



Faculty of Cognitive Sciences and Human Development

**DEVELOPMENT OF COMPUTER-ASSISTED CAREER GUIDANCE
SYSTEM FOR COGNITIVE SCIENCE UNDERGRADUATES**

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**DEVELOPMENT OF COMPUTER-ASSISTED CAREER GUIDANCE SYSTEM
FOR COGNITIVE SCIENCE UNDERGRADUATES**

NIGEL WONG CHEE FOONG

This project is submitted
in partial fulfilment of the requirements for a
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The project entitled 'Development of Computer-Assisted Career Guidance System for Cognitive Science Undergraduates' was prepared by Nigel Wong Chee Foong and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfillment of the requirements for a Bachelor of Science with Honours (Cognitive Science)

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ABSTRACT

Cognitive Science is a program offered by Universiti Malaysia Sarawak (UNIMAS) as an undergraduate program. The program covers a wide array of topics and exposes the students to many different fields. The problem arises when the students do not know where their interest lies as the nature of their program does not provide them with a specific direction. As a result, they struggle to pursue a career in a field that interests them and this may result in low job satisfactions in the future. This project aims to provide a potential solution for this problem by developing a computer-assisted career guidance system to assist them in making the best possible career choice. The system makes use of the RIASEC personality inventory to determine the user's personality type and attempts to suggest them with careers which might interest them enough to pursue it. The questionnaire was adopted from the RIASEC personality inventory and the suggested careers were filtered to only include those which are relevant to Cognitive Science.

Keywords: career guidance system, personality type, RIASEC, careers, cognitive science

CHAPTER 1

INTRODUCTION

1.1 Introduction

Most of the college and university graduates nowadays face a problem during their graduation phase. They struggle to select the appropriate careers for themselves (Burns, Morris, Rousseau, & Taylor, 2013). As a fresh graduate, the most challenging thing is to get a job which pays while they do something that they really like. Most of them would get a job associated with their diploma or degree qualifications but there still lies a problem with this approach.

For programs with a wide scope, graduates face a huge problem in identifying their field of interest. Unless they already decided on their field of interest while in their college years, they could face a huge dilemma in their graduation phase. As many graduates would agree to, pursuing a career is a difficult task. Most of them do not know where or what their interest is and this proves to be a difficult question to answer.

There are many approaches to help these students and one of them is by providing them with guidance and assistance for their prospective careers by the nature of their personality. Different personalities excel in different professions and this could potentially help them solve the conundrum of selecting a career.

Therefore in this study, prospective solutions for assisting these students to make the best possible decision regarding their future career would be reviewed and a proposed system for solving this particular problem would be developed.

1.2 Background of Study

The Cognitive Science program is offered by Universiti Malaysia Sarawak or UNIMAS as an undergraduate program. It is the scientific interdisciplinary study of the mind and its processes (Friedenberg & Silverman, 2011). To study something as complex as the mind, a multidisciplinary approach must be applied. Hence, the students of Cognitive Science program are exposed to a wide array of topics. The topics are philosophy, linguistics, anthropology, neuroscience, artificial intelligence and psychology.

Being a program with multiple topics of interest, students have to cope with the demands of studying these topics without being specialized in a specific field. Although the students are poised to learn more skills, they are also in danger of being lost and confused about their prospective careers. Being an undergraduate who is about to graduate but still unsure of his or her prospective career is frustrating.

Therefore, a potential solution to overcome this problem is by developing a computer assisted career guidance system to help resolve this problem. The system is proposed to help Cognitive Science students select the best possible career option for their future endeavors.

1.3 Problem Statement

The students of Cognitive Science program are exposed to a wide array of topics due to the nature of the program. There are courses which covers topics from the field of philosophy, psychology, artificial intelligence, linguistics, anthropology and neuroscience (Faculty Guidebook of FCSHD, 2016). As the program has a wide scope of study, the students had to identify their field of interest before graduating in order to pursue a career in that particular field.

According to Burns, Morris, Rousseau, and Taylor (2013), most students are unable to select a suitable career. Coupled with the nature of the Cognitive Science program, the career selection process becomes an even more difficult task. Learning skills in multiple fields sounds good on paper but in reality, the job market wants manpower who are specialized in a specific field that they need in order to reduce costs such as training costs for new employees.

Being a degree holder of the Cognitive Science program does not mean that he or she is a master of several fields but as someone who has a competent level of knowledge and skills in those fields. In other words, they are similar to a jack of all trades, master of none. Therefore, they should identify their field of interest as early as possible so that they are able to plan and make good decisions for their future career.

In order to help these graduates identify their field of interest in order for them to prepare themselves for specializing their skills for the job market, a system is proposed to provide them with a simple analysis of their personality and recommendation of several jobs which are suitable for them based on their personality. This is to help them achieve a better job satisfaction in the future. According to Judge, Heller and Mount (2002), there is a correlation between personality and job satisfaction. Specific personalities match specific jobs therefore it is important that when one chooses a career, he or she should choose one that matches with their career in order to have a good job satisfaction (Judge, Heller, & Mount, 2002).

1.4 Research Objectives

The research objective is to design and develop a computer-assisted career guidance system for the undergraduates of the Cognitive Science program. By utilising the system, the students could get valuable insight of themselves and assistance for selecting the best possible

career option for themselves. In order to achieve the main objective, the following specific objective must be achieved first:

- To adopt an appropriate questionnaire model for evaluating the students' personality and provide career guidance assistance based on the results

1.5 Research Questions

The research objectives contribute to the conceivment of several research questions which are:

- i. What type of questionnaire model is appropriate to evaluate a student's personality type and recommend a career suited to his or her personality?
- ii. What type of evaluation is suitable for evaluating career guidance systems?

1.6 Significance of Study

The significance of this study is that it could possibly assist the students of the Cognitive Science program in making the best possible decision regarding their future career based on their personality. According to Holland (1997), people seek work environments which are suitably aligned with their personality and make use of their talents and abilities. Hence, the proposed system could potentially help these students solve their dilemma by providing them with a clearer direction on their future career trajectory.

1.7 Contribution of the Proposed System

The expected contribution for the proposed system is that it can help the Cognitive Science undergraduates to understand and know more about their own personality before choosing the specific field that he or she wants to pursue a career in. Besides that, the proposed system also recommends suitable careers for the user based on the personality analysis results. This is because certain personalities suit certain jobs or careers (Holland, 1997). This way, the undergraduates can start planning the trajectory of their future career earlier and therefore lead to better career decisions.

1.8 Relationship with Cognitive Science

Expert systems are systems which imitates the decision-making ability of a human expert (Jackson, 1998). To achieve this, a human expert's knowledge must be encoded into the machine language in order for the system to execute the commands. It involves artificial intelligence and linguistics which are two of the disciplines of the Cognitive Sciences multidiscipline (Friedenberg & Silverman, 2011). The knowledge stored within the system, are represented by the if-then rules which consist of linguistic variables. Besides that, the computer assisted career guidance system has been researched and there are indications that there is cognitive and behavioral changes in the students who utilise the system (Seeger, 1988). There are also positive effects on career planning, career exploration, confidence in career choice and career development activity in students who utilised the system.

1.9 Conclusion

In conclusion, this chapter touches on the background of the study and discusses the current situation in UNIMAS regarding the computer-assisted career guidance system. The problem statement was also mentioned and the objectives of the current study were established as well. In addition, the significance of the study, expected contributions of the proposed system and its relationship with Cognitive Science was also explained.

CHAPTER 2

LITERATURE REVIEW

2.1 Computer Assisted Career Guidance System (CACGS)

The computer assisted career guidance system (CACGS) is a system which assists its users in making career decisions (Adawiyah & Ismail, 2006). This system provides users with career guidance and vocational counselling services through the means of computers which is similar to those which are provided by counsellors (Muroyama, 2004). It is normally used to help its users in career planning and assist them in selecting their career. As the system usually based on rules which are made up from the knowledge of the experts, it is categorized as an expert system (Razak, Hashim, Noor, Halim, & Shamsul, 2014).

The CACGS enhances the traditional career and counselling assessments in a way that is time and cost-effective (Glavin & Savickas, 2010). This is because these systems are able to provide the users with instant access to multiple means of assessment tools and link the results to occupational information and possible intervention methods (Tracey, 2010). There are some variations of the CACGS which are able to generate personalized educational plans for the users who are in academic settings or recommend possible careers and jobs for job seekers.

Most of the CACGS require continuous and periodical updates due to the ever-changing landscape and dynamism of the job market in order to meet the evolving needs of the users. Meanwhile, there are also many systems which employ sophisticated scoring and matching algorithms which are not commonly found in traditional face-to-face counselling sessions (Betz & Borgen, 2010).

The effect of using CACGS has been widely associated with positive outcomes where the users are more mature in their career planning progress, vocational identity, career satisfaction and increased career decidedness (Copeland, et al., 2011). There are also reports suggesting that the use of CACGS cause cognitive and behavioral changes in the user where there are positive effects on their career planning, career exploration, confidence in career choice and career development activity in students who utilised the system (Seeger, 1988). Therefore, CACGS are being widely studied to verify and validate their effects on the users so that better systems or career interventions could be deployed in the future.

2.1.1 Brief History of Computer Assisted Career Guidance System (CACGS)

The first CACGS was developed in the mid-1960s by several independent researchers. They were keen to design programs which could utilize the strengths of a computer which was thought to be quicker and faster than the human brain in that era to improve the vocational guidance practice in public schools (Cooley, 1968). Since then, the popularity of CACGS has grown exponentially over the next few decades in both the traditional education and private sectors (Fowkes & McWhirter, 2007).

2.2 Current situation of Computer Assisted Career Guidance System in UNIMAS

UNIMAS or Universiti Malaysia Sarawak is a university in the state of Sarawak in Malaysia. It offers many different courses to undergraduates and postgraduates as well. However, our topic of interest is the Cognitive Science program. Cognitive Science is the scientific interdisciplinary study of the mind (Friedenberg & Silverman, 2011). Studying something as complex as the mind requires a multidisciplinary approach. Therefore, Cognitive

Science covers a wide array of topics. The topics in question are philosophy, linguistics, anthropology, neuroscience, artificial intelligence and psychology.

The students of Cognitive Science are exposed to many different topics. They learn many different skills due to the nature of the course but there lies a problem beneath this. These students are confused and unsure of their prospective careers. This is because the field of study in Cognitive Science is too broad (Faculty Guidebook of FCSHD, 2016). For instance, there are core courses such as Cognitive Neuroscience, Philosophy, Introduction to Linguistics Analysis, Artificial Intelligence, Human Development Psychology included in the Bachelor's Degree of Cognitive Science in UNIMAS which shows that the students are exposed to a wide scope of study and therefore leads to a wide selection of possible careers.

According to Burns et al. (2013), most students are already struggling to choose a suitable career. Adding the fact that Cognitive Science students are not specialized in any field, it becomes even more difficult for them to choose a suitable career for themselves. Therefore, having a computer assisted career guidance system specifically for these students could potentially assist them in choosing a career suitable for themselves.

2.3 Expert System

Expert systems are systems which imitates the decision-making ability of a human expert (Jackson, 1998). It is designed to solve problems through reasoning, as if emulating a human in solving problems. The reasoning are based on the knowldege stored within the system, which are represented by the if-then rules instead of the more traditional procedural codes.

2.3.1 Components of Expert Systems

Expert systems are composed of two sub-systems which is the knowledge base and the inference engine (Smith, 1985). The two components are separated from each other and they make up the important components of an expert system as it requires knowledge and a control structure to process the knowledge (Turban & Aronson, 2001).

2.3.1.1 Knowledge Base

A knowledge base is a storage or technology which is used for storing complex structured or unstructured information to be used by a system. It is an essential part of a knowledge-based system such as the expert system. A knowledge base usually stores a set of concepts, instances or relations (Deshpande, et al., 2013).

The knowledge base contains the knowledge necessary for the system to access in order to understand, formulate and solve problems (Tripathi, 2011). The knowledge stored within the knowledge base are acquired from human experts using the knowledge acquisition module. The knowledge stored within the knowledge base contains both heuristic and factual knowledge.

2.3.1.2 Inference Engine

An inference engine is an important component of an expert system. It is the controller or more specifically, the brain of the expert system (Tripathi, 2011). The inference engine controls and acts as the interpreter of the expert system whereby it supplies the methodology for reasoning to the expert system. It analyzes, interprets and processes the rules in order to come up with results and help in decision making. There are two known approaches to the inference engine which is the forward chaining and backward chaining.

2.4 Inference Engine Approaches

Inference engines usually work in one of the two modes which is either forward chaining or backward chaining. The inference engine can be driven by either the antecedent, which is on the left hand side of the rule or by the consequent, which is on the right hand side of the rule (Griffin & Lewis, 1989). The antecedent and consequent decides whether an inference engine operate in the forward chaining mode or the backward chaining mode.

2.4.1 Forward Chaining

Forward chaining is a method of reasoning for an inference engine. Forward chaining is a popular method of reasoning implementation for expert systems. The reasoning behind forward chaining is that information is collected to obtain logical conclusions (Al-Ajlan, 2015). For instance, to help students in selecting a career, a counsellor would have to ask and collect information regarding the student before he or she could help the student.

Forward chaining begins with data which are available and utilises inference rules to draw out more information until the goal is reached. An inference engine operating in the forward chaining mode searches the inference rules until a rule with a true antecedent is found. If such a rule is found, the inference engine would then infer from the consequent so that the information is added as a new data (Feigenbaum, 1988).

2.4.2 Backward Chaining

The backward chaining process is the opposite or reverse of the forward chaining. It works backwards from a list of possible conclusions to evaluate if they are true. The backward chaining inference method works backward from the consequent to the antecedent to determine if there is any available data which could support any of these consequents (Russell & Norvig, 2010). As an example, a student who tells the counsellor that he aspires to be a doctor would

prompt the counsellor to question the student to see if he or she has the attributes of becoming a doctor.

2.5 Holland Codes (RIASEC)

The Holland Codes or RIASEC model refers to a theory of careers and vocational choice which is based on personality types (Holland, 1997). The theory was developed by American psychologist John L. Holland and revolves around the career choices of individuals and their personality types.

RIASEC is an acronym for the six types of personality as described by Holland. The six types of personality are Realistic, Investigative, Artistic, Social, Enterprising and Conventional (Nauta, 2010). The six types of personalities were initially named as motoric, intellectual, esthetic, supportive, persuasive and conforming respectively. Each personality corresponds to different types of job or careers which are thought to be suitable to the personality types.

2.5.1 Realistic

People with the Realistic interests are good in practical things such as hands-on problems or solutions. They are more comfortable in working with things like plants, machinery, tools and etc. They are also not as good in working closely with humans and dislike careers that involve lots of paperwork.

2.5.2 Investigative

People who fall under this category are those who enjoy thinking and analyzing. They prefer to do things that involve researching and problem-solving rather than doing physical activities. They dislike leading or persuading people.

2.5.3 Artistic

People who belong to this type of personality loves to engage in activities where their creativity is utilised. They are also sensitive towards things that involve designs and patterns. They do not like working environments or conditions that bound them to certain rules as this limits their creativity.

2.5.4 Social

People of the Social personality type are helpful to other people and promotes learning and personal developments. They are more inclined to work with people instead of machines or non-living things. They love to teach, give advice or help other people.

2.5.5 Enterprising

People who fall under this category is easy-going and enjoy carrying out projects and starting businesses. They are good in persuading and leading people and making decisions. They have no qualms about taking risks for profits.

2.5.6 Conventional

People who are of the Conventional personality type are more interested in activities which follow a certain set of rules, procedures or routines. They can handle repetitive tasks and prefers working with data as opposed to concepts or ideas. They like to work in environments where there are precise guidelines to be followed.

2.6 Myers-Briggs Type Indicator (MBTI)

The Myers-Briggs Type Indicator or commonly abbreviated as MBTI, is an introspective self-report questionnaire developed to investigate the psychological and mental preferences of people and the way they make decisions as well as the way they perceive the