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Career Guidance
Using Expert System Approach

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The lack of quality career guidance in African high schools, caused by shortage of human and time resources that the process demands, has led to the choice of unsuitable careers resulting in widespread poor performance at the workplace. The focus of this paper is the use of Expert Systems that store the highly specialized knowledge of career counseling and dispenses it to the needy youth in a cheap and quick process. Initial results of the evaluation of the model, has shown a career diagnosis accuracy of 71%.

1. Introduction

A study, done as part of this research, and detailed later in the paper, concluded that there is a mismatch between the careers most high school graduates choose and the ones of their natural interest.

Appearing in a report by Osoro et al [2000], are results of a separate study that concluded that one of the main reasons why people are later dissatisfied in their vocations is uninformed choice of vocation immediately after school. Interviews with Ministry of Education (Kenya) officials and career guidance teachers confirmed that students are simply given the careers booklet with university courses, their prerequisite subjects and cut-off points, instead of career guidance and counseling. This is due to limited skilled human and time resources. This problem may be minimized by the use of an Expert System that would store the specialized knowledge of the career counselors and dispense this knowledge in under thirty minutes to a high school graduate.

There is, clearly lack of a quality and cost-effective Career Guidance Model. This paper presents results and analysis of the studies mentioned above, the process of identifying desirable activities in the career guidance process and the integration of those activities into a career guidance model using Expert Systems, for easy and quick querying by a high school graduate. Based on the proposed model, an application may be constructed to provide instantaneous career guidance to high school graduates.

2. Related Approaches

2.1. Career Guidance Activities

Most reputable career guidance models involve the following activities; student visits to prospective colleges to get a first hand experience of training tasks; job simulation to enable the student get a first hand experience of tasks in the job environment; exposing students to resource persons and industry people. White [2002] reports a model that integrates a personality analysis, besides the above-mentioned activities. The premise for the use of the personality analysis to diagnose one's natural career is that human performance in a job situation is dependent on;

   a) One's ability to comprehend certain unique cognitive concepts demanded by a job situation.

   b) One's natural disposition toward certain tasks and environments and not others [Naralmbaiah and Yan Wah, 2004]

Point a), above is about scholastic aptitude ability and is addressed by most education system's college entrance examinations.

Natural disposition toward certain tasks, objects and environments is defined as personality. It implies that if one's personality type could be determined, then their natural tasks and working environments could also be determined [Keirsey and Bates 1998].

2.2. Personality Analysis

The main personality analysis models, as presented by Quenk [1999] are the following; The Enneagram, the Big Five, the Astrology Sign, the Aura Color models and the Myers Briggs Typology Indicator (MBTI). Other personality analysis models are derivatives of the above-mentioned ones. A summary of the approaches in each of these models is briefly presented here below;

The Enneagram model is based on theology. It identifies which of the 9 personality types, one belongs to. It also describes the nature of the conflicting forces of each personality and the cycle of change that is constant in human nature.

The Astrology Sign model analyses personality by determining which planet rules one's sign of zodiac. It then indicates one's associating quadruplicate (one of four attributes). It then reveals which of the four elements (air, earth, water and fire) one most relates to in order to show how that element affects one's sign's predisposition.

The Aura Color model is based on color psychology. It proposes that each person has a natural inclination toward certain colors and a natural dislike towards others, and that one's favorite color points to their personality.

The above-mentioned models are not founded on solid science, hence are not reliable.

The Big 5 model considered as one of the most accurate models [Quenk 1999], is based on cognitive science. It defines 5 distinct personality traits, namely; level of extroversion; level of orderliness; level of emotional stability; level of accommodation; level of inquisitiveness.

Each of the above parameters is measurable in five degrees. A user's set of responses to appropriatelydesigned questions may, therefore, be 1 of 125. This becomes its main weakness, as it introduces too many groupings (125 different ways to respond) which are hard to model.

The Myers-Briggs Typology Indicator (MBTI) measures 4 significant human attributes; Personality, Outlook, Temperament and Lifestyle to identify one's personality type.

Under Personality, one can either be extroverted or introverted. Under Outlook, one can either be sensory (uses any or a combination of the five senses to comprehend situations and make decisions) or intuitive (imagine beyond sensory experience). Under Temperament, one can either be thinking or feeling. Lastly, under Lifestyle, one can either be judgmental or perceptive.

Appropriate questions are presented to a test-taker. The taker's responses to these questions are used to evaluate his/her personality type, which clearly is one out of a possible 16 (four attributes, each having two options implies 16 possible sets of responses).

MBTI is therefore known as the 16-Personality Type model.

Each of the 16 personality types has been competently linked, after decades of research, to a set of related job categories [Keirsey 1995]. The study reported here adopted this model due to ease of grouping and its firm grounding in psychology.

3. Methodology

The approach used in the research reported in this paper involved field surveys from which observations and analysis were done. The conclusions were used in developing a model which is presented in later sections of this paper. In order to assess the level of effectiveness, an experiment was designed and results evaluated. These are also presented.

3.1. Surveys

In a survey carried out in 2007, to estimate the level of professionals' satisfaction with the tasks and nature of their careers, 314 professionals were interviewed. They were over 35 years of age and drawn from 16 different professions around Nairobi city. The results are detailed in Table 1 and Fig. 1 here below. In a second survey, also done as a part of this research in 2007, Ministry of Education (Kenya) officials and career guidance teachers in 22 randomly-sampled high schools across the country were interviewed. It was in an attempt to determine what career guidance practices are carried out in Kenyan high schools. The results of the survey are detailed in Table 2 below.
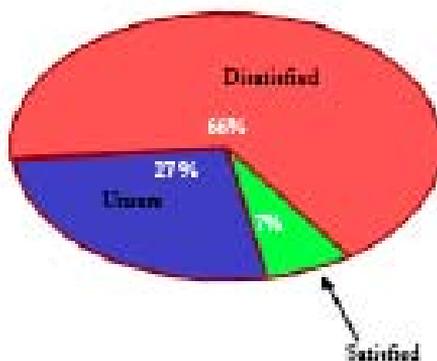
3.2. Survey Results and Analyses

3.2.1. *Extent of Satisfaction with Vocation*

Table 1 - Extent of Satisfaction with Vocation

	OPINION	NUMBER & PERCENTAGE
1.	Those who are sure they chose wrong	207 (66%)
2.	Those who have not really thought about it	84 (27%)
3.	Those who are sure they chose right	23 (7%)

Fig. 1: Extent of satisfaction with Vocation

As can be seen in Table 1 and Fig. 1 above, only 7% of survey participants were satisfied with the tasks and nature of their vocation, with 66% being unsatisfied. This survey concluded that there is a mismatch between the careers most high school graduates choose and the ones of their natural interest.

3.2.2. *Career Guidance Practices in Kenya*

Table 2 below shows the various categories of schools and the means of career guidance being practiced currently.

Table 2 - Career Guidance Practices in Kenyan High Schools

	TYPE OF HIGH SCHOOL	PRACTICES
1	Private Academies	Trips to university fairs; Individual attention to students; Career debates among students
2	High Cost Public Schools	Counselor discusses with interested student. No full time counselor as each counselor has teaching load too
3	Other Public Schools (nearly 90% of all Kenyan high school students)	No real counseling done, only instruction on use of the careers booklet, which contains a list of college courses and their cut-off points

Approximately 90% of public high school students in Kenya are not provided any reasonable career guidance. This is due to limited skilled human and time resources. This research concentrated on public schools because they form a bulk of the student population. This problem may be minimized by use of Expert Systems, which would store the specialized knowledge of the career counselors and dispense this knowledge as required by potential users.

3.3. Model Design

From the description of the activities reviewed in Section 2.1 above, we propose that a suitable system should have the following features;

a) Personality Analysis module

b) Decision-making classes, class discussions; Visits to prospective colleges so that the students get first hand experience of training tasks in each course; Job simulation to enable student make informed decisions. These can be grouped into a simulation module which we here call the auxiliary module.

c) Scholastic Aptitude Testing (SAT), such as college-entrance examinations, to evaluate one's cognitive ability. This enables determination of the level of college course the student should join.
Specifically whether at certificate, middle-college diploma or degree level.

We propose a model that consists of three sections; the first being the Personality Analysis Expert System, with the last being the College-Entrance Criteria Expert System.

The middle section contains a simulation of activity b) above. To enable one to choose a specific job category from the small set recommended by the Personality Analysis, interactive decision-making and class discussion sessions can be modeled by the use of multimedia or other techniques. The proposed Career Guidance model would appear as illustrated in Fig. 2.

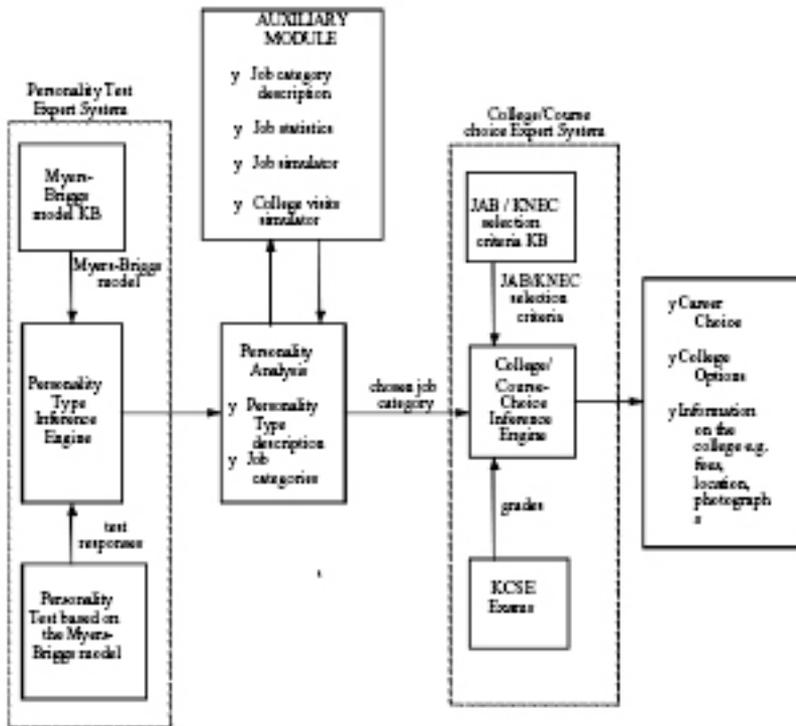**Fig. 2: Proposed Career Guidance Model**

Figure 2 above shows the architecture of the proposed model. It indicates how various activities are integrated. A description of the working of the core modules is presented briefly here below.

3.3.1. The Personality Analysis module

This module hosts the knowledge and rules needed to perform personality analysis. The knowledge and rules are based on the Myers-Briggs Typology Indicator (MBTI) model. The following is short description of the working of this model;

According to Keirsey [1995], there are four possible human natures Artisan, Idealist, Guardian and Rational. Parameters for classifying these human natures are indicated below;

1. Personality -   Extrovert (E)   or   Introvert (I)
2. Outlook -   Sensory (S)   or   Intuitive (N)
3. Temperament - Thinking (T)   or   Feeling (F)
4. Lifestyle -   Judgmental (J) or   Perceptive (P)

Note: The letters used against a name indicate abbreviations used later on in the paper or in the prototype.

As shown in Table 3 below, an Idealist nature is one whose Outlook is Intuitive (N) with a Temperament of Feeling (F). If his/her Lifestyle is Judgmental (J), then he/she is an Idealist who is a Mentor. If his Personality is Extrovert (E), then he/she is a Mentor of personality type ENFJ and is fit for the careers of Teacher, Counselor or Home Economist. Artisan, Guardian and Rational natures can be similarly analyzed into their more detailed derivatives, to determine the appropriate careers.

Table 3 - Personality Analysis and job suitability Chart

OUTLOOK	HUMAN NATURE	TEMPERAMENT/ LIFESTYLE	PERSONALITY
Introspective (Intuitive), N	Idealist (Feeling), NF	Mentor (Judgmental), NF J	Teacher/Counselor/Home Economist, ENFJ
			Counselor/Teacher/Psychiatrist, INFJ
		Advocate (Perceptive), NFP	Childcare/Secretary/Counselor, NFP
			Psychologist/Editor/Artist, INFP
	Rational (Thinking), NT	Coordinator (Judgmental), NTJ	Manager/Lawyer/Operations Research, ENTJ
			Sales/Journalist/Photographer, INTJ
		Engineer (Perceptive), NTP	Engineer/Scientist/Social-Scientist, ENTP
			Scientist/Engineer/Writer, INTP
Observant (Sensory), S	Guardian (Judgmental), SJ	Administrator (Thinking), SJT	Financial Manager/Manager/Supervisor, ESTJ
			Accountant/Engineer/Technician, ISTJ
		Conservator (Feeling), SJF	Counselor/Childcare/Social Worker, ESFJ
			Health-worker/Teacher/Librarian, ISFJ
	Artisan (Perceptive), SP	Operator (Thinking), SPT	Builder/Plumber/Carpenter, ESTP
			Craft Worker/Statistician/Technician, ISTP
		Entertainer (Feeling), SPF	Actor/Musician/Teacher, ESFP
			Painter/Outdoor/Stock-clerk, ISFP

Responses to a set of questions given by the user, as shown on the interface of the prototype illustrated in Fig. 4, determine which of the possible sixteen personality types the respondent belongs to. Using the personality type, the model would determine which career one is best for [Keirsey 1995].

3.3.2. College Entrance Expert System

Many colleges have some criteria based on grades scored in selected subjects in specified examinations, for admitting students. The rules in this module should be derived from the criteria each specific country, state or region uses. For the prototype described here below, the Kenya national examination council (KNEC) grading system, Kenya certificate of secondary examination (KCSE) and public university joint entrance criteria, Joint admission board (JAB) were modeled.

### 3.4. The Prototype and Evaluation of the Model

In order to assess the effectiveness of the model presented above, a prototype implementing the designs described was developed. A typical screen showing the user interface and the type of questions is shown in Fig. 3;

Fig. 3: A Typical Interface of the Developed Prototype

The implementation was done in Visual Studio and MS Access. The choice of the tools was purely on ease of coding.

The prototype was tested on 104 professionals, all over 35 years of age, from diverse occupational backgrounds. Of the 104 professionals, 74 respondents representing 71% of the sample had the occupations they desired match their personality types. The types were automatically determined by the prototype depending on the answers given by the respondents. A summary of the results is shown in Fig. 5

Fig. 4: Respondents Whose Desired Occupations Match Personality Types
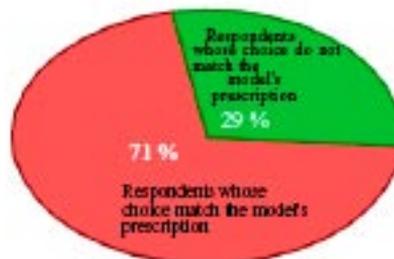
The assumption made during evaluation is that at over 35 years of age, most literate professionals have been exposed to different environments and people and therefore they know their strengths and weaknesses, likes and dislikes. They also know almost all possible career opportunities that are available.

4. Conclusion

This paper has demonstrated a model based on expert system concepts that can achieve effective career guidance objectives. It was also established that a significant percentage of professionals in Kenya are dissatisfied with the tasks and nature of their current vocations. Career counselors play an insignificant role in career choice by public high school students and that most Kenyan high school students do not get quality career guidance as qualified counselors and time for guidance is lacking.

Through prototype evaluation, we have shown that if public high schools in Kenya implemented a system based on this model, then it is possible to achieve a career satisfaction level of up to 71% from the current 7%. This is a clear improvement.

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