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An evaluation of an apprentice selection process

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Orientation: The artisan job family is the number one area of concern with regard to filling vacancies both nationally and globally. Hence, artisanship has been identified as a scarce and critical skill. The domestic economy and the effectiveness and success of many organisations could be strengthened if the artisanal crisis is adequately addressed.

Research purpose: This article proposes a screening process for organisations to use during the selection of apprentices. The selection process has four phases: application review, rating of application documentation, aptitude testing and skills-based teamwork assessment, and interviews. The effect of the selection phases on the survival of the applicants was investigated.

Motivation for the study: This study adds to the limited body of literature on artisans, apprentices and the selection of individuals for these technical positions. In addition, it provides recommendations to optimise the selection process for this job family.

Research design, approach and method: Large amounts of archived data from an annual apprentice selection process at a large multinational automotive firm were accessed. A quantitative measure, survival analysis, was used to assess whether the survival curves were statistically different across the groups.

Main findings: The four selection phases had a significant effect on the survival time of the applicants in the selection process. The significance of the Gehan–Wilcoxon statistic suggests that the survival distribution across the applicants was not because of chance but rather indicates a true difference in the data. The constructs assessed at each phase had a significant effect on the selection success of the apprentice applicants. The termination rate of applicants was steady across all four selection phases.

Practical/managerial implications: The multiple-hurdle selection process employed in this study should be replicated and employed as the national selection tool for apprentices. The use of standardised application documentation is recommended, and job preparation workshops should be provided to assist apprentice applicants.

Contribution/value-add: The findings of this study are relevant to the South African automotive industry, as well as the manufacturing sector. The findings are also of value to human resource practitioners, educators, social scientists, and industrial and organisational psychologists.

Keywords: apprentice; artisan; human resource; selection; selection process; staffing.

Introduction

Given the numerous changes prevalent in the 21st century, organisational success and survival have become increasingly dependent on its staffing practices (Hoffman et al. 2018; ManpowerGroup 2018). Furthermore, human capital development, through the attraction, selection, remuneration, development and retention of scarce skills, has been emphasised as a national priority (Reddy et al. 2016). Local companies are strategically aligning their human resource (HR) practices to remain competitive (Manufacturing, Engineering and Related Services Sector Education and Training Authority [merSETA] 2016; Nomvete, Patel & Letsoala 2018). Whilst the competition can replicate particular assets and processes, such as product design and operational technology, HR assets remain inimitable (Breaugh 2013; Shatouri, Omar & Igusa 2012).

Staffing practitioners, therefore, find themselves in a curious position. Despite the aforementioned, many business decision-makers continue to disregard the value of effectual staffing practices (Lievens & Chapman 2019). In addition, a significant decrease in staffing research since the 1980s has been observed (Schreuder & Coetzee 2010). This has led to a call for researchers to positively

respond to the staffing-related needs expressed by the business community. Specifically, there is a need for research that can predict emerging challenges and offer viable solutions to these challenges (Pietersen 2018; Vernon, Hocking & Tyler 2016).

One such challenge is the shortage of artisanal skills, both nationally and globally (Heutter 2020; Kilcarr 2016; Martin 2016). International businesses regularly state that the most difficult job to fill is that of technician (Giffi et al. 2015; ManpowerGroup 2018). A large portion of local technical vacancies also cannot be filled, as applicants do not meet the educational and skill prerequisites (De Kock 2012). In response, the South African government issued the *National List of Occupations in High Demand* to elucidate and draw attention to the artisanal trades (Government Gazette 2018).

Despite offering better employment prospects and higher earnings, international organisations are still struggling to source sufficiently skilled persons to fill vacant technical positions (ManpowerGroup 2018; Schwab 2019). Whilst nationally, the South African government has launched several initiatives to help to address the shortage. However, regardless of these and other non-governmental initiatives, the problem of artisanal skills scarcity persists (Pandor 2018; Waite & McDonald 2019). Furthermore, it is believed that this problem will worsen in the upcoming years as technology enhancement and globalisation accelerate (Deloitte 2018; Qonde 2019).

The South African automotive industry is a prime example of this issue. In recent years, they have had to make substantial changes to their modus operandi as increased production pressure, the rise of emerging markets and alternative technology advancements have meant that advanced production techniques are increasingly needed (Giffi et al. 2015; Gonyora et al. 2021; Ikome & Laseinde 2020). This, in turn, has increased the industry's reliance on artisanal skills (Nomvete et al. 2018; Reddy & Kruss 2015; Wildschut et al. 2015). Artisanal development is regarded as a priority within the manufacturing sector as artisans fulfil the role of vital enablers to the sector's competitiveness (merSETA 2016; Nomvete et al. 2018). The shortage of these artisanal skills is observed as a key factor aiding the 'slow adoption of technology, lowered productivity, lowered competitiveness and high cost of production over time' (Nomvete et al. 2018:iii).

Problem investigated

The cost of training an apprentice is over R500 000 (Hauschildt 2018). Despite this high cost to companies, only 24%–45% of apprentices are currently passing the trade test each year (Government Gazette 2015; Van Rooyen et al. 2010). In order to mitigate this significant shortfall in the annual production rate of artisans, it is vital that the correct persons are selected for apprenticeship programmes (Duarte 2017).

The use of suitable HR practices, including those applicable to recruitment, selection, training and development, can shape the continued success of the local manufacturing sector (Chalikias et al. 2014). Employers within this sector have called on governmental support agencies, such as the merSETA, to invest in improved selection methods within apprenticeship programmes (Government Gazette 2015; merSETA 2016). The use of rigorous selection techniques (Goastellec & Ruiz 2015; Imdorf 2017; Rowe et al. 2017) and multiple selection criteria (Kruss et al. 2012) has been linked to lower dropout rates in the artisanal learning pathway. The national government has recommended the implementation of minimum entry requirements and the use of aptitude and attitude testing in the selection of apprentices (Government Gazette 2015).

In addition to the aforementioned decline in staffing research, there is currently little research on the evaluation of human resource selection (HRS) practices (Louw 2012; Louw-Potgieter 2012). Specifically, there is inadequate empirical literature on the selection practices used for apprentices, both internationally and nationally. Furthermore, the ideal steps to be used in the selection and training of apprentices need to be determined in order to accurately identify and retain artisans within organisations. Once again, limited, and mostly outdated, international empirical research on the broad processes employed in the selection of apprentices is available and scant research exists on the situation in South Africa (SA). There is, therefore, a need for specific research on the profiling and selection of apprentices (Puchert, Dodd & Viljoen 2017a, 2017b). A recent systematic literature review on empirical research articles published between 1990 and 2020 in scholarly databases revealed only 12 articles with content related to the selection of apprentices (Puchert, Van Niekerk & Viljoen [in press]). There is only modest outdated research on the optimum profile of a successful apprentice applicant (e.g. Barnes & Meadows 2008; Gump 2006; Mottram, Clarke & Downs 1980). This contextualises the call made within the manufacturing sector for stakeholders to disclose best practice scenarios in their selection of apprentices. This disclosure will improve the image of apprenticeships and stimulate innovation and development within the sector (Evans-Klock 2012; Rauner et al. 2012). Against this background, the central research question addressed within this study is as follows: what is the effect of various selection phases on the survival of apprenticeship applicants?

Research objectives and hypotheses

The primary objective of this study was to assess the effect of screening phases on the selection of applicants onto an apprenticeship programme in the automotive industry. Four secondary objectives were also ascertained:

1. To measure the effect the preliminary screening phase has on the selection of applicants onto the apprenticeship programme.
2. To measure the effect the secondary screening phase has on the selection of applicants onto the apprenticeship programme.

3. To measure the effect the psychological assessment phase has on the selection of applicants onto the apprenticeship programme.
4. To measure the effect the interview phase has on the selection of applicants onto the apprenticeship programme.

Following these secondary objectives, the four hypotheses for this study were as follows:

H_{01}: The preliminary screening phase does not have a significant effect on the applicants' selection onto the apprenticeship programme.

H_1: The preliminary screening phase has a significant effect on the applicants' selection onto the apprenticeship programme.

H_{02}: The secondary screening phase does not have a significant effect on the applicants' selection onto the apprenticeship programme.

H_2: The secondary screening phase has a significant effect on the applicants' selection onto the apprenticeship programme.

H_{03}: The psychological assessment phase does not have a significant effect on the applicants' selection onto the apprenticeship programme.

H_3: The psychological assessment phase has a significant effect on the applicants' selection onto the apprenticeship programme.

H_{04}: The interview phase does not have a significant effect on the applicants' selection onto the apprenticeship programme.

H_4: The interview phase has a significant effect on the applicants' selection onto the apprenticeship programme.

Literature review

The significant challenges currently facing business include micro-issues, such as the increased mobility and diversity of the workforce, as well as macro-challenges such as technological innovation and advances, volatile business environments and global economic changes (Bahn 2015; Dewe & Cooper 2012). Amidst these challenges, the human capital resource is a vital strategic resource for any organisation (Delery & Roumpi 2017).

A critical human resource management (HRM) issue is the optimisation of the human capital potential within an organisation. This needs to be facilitated through the implementation of more creative and aggressive HRM techniques and systems (Bondarouk & Brewster 2016; Ehnert & Harry 2011; Taylor Osland & Egri 2012). Not only can a solid investment in appropriate HRM activities enhance organisational performance (Delery & Roumpi 2017) but it is also required given the international shortage of technical talent (Berenson & Smith 2009; Tarique & Schuler 2012). The recruitment and selection processes used by organisations need to elevate their human capital competitive advantage. The key to implementing this is through the optimal matching of individuals with the required skills for a vacant position (Cabello-Medina et al. 2011; Jiang et al. 2012). Poor selection decisions can incur significant additional costs such as re-hiring and training fees (Lough & Ryan 2010; Mueller & Wolter 2014). Inadequate selection criteria can also result in employee selection errors and high employee turnover (Kalugina & Shvydun 2014).

Two HRS models are employed by organisations, namely the multiple-hurdle and the compensatory models. In the former model, various selection steps are used. Applicants must overcome each step to advance to the next, with the pool of applicants becoming increasingly smaller after each selection step. The compensatory model requires all applicants to complete all the selection steps. In this case, the final selection decision is based on the information gained at each step (Wärnich et al. 2018; Werner et al. 2017).

As already highlighted, there are no set, typical or generally accepted HRS processes. Instead, a wide array of selection methods and procedures are employed. No two organisations will facilitate their selection in the same way (Jackson et al. 2018; Markoulli et al. 2017). The selection criteria specified in the job description and job specification should guide the selection process and should inform the most appropriate methods to be used. These include the initial evaluation of curricula vitae (CV), assessing application forms, facilitating interviews, conducting assessments and psychological testing, as well as completing medical and reference checks (Noe et al. 2020; Wärnich et al. 2018; Werner et al. 2017). Some organisations use a singular method (i.e. using just CV assessment, interviewing or testing) to make selection decisions (Chan & Kuok 2011). However, the sole use of CV evaluation has been criticised given the subjectivity employed by most reviewers, thereby mitigating the true identification of the best candidates through this method (Kalugina & Shvydun 2014). Alternatively, a systematic selection approach has been shown to improve the success rates obtained (Grigoryev 2006). A combination of the application form, interviews, reference checking and an assessment centre is the most popular combination of selection methods (Sackett & Lievens 2008). Concerning validity in predicting job performance, the combination of general mental ability (GMA) and integrity testing has the highest composite validity (0.78). The second most valid combination (0.76) is a GMA test and a structured interview. These two are also deemed to be the best combinations as they are less expensive to implement (Schmidt, Oh & Shaffer 2016).

The early detection in a selection process of applicants who have the required attributes needed allows an organisation to focus on the best candidates to fill the vacancy (OECD 2017). The use of pre-screening devices has hence become increasingly popular. The popularity of the application blank evaluation technique centres on the fact that it facilitates the easy comparison and filtering of applications helps to quickly reduce large pools of applicants (Wickramasinghe 2007) and is believed to be, in part, an indirect assessment of GMA (Schmidt et al. 2016).

A well-composed motivational letter, tailored to the specific occupation and field being applied for, can act as a catalyst for promoting an applicant into the next phases of the

selection process (Ross & Young 2005; Stewart & Knowles 2000; Tomaska & Nosek 2018). Similar recommendations have been made regarding the compilation of a CV. Applicants should specifically write a CV for the position applied, and it should be presented in an accurate, concise and honest manner (Wallwork 2014).

Organisations consistently place a strong emphasis on the use of educational qualifications as a selection criterion. The academic qualifications and extracurricular activities of applicants, as documented on their CV are strongly correlated with higher employability (Cole et al. 2007). Educational achievements are also a key determinant of the job level, quality and income a person can attain (Brewer 2013; Schmidt et al. 2016). The type of secondary education (incorporating subject choice) held by applicants was informative in revealing their general and technical aptitudes. This, in turn, had a high correlation with the employability of these applicants. The case was, therefore, made for the use of education as a cost-effective preliminary screening technique. This selection method can reduce the applicant pool before the use of costlier psychometric tests (Puchert et al. 2017a, 2017b).

There is a well-documented increase in organisations using formal psychological tests in their selection activities (Louw 2013; Memon et al. 2018). Psychometric testing was ranked the fourth most popular selection method within South African organisations (Louw 2013). The lying and/or misrepresentation prevalent in job applications and submitted CVs has resulted in HR decision-makers needing to confirm the facts before making a final selection decision. At least 86% of organisations have revealed that this form of fraud occurs in their recruitment and selection experiences. This has led to the increased popularity of the psychological step in organisational selection processes (Trindale 2015).

Decades of research have confirmed the strong relationship between cognitive ability and other measures of success and optimal performance (Macpherson & Stanovich 2007; Schmitt 2014). This body of empirical evidence has consistently highlighted the proficiency of cognitive ability tests to predict outcomes, including academic success in terms of grades, work success, such as job performance assessments and everyday life, for example, divorce and mortality rates (Heaven & Ciarrochi 2012; Kuncel & Hezlett 2010; Kuncel, Ones & Sackett 2010; Nisbett 2013; Schmitt 2014; Van der Flier, Thijs & Zaaiman 2003). Many selection methods, whilst valid predictors of job performance, have little or no incremental validity over GMA assessments (Schmidt & Hunter 1998).

Another subset of psychological testing, psychomotor and dexterity aptitude testing, has also been successfully used in the selection of candidates. Examples include the selection of doctors and medical students for surgical training. Eye–hand coordination, dexterity and visual–spatial aptitudes were assessed to identify the best candidates for the vacant positions (Francis et al. 2001; Gallagher, Leonard & Traynor 2009). Two other specific aptitude tests, namely complex coordination and two-hand coordination were used in the selection of pilots and were able to accurately identify those recommended to fighter pilot status (Bordelon & Kantor 1984).

The performance of applicants in interviews is also a reliable predictor of on-the-job performance (Schmidt et al. 2016; Schmidt & Zimmerman 2004). Interviews are the preferred selection method as the technique facilitates more person-specific information, which are deemed necessary to make an appropriate selection decision. Interviews provide recruiters with information regarding the applicants' personality, attitudes and transferable skills, in comparison with merely their level and type of academic qualification (Branine 2008). The most significant benefit of interviews, however, rests within the type of questions asked. Effective interview questions will provide recruiters with a clear indication of whether the person has demonstrated, in the past and under similar conditions, the core skills required for a position. Past performance is critical to present and future performance (Fernández-Aráoz 2014).

A combination of technical and human relations skills is required within most organisations. This blend of skills facilitates employees moving beyond the mere step-by-step implementation of delegated tasks (Hauschildt 2016; Sermsuk, Triwichitkhunb & Wongwanich 2014). There are a wide range of core skills deemed a high priority for most employers, which include the ability to solve problems independently, analytical skills, creative thinking, effective communication, leadership, motivation, organisational ability and teamwork (Ahmad & Schroeder 2002; Brewer 2013). Organisations are therefore encouraged to include these skills as criteria in their selection processes (Lengnick-Hall & Lengnick-Hall 2003). The organisational human capital and learning capability will be enhanced through the adoption of interpersonal skills as a selection criterion and the use of people interaction exercises as a selection practice (López-Cabrales, Real & Valle 2011). Employability and teamwork skills are deemed critical to facilitate the adjustment of technical students to workplace demands (De Guzman & Ok Choi 2013; Goastellec & Ruiz 2015; OECD 2017).

Various stakeholders have encouraged the implementation of rigorous recruitment and selection practices for apprentices (Government Gazette 2015; Lovender 2015). Specifically, the national government has requested collaboration between employers to establish the pros and cons of the various methods being used to select apprentices. It is believed that through this sharing of information best practices can be identified and used by other employers. The government has also called for the identification of an appropriate national recruitment and selection tool to be adopted for apprenticeship programmes (Government Gazette 2015).

Rapid technological change and increased competition in the South African manufacturing sector have led to challenges that have impacted various aspects of apprenticeship development, including the training content, processes and selection methods used (Evans-Klock 2012; merSETA 2016; Nomvete et al. 2018). In order to successfully attract and identify the talent needed, the automotive industry has proactively implemented innovative recruitment and selection methods (Giffi et al. 2015; Piro 2011).

The completion of technical subjects and the attainment of reliable technical qualifications are used as selection criteria for apprentices within South African automotive firms. The minimum entrance requirement is often a Grade 12 or equivalent qualification that includes science and mathematics (COTVET 2014; Martin 2016). When sourcing technical staff, global automotive firms also place a high value on above-average academic achievements, specifically in engineering and science (Brewer 2013; Forsblom et al. 2016; Kramer et al. 2015).

Besides technical knowledge and skills, the automotive industry has emphasised the vital role of other attributes, such as flexibility and teamwork. Business insight, ingenuity, effective communication and problem-solving competencies, as well as enthusiasm for working in the automotive industry, are deemed to be significant selection criteria within automobile manufacturing organisations (De Guzman & Ok Choi 2013; Giffi et al. 2015; Mueller & Wolter 2014). The commitment, discipline and vocational identity of apprenticeship applicants to the trades should be prioritised and used as a key criterion within the selection process (Mahembe 2012).

Within the automotive industry, the use of psychological testing during selection has become more common (Piro 2011). This trend is driven by inconsistent educational standards, a mistrust of school grades and the inability to equitably compare applicants using their educational achievements (Mueller & Wolter 2014; Siegenthaler 2011). A variety of assessments and tests, including the testing of mathematics, reading comprehension, group problem-solving and simulated work assessments, were used internationally in the selection of operator-level employees (Gump 2006). The success of apprentice applicants in their first year of studying was predicted through the use of aptitude testing (Mottram et al. 1980). The selection of apprentices is regarded as different from the selection of other forms of staff because applicants applying for an apprenticeship are apt to be similar in many ways (i.e. recent school-leavers with comparable qualifications and minor work experience). The use of various psychological tests and situational judgement assessments can, therefore, be valuable in ensuring that objective selection decisions are made (OECD 2017). In 2017, a local study also recommended a multiple-phase selection process that included aptitude testing, as the optimum selection process for automotive operators (Puchert et al. 2017a, 2017b).

Interviews are a commonly used selection method within the manufacturing sector (Giffi et al. 2015) and specifically for apprentice selection (e.g. Goastellec & Ruiz 2015; Grosvenor 2016; NAS 2017). Nevertheless, there are only three studies that provide definitive evidence of the prognostic value of interviews in the selection of apprentices. Forsblom et al. (2016) and Tang (2015) confirmed that companies that used interviews as one of their selection methods were able to proactively reduce the number of apprentices prematurely terminating their apprenticeship. Mummenthey and Du Preez (2010) found that the apprentice applicants' enthusiasm, positive attitude and passion for the job established through an interview led to lower dropout rates in apprenticeship programmes. Naidoo and Hoque (2017) also regarded the development of appropriate work ethic skills as a critical factor in the success of apprenticeship programmes.

Human resource practitioners are practically able to choose from an extensive list of methods when implementing a selection process. A few of these methods have been reviewed in the previous section. This same section has, however, also highlighted that staffing research has declined, and there is a need for more information specifically on the optimal selection process for apprentices. The question this study, therefore, aims to answer is: what is the effect of various selection phases on the survival of apprenticeship applicants?

Research methodology

The epistemological position adopted was a positivistic one as quantification, replicability and objectivity were desired (Bryman 2016). The study aimed to assess the effect of four screening phases on the survival of applicants in a selection process for apprentices implemented within the national automotive industry. The nature of the archived data resulting from the various phases of the selection process was structured, specific and objective. Therefore, a quantitative research approach was appropriate (Quinlan et al. 2015).

The data were collected through the annual recruitment and selection process for apprentices employed by a South African automotive plant. For the sake of anonymity, this organisation will be referred to as the client. As shown in Table 1, applicants applied over three intake years, namely from 2012–2014. The applicants applied for either the automotive electrical or millwright apprenticeship vacancies. Following the recruitment drive, a multiple-hurdle selection process was employed. This archival and longitudinal study tracked the applicants from these three intake years through the various phases of the selection process. After the 4-year apprenticeship, the selected apprentices sat for the trade test, between 2015 and 2017.

The population for this study is broadly defined as work-seekers, with the target population being individuals seeking to be in apprenticeship positions in SA. The database of potential apprentices who had applied to a specific

TABLE 1: Sample frame.

Year of intake	Number of applicants	Number of apprentices in the trade test	Year of apprenticeship completion
2012	1036	28	2015
2013	1250	22	2016
2014	1126	27	2017
Totals	**3412**	**77**	-

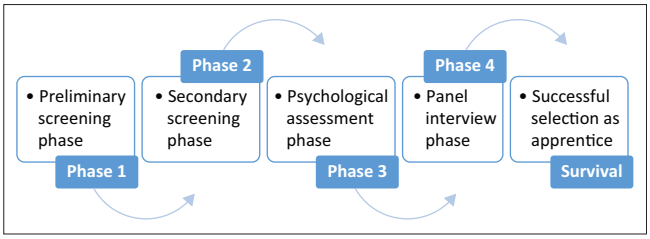

FIGURE 1: The selection phases.

automotive firm was the sampling frame. A non-probability convenience sample was used in this study, with the sample size being 3412 applicants.

The four-phase selection process implemented by the Client is summarised in Figure 1. Furthermore, as indicated in Table 1, there was a substantial reduction from the initial number of applicants in each intake year. From the 3412 applicants who entered the selection process at phase one, only 77 survived the various phases, completed the apprenticeship training during the 4-year period and attempted the national trade test.

Phase one of the selection process, the preliminary screening phase, involved checking compliance on several stipulations. This included submitting all the required documentation (e.g. certified copies of qualifications and identity documents) and obtaining the minimum educational requirements. Besides these two criteria, other reasons for termination at this phase included not specifying in the motivational letter the apprenticeship type applied for, not indicating the internal application number, handwritten applications, having not completed pure mathematics (i.e. an applicant had studied mathematical literacy or not studied this subject at all) and science at Grade 12 or equivalent. Applications were rated as recommended to the next phase if their applications complied with all of these criteria.

In the secondary screening phase, the documents submitted by the applicants were rated on nine criteria by the senior training instructors at the Client. Table 2 summarises these nine criteria and the rating categories and ranges used to rate these criteria. Using scoring matrices, the applications were then collated into five piles according to the total percentage score obtained. The highest scoring applicants (i.e. those scoring 81% and above) were considered eligible and were given the recommendation status. These applicants survived and proceeded to phase 3 of the selection process. The client completed this phase by forming two piles of applications, namely survive or terminate.

TABLE 2: Operationalisation of phase two criteria.

Criteria	Description	Rating categories	Rating range
Secondary education type	Type	2	Technical or non-technical
Mathematics performance	Percentage obtained	5	1% – 19% to 80+%
Science performance	Percentage obtained	5	1% – 19% to 80+%
Motivational letter	Quality of submitted document	5	Well below average to outstanding
Curriculum vitae	Quality of submitted document	5	Well below average to outstanding
Practical experience	Amount and quality obtained	3	None to credible
Qualification	Amount and quality obtained	5	Below average to exceptional
Leadership potential	Amount and quality obtained	3	Below average to above average
Recommendation status	Survival or termination	2	Yes or no

Phase 3 of the selection process consisted of a psychological assessment phase, overseen by an external consultancy firm. The phase culminated in an overall recommendation rating per applicant using the clinical judgement of the overseeing psychometrist. Four rating categories were employed, namely highly recommended, recommended, recommended with reservation and not recommended. Applicants who had obtained a highly recommended or recommended rating in this phase were considered for phase 4. This rating was derived from three forms of psychological testing, namely general aptitude, technical aptitude and a teamwork competency assessment. Collectively, general aptitude here refers to the vocabulary, verbal reasoning, non-verbal reasoning, reading comprehension, comparison and memory sub-tests of the differential aptitude test battery (Coetzee & Vosloo 2000). The technical aptitude of the applicants was assessed through the dexterity, co-ordination, assembly, calculations, spatial perception 2-D and spatial perception 3-D sub-tests of the trade aptitude test assessment battery (Taljaard 1983). The third component of this phase was a teamwork competency assessment. During a practical group exercise, applicants were observed and assessed on nine dimensions: assertiveness, conflict management, feedback, initiative, influence and persuasion, listening, questioning, problem-solving, and teamwork.

Applicants who were not recommended from the phase 3 event were terminated. Those who survived progressed to the panel interview phase of the selection process. Two senior training instructors, from within the client, used a structured interview sheet during this fourth phase. As reflected in Table 3, there were two components to this interview, namely the standard interview and the general impression aspect. Applicants were asked seven standard questions to assess constructs such as their initiative, problem-solving and quality orientation. In addition, five criteria were evaluated in terms of the general impression portrayed by the applicants. For both of these components, the applicants were scored on a four-point Likert scale, ranging from well below average to excellent. The top-performing applicants from this selection phase were then

recommended and selected for the apprenticeship programme.

The archived data, spanning the 6-year period between 2012 and 2017 and documenting the results for the four selection phases, and the final national trade test were in hard copy raw data format. This data needed to be processed, captured into Microsoft Excel and extracted to allow for analysis to proceed.

The Statistical Package for the Social Sciences', version 21, software package was used for statistical analyses whilst descriptive statistics were used to explain some of the gathered data (Bryman & Bell 2015). The demographic details (i.e. age, race and gender) of the applicants are provided in a frequency table. A cross-tabulation table was used to show the number of successful people and their percentage in each of the four phases within the multi-hurdle selection process.

Inferential statistics were used to draw inferences and make predictions about the population from the Client's database (Quinlan 2011). Specifically, the survival analysis procedure was used. This form of analysis, widely used within the medical field (Agarwal 2012; Ajagbe, Kabair & O'Connor 2014), is increasingly being used in other sectors (Singh & Mukhopadhyay 2011). The procedure, used to analyse the progression of the applicants through the various phases of the selection process, was particularly useful as it facilitated an understanding of the applicant dropout rate per selection phase. This inferential technique assumes that the probability of an event of interest occurring depends only on time. In this study, the evaluation of the applicants in each selection phase results in the applicant being successful or not. Cases that enter the study at different times should then behave similarly (Hosmer, Lemeshow & May 2011).

The Gehan–Wilcoxon proportional hazards statistical tool, a non-parametric test, compared the survival curves of the applicants across the four phases of the selection process. The statistical significance level was set at 0.05. This indicated the survival probability of the applicants at each selection phase (Austin 2017). Furthermore, life tables were used as a descriptive procedure to provide the survival function of applicants. Any point on the survival curve shows the probability that the applicant will remain under consideration post the phase (Hosmer et al. 2011).

TABLE 3: Operationalisation of phase four components.

Components	Description	Rating categories	Rating range
Standard interview	Seven standard questions: Initiative, practical learning, problem-solving, quality orientation, teamwork, motivational fit, buy-time questions	4	Well below average to excellent
General impression	Five criteria: Presentability, communication, understanding, culture and task fit, punctuality	4	Well below average to excellent
Recommendation status	Survival or termination	2	Yes or no

Empirical results

Demographic profile of the applicants

Information on three demographic constructs, the race, gender and age of the applicants were obtained in the first phase of the selection process (N = 3412) and are provided in Table 4.

The majority (67%) of the applicants were male and between 25 and 29 years. The second-largest age distribution category (25.7%) was found in the 20–24-year-old category, whilst applicants who were between 30 and 34 years occupied the third-largest age distribution category (19.6%). In terms of race distribution, a noteworthy proportion (90.6%) of the applicants was black African. The second-highest race distribution category was the mixed race category at 7.3%.

Descriptive statistics

Transition matrices tabulating the survival rates of the applicants across the four selection phases are provided in Table 5. Of the total sample (N = 3412), 43.8% were successful in the preliminary selection phase and survived into phase 2. The remaining 56.2% of the sample were terminated as their applications did not confirm the attainment of the minimum

TABLE 4: Demographic profile of the applicants.

Demographic Data	Category	Frequency	%
Gender	Male	2286	67
	Female	1126	33
Race	Black African	3090	90.6
	Mixed race	250	7.3
	Indian/Asian	7	0.2
	White	65	1.9
Age	15–19	131	3.8
	20–24	877	25.7
	25–29	1263	37
	30–34	670	19.6
	35–39	348	10.2
	40–44	88	2.6
	45+	22	0.6
	Missing*	13	0.4

*, No identification number was provided or it could not be read.

TABLE 5: Cross-tabulation of phase survival rate outcomes.

Phase	Outcome	Count	%
One	Yes	1496	43.8
	No	1916	56.2
	Total	3412	100
Two	Yes	424	28.3
	No	1072	71.7
	Total	1496	100
Three	Yes	143	33.7
	No	269	63.4
	Not shown	5	1.2
	Disqualified	6	1.4
	Not available	1	0.2
	Total	424	100
Four	Yes	77	55
	No	63	45
	Total	140	100

educational requirements and did not include all the required documentation.

In the secondary phase, the applications were rated on eight constructs. The majority (71.7%) of the applicants (n = 1496) were not successful in phase 2. This meant that only 28.3% of the candidates met the criteria and qualified for the third selection phase.

Phase 3 refers to the psychological assessment phase of the selection process. Three constructs (i.e. general aptitude, technical aptitude and teamwork competency) were assessed. As indicated in Table 5, a significant portion (63.4%) of the sample (n = 424) did not qualify this third selection phase. Of those recommended to attend this screening phase, only 33.7% qualified for phase 4. Across the three intake years, five applicants did not attend the assessments despite being invited, six were disqualified for cheating in the assessments and one was no longer available to participate in the selection process.

The phase 4 outcomes are derived from the two components within the interview selection phase, namely the applicants' responses to the standard questions, and the general impression created by these applicants. The majority (55%) of the 140 applicants who participated in this fourth phase were eligible to enter the apprenticeship programme. Three more applicants were successful but did not pass the subsequent medical test and were therefore excluded from the selection process.

Inferential statistics

The overall life table, presented in Table 6, subdivides the period of observation into the four phases and estimates the probability of the applicants' survival for each selection phase. From this life table, it can be observed that over half (56%) of the initial applicant pool was terminated at the first selection phase, the preliminary application review (Phase One). The probability density of being terminated after this phase was high at 0.561.

However, the highest number (72%) of terminal events occurred within the secondary screening phase (Phase two) wherein the documents submitted by the applicants were rated on nine criteria. The probability density of being terminated at this phase is 0.318. Only 412 (28%) of the 1496 applicants entering this second selection phase survived to progress to the third selection phase.

After the second selection phase, as the phases progressed, the probability of cumulative survival increased. The proportion surviving at the end of each phase increased from 28% in phase 2 to 35% in phase 3, and 54% in phase 4. The highest survival rate (54%) was at the fourth phase, which involved the panel interview, whilst there was a slight increase of 7% in survival rate from phase 2 to phase 3. This was the psychological assessment phase.

This difference in the survival curves across the four selection phases is depicted in Figure 2. The probability of cumulative survival is indicated for each of the selection phases. The survival curve illustrates the probability of the applicants surviving a selection phase. The gradient is initially very steep. The line of this gradient does, however, decrease as the selection process progresses.

As indicated in Table 7, the significance of the Gehan–Wilcoxon statistics attained for each phase suggests that the survival distribution across the groups was not because of chance. Rather, these statistics represent the existence of a true difference in the data.

The comparisons between the recommendation category groups in each of the four selection phases, presented in Table 7, were exact and reflected statistical significant values < 0.05. The findings for hypotheses one to four show that higher ratings in each phase were associated with a longer

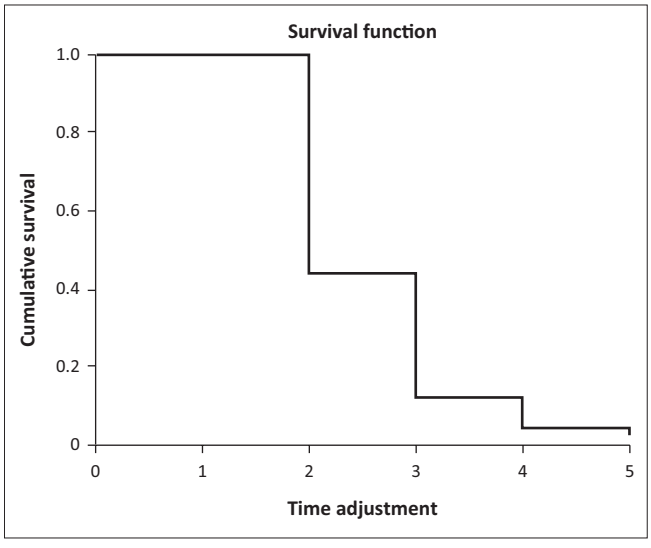

FIGURE 2: Survival chart.

TABLE 6: Life table of overall results.

Interval start time	No. entering interval	No. withdrawing during interval	No. exposed to risk	No. of terminal events	Proportion terminating	Proportion surviving	Cumulative proportion surviving at end of interval	Probability density*	Hazard rate*
1	3412	0	3412.000	1916	0.56	0.44	0.44	0.561 (0.008)	0.78 (0.02)
2	1496	0	1496.000	1085	0.72	0.28	0.12	0.318 (0.008)	1.14 (0.03)
3	412	0	412.000	269	0.65	0.35	0.04	0.079 (0.005)	0.97 (0.05)
4	143	0	143.000	66	0.46	0.54	0.02	0.019 (0.002)	0.60 (0.07)
5	77	0	77.000	77	1.00	0.00	0.00	0.000 (0.000)	0.00 (0.00)

*, Standard error in brackets.

TABLE 7: Overall comparisons*.

Phase	Wilcoxon (Gehan) statistic	df	Sig.
Preliminary screening (phase one)	180.532	4	0.000
Secondary screening (phase two)	149.206	2	0.000
Psychological assessment (phase three)	124.593	3	0.000
Panel interview screening (phase four)	47.435	4	0.000

*, Comparisons are exact.

survival time. Conversely, lower rating levels per phase resulted in a higher probability density value, and hence, a higher probability of termination in any selection phase. This evidence, therefore, supports alternate hypotheses one to four. It can therefore be concluded that the preliminary, secondary, psychological assessment and interview phases each had a significant effect on the applicants' selection onto the apprenticeship programme.

Discussion of results

Phase 1: Preliminary screening

Hypothesis 1:

> **H_{01}:** The preliminary screening phase does not have a significant effect on the applicants' selection for the apprenticeship programme.
>
> **H_1:** The preliminary screening phase has a significant effect on the applicants' selection for the apprenticeship programme.

The majority (56.2%) of the applicants were terminated in this first selection phase. The purpose of this phase was to establish whether all the required documentation had been submitted, and the minimum educational requirements had been met. The high termination rate at this phase suggests that the applicants needed to make a reasonable effort to understand and comply with the submission requirements before applying for a vacant position. This finding is in line with the literature. This finding supports the existing literature, which concludes that pre-screening devices are increasingly being used by companies, specifically to reduce large pools of applicants (Schmidt et al. 2016; Wickramasinghe 2007).

It is concluded that the applicants' recommendation status from the preliminary screening phase had a significant effect on their selection for an apprenticeship programme in the national automobile manufacturing sector. These results presented sufficient evidence to reject the null hypothesis and concluded that the preliminary screening phase exerted a significant effect on the applicants' selection for the apprenticeship programme.

Phase 2: Secondary screening

Hypothesis 2:

> **H_{02}:** The secondary screening phase does not have a significant effect on the applicants' selection for the apprenticeship programme.
>
> **H_2:** The secondary screening phase has a significant effect on the applicants' selection for the apprenticeship programme.

Most (71.7%) of the applicants were rejected after the second selection phase. This phase was concerned with scrutinising the quality of the submitted documentation and assessing the documentation on the eight screening criteria. The low survival rate of this selection phase implies that applicants should concern themselves with how they compile their application documentation to ensure a positive rating in this type of selection activity.

This finding is in line with the recommendations and findings of various authors who highlight the potential impact of a customised and professional CV and motivational letter on applicants' promotion to subsequent phases of a selection process (Ross & Young 2005; Stewart & Knowles 2000; Tomaska & Nosek 2018; Wallwork 2014). The amount and quality of the applicants' educational qualifications, work experience and extracurricular activities have also been strongly linked to higher employability (Brewer 2013; Cole et al. 2007; Juhdi et al. 2010; Schmidt et al. 2016; Wickramasinghe 2007).

The case has previously been made for the use of education as a cost-effective preliminary screening technique to reduce the automotive operator applicant before the use of costlier psychometric tests (Puchert et al. 2017a, 2017b). With a significant portion of the applicant pool already being terminated, the client was able to invest in the costlier and time-consuming psychological assessments in the third phase and interviews in the fourth phase.

The second null hypothesis was therefore rejected, and it is concluded that the applicants' rating in the secondary screening phase had a significant effect on their selection onto the apprenticeship programme in the national automobile manufacturing sector.

Phase 3: Psychological assessment

Hypothesis 3:

> **H_{03}:** The psychological assessment phase does not have a significant effect on the applicants' selection for the apprenticeship programme.
>
> **H_3:** The psychological assessment phase has a significant effect on the applicants' selection for the apprenticeship programme.

A significant proportion (63.4%) of the sample was terminated at the third selection phase. Obtaining higher ratings in the general aptitude, technical aptitude and teamwork assessments improved the survival time of applicants across the selection phases. On average, applicants in the 'highly recommended' group progressed further than the other groups. It is concluded that the applicants' recommendation status from the assessment phase had a significant effect on their selection for the apprenticeship programme in the South African automobile manufacturing sector. The third alternate hypothesis was, therefore, accepted.

Similar findings of a predictive relationship between general aptitude ratings and employability have been established in previous research. Kuncel and Hezlett (2010), Kuncel et al. (2010) and Schmitt (2014), as well as Schmidt and Hunter (1998), documented cognitive ability to be the most consistent and strongest predictor of performance in academic and employment contexts. This is also consistent with the findings of other researchers, such as Bordelon and Kantor (1984), Francis et al. (2001) and Gallagher et al. (2009) who discovered a predictive relationship between technical aptitude ratings and employability. The need for these employability competencies, such as teamwork, interpersonal, thinking and problem-solving skills, is a regular feature within vocational training and employment literature (Brewer 2013; De Guzman & Ok Choi 2013; Hauschildt 2016; López-Cabrales et al. 2011).

Phase 4: Panel interview

Hypothesis 4:

> **H_{04}:** The interview phase does not have a significant effect on the applicants' selection for the apprenticeship programme.
>
> **H_4:** The interview phase has a significant effect on the applicants' selection for the apprenticeship programme.

The applicants who performed better in the standard interview and general impression aspects of the interview qualified for more selection phases. It is therefore concluded that the applicants' recommendation status from the interview phase had a significant effect on their selection for the apprenticeship programme in the South African automobile manufacturing sector. This is consistent with other research concluding the success of the interview technique in assessing the latent competencies of applicants (Branine 2008; Fernández-Aráoz 2014) and reducing the number of premature terminations from apprenticeship programmes (Forsblom et al. 2016; Tang 2015). The results indicated that the interview phase had a significant effect on the applicants' selection for the apprenticeship programme; the fourth null hypothesis is, therefore, rejected, and the alternative hypothesis is accepted.

Managerial implications

A call was made by the South African government for collaboration between employers to establish best practices to be incorporated by other employers in their selection policies (Government Gazette 2015). It is recommended that the national government should follow up on this suggestion. The four selection phases used in this study were predictive of high-quality incumbents and the selection process was concluded to be valuable and of high quality. The positive evaluation of this selection process provides evidence to support its confirmation as the national selection tool.

A multiple rather than a singular phase selection process should be used consistently by HR practitioners. The efficacy and enhanced predictive validity gained from implementing multiple tools to make a selection decision had been previously established (Van der Flier et al. 2003). A multiple-phase selection process for entry-level automotive operators was also previously recommended (Gump 2006; Puchert et al. 2017a, 2017b). A multiphase selection process can also minimise the risk associated with misrepresentation and lying often found in CVs and job applications (Trindale 2015).

A high portion of applications were not successful in the two initial screening phases of this selection process. In these two phases, applicants were often unsuccessful as they had omitted required information or they had not adequately followed the submission guidelines. Apprentice applicants are unlike other staff as this pool of candidates is usually young and inexperienced (OECD 2017). Organisations are therefore encouraged to design and use standardised template forms or application documents in order to facilitate the numerous advantages of this pre-screening method (Schmidt et al. 2016; Wickramasinghe 2007). These standardised forms would prompt applicants to provide the required information, which would minimise the likelihood of high-calibre applicants being terminated because of carelessness when compiling their initial application documentation. This could also be extended to the provision of templates for applicants to use for their CV and motivational letter. Furthermore, initial briefing sessions for applicants should be provided to assist in the comprehension of the requirements and the manner in which to complete the application documentation. The addition of these application aids would ensure the required information is readily available. This would make the screening process more streamlined and time- and cost-effective.

Organisations and educational providers should provide job preparation workshops to assist applicants in improving their qualifying opportunities within selection processes. A significant portion of applicants in this study were terminated in the early selection phases because of their inappropriate completion of the application documentation. These workshops should provide guidance on how to adequately complete the application documentation, as well as compile a professional CV and motivational letter. This should highlight to applicants the value of paying attention to the layout, structure and quality of these application documents. These workshops should also equip students on what to expect from a selection process and help them gain an appreciation of basic work ethic or employability skills, such as punctuality and professionalism.

Applicants are encouraged to gain reliable experience in their field of application and interest. This may involve volunteering or carrying out work without pay. Apprentice applicants should actively pursue extra-curricular activities. By proactively developing a wide array of skill sets, they can enhance their employability opportunities and improve their chances of being selected for an apprenticeship programme. Whilst waiting to be selected for an apprenticeship programme, applicants should also continue to study in their interest area and obtain post-secondary education level qualifications.

Limitations

This study enabled a large sample of applicants to be investigated from an annual recruitment process, completed by a national automotive assembly plant. However, this convenience sampling method had its disadvantages. There may have been sampling bias and it is potentially not representative of the entire population (Bryman 2016). This sample was drawn from a specific geographical area as this was a selection priority specified by the client. Furthermore, the selection process itself and several of the methods employed therein were designed by the client and were designed for the express purpose of fulfilling the mandate set by the client. Another potential limitation is that the broad guidelines suggested from this research can only be applied to the South African automotive industry. However, the purposes of selection processes are common to most organisations.

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Authors' contributions

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References

Agarwal, G.G., 2012, 'Statistics for surgeons – Understanding survival analysis', *Indian Journal of Surgical Oncology* 3(3), 208–214. https://doi.org/10.1007/s13193-012-0149-z

Ahmad, S. & Schroeder, R.G., 2002, 'The importance of recruitment and selection process for sustainability of total quality management', *International Journal of Quality and Reliability Management* 19(5), 540–550. https://doi.org/10.1108/02656710210427511

Ajagbe, O.B., Kabair, Z. & O'Connor, T., 2014, 'Survival analysis of adult tuberculosis disease', *PLoS One* 9(11), e112838. https://doi.org/10.1371/journal.pone.0112838

Austin, P.C., 2017, 'A tutorial on multilevel survival analysis: Methods, models and applications', *International Statistical Review* 85(2), 185–203. https://doi.org/10.1111/insr.12214

Bahn, S., 2015, 'Managing the well-being of temporary skilled migrants', *International Journal of Human Resource Management* 26, 2102–2120. https://doi.org/10.1080/09585192.2014.971849

Barnes, J. & Meadows, B., 2008, *On the brink? Skills demand and supply issues in the South African automotive components industry*, viewed 16 February 2022, from https://www.yumpu.com/en/document/read/30601200/skills-demand-and-supply-issues-in-the-south-african-automotive-.

Berenson, M. & Smith, M., 2009, *Beyond hiring: An integrated approach to talent management*, viewed 16 February 2022, from https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/Public%20Sector/PDFS/McK%20on%20Govt/Change%20under%20pressure/TG_MoG_6_Beyond_hiring.ashx.

Bondarouk, T. & Brewster, C., 2016, 'Conceptualising the future of HRM and technology research', *The International Journal of Human Resource Management* 27(21), 2652–2671. https://doi.org/10.1080/09585192.2016.1232296

Bordelon, V.P. & Kantor, J.E., 1984, *Utilization of psychomotor screening for USAF pilot candidates: Independent and integrated selection methodologies (Final report for period 1978 – August 1984),* Air Force Labs, viewed 15 February 2022, from https://apps.dtic.mil/sti/citations/ADA170353.

Branine, M., 2008, 'Graduate recruitment and selection in the UK: A study of the recent changes in methods and expectations', *Career Development International* 13(6), 497–513. https://doi.org/10.1108/1362043081090166

Breaugh, J.A., 2013, 'Employee recruitment', *Annual Review of Psychology* 64(1), 389–416. https://doi.org/10.1146/annurev-psych-113011-143757

Brewer, L., 2013, *Enhancing youth employability: What? Why? And how? Guide to core work skills,* International Labour Office, Skills and Employability Department, viewed 16 February 2022, from https://www.oitcinterfor.org/sites/default/files/file_publicacion/wcms_213452_0.pdf.

Bryman, A., 2016, *Social research methods,* 5th edn., Oxford University Press, Oxford.

Bryman, A. & Bell, E., 2015, *Business research methods,* International 4th edn., Oxford University Press, Oxford.

Cabello-Medina, C., López-Cabrales, A. & Valle-Cabrera, R., 2011, 'Leveraging the innovative performance of human capital through HRM and social capital in Spanish firms', *International Journal of Human Resource Management* 22(4), 807–828. https://doi.org/10.1080/09585192.2011.555125

Chalikias, M., Kyriakopoulos, G., Skordoulis, M. & Koniordos, M., 2014, 'Knowledge management for business processes: Employees' recruitment and human resources' selection: A combined literature review and a case study', in A. Kravets, M. Shcherbakov, M. Kultsova & T. Iijima (eds.), *Knowledge-based software engineering, JCKBSE 2014, Communications in computer and information science,* vol. 466, pp. 505–520, Springer, Cham.

Chan, S.H. & Kuok, O.M., 2011, 'A study of human resources recruitment, selection, and retention issues in the hospitality and tourism industry in Macau', *Journal of Human Resources in Hospitality and Tourism* 10(4), 421–441. https://doi.org/10.1080/15332845.2011.588579

Coetzee, N. & Vosloo, H.N., 2000, *Manual for the differential aptitude tests form K,* Human Sciences Research Council, Pretoria.

Cole, M.S., Rubin, R.S., Feild, H.S. & Giles, W.F., 2007, 'Recruiters' perceptions and use of applicant résumé information: Screening the recent graduate', *Applied Psychology: An International Review* 56(2), 319–343. https://doi.org/10.1111/j.1464-0597.2007.00288.x

De Guzman, A.B. & Ok Choi, K., 2013, 'The relations of employability skills to career adaptability among technical school students', *Journal of Vocational Behavior* 82(3), 199–207. https://doi.org/10.1016/j.jvb.2013.01.009

De Kock, P., 2012, *Skills drive needed for the auto industry*, viewed 16 February 2022, from https://brandsouthafrica.com/skills-drive-needed-for-auto-industry/.

Delery, J.E. & Roumpi, D., 2017, 'Strategic human resource management, human capital and competitive advantage: Is the field going in circles?', *Human Resource Management Journal* 27(1), 1–21. https://doi.org/10.1111/1748-8583.12137

Deloitte, 2018, *The rise of the social enterprise: 2018 Deloitte global human capital trends,* viewed 15 February 2022, from https://www2.deloitte.com/content/dam/insights/us/articles/HCTrends2018/2018-HCtrends_Rise-of-the-social-enterprise.pdf.

Dewe, P. & Cooper, C., 2012, *Well-being and work: Towards a balanced agenda*, Palgrave Macmillan, London.

Duarte, J., 2017, *Skilled young artisans needed*, Pretoria News, viewed 15 February 2022, from https://www.iol.co.za/pretoria-news/skilled-young-artisans-needed-10816669.

Ehnert, I. & Harry, W., 2011, 'Recent developments and future prospects on sustainable human resource management: Introduction to the special issue', *Management Revue* 23, 221–238. https://doi.org/10.1688/1861-9908_mrev_2012_03_Ehnert

Evans-Klock, C., 2012, *Upgrading informal apprenticeship: A resource guide for Africa,* International Labour Office, New Delhi.

Fernández-Aráoz, C., 2014, '21st-century talent spotting', *Harvard Business Review,* viewed 15 February 2022, from https://hbr.org/2014/06/21st-century-talent-spotting.

Forsblom, L., Negrini, L., Gurtner, J.-L. & Schumann, S., 2016, ,Dropouts in Swiss vocational education & the effect of training companies' trainee selection methods', *Journal of Vocational Education & Training* 68(4), 399–415. https://doi.org/10.1080/13636820.2016.1222596

Francis, N.K., Hanna, G.B., Cresswell, A.B., Carter, F.J. & Cuschieri, A., 2001, 'The performance of master surgeons on standard aptitude testing', *The American Journal of Surgery* 182(1), 30–33. https://doi.org/10.1016/S0002-9610(01)00652-3

Gallagher, A.G., Leonard, G. & Traynor, O.J., 2009, 'Role and feasibility of psychomotor and dexterity testing in selection for surgical training', *Surgical Education* 79(3), 108–113. https://doi.org/10.1111/j.1445-2197.2008.04824.x

Giffi, C., McNelly, J., Dollar, B., Carrick, G., Drew, M. & Gangula, B., 2015, *Overwhelming support: U.S. public opinions on the manufacturing industry,* viewed 15 February 2022, from https://www.themanufacturinginstitute.org/~/media/827DBC765339 42679A15EF7067A704CD.ashx.

Goastellec, G. & Ruiz, G., 2015, 'Finding an apprenticeship: Hidden curriculum and social consequences', *Frontiers in Psychology* 6, 1441. https://doi.org/10.3389/ fpsyg.2015.01441

Gonyora, A.M., Migiro, S., Mashau, P. & Ngwenya, B., 2021, 'The impact of open innovation challenges on automotive component manufacturers' competitiveness: An insight from the South African automotive industry', *African Journal of Science, Technology, Innovation and Development.* https://doi.org/10.1080/20421338.2021.1937814

Government Gazette, 2015, *Draft national artisan development trade test pass rate and quality improvement strategy* (Vol. 602, No. 39077), viewed 15 February 2022, from https://www.dhet.gov.za/LegislationActs/Draft%20National%20 Artisan%20Development%20Trade%20Test%20Pass%20Rate%20and%20 Quality%20Improvement%20Strategy%202015.pdf.

Government Gazette, 2018, *National list of occupations in high demand: 2018* (Vol. 636, No. 41728), viewed 15 February 2022, from https://www.dhet.gov.za/ Information%20Systems%20Coordination/GAZETTE.pdf.

Grigoryev, P., 2006, 'Hiring by competency models', *The Journal for Quality and Participation* 29(4), 16–18.

Grosvenor, H., 2016, *Selecting apprentices: Lessons we can learn from Germany*, viewed 15 February 2022, from https://www.personneltoday.com/hr/selecting-apprentices-lessons-can-learn-germany/.

Gump, S.E., 2006, 'Who gets the job? Recruitment and selection at a "second-generation" Japanese automotive components transplant in the US', *International Journal of Human Resource Management* 17(5), 842–859. https://doi.org/10.1080/09585190600640877

Hauschildt, U., 2016, *COMET South Africa: Final report and documentation of test results of electricians, mechatronics, motor mechanics, and welders including an analysis of test motivation, vocational identity and occupational commitment, pre-test analysis for fabricators and millwrights and an analysis of pre-tests for teachers and trainers,* viewed 15 February 2022, from https://www.merseta.org.za/wp-content/uploads/2021/04/Final-COMET-Report-December-2016.pdf.

Hauschildt, U., 2018, *A review of methodologies for reviewing the costs and benefits of in-company apprenticeship training*, viewed 16 February 2022, from https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_725494.pdf.

Heaven, P.C.L. & Ciarrochi, J., 2012, 'When IQ is not everything: Intelligence, personality and academic performance at school', *Personality and Individual Differences* 53(4), 518–522. https://doi.org/10.1016/j.paid.2012.04.024

Heutter, J., 2020, *TechForce finds technician 'shortage continues to worsen', notes COVID-19 might help supply*, viewed 16 February 2022, from https://www.repairerdrivennews.com/2020/09/02/techforce-finds-technician-shortage-continues-to-worsen-notes-covid-19-might-help-supply/.

Hoffman, M., Kahn, L.B. & Li, D., 2018, 'Discretion in hiring', *The Quarterly Journal of Economics* 133(2), 765–800. https://doi.org/10.1093/qje/qjx042

Hosmer, D.W., Lemeshow, S. & May, S., 2011 *Applied survival analysis: Regression modelling of time-to-event data,* 2nd edn., John Wiley & Sons, Hoboken, NJ.

Ikome, J.M. & Laseinde, O.T., 2020, 'The global constrains of South African automotive industry and a way forward', in E. Markopoulos, R. Goonetilleke, A. Ho & Y. Luximon (eds.), *Advances in creativity, innovation, entrepreneurship and communication of design, AHFE 2020, Advances in Intelligent Systems and Computing,* vol. 1218, pp. 219–226, Springer, Cham.

Imdorf, C., 2017, 'Understanding discrimination in hiring apprentices: How training companies use ethnicity to avoid organisational trouble', *Journal of Vocational Education & Training* 69(3), 405–423. https://doi.org/10.1080/13636820.2016.12 78397

Jackson, D.J., Dewberry, C., Gallagher, J. & Close, L., 2018, 'A comparative study of practitioner perceptions of selection methods in the United Kingdom', *Journal of Occupational and Organizational Psychology* 91(1), 33–56. https://doi.org/10.1111/joop.12187

Jiang, K., Lepak, D.P., Hu, J. & Baer, J.C., 2012, 'How does human resource management influence organizational outcomes? A meta-analytic investigation of mediating mechanisms', *Academy of Management Journal* 55(6), 1264–1294. https://doi.org/10.5465/amj.2011.0088

Juhdi, N., Pa'Wan, F., Othman, N.A. & Moksin, H., 2010, 'Factors influencing internal and external employability of employees', *Business and Economics Journal* 11, 1–10, viewed from https://asset-pdf.scinapse.io/prod/2117893205/2117893205.pdf.

Kalugina, E. & Shvydun, S., 2014, 'An effective personnel selection model', *Procedia Computer Science* 31, 1102–1106. https://doi.org/10.1016/j.procs.2014.05.365

Kilcarr, S., 2016, *Is the technician shortage becoming a catastrophe?,* viewed 16 February 2022, from https://www.fleetowner.com/fleet-management/article/21692967/is-the-technician-shortage-becoming-a-catastrophe.

Kramer, M., Tallant, K., Goldberger, A.E. & Lebus, F., 2015, *The global STEM paradox,* The New York Academy of Sciences, viewed 16 February 2022, from https://www.fsg.org/publications/global-stem-paradox#download-area.

Kruss, G., Wildschut, A., Janse van Rensburg, D., Visser, M., Haupt, G., & Roodt, J., 2012, *Developing skills and capabilities through the learnership and apprenticeship pathway systems,* viewed 16 February 2022, from https://repository.hsrc.ac.za/bitstream/handle/20.500.11910/3600/7027%281%29.pdf?sequence=1&isAllowed=y.

Kuncel, N.R. & Hezlett, S.A., 2010, 'Fact and fiction in cognitive ability testing for admissions and hiring decisions', *Current Directions in Psychological Science* 19(6), 339–345. https://doi.org/10.1177/0963721410389459

Kuncel, N.R., Ones, D.S. & Sackett, P.R., 2010, 'Individual differences as predictors of work, educational, and broad life outcomes', *Personality and Individual Differences* 49(4), 331–336. https://doi.org/10.1016/j.paid.2010.03.042

Lengnick-Hall, M. & Lengnick-Hall, C., 2003, 'HR's role in building relationship networks', *Academy of Management Executive* 17(4), 53–63. https://doi.org/10.5465/ame.2003.11851841

Lievens, F. & Chapman, D., 2019, 'Recruitment and selection', in A. Wilkinson, T. Bacon, S. Snell & D. Lepak (eds.), *The SAGE handbook of human resource management,* pp. 123–150, Sage, Los Angeles, CA.

López-Cabrales, A., Real, J.C. & Valle, R., 2011, 'Relationships between human resource management practices and organizational learning capability: The mediating role of human capital', *Personnel Review* 40(3), 344–363. https://doi.org/10.1108/00483481111118658

Lough, J. & Ryan, M., 2010, 'Research note: Psychological profiling of Australian police officers: A three-year examination of post-selection performance', *International Journal of Police Science and Management* 12(3), 480–486. https://doi.org/10.1350/ijps.2010.12.3188laut

Louw, G., 2013, 'Exploring recruitment and selection trends in the Eastern Cape', *South African Journal of Human Resource Management* 11(1), 1–10. https://doi.org/10.4102/sajhrm.v11i1.319

Louw, J., 2012, 'Programme evaluation: Can it improve human resource management practice?', *South African Journal of Human Resource Management* 10(3), a428. https://doi.org/10.1402/sajhrm.v10i3.428

Louw-Potgieter, J., 2012, 'Evaluating human resource interventions', *South African Journal of Human Resource Management* 10(3), a420. https://doi.org/10.4102/sajhrm.v10i3.420

Lovender, P., 2015, 'Why apprentices drop out in Australia and the policy implications', in *proceedings of the sixth research conference of the International network for innovative apprenticeships (2015)*, viewed 16 February 2022, from https://www.inap.uni-bremen.de/dl/inap%20conference%20proceedings%202015.pdf.

Macpherson, R. & Stanovich, K.E., 2007, 'Cognitive ability, thinking dispositions, and instructional set as predictors of critical thinking', *Learning and Individual Differences* 17, 115–127. https://doi.org/10.1016/j.lindif2007.05.003

Mahembe, E., 2012, *AATP post trade test tracer study: Final Report,* Underhill Corporate Solutions, Pretoria, viewed 16 February 2022, from https://www.merseta.org.za/wp-content/uploads/2021/04/AATP-Tracer-Study-Report-20-September-2012.pdf.

ManpowerGroup, 2018, *Talent shortage survey 2017/2018*, viewed 16 February 2022, from https://manpowermi.com/news/manpowergroup-releases-2018-talent-shortage-survey-results/.

Markoulli, M.P., Lee, C.I.S.G., Byington, E. & Felps, W.A., 2017, 'Mapping human resource management: Reviewing the field and charting future directions', *Human Resource Management Review* 27(3), 367–396.https://doi.org/10.1016/j.hrmr.2016.10.001

Martin, J., 2016, 'Lead students to high-paying jobs and lower debt through apprenticeships', *Tech Directions*, viewed 16 February 2022, from http://www.omagdigital.com/publication/?i=294969&article_id=2431550&view=articleBrowser&ver=html5.

Memon, M., Ahmed, F., Qureshi, M. & Brohi, N.A., 2018, 'Effectiveness of psychometric testing in recruitment process', *Journal of Organizational Behavior Research* 3(1), 293–306. https://odad.org/article/effectiveness-of-psychometric-testing-in-recruitment-process

merSETA, 2016, *Tracer study: Final report 30 March 2016,* viewed 16 February 2022, from https://www.lmip.org.za/document/tracer-study-final-report.

Mottram, R., Clarke, A. & Downs, S., 1980, 'Recruiting apprentices: The use of the job disposition questionnaire', *Journal of Occupational Psychology* 53, 265–279. https://doi.org/10.1111/j.2044-8325.1980.tb00033.x

Mueller, B. & Wolter, S.C., 2014, 'The role of hard-to-obtain information on ability for the school-to-work transition', *Empirical Economics* 46(4), 1447–1471. https://doi.org/10.1007/s00181-013-0709-2

Mummenthey, C. & Du Preez, R., 2010, 'Implementing efficient and effective learnerships in the construction industry', *South African Journal of Industrial Psychology* 36(1), 1–11. https://doi.org/10.4102/sajip.v36i1.766

Naidoo, M. & Hoque, M., 2017, 'Reducing youth unemployment beyond the youth wage subsidy: A study of Simtech apprentices', *South African Journal of Human Resource Management* 15, 1–10. https://doi.org/10.4102/sajhrm.v15i0.845

National Apprenticeship Service (NAS), 2017, *Employer guide to apprentice recruitment,* viewed 16 February 2022, from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/609449/Employer_Guide_February_2017.pdf.

Nisbett, B.R.E., 2013, 'Schooling makes you smarter: What teachers need to know about IQ', *American Educator* 37(1), 10–19, viewed 16 February 2022, from https://www.aft.org/sites/default/files/periodicals/Nisbett.pdf.

Noe, R.A., Hollenbeck, J.R., Gerhart, B. & Wright, P.M., 2020, *Fundamentals of human resource management,* 8th edn., McGraw-Hill/Irwin, New York, NY.

Nomvete, S., Patel, R. & Letsoalo, L., 2018, *Sector skills plan update 2019/2020: Promoting artisan development for employability*, viewed 16 February 2022, https://www.merseta.org.za/wp-content/uploads/2021/04/merSETA-Sector-Skills-Plan-2019-2020.pdf.

OECD, 2017, *Engaging employers in apprenticeship opportunities,* OECD Publishing, Paris.

Pandor, G.M.N., 2018, *Draft national artisan development strategy and implementation plan 2017,* viewed 16 February 2022, from https://www.dhet.gov.za/Skills%20Development/Draft%20National%20Artisan%20Development%20Strategy%20And%20Implementation%20Plan%202017%20-%20For%20Public%20Comment%20(1).pdf.

Pietersen, C., 2018, 'Research trends in the South African journal of human resource management', *South African Journal of Human Resource Management* 16(0), a825. https://doi.org/10.4102/sajhrm.v16i0.825

Piro, K., 2011, 'Investigating the impact of a psychometric assessment technique in the South African automotive industry', Unpublished doctoral thesis, Nelson Mandela Metropolitan University.

Puchert, J.I., Dodd, N. & Viljoen, K.L., 2017a, 'Secondary education as a predictor of aptitude: Implications for selection in the automotive sector', *South African Journal of Industrial Psychology* 43(0), a1416. https://doi.org/10.4102/sajip.v43i0.1416

Puchert, J.I., Dodd, N. & Viljoen, K.L., 2017b, 'The relationship between type of secondary education and subject choice with technically-oriented aptitudes for automotive operators', *South African Journal of Industrial Psychology* 43(0), a1435. https://doi.org/10.4102/sajip.v43i0.1435

Puchert, J.I., Van Niekerk, R. & Viljoen, K.L., (in press), *Apprentice selection: A systematic literature review from 1990 to 2020,* Manuscript accepted for publication.

Qonde, G.F., 2019, *Skills supply and demand in South Africa*, Department of Higher Education and Training, viewed 16 February 2022, from https://www.dhet.gov.za/SiteAssets/Report%20on%20Skills%20Supply%20and%20Demand%20in%20South%20Africa_%20March%202019.pdf.

Quinlan, C., 2011, *Business research methods*, South-Western Cengage Learning, Shanghai.

Quinlan, C., Babin, B., Carr, J., Griffen, M. & Zikmund, W.G., 2015, *Business research methods,* 1st edn., South-Western Cengage Learning, Boston, MA.

Rauner, F., Heinemann, L., Hauschildt, U. & Piening, D., 2012, *Project report: COMET-pilot test South Africa,* viewed 16 February 2022, from https://www.merseta.org.za/wp-content/uploads/2021/04/COMET-RSA-Study-Report-April-2012.pdf.

Reddy, V., Bhorat, H., Powell, M., Visser, M. & Arends, A., 2016, *Skills supply and demand in South Africa*, LMIP Publication, Human Sciences Research Council, Pretoria.

Reddy, V. & Kruss, G., 2015, *The labour market intelligence partnership: Update 2014*, Human Sciences Research Council, Pretoria, viewed 16 February 2022, from https://www.lmip.org.za/sites/default/files/news/LMIP%20Update2014_Web_.pdf.

Ross, C.M. & Young, S.J., 2005, 'Résumé preferences: Is it really "business as usual?"', *Journal of Career Development* 32(2), 153–164. https://doi.org/10.1177/0894845305279162

Rowe, L., Moss, D., Moore, N. & Perrin, D., 2017, 'The challenges of managing degree apprentices in the workplace: A manager's perspective', *Journal of Work-Applied Management* 9(2), 185–199. https://doi.org/10.1108/JWAM-07-2017-0021

Sackett, P.R. & Lievens, F., 2008, 'Personnel selection', *Annual Review of Psychology* 59, 16.1–16.32. https://doi.org/10.1146/annurev.psych.59.103006.093716

Schmidt, F.L. & Hunter, J.E., 1998, 'The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research finding', *Psychological Bulletin* 124(2), 262–274. https://doi.org/10.1037/0033-2909.124.2.262

Schmidt, F.L., Oh, I.-S. & Shaffer, J.A., 2016, *The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 100 years of research findings,* Working paper, viewed 16 February 2022, from https://home.ubalt.edu/tmitch/645/session%204/Schmidt%20&%20Oh%20MKUP%20validity%20and%20util%20100%20yrs%20of%20research%20Wk%20PPR%202016.pdf.

Schmidt, F.L. & Zimmerman, R.D., 2004, 'A counterintuitive hypothesis about employment interview validity and some supporting evidence', *Journal of Applied Psychology* 89(3), 553–561. https://doi.org/10.1037/0021-9010.89.3.553

Schmitt, N., 2014, 'Personality and cognitive ability as predictors of effective performance at work', *Annual Review of Organizational Psychology and Organizational Behavior* 1, 45–65. https://doi.org/10.1146/annurev-orgpsych-031413-091255

Schreuder, D. & Coetzee, M., 2010, 'An overview of industrial and organisational psychology research in South Africa: A preliminary study', *South African Journal of Industrial Psychology* 36(1), a903. https://doi.org/10.4102/sajip.v36i1.903

Schwab, K., 2019, *The world economic forum's global competitiveness report 2019,* viewed 15 February 2022, from https://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf.

Sermsuk, S., Triwichitkhunb, D. & Wongwanich, S., 2014, 'Employment conditions and essential employability skills required by employers for secondary school graduates', *Procedia – Social and Behavioral Sciences* 116, 1848–1854. https://doi.org/10.1016/j.sbspro.2014.01.482

Shatouri, R.M., Omar, R. & Igusa, K., 2012, 'Towards a new era of sustainability in the automotive industry: Strategic human resource management and green technology innovation', *World Academy of Science, Engineering and Technology* 6(9), 217–222.

Siegenthaler, M., 2011, 'Can a standardised aptitude test predict the training success of apprentices? Evidence from a case study in Switzerland', *Empirical Research in Vocational Education and Training* 3(2), 105–128. https://doi.org/10.1007/BF03546501

Singh, R. & Mukhopadhyay, K., 2011, 'Survival analysis in clinical trials: Basics and must know areas', *Perspectives in Clinical Research* 2(4), 145–148. https://doi.org/10.4103/2229-3485.86872

Stewart, J. & Knowles, V., 2000, 'Graduate recruitment and selection practices in small businesses', *Career Development International* 5(1), 21–38. https://doi.org/10.1108/13620430010309332

Taljaard, J.J., 1983, *Manual for the trade aptitude test battery (TRAT),* Human Sciences Research Council, Pretoria.

Tang, W., 2015, 'Exploration and practice of modern apprenticeship training with school-enterprise dual system: A case study of Guangzhou Industry & Trade Technician College', in *proceedings of the sixth research conference of the International network for innovative apprenticeships (2015),* viewed 15 February 2022, from https://www.inap.uni-bremen.de/dl/inap%20conference%20proceedings%202015.pdf.

Tarique, I. & Schuler, R., 2012, *Global talent management literature review,* viewed 15 February 2022, from https://smlr.rutgers.edu/sites/smlr/files/Documents/Faculty-Staff-Docs/Randall%20Schuler_GTM%20SHRM_%20Report_Final_Oct%2028%2C2012_0.pdf.

Taylor, S., Osland, J. & Egri, C.P., 2012, 'Guest editors' introduction: Introduction to HRM's role in sustainability: Systems, strategies, and practices', *Human Resource Management* 51, 789–798. https://doi.org/10.1002/hrm.v51.6

Tomaska, L. & Nosek, J., 2018, 'Ten simple rules for writing a cover letter to accompany a job application for an academic position', *PLoS Computational Biology* 14(5), e1006132. https://doi.org/10.1371/journal.pcbi.1006132

Trindale, R., 2015, 'Is your background screening keeping up with today's hiring challenges?', *Employment Relations Today* 42(2), 1–7. https://doi.org/10.1002/ert.21492

Van der Flier, H., Thijs, G.D. & Zaaiman, H., 2003, 'Selecting students for a South African mathematics and science foundation programme: Effectiveness and fairness of school-leaving examinations and aptitude tests', *International Journal of Educational Development* 23(4), 399–409. https://doi.org/10.1016/S0738-0593(02)00071-8

Van Rooyen, L., Du Toit, D.H., Botha, E. & Rothmann, S., 2010, 'Artisan retention in an organisation in South Africa', *South African Journal of Human Resource Management,* 8(1), 1–8. https://doi.org/10.4102/sajhrm.v8i1.300

Vernon, D., Hocking, I. & Tyler, T.C., 2016, 'An evidenced-based review of creative problem solving tools: A practitioner's resource', *Human Resource Development Review* 15(2), 230–259. https://doi.org/10.1177/1534484316641512

Waite, A.M. & McDonald, K.S., 2019, 'Exploring challenges and solutions facing STEM careers in the 21st century: A human resource development perspective', *Advances in Developing Human Resources*, 21(1), 3–15. https://doi.org/10.1177/1523422318814482

Wallwork, A., 2014, 'The qualities of a good CV and résumé', in A. Wallwork (ed.), *CVs, résumés, and LinkedIn: A guide to professional English*, pp. 1–16, Springer, Italy.

Wärnich, S., Carrell, M.R., Elbert, N.F. & Hatfield, R.D., 2018, *Human resource management in South Africa,* 6th edn., South-Western Cengage Learning, Boston, MA.

Werner, A., Botha, C., Mey, M., Ngalo, O., Poisat, P., Van Hoek, L. et al., 2017, *Human resources management,* 10th edn., Oxford University Press, Oxford.

Wickramasinghe, V., 2007, 'Staffing practices in the private sector in Sri Lanka', *Career Development International* 12(2), 108–128. https://doi.org/10.1108/13620430710733613

Wildschut, A., Gamble, J., Mbatha, N. & Meyer, T., 2015, 'Planning for artisanal skills: The importance of understanding changing artisanal milieus and identities', in *Labour Market Intelligence Partnership Ministerial briefing note (March 2015): Creating a credible institutional mechanism for skills planning in South Africa*, Human Sciences Research Council, Pretoria, viewed 15 February 2022, from https://www.lmip.org.za/sites/default/files/documentfiles/LMIP%20Briefing%20Note_0.pdf/.