written on the basis of whether evidence was there or absent. This was known to FRED from the binary variables generated in the input module however, FRED needed to put this in a logical written format and used a numerical variable named COMMA, to structure text. An example of text produced by the Report Generator on a question is shown in Figure 3.

INSERT FIGURE 3 HERE

The third module was the DNG that checked the consistency of answers and highlighted consistent areas of omission producing personalised areas of development for each individual. For instance, inviting suggestions from others to develop was assessed by the Improving and Learning (IL) competency specifically by the 4th behavioural indicator on question 1 (Q1IL4), the 4th behavioural indicator on question 2 (Q2IL4), the 3rd behavioural indicator on question 3 (Q3IL3) and the 2nd behavioural indicator on question 3 (Q3IL3). If this evidence was missing then the following code would generate the appropriate response:

> *IF Q1IL4 =0 AND Q2IL4=0 AND Q3IL3=0 AND Q4IL2 =0 THEN PRINT [to named data file] "Inviting suggestions on ways to improve or move forward and being open to new ideas"*

This first half of the DNG wrote responses into the opened data file producing a bulleted list of development needs specific to the individual (See Figure 4). The second portion of the DNG produced generic development activities but moderated these if questions were not answered fully. FRED at this stage closed the data file, which was then converted into an MS Word file. The knowledge base for this section used 30 rules in total. FRED also produced a final summary report for the data entry person who could check that the input was correct on both of the two competencies as part of quality assurance.

INSERT FIGURE 4 HERE

Testing

A rigorous testing procedure was followed to ensure that FRED was producing the correct information. This involved testing the mechanics of the system to ensure that the input screen worked and that the system produced the correct variables based on the behavioural indicators assessed. Several simulated application forms were generated, which had variations or consistently missing behavioural indicators from which the responses made by FRED were easily predicted, e.g., the person consistently didn't ask for feedback from others. Responses made by FRED were then compared between the actual and predicted outcomes and any differences between the two corrected within the programming.

The implementation of FRED

Out of 840 employees who initially requested an Application Pack, 326 individuals submitted a competency based application form. These 326 applicants were from various ethnic minorities that were similar in background to the initial requests received with slightly more applications from individuals of an Asian background (See Figure 5). More females (N=215) than males (N=111) applied for the scheme.

INSERT FIGURE 5 HERE

Applicants wrote a maximum of 250 words for each of the four questions they were presented with in the Stage One assessment. These responses were then marked by an Assessor against each competency based behavioural element. The summation of all behavioural elements then provided a total score, which was used to select 190 applicants for the Stage Two assessment centre. The remaining 136 applicants were not invited to Stage Two and as such were given feedback through a covering letter and the personal development report produced by FRED. The reports were then formatted to the exact client requirements and sent to the applicants who received their feedback within a week of the final marks being assessed and confirmed by the client.

Questionnaires were then issued to all 840 individuals who requested an application pack. 117 individuals replied to the questionnaire of which 64 had applied to the scheme. 39 individuals stated that they would be more likely or just as likely as before to apply to PIP having been through the selection procedure and received feedback on their performance. Only 21 applicants said they would be less likely to apply to the scheme and none of these stated that this was due to the expert system feedback. All applicants were given the opportunity to suggest improvements to all aspects of the selection procedures and none suggested enhancements to the expert system reports.

DISCUSSION

FRED is a commercially successful system that produced developmental feedback reports that were well received by unsuccessful applicants of the Personal Improvement Programme. This approach had major advantages over other traditional forms of feedback offering a completely consistent approach for providing feedback to unsuccessful applicants. Feedback was consistent and fair as given the same answers FRED would generate the same report without personal biases or prejudice. The text was sensitive and carefully thought out by a team of experts. FRED offered a sensitive, comprehensive and cost-effective method of producing feedback reports for individuals from an ethnic minority. The project was thus a successful venture for both the client and the consultancy that provided the system as a service. This project continued on the following year where the system described here was modified slightly to respond to different application questions. After this, the client took over the entire project and source code of the expert system, which still runs today.

Even though FRED is a commercial success, it almost was never implemented. A number of authors have noted that the implementation of expert systems into an organization is a major stumbling block for expert system design (Awad, 1996; Sagheb-Tehrani, 2006). This was indeed a major hurdle for the development of FRED whereby resistance to using the expert

system approach was noted in the consultancy that commissioned the program. In order to overcome this resistance, the advantages of the expert system approach had to be sold as being superior to any other traditional approaches. This was achieved by detailing the system success factors (Awad, 1996), which were:

- the user of the expert system had prior knowledge of expert systems;

- the user had expert knowledge in the domain of selection techniques and providing feedback to applicants;

- the user was involved in all stages of the knowledge acquisition process and the final evaluation of the system;

- the payoff of the system was large in terms of sensitivity, wording and cost;

- the expert system was designed away from the core business of the consultancy and the data entry into the system was outsourced meaning a minimum of disruption;

- the main advocate of the project used PRINCE2 project management techniques, which aided the project to be delivered on time, on budget and to the required quality.

Through detailing these system success factors the development of FRED was commissioned. This demonstrated to the consultancy that such expert systems could be easily deployed in a commercial setting. It also demonstrated to the client, that the consultancy was, at the leading edge of selection implementing innovative solutions to solve recruitment issues.

Limitations to the project were noted with the post-system evaluation where only a questionnaire survey had been completed. Dijkstra (1999) described a phenomenon whereby some individuals blindly accepted the advice of the expert system even though this is not necessarily correct. Obviously, in this case great effort was made to ensure that the information provided to applicants was correct. The reactions in the questionnaire were

positive and taken as a mark of success for the project in that the feedback reports were not criticised or mentioned in terms of improvement. Nonetheless, consistent with Dijkstra (1999) applicants may blindly accept what was written in the feedback report without question. To combat this limitation the letter enclosing the feedback report strongly suggested to rejected applicants that they talk the report over with their manager. This procedure would thus ensure accuracy of feedback as the managers would be able to support the findings in the expert system report. However, no formal survey of whether this practice was undertaken although some evidence from the client did suggest that applicants were discussing the report with their managers.

CONCLUSION

Expert systems can offer a consistent and sensitive method of delivering feedback to unsuccessful applicants in the early stages of the selection process. The paper outlines a commercially successful venture that performed well in the context of providing individuals from an ethnic minority feedback that was consistent and fair. This feedback was considered important by the Government Department that commissioned the work as concerns about the impact of rejection on applicants were raised by the Multi-cultural team. Arguably, the use of expert systems should be promoted further in the early stages of selection to provide feedback to rejected applicants. This is particularly important for those internal applicants who disheartened by rejection from a selection process may leave the organization. It may also be easier with online application forms that are systematically assessed sometimes without the need for an assessor.

In addition, in line with the results from the implementation of this expert system, further research needs to be undertaken to explore how expert systems can provide feedback in a selection context. Applicant's reactions to the selection process and ways in which feedback may moderate these reactions also need to be raised as a research issue.

Expert systems have enjoyed much commercial success in the area of selection where they are often used to assist the hiring decisions of organizations through the interpretation of psychometric tests. This success as this paper has shown can also be readily transferred into the area of personal development where expert systems can also be effectively utilised. Expert systems can provide timely, sensitive and meaningful feedback to individuals who may not readily wish to discuss their performance and thus improve the chances that these individuals may do better in their careers.

Acknowledgements

References

Abdullah, M.S., Kimble, C., Benest, I. and Paige, I. (2006) Knowledge-based systems: A re-evaluation. *Journal of Knowledge Management.* 10 (3), 127-142.

Alvero, A. M., Bucklin, B. R., & Austin, J. (2001). An objective review of the effectiveness and essential characteristics of performance feedback in organizational settings. *Journal of Organizational Behavior Management*, 21, 3–29.

Auluck, R. (2001). 'The Management of Diversity: The UK Civil Service Journey Continues', *United Nations Expert Group Meeting on Managing Diversity in the Civil Service*, 3-4 May 2001, New York: UN Department of Economic and Social Affairs).

Awad, E.M. (1996) *Building expert systems: principles, procedures and applications.* West Publishing Company, USA.

Ballantyne, I. and Povah, N. (2004) *Assessment & Development Centres.* Gower Publishing Ltd. Hants.

Bartram, D. (1995) The role of computer-based test interpretation (CBTI) in occupational assessment. *International Journal of Selection and Assessment,* 3 (3), 178-185.

Borman, W.C., Hanson, M. and Hedge, J.W. (1997). Personnel Selection. *Annual Review of Psychology*, 48, 299-337.

Bushnell, I., Paltiel, L. and Young, S. (1998) Validating personality reports derived from computer based test interpreters. *Paper presented at the BPS Third Tst User Conference*, Brighton, UK.

Dijkstra, J.J. (1999) User agreement with incorrect expert system advice. *Behaviour & Information Technology*, 18 (6) 399 - 411

Dulewicz, V. and Higgs, M. (2004) Can Emotional Intelligence be developed? *International Journal of Human Resource Management*, 15 (1), 95-111.

Epsein, M.L. and Brosvic, G.M. (2002) Students prefer the immediate feedback assessment technique. *Psychological Reports,* 90 (3), 1136-1138.

Fox, R.C., (2005) Cultural Competence and the Culture of Medicine. *New England Journal of Medicine*, 353 (13), 1316-1319.

Giarratano, J. and Riley, G. (2004) *Expert Systems: Principles and Programming,* 4th Edition, Thomson Learning, UK.

Gilliland, S.W., Groth, M., Baker, R.C., Dew, A.F., Polly, L.M. and Langdon, J.C. (2001) Improving Applicants' Reactions To Rejection Letters: An Application Of Fairness Theory. *Personnel Psychology*, 54 (3), 669-703.

Herbst, P. (1997) *The Color of Words: An Encyclopaedic Dictionary of Ethnic Bias.* Intercultural Press Inc., USA.

HMSO (2003), Race Relations Amended Act, HMSO, London, (originally Race Relations Act (1976)).

Honeyford, R. (2003) The Language issue in multi-ethnic English schools. In R. Harris & B. Rampton (Eds.), *The Language, Ethnicity and Race Reader.* London: Routledge.

Hufton, N. and Elliott, J. (2000) Motivation to learn: The pedagogical nexus in the Russian school: Some implications for transnational research and policy borrowing. *Educational Studies*, 26 (1), 115-136.

Jackson, P. (1999) *Introduction to expert systems 3rd Edition.* Addison-Wesley, USA.

Kaula, R. and Lander, L.C. (1995) A module-based conceptual framework for largescale expert systems. *Industrial Management and Data Systems,* 95 (2), 15-23.

Knotts, R.M.H. (1999) Civil aircraft maintenance and support: Fault diagnosis from a business perspective. *Journal of Quality in Maintanence Engineering.* 5 (4), 335-347.

Lamsdale, C., Wood, R. and Mulrooney, C. (1999) An alternative to an assessment centre on six pieces of paper? *International Journal of Selection and Assessment,* 7 (3), 170-176.

Lu, N., Liu, X., Zhang, C. and Tian, Y. (2001) Expert systems of the personality disorders questionnaire for the CCMD-R. *Chinease Mental Health Journal,* 15 (2), 137-139.

Martin, C.J., Bassey, R.K. and Biggs, D.M. (2005) Self-esteem, stress and reactions to selection and recruitment outcomes. *Selection Development and Review.* 21 (3), 8-12.

Martinez-Miranda, J. and Aldea, A. (2005) Emotions in human and artificial intelligence. *Computers in Human Behavior.* 21 (2), 323-341.

Patterson, F., Ferguson, E., Norfolk, T. and Lane, P. (2005) A new selection system to recruit general practice registrars: preliminary findings from a validation study. *British Medical Journal*; 330 (7493), 711-714

Roberson, Q.M. and Stewart, M.M. (2006) Understanding the motivational effects of procedural and informational justice in feedback processes. *British Journal of Psychology.* 97, 281-298

Ochs, E.P. and Binik, Y.M. (1998) A sex-expert computer system helps couples learn more about their sexual relationship. *Journal of Sex Education and Therapy.* 23 (2), 145-155.

Sagheb-Tehrani, M. (2006) The design process of expert systems development: some concerns. *Expert Systems,* 23 (2), 116-125.

Seong-in, K., Hyun-Jung Ryu, M.A., Jun-Oh Hwang, M.A. and Marie Seong-Hak, K. (2006) An expert system approach to art psychotherapy. *The Arts in Psychotherapy.* 33, 59-75.

Shaw, M.L.G. and Gaines, B.R. (2005) Exertise and expert systems: emulating psychological processes, in *The Essential Practitioner's handbook of Personal Construct Psychology*, F. Fransella (ed.), John Wiley & Sons, Ltd, Chichester, UK.

Wagman, M. (1988) *Computer psychotherapy systems: Theory and research foundations.* Gordon and Breach Publishers. Amsterdam, Netherlands.

Wilson, P. (1998) Computer Generated Assessment Centre Feedback: Design, Integration and Evaluation. *Division of Occupational Psychology Conference Book of Proceedings.*

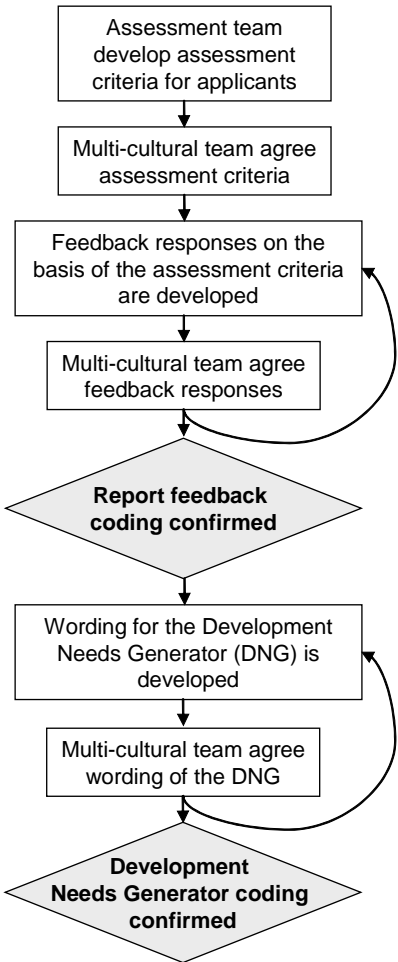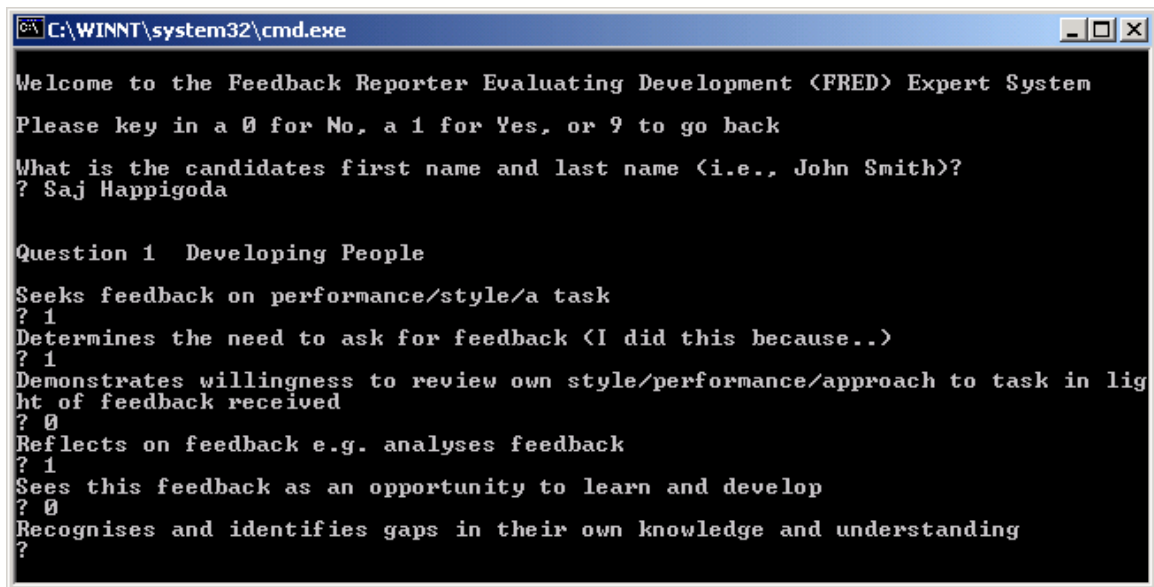**Figure One: Knowledge elicitation for FRED**

Figure Two: The input screen for FRED


```
C:\WINNT\system32\cmd.exe                                        _ □ ×

Welcome to the Feedback Reporter Evaluating Development (FRED) Expert System

Please key in a 0 for No, a 1 for Yes, or 9 to go back

What is the candidates first name and last name (i.e., John Smith)?
? Saj Happigoda


Question 1  Developing People

Seeks feedback on performance/style/a task
? 1
Determines the need to ask for feedback (I did this because..)
? 1
Demonstrates willingness to review own style/performance/approach to task in lig
ht of feedback received
? 0
Reflects on feedback e.g. analyses feedback
? 1
Sees this feedback as an opportunity to learn and develop
? 0
Recognises and identifies gaps in their own knowledge and understanding
?
```

Figure 3: Example of text produced from the Report Generator

Question 3: Please provide an example of something that you would like to change in order to improve the way that things are done at work or in your home environment. Why does it need improving? How would you do this and when would you know if the change had been successful?

Question 3 covered the Improving and Learning Competency.

Positive evidence on the Improving and Learning Competency was shown in that you; recognised the need for improvements, explained why the improvement was necessary, suggested improvement ideas and suggested ideas on evaluating the effectiveness of change.

There was an absence of positive evidence on the Improving and Learning Competency in that you failed to demonstrate a clear indication that you; consulted others for suggestions on how to improve the current situation, were open to adopting new ideas, considered a variety of options, adapted existing knowledge to make improvements and calculated the risks associated with the changes.

Figure 4: Example of text produced by the Development Needs Generator

Development Needs identified within the Application Form

Given the evidence above, in order to maximise your own personal development, it is suggested that you concentrate on the following areas:

- Seeking feedback on performance
- Displaying receptiveness to feedback
- Adjusting and learning from own mistakes
- Consistently asking, 'could this be done better?'
- Putting forward ideas
- Seeking feedback
- Asking others their views

The evidence within your Application Form may have been insufficient in this instance for two main reasons: (1) You may not have had the experience or opportunity to demonstrate a particular aspect of the Competency; (2) You may have forgotten or overlooked situations where you have demonstrated a particular aspect of the Competency.

Figure 5: Ethnic background of applicants (N=326)

Chinese
1%

Other
1%

Asian and White
1%

Black Other
3%

Black Caribbean and White
2%

Asian Bangladeshi
4%

Black Caribbean
19%

Asian Indian
35%

Black African and White
3%

Black African
12%

Asian Other
5%

Asian Pakistani
14%