Generic skills assessment:

Development and validation of an instrument for apprentices in the traditional trades.

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Abstract

The Swinburne University Apprentice Skills Assessment (SUASA) is a recently developed generic skills measure using a six-factor model containing thirty seven items based on industry underpinnings. The aim of this study was to empirically validate this measure with a sample of apprentices in the traditional trades. Four hundred and fifteen males and twenty nine females completed the SUASA in a paper and pencil format. A factor analysis of the data showed only evidence for two of the six factors as originally conceived (communication, and teamwork). Other factors (self-management, problem solving, learning, and initiative and enterprise) did not adequately represent the pattern of responses by this cohort. The potential use of the generic skills scale is discussed including directions for redeveloping the scales that did not fit with the original design.
Introduction

In Australia we have a specialist skill shortage in the trades. This skill shortage can be attributed to the cyclic nature of our economy (i.e., supply and demand of staff), barriers to entry for some industries (i.e., employees are required to have specific competencies for employment, for example electrical and plumbing tradespeople are required to be licenced), an ageing population (e.g., people retiring), people moving interstate or overseas, new technologies (e.g., national broadband network (NBN), and renewable energy), and attrition (people leaving the trade). Those that remain in the working population either have to up-skill to meet the shortfall or leave and do another job.

In addition to these historical factors, the skill shortage can also be attributed to people having an insufficient range and level of skills (for example, fault finding, and customer service) to be able to up skill, multitask, or get through a course of training. This is evident in apprenticeships where empirical evidence is available concerning the numbers of people completing and leaving their course of training.

The failure to develop and apply effective generic skills is a barrier to successful training for apprentices. The result is seen in the low rates of completion in the trades, this is especially evident in Hairdressing [36.5%] and the food trades (for example, Cookery [27.7%] Karmel, 2011, Table 2, p10)

Generic skills such as communication, problem solving, learning, self-management, initiative and enterprise, and team building are embedded in curricula for registered training organisations. Employers also use these skills in position descriptions, selection criteria, and job advertisements. Given these practices, it is vital to determine whether there is a transfer
of skills by an apprentice from the school context to the workplace including the practice of reflective learning. For example, the effective use of diagnostic skills on the job, and classroom activities encompassing problem solving techniques show a direct correlation of skills transfer.

There are 462,400 apprentices and trainees employed in the Australian working population as at June 30 2011, (NCVER, 2011, p1). Apprentices in training sustain Australia’s national skill base and provides employment. When apprentices do not complete their apprenticeship, it erodes the future skill capacity of this nation.

The NCVER 2009 annual apprentice and trainee statistics report show the completion rate for contracts of training for all types of apprenticeships and traineeships that commenced in 2004 and finished in 2008 was 45.8% (p1). This report also documents the attrition rates for all types of apprentices and trainees that ceased their contracts of training within the first twelve months of commencing their apprenticeship. The figures show for the years 2001 to 2008 the attrition rate of apprentices who did not complete their first year of their apprenticeship was between 27.8% and 32.2% (p1). Many researchers e.g. Harris et al 2001, Gow et al., 2008, and Snell and Hart 2008 have commented on the reasons why apprentices leave their apprenticeship and are not acquiring the skills developed on the job. In the Apprenticeships for the 21st century report (2011) they state that some of those reasons include personal issues, environmental issues, and learning issues (p13). They go on to say the reasons apprentices give for non-completion can be clustered into four items which are workplace and employer issues, lack of support, not liking the job, and low wages (p23). In this same report they also give a reason why apprentices stay which is dependent on person and context orientated factors (p14).
Therefore, understanding why apprentices leave or stay in an apprenticeship is a motivator for this scale development. The findings from the self-report measure of generic skills can be used with other self-report measures (i.e., personality and Emotional Intelligence) to better explain the attrition or retention of apprentices’ generic skills.

**A Review Of Generic Skills**

In Australia in 1991, the Finn committee published a report titled “Young people’s participation in post compulsory education and training”, which concluded that young people needed key competencies in preparation for training and employment irrespective of the pathways they take. These competencies included the following:

a) Language,

b) Communication,

c) Mathematics,

d) Scientific and Technological understanding,

e) Cultural understanding,

f) Problem solving, and

g) Personal and interpersonal characteristics.

Following from the outcomes in the Finn report in 1992, the Mayer committee in their key competencies report “Putting general education to work”, developed a means for describing the key competencies (p3), this provides a common reference point for both curriculum and teaching for their work, and also gave a method for assessing and reporting achievement. The key competencies identified included:
a) Collecting, analysing, and organising information.

b) Planning and organising activities.

c) Communicating ideas and information.

d) Working with others and in teams.

e) Using Mathematical techniques and ideas.

f) Solving problems.

g) Using Technology.

The next major work in the generic skills came from Kearns (2001). He defined generic skills to be “the skills which can be used across a large number of different occupations including the key competencies which encompassed a range of other cognitive, personal, and interpersonal skills which are relevant to employability.” (Appendix 1, p83)

In 2002 the Australian Chamber of Commerce and Industry (ACCI) and the Business Council of Australia (BCA) commissioned the report “Employability Skills for the Future” that mapped the Key competencies identified by the Mayer committee against eight new employability skills. They were communication, teamwork, problem solving, initiative and enterprise, planning and organising, self-management, learning, technology (p58).

The ACCI and BCA termed the skills used in their report as “skills required not only to gain employment, but also to progress within an enterprise so as to achieve one’s potential and contribute successfully to enterprise strategic directions”. They coined the term “Employability skills” because it would be more palatable for industry to understand.
Employability skills are narrowly focused and context dependent whereas generic skills are broadly defined and less job specific.

In the NCVER article “Defining Generic skills – at a glance” (2003) they state that generic skills are “those that apply across a variety of jobs and life contexts and are also known by several other names, including key skills, core skills, essential skills, key competencies, necessary skills, transferable skills and employability skills”. (p1)

The differences between these definitions can be confusing, as has been remarked by Clayton et al. (2003) who said ” The language associated with the concept of generic skills is quite complex and there is no real agreement as to what constitutes these skills, let alone how to validly and reliably recognise them in practice. It is evident that practitioners do not speak, or think, about generic skills in the same terms.”(p7)

This paper will define generic skills in its broadest terms and will not be job, trade, or situation specific in its assessment of apprentices.

Assessment of generic skills

The constructs used in the research design of the generic skills assessment is based on the employability skills framework (2006, Table3, p12) which are communication, problem-solving, self-management, teamwork, Initiative and enterprise, and learning.

The main aim of this study was to develop, construct, and validate a measure of six generic skills factors and then survey the instrument with all types of apprentices across Australia. The motivation for doing this was to provide a measure that could act as a basis for generic skills research and to provide a psychometric measure for future work with apprentices across all trades.
This newly created generic skills instrument for apprentices was named the Swinburne University Apprentice Skills Assessment (SUASA). It is yet to be tested against other measures in this research project (i.e., Personality and Emotional Intelligence) to examine what relationships exist between them.

The data was analysed using SPSS version 19. An exploratory factor analysis was conducted to determine if the survey data was well described by six factors corresponding to the six factor list. Contrary to expectations, two constructs (teamwork, and communication) were statistically significant. The remaining constructs (problem solving, self-management, initiative and enterprise, and learning) had weak correlations with each.

The data analysis showed items from these constructs were interdependent. Therefore these remaining items were clustered into four new constructs as listed in table 1 of the results section in this paper.

This assessment instrument is important to the research of apprentices because firstly, to the author’s knowledge at this point in time, no previous studies in Australia have conducted an extensive scale development for skills assessment with this cohort. Secondly, there are lots of cases, statistics, and results that point to the effects of an apprentices behaviour but no empirical evidence linking these with some causes why they happen.

The research seeks to find causes for an apprentice’s actions and behaviours to yield information about future work performance, training ability, and communication amongst peers. It also takes a snapshot of the tacit knowledge these apprentices possess. It is beyond the scope of this paper to show results of apprentices’ generic skills from the newly developed self-report instrument. This will be explored in future research.
Developing a psychometric measure for generic skills is an important process in the goal of producing a valid and reliable instrument with a factor structure and content scales. The self-report measure forms a foundation from where to begin to understand an apprentice’s behaviour. It also eliminates the “gut instinct” or second guessing some may use when wanting to make informed choices for apprentices.

Method

Participants

Across the Australian sample of apprentices used in the survey titled “Generic Skills”, 93.5% of them were male, doing an electrical apprenticeship, residing in Victoria, attending a public training college in Melbourne, and doing day release training.

Most of the sample was between nineteen and twenty three years of age and had year twelve as the highest level of education prior to commencing their apprenticeship.

The distributions of the demographic variables seen in the histograms were all slightly positively skewed. The outliers for the demographic variables were found above the 99% spread of the population sample.

Materials

The questionnaire developed for the current study was adapted from questionnaires that suited the constructs used.

The questionnaire items were selected from, the Self Concept Enhanced Learning Facilitation (SELF) description questionnaire III manual (Marsh, 1990), Multiple Intelligence test Chislett.V & Chapman. A (2006), Multiple Intelligence test - Birmingham Grid For

Stage one of the study involved conducting a pilot survey from the one hundred and twenty-two items selected to fit the six constructs and placing them into a questionnaire titled “Employability Skills Survey”. The items were rated on a five point Likert scale, from one (1) almost never, two (2) seldom, three (3) sometimes, four (4) usually, to five (5) almost always. Demographic items like age, gender, location, registered training organisation (RTO) type, type of apprenticeship, year of apprenticeship, and type of training, were also included on the front page of the questionnaire.

The items were assembled into clusters according to their constructs in the questionnaire. The data was designed to be captured using the paper and pencil format. The questionnaire was also devised so the Teleform scanner was going to be used to extract SPSS scripts at a later stage for data analysis.

Stage two of the survey required working with the data received from stage one and revising the Employability skills questionnaire. After modifications, forty seven items remained and the survey instrument was retitled the “Generic Skills Survey” (Apprentices).

The items again were rated on a five point Likert-type scale, from one (1) almost never, two (2) seldom, three (3) sometimes, four (4) usually, to five (5) almost always. Additional demographic items were included like home postcode, country, state, name of the registered training organisation (RTO) attending, highest level of education prior to commencing their apprenticeship, optional student identification number, and a tick box if
wanting any feedback from the survey. A space was added for an email address if people wanted to be contacted to give feedback.

Procedure

Prior to commencing the survey an ethics approval was obtained from the university’s human research ethics committee. The development of the generic skills questionnaire followed a three stage approach.

Stage one involved identifying the constructs used. This required doing an extensive review of the literature relating to generic and employability skills for apprentices. The next step involved finding items to fit the constructs.

The items were then assembled into a questionnaire and the title was named “Employability skills”. After some discussion in the vocational education community about the focus of the questions in the survey, it was decided to change the title to “Generic skills” to depict life experiences of skills for all contexts rather than the narrow understanding of employability skills for the workplace.

Invitations to participate was via a selection of public and private training colleges from across Australia and New Zealand who were delivering training to indentured apprentices from any trade and any year level. Distribution of the questionnaires was via a classroom teacher who handed them out during class time. In the case of one group training company, questionnaires were posted together with a reply paid envelope attached. The questionnaire was designed to take approximately thirty minutes and was conducted between February and April 2010.
The main function of stage one of the pilot survey was to examine the robustness of the questions and to ensure that students interpreted the items as intended. Stage one was also conducted because no prior knowledge was assumed as to how respondents would view the constructs chosen for the questionnaire.

Stage two commenced immediately after the completed questionnaires were collected. Data was imported directly into SPSS version 19 and scripts were generated for a more detailed analysis. Basic descriptives were calculated for the one hundred and twenty two questions that respondents rated on the five point Likert scale.

Questions in the survey were then exposed to a seven stage examination as listed below. They were changed based on the logic of how an apprentice might view them.

1. Rephrasing negatively worded sentences to provide clear and concise statements.
2. Removing negatively worded items to eliminate unnecessary confusion.
3. Simplifying items that were too long to ensure constructs were represented easily.
4. Removing items that were similar to others that could be confused with a different construct.
5. Ensuring that apprentices could understand the instructions and complete the survey without confusion.
6. Ensuring the wording of individual items was familiar to apprentices.
7. Examining the sentence structure (i.e. questions where the first person or present tense was used, it was changed to the third person or impersonal)

Items were deleted where the likely responses may have invoked an ambiguous understanding. The survey was conducted between September and December 2010. A participant information statement was also included with the survey that explained the
rationale for the study and instructions for participation. It also contained a consent form which acknowledged the respondents agreement to participant and the researcher’s contact details. No incentives or gifts were given to participants to participate in the survey.

In this stage of the study, a wider sample of participants was sought and netted six hundred and twenty seven responses. Those that participated in stage one were not asked to participate again. This was done to avoid results that may conflict with the sample of participants that were doing it for the first time.

Distribution was again via training colleges from across Australia but now included New Zealand, USA, and Scotland. The same method of distributing questionnaires was used as in stage one, via the classroom teacher. This method was sought because it gave the best results for obtaining the maximum number of completed responses rather than online or direct mail out.

Stage two was conducted to test the six constructs used (communication, problem solving, learning, teamwork, initiative and enterprise, and self-management) and to see if these factors aligned with the appropriate items chosen.

Stage three of the study required analysing the data from the SPSS scripts generated. Exclusions from the responses collected were applied to those under eighteen years of age who may have responded to the survey which did not meet ethics approval. Also, it was limited only to include Australian participants. Data collected from the overseas training colleges will be used in another part of the study in this research project.

The sample number was now four hundred and forty six which is above the required sample of one hundred and ten to one hundred and forty participants with six factors and forty two
or more variables as stipulated by Mundfrom DJ, Shaw DG, and Tian LK (2005). This sample is also above the required sample of three hundred and eighty four as recommended by Cavana et al (2001, p278). This stage produced the final version of the generic skills questionnaire which contained thirty seven items representing the six constructs used.

**Results**

The structure of the thirty seven item questionnaire that assessed apprentices’ generic skills was collected from four hundred and fifteen males and twenty nine females. The data was subjected to a factor analysis. This attempted to identify the factors which explained the pattern of correlations within the set of items used in the questionnaire. When the factor analysis was conducted, principal axis factoring was used as an extraction method together with promax as a rotation method.

After the data analysis was conducted, six factors with Eigen values exceeding one were identified as underlying the thirty seven item questionnaire. In total these factors accounted for one hundred percent (100%) of the total variance explained in the questionnaire data. The results of the factor analysis are shown in the factor loadings matrix in table 2.

Prior to running the factor analysis, examination of the data indicated that not every variable was perfectly distributed. Given the robust nature of factor analysis, these deviations were not considered problematic. A linear relationship was not established amongst the variables.

After stage one was conducted, some questions were deleted or modified, as handled by the seven stage examination. A factor analysis was also conducted as a dimension reduction
technique to see if the six constructs chosen in the survey had any relationship (i.e. maximally correlated or minimally correlated) with the items.

The items remaining from these two examinations totalled forty seven and formed the redesigned generic skills questionnaire.

Stage two was used to test if the data was normally distributed. Using the descriptives with a 95% confidence interval showed that the data was slightly negatively skewed. The Shapiro – Wilk test (sig. value < .5) also confirmed that the data significantly deviated from the normal distribution. The graphical Q-Q plot also confirmed the data was not normally distributed showing the data points straying from the line in an obvious nonlinear fashion.

A factor analysis conducted was used to find the natural relationship between the questions used, and to test the various constructs. Eleven potential factors with Eigenvalues exceeding 1 were identified as supporting the forty seven items. These factors accounted for 47.6 % of the variance in the questionnaire data.

The results of Stage two revealed 11 factors underlying the forty seven questions did not agree with the original design containing the six constructs. This was confirmed with a scree plot which graphed the Eigen values against the component number. The factors that were retained for analysis was those with an Eigen value over one. Those discarded were items with values less than one that served little use to the end result. This model was retested which included running the data again to perform a factor analysis. This was conducted to make the forty seven items fit this six factor model. Prior to re running the data, items were eliminated if any item loading was below 0.5.
Of the six expected factors, only team work and communication were evident in the factor loadings Table 2.

The remaining items did load on the original four factors tested, whose structure was not quite as expected. Based on the items loadings, new names were given to the other four factors as shown by the table below. The Cronbach’s alpha ($\alpha$) was included in Table 1 as a measure of reliability. The number indicates a measure of internal consistency or in other words, how closely related the items are as a group. The higher the value means that it is reliably measuring the underlying construct.

**Table 1**

Note: The total number of respondents who took part in the survey was 446

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<th>FACTOR</th>
<th>No Of ITEMS</th>
<th>No. Of respondents</th>
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<th>VARIANCE</th>
<th>$\alpha$</th>
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<td>3.66</td>
<td>0.09</td>
<td>.75</td>
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<tr>
<td>accomplishing &amp; reporting</td>
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<td>425</td>
<td>3.79</td>
<td>0.05</td>
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<td>active participation</td>
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<td>431</td>
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<td>0.06</td>
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An examination of the questionnaire item total statistics indicated that the alpha (\(\alpha\)) value would decrease if any of the items in each of the constructs were deleted. All of the items were kept because they will be useful when cross referencing with data from other instruments in future research.
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Discussion

The aim of this paper is to develop and validate a generic skills instrument for apprentices in the traditional trades based on six constructs which include communication, problem solving, learning, team building, initiative and enterprise, and self-management. The results did not support the original design with six constructs used to collect the data.

After analysis of the data, thirty seven items were found to support six constructs although only two of the original factors (communication, and team building) were statistically significant. The remaining items formed four new clustered constructs that were aligned with self-management, learning, problem solving and initiative and enterprise. These new factors were called working and interacting, application and opinion, accomplishing and reporting, and active participation.

The practical implications of this survey instrument are, it can be useful to identify the effectiveness of skills people have prior to commencing employment, beneficial when planning training, identifying skills gaps in apprentices when developing intervention strategies to boost efficiencies in training and productivity and, to have stakeholders better informed about apprentices skills. It also a useful tool to assess potential work performance from industry required skills.

The shortcomings of the SUASA were twofold. Firstly, the original items chosen for the questionnaire did not fit the six constructs (communication, problem solving, learning, team building, initiative and enterprise, and self-management). It appears the respondents did
not view the questions as expected which the four new constructs showed. Secondly, because the items came from industry requirements and government policy, they were not subjected to an evidence based research model which may be why the data did not fit the original constructs and a reason why apprentices viewed them as the four new constructs showed.

The majority of peoples highest level of education collected by the data was year twelve and the ethical clearance to commence this study was eighteen and above. Therefore, it was expected that apprentices were able to interpret questions in the survey instrument without much difficulty.

**Conclusion**

A new assessment tool was created and called the Swinburne University Apprentice Skills Assessment (SUASA) which can be used with apprentices from all trades. It is a tool for data capture and can be used with other validated assessment tools. It contributes to vocational education research because it uses industry required skills (Communication, Problem solving, Learning, Teambuilding, Initiative and Enterprise, and Self-Management) and has the potential to provide an understanding of an apprentices behaviours and actions. It will also be of benefit to all stakeholders of apprentices because it will assist them when making informed choices about this cohort.

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