A VoiceXML Enabled Locus of Control Scale System Designed to Engage School Pupils Lacking Commitment in the career development and decision-making process

Stephen Kenny, Kevin Curran, Rob Miller, Mark Shevlin
School of Computing and Information Systems Management,
Faculty of Engineering, University of Ulster, Magee Campus
kenny-s1@ulster.ac.uk

Abstract

Careers advisors encourage pupils to become more involved in the process and engage in their own career planning. Many pupils express an expectation of receiving direct career guidance where they are 'told' what to do. Such pupils who place their futures in the hands of luck or fate typically lack personal involvement or commitment to the process. This paper outlines the development of a voice-enabled application which implements a locus of control scale specific to the domain of adolescent career development and choice. Here, a 20-item scale representing expectations related to Internality, Luck, Helplessness and Powerful Others is proposed as beneficial in the career guidance process as a means of indicating the extent to which pupils would engage and participate in the process and assume responsibility for their own future. The newly developed Career Locus of Control Scale voice application allows greater accessibility and faster results than the traditional paper or web based methods. According to our preliminary research here, we believe that VoiceXML can indeed lead to improved system interface interaction, enabling people to more easily navigate computerized systems.

1 Introduction

The belief that career outcomes are largely dependent on one's own actions or on forces outside one's control have decreased confidence in career decision making tasks, however, positive relationships have been reported between internal locus of control and career decision-making attitudes [1]. Where individuals hold strong expectations about the extent to which they can influence their career through personal involvement, it may be anticipated that they will seek to engage in and throughout the process of career development [2]. Students who hold strong internal expectations of control over future career-related rewards may be more likely to actively participate in the process of career decision-making by demonstrating a degree of personal initiative and self-motivation.

In contrast, students who hold stronger external expectations for control over future career-related rewards would be more likely to delegate responsibility to significant adults, such as the careers advisor where direction may be favoured. According to Tinsley et al. (1980) expectations which represented a "Counsellor Expertise" factor suggested that the counsellor would direct the client through the process and would be better placed to decide which treatment plan would be most suitable. Plumly and Oliver (1987) have described such individuals as "not self-starters". Previous research has reported that many young clients express an expectation of receiving directive career guidance where they will be 'told' many useful things by the Careers Adviser. Such clients may also be more likely to place their futures in the hands of luck or fate reducing the need for personal involvement in or commitment to the process [3]. Students who are undecided about their future careers may choose to attend community college as a means of testing potential educational and occupational options. At this point perceived career knowledge and locus of control is unknown. Knowing how individual clients may approach the task and the likelihood of individual clients

engaging in the career choice process appears to be a potentially beneficial piece of information for careers advisors as it may assist in deciding how and when to intervene in individual cases to increase effectiveness. This warrants particular interest as careers advisers have reported that among the aims of career guidance interviews are encouraging clients to become more involved in the entire process and to engage in their own career planning [4].

Since the arrival of voice extensible mark-up language (VXML) in 2001 developers can now take content from the web and make it available by a standard telephone. By dialling a pre-determined telephone number a voice application can receive input from the caller via speech recognition or by the dtmf (touch Tone) tones from their telephone keypad. Until recently, Internet applications have primarily been dependent on visual interfaces to provide access to information or services. Now advances in speech recognition technology are allowing the creation of voice applications; the user interacts with these applications by speaking to them through a telephone rather than by using traditional input devices. Driving this technology is Voice Extensible Markup Language, or VoiceXML. VoiceXML is a standard language for building interfaces between voice recognition software and Web content. Just as HTML defines the display and delivery of text and images on the Internet, VoiceXML translates XML- tagged Web content into a format that speech recognition Software can deliver by phone. With VoiceXML, users can create a new class of Web sites using audio interfaces, which are not really Web sites in the normal sense because they provide Internet access with a standard telephone. This has a great impact on people who are very mobile, who move from one location to the next on a regular basis and always have access to a telephone. It also has a profound impact on people with disabilities, especially the blind and visually impaired, where all that is necessary is their own voice to acquire the information they need. Voice is the most accessible, mobile and easy to use interface that exists today because it can become a common user interface. By applying voice technology to mobile phones, information transactions can take place verbally. Hence, by allowing voice access to information anytime, anywhere, from any device, voice recognition can provide a more effective way for companies to communicate with customers, save money and facilitate those with disabilities. This paper examines the various procedures involved in the design and implementation of a VoiceXML application for allowing ease of access to information on bus times through a spoken dialogue interface and a discussion on the benefits of adopting this technology for the elderly and disabled.

The main aim of this research is to develop a VoiceXML enabled locus of control scale system specific to the domain of adolescent career development and choice. It was considered that such a scale could be beneficial in the career guidance process as a means of representing the extent to which young people would engage and participate in the process and assume responsibility for the future trajectory of their careers. More specifically, it will involve the design, construction, testing and evaluation of a 20-item scale via a voice application capable of recording a client's inputs, saving the inputs to a database and then immediately collating and presenting the output and results to both the careers advisor and client for discussion. An existing web based system has been previously developed by the author however this system aims of widening user participation and examining the usefulness of voice technology for similar systems. This technology may also provide greater accessibility to people with disabilities including the blind and visually impaired.

2 Literature review

The concept of a 'Locus of Control' was first proposed as a personality variable by Rotter (1966). Two types of individuals were identified: those with internal locus of control, who perceived success and failure as a consequence of their own actions and reactions, and those with external locus of control, who attributed both success and failure to external factors such as luck, coincidence, fate or the influence of people stronger than themselves [5]. Rotter defined the concept as a "generalized attitude, belief or expectancy regarding the nature of the causal

relationship between one's own behaviour and its consequences" [6]. Rotter's concept has been widely tested in various fields including learning, work and health. The link between internal locus of control and career success may be explained by the fact that individuals with an internal locus of control have faith in their ability to achieve objectives. They feel personally responsible for the jobs success and failure. Many other theorists support Rotter's Locus of Control; Place (1979) found that internal locus of control was an accurate predictor of levels of efficiency in the work in governmental departments of trade [7]. McCullough et al (1994) reported that successful leaders portrayed a high internal locus of control, whereas less successful leaders typically had a low internal locus of control [8].

2.1 Domain Specific Locus of Control

Since the publication of Rotter's original scale in 1966 there has been an increasing number of domain-specific locus of control scales developed. These cover various areas including; health, marital satisfaction, parenting and academic achievement. The focus on domain-specific measures was due to weak correlations reported when using global locus of control scales and the failure of factor analytic procedures to find a one-dimensional structure of Rotter's original scale [3].

Levenson (1981) addressed the issue of the dimensionality of the locus of control construct. Levenson attempted to measure the components of locus of control through the development of the Internality, Powerful Others, and Chance Scales [9]. The scale retained the construct of Internality, reflecting the degree to which people believe they will have control over rewards in their own lives, but differentiated between two sources of external control. The Powerful Others scale reflects the degree to which people believe that significant others will have control over rewarding outcomes. The Chance scale reflects the degree to which people believe that luck will significantly influence salient outcomes [3]. Focusing on the academic domain, Palenzuela (1984, 1988) has developed a multidimensional locus of control scale based on the concept of expectancy for contingency and non-contingency between actions and salient outcomes. Palenzuela (1988) recommended drawing a distinction between two kinds of externality; expectancy for luck or chance and expectancy for helplessness [10]. The result of Palenzuela's work hypothesised three correlated factors assigned the labels, internality (contingency), helplessness (non-contingency) and luck (chance). Although Levenson's concept of 'powerful others' was integrated into 'helplessness' it was felt appropriate to retain references to specific groups, such as careers adviser and employers. In addition to domain-specificity and multidimensionality, many locus of control measures make the distinction between expectations for the future and causal accounts or explanations of the past. Palenzuela (1984, 1988) suggested that expectancies for control and causal attributions differed in three major ways. First, locus of control is principally concerned with expectancies for the future whereas attributions refer to causal accounts of past experiences or outcomes. Second, the assessment of locus of control expectancies must precede an outcome whereas causal attributions explain previously known outcomes. Third, there is considerable confusion surrounding the terms 'internal' and 'external'. The attributions perspective uses the construct to indicate the location or locus of causality; that is, whether the cause is physically internal or external to the individual [3].

2.3 Social Learning Theory

In contrast to the academic theory, the social learning theory perspective invokes the concept of reward contingency where an internal locus of control can be assigned to a person who expects reinforcements or rewards as a direct result of his/her behaviour or personal attributes. Expectations of non-contingency suggest an external locus of control belief. These points of clarification assume considerable importance at both the conceptual and operational levels. Gross et al (1988), having explored expectancies and experience, concluded by recommending, "…that

future studies carefully distinguish between the constructs of expectancies and experience and document this difference to assure clarity of constructs" [11].

2.4 Career Locus of Control Scale

Trice et al (1989) proposed an 18-item scale to assess the degree to which respondents consider their career outcomes as dependent on their own actions or largely under the control of powerful others or chance factors. In a series of validity studies, the Career Locus of Control Scale discriminated between college graduates who were already under employment or had applied for jobs, and those who had not yet applied for jobs. The scores obtained from this scale indicated an acceptable reliability however the scale is scored so high that higher scores indicate an external locus of control [12].

2.5 Voice Extensible Mark-up Language – VoiceXML

Developed in 2001 vxml is derived from Extensible Mark-up Language (XML). Just as XML and HTML is presented by a web browser, VXML is presented by a voice browser. A powerful language capable of delivering web based content directly to interactive voice applications. HTML typically displays and delivers text, images and graphics on the internet just as VXML formats XML content that speech recognition software can then translate and deliver to the user by telephone.

VXML is used successfully in various commercial areas including; call centers; telephone banking applications; ticket reservation services and voice mail services. As VXML provides web content over a telephone, one of its main advantages is that it is possible to access an application now without an internet connection or even a computer. The following ‘Selling’ points have also been highlighted by many as some of the key reasons VXML is commercially successful; providing a voice based interface is an advantage to the visually impaired who cannot use a visual interface; using the application to access web based content through a mobile phone while on the move may be more convenient than using a laptop or personal computer; by using VXML applications a greater range of customers can be reached as the number of telephone users is far greater then the number of people who can use a computer [13].

By applying voice technology to mobile phones, therefore allowing access to information anytime, anywhere, VXML and voice recognition applications can provide a more effective way for companies to communicate with customers, save money and facilitate those with disabilities.

3 VoiceXML LOC Application

Initially, a pool of items was written to reflect the constructs of internality, helplessness, luck or chance, and powerful others relevant to the domain of career choice. This resulted in a 47-item version being drafted, with 14 internal, 13 luck, 10 helplessness, and 10 powerful others items [3].

Care was taken to ensure that all items referred to future outcomes and were correspondingly written in the future tense. In addition, all items were written in the first person using words thought to be familiar to 15-16 year old school pupils. A standard response format was selected with a six-point scale of agreement / disagreement anchored from ‘Strongly Disagree’ (1) to ‘Strongly Agree’ (6), as outlined in figure 1. The questionnaire was completed by randomly ordering items, including an introductory statement outlining what was to follow, setting out instructions and directions, and including an example to ensure adequate task comprehension. See figure 2.

1.	**If I am to get the job I want I will have to do well and try hard**	◉1 ○2 ○3 ○4 ○5 ○6
2.	**If I get a good job it will be a direct result of my own ability and motivation.**	◉1 ○2 ○3 ○4 ○5 ○6
3.	**If I do not get the job offers I want then I will have to work harder at my job search.**	◉1 ○2 ○3 ○4 ○5 ○6
4.	**The job I will get will depend mainly on how well I do and how hard I try.**	◉1 ○2 ○3 ○4 ○5 ○6
5.	**I believe that through my own efforts I will be able to be anything I choose.**	◉1 ○2 ○3 ○4 ○5 ○6

Figure 1: Example questions with six-point scale of agreement / disagreement.

3.1 Item selection and scale construction

The career locus of control scale was anticipated to be used in a guidance setting therefore it was desirable that the scale be short for quick completion and balance. Consequently, it was decided that five items per factor be selected. The choice of five items was based on trying to achieve a balance between the speed of completion and using enough items to generate adequate scale variability. Five items per factor allows a possible range of scores from 5 to 30 for each dimension and from 20 to 120 for the entire scale.

LOCUS OF CONTROL SCALE

Instructions:
Please read the statements below carefully. Using the key provided, choose a number which expresses how you feel about each statement. Using your mouse, click the appropriate number beside each statement.

Example:
When I make Plans, I am almost certain to make them work ○1 ○2 ○3 ○4 ◉5 ○6

(If you agree with this statement then you should click 5 as shown above)

Key:

Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	**2**	**3**	**4**	**5**	**6**

Figure 2: Introductory Section – what the user will hear first when they call the application.

3.2 Developing the Infrastructure

To develop a VXML application it is necessary to download a debugging tool which is used to create and debug the VXML application. There are many of tools available on the Internet but can cost a lot of money. The tool used to build the LOC Voice Application is called *Prophecy*[1]. The Prophecy tool caters for various programming languages including VXML and it allows developers to test the application locally by simulating a phone call and therefore eliminating the need to pick up a phone and dial a specific number each time the application is tested or debugged.

The voice-enabled application was built using standard VXML, XML, JavaScript and Active Server Pages (ASP) to interact with a Microsoft Access database. This enabled the application to contain

[1] http://evolution.voxeo.com

the relevant objects required to complete the scale and collate the results including access to the database. The voice application is aimed at adolescents where for many it will be their first experience with a voice application. Many students may encounter difficulty understanding the speech synthesis prompts therefore it is important to maintain short, clear and concise dialog throughout the entire process. Another factor to consider was the grammar; incorrect or confusing grammar may hinder the validity of the results as the student may not fully understand what is required.

The voice application is designed to greet the caller initially and then introduce them to the main menu. From the main menu the caller may proceed straight to the LOC survey by pressing or saying 'One', or if the caller is in any doubt, they may access the help system by pressing or saying 'Two'. The help system is designed taking the preceding points into consideration. The help system is clear concise and contains simple grammar ensuring the caller is fully aware of what is required. From the help system the user is returned to the main menu from where they may choose to proceed to the survey or listen to the help again.

Error handling is also factored in throughout the application whereby if the application does not understand the user's response, or perhaps the user has not responded at all, then appropriate 'nomatch' and 'noinput' tags are in place to catch the error and re-prompt the caller. Also if the caller terminates the interaction at any time by hanging up the phone, the voice server will detect this and it then disconnects itself.

4 Evaluation and Testing

At the early stages of implementation, the scale was simply designed to record the student's answers and then display the results. An initial prototype of this scale was built and tested, however, while the prototype worked efficiently, it was decided that the student's results should be saved to a database before being displayed. This is to facilitate future research by making records of the student's age, gender and subsequent test scores. By including a database to the scale, researchers or indeed the careers advisor can access specific records in order to identify new patterns or trends, for example, the careers advisor can access the records of all 15 year old males who took the test in 2006, and then compare those results to the records of all 15 year old males who take the test in 2007. It must be noted that all records stored to the database are completely anonymous. No records of the student's name or student number are stored.

4.1 Validation

Each question in the questionnaire holds as much significance as the next; therefore it is essential that when a student takes the test, they must provide an answer for each question otherwise the final result would be misleading. This is accommodated automatically in vxml by using the 'Prompt' tag. When the caller is prompted to answer a question the voice application will wait until there a viable response is provided. For example, when a caller is asked for their gender, the application will wait until the caller says 'Male' or 'Female'. If the caller says something else that is not recognised this will invoke an error which ultimately will result in the caller being asked the same question again.

Figure 3: typical user answering the survey

4.2 Connecting the Database

When the student or caller completes the questionnaire all answers are stored to a database. This is achieved using ASP; a separate page was created and saved as 'addrecord.asp'. This page contains code to open a connection to the database, add the new records, update the database and finally close the connection. The database created is saved as 'loc.mdb' and contains two tables; 'students' and 'standards'. The students table contains their age, gender and a numeric value for each separate question. The standards table contains the current standards for both males and females for each of the four measurable dimensions on the scale; Internality, Luck, Helplessness and Powerful Others [3].

In theory the coding behind the database was correct, however, testing the connections to the database required the PC to be configured as a local server or Internet Information Server (IIS) with the folder C:\inetpub\wwwroot authorised to deliver pages. Therefore it was required to run all .asp files and the database from the wwwroot folder. When the student's information is submitted to the database the voice application informs them that they have successfully completed the questionnaire and then presents the results. From here the student has the option to have the results repeated, return to the main menu or exit the application.

Calculating the totals

The final results page is a separate page saved as 'listrecord.asp'. This page contains code to open a connection to the database, retrieve the last record in the database and finally close the connection. In order to display the total score for each of the four dimensions on the scale; it was necessary to create an array list containing the values in the last row of the recordset. Then the total for each dimension was calculated by declaring a variable and then extracting numeric values from the array list applicable to each dimension.
For example:

```
internality=0
For col = 2 to 6
internality=internality+ resultsArray(col, indexLastRow)
Next
```

When the totals for each dimension are calculated, they are firstly saved to the database and then measured against the standard scores retrieved from the database, collated and presented back to the user as the overall result of the scale.

The Career Locus of Control Scale was developed on the principles of domain-specificity, multidimensionality, and expectations for the future. Data from a large sample of adolescent participants was randomly split for the purposes of item selection for a short scale, and to assess concurrent validity in terms of identifying factor structures in a study elsewhere [3]. The External scale is negatively associated with Levenson's Internality dimension and positively associated with Levenson's Powerful Others and Chance scales. It also seems evident that Internal and External may reflect independent expectations as the status on one dimension cannot be predicted from status on the other. This scale may not be suitable for older participants who can psychologically differentiate between the different components of externality thereby ignoring potentially useful subscale information. However, the scale and scores derived from it in terms of two sub-scales, Internality and Externality, appear to provide information that may be useful in terms of a research and counselling context with young people. The findings to date suggest that the Career Locus of Control Scale has produced scores that merit reliability and validity. At the moment the Career Locus of Control Scale may only be considered useful in a research context. However, it is anticipated that after further validation and the compilation of suitable normative data the scale

could be beneficial in the career guidance context as a means of ascertaining the type of interaction best suited to particular clients.

VoiceXML implements a client server paradigm, where a web server provides VoiceXML documents that contain dialogs to be interpreted and presented to the user; the users responses are then submitted to the Web Server, which responds by providing additional VoiceXML documents, as appropriate. Unlike proprietary Interactive VoiceResponse (IVR) systems, VoiceXML provides an open application development environment that generates portable applications. This makes it a more cost effective alternative for providing voice access services.

5 Conclusion

Technological advances and the continuing convergence of computing and the telecommunications are reducing barriers, but for many people with disabilities the impact is more profound. Computerised voice recognition provides even further opportunities, particularly for those with severe arthritis or those who are visually impaired and blind. The capacity to communicate with, and collect information from almost any point on the globe or from one's home, has already expanded the ability of persons with disabilities to participate in an information oriented society more effectively than before. Careers advisors encourage pupils to become more involved in the process and engage in their own career planning. Many pupils express an expectation of receiving direct career guidance where they are 'told' what to do. Such pupils who place their futures in the hands of luck or fate typically lack personal involvement or commitment to the process.

This paper has outlines the development of a voice-enabled application which represents a locus of control scale specific to the domain of adolescent career development and choice. Here, a 20-item scale representing expectations related to Internality, Luck, Helplessness and Powerful Others has been developed as a voice application which allows greater accessibility and faster results than previous methods. According to our preliminary research here, we believe that VoiceXML can indeed lead to improved system interface interaction, enabling people to more easily navigate computerized systems. Voice command input can be more natural and much faster. People can speak in a natural voice to interact with their computers. Thus, combined with affordable pricing, and increased consumer demand, is leading to the evolution of transparent computing, where human/machine interaction is so natural that it is almost invisible.

6 References

[1] Taylor, K. M. Pompey, J. (1990) "An examination of the relationships among career decision-making self-efficiency, career salience, locus of control, and vocational indecision", *Journal of Vocational Behaviour*, Vol.37, pp. 17-31.

[2] Millar, R. (1994). *Client and careers officer perceptions of careers guidance and their relationships to models and outcomes*. Unpublished DPhil: Londonderry, University of Ulster.

[3] Millar, R. Shevlin, M (2006). *The Development and Factor Structure of a Career Locus of Control Scale for Use with School Pupils*. Unpublished DPhil: Londonderry, University of Ulster.

[4] Kidd, J.M., Killeen, J., Jarvis, J., & Offer, M. (1993). *Working Models of Careers Guidance: The Interview*. London: Department of Employment Group.

[5] Klein, J. Wasserstein-Warnet, M. (1999) "Predictive validity of the locus of control test in selection of school administrators", *Journal of Educational Administration,* Vol.38, No. 01, August, pp. 07-25.

[6] Rotter, J.B. (1966) "Generalized expectancies for internal versus external control of reinforcement", *Psychological Monographs, 80,* Whole No. 609, pp. 01-28.

[7] Place, H. (1979) "A biographical profile of women in management", *Journal of Occupational Psychology,* Vol. 52, No. 04, pp.264-276.

[8] McCullough, P.M., Ashbridge, D. Pegg, R. (1994) "The effect of self esteem, family structure, locus of control, and career goals on adolescent leadership behaviour", *Adolescence,* Vol. 29, No. 115, pp. 605-611.

[9] Levenson, H. (1981). Differentiating among internality, powerful others and chance. In H.M. Lefcourt (Ed.), *Research with the locus of control construct, Volume 1: Assessment methods*. NY: Academic Press.

[10] Palenzuela, D.L. (1988) "Refining the theory and measurement of expectancy of internal vs external control of reinforcement", *Personality and Individual Differences,* Vol. 09, pp. 607-630.

[11] Gross, W.C. Tiffany, D.W. Tiffany, P.G. Jackson, T.T. (1988) "Expectancies and/or experience - divergent views of perceived control", *Journal of Personality Assessment,* Vol. 52, pp. 512-515.

[12] Lease, S.H. (2004) "Effect of Locus of Control, Work Knowledge, and Mentoring on Career Decision-Making Difficulties: Testing the Role of Race and Academic Institution", Journal *of Career Assessment,* Vol. 12, No. 3, August, pp. 239-254.

[13] Shukla, C. Dass, A Gupta, V. (2002) *VoiceXML 2.0 Developer's Guide*, California USA: McGraw-Hill/Osborne.

Article received: 2007-03-01