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# Personality traits and employee engagement: The moderating effect of age and gender

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**Orientation:** Employee engagement (EE) has been identified as a key aspect driving employee and organisational performance outcomes. Personality traits could assist in predicting levels of EE, while the moderating effect of age and gender could assist in determining whether these two biographical groups should be managed differently. However, overemphasis on these biographical distinctions could undermine an organisation's commitment to diversity, equity and inclusion (DEI) by reinforcing stereotypes or fostering inequitable practices.

**Research purpose:** The purpose was to determine the moderation effect of age and gender on the relationship between personality traits and EE.

**Motivation for the study:** Understanding the moderation effect of age and gender on the relationship between personality traits and EE could provide a deeper understanding of whether employees with different personality traits possess different levels of engagement given their age and gender.

**Research approach/design and method:** Data obtained from a random sample of 124 employees in a financial organisation were subjected to multiple regression moderation analyses to determine whether age and gender moderated the relationship between personality traits and EE. Additional biographic variables measured were not controlled during the regression analyses.

**Main findings:** The results of the study found that age and gender did not moderate the relationship between personality traits and EE.

**Practical/managerial implications:** The use of the Occupational Personality Questionnaire (OPQ32r) to measure personality traits to determine their relationship with EE should be done with caution. Age and gender play no role in determining whether employees with different personality traits will possess different levels of EE.

**Contribution/value-add:** This study contributed to existing knowledge about the use of personality traits for determining employees' level of EE and the role of age and gender in this relationship.

**Keywords:** age; biographical variables; employee engagement; gender; personality assessment; personality traits; multiple regression moderation analysis.

## Introduction

### Orientation

Organisations around the world prioritise effectiveness, as it has been linked to profitability, expansion and long-term sustainability (Cooks-Campbell, 2022; Cummings et al., 2019). However, achieving this effectiveness depends heavily on employees, whose contributions are essential for reaching organisational goals, as without them an organisation's survival may be at risk (Syarafina & Sushandoyo, 2022). As a result, employee engagement (EE) has become a key focus in both academic research and management studies (Ababneh, 2015; Du Plessis & Martins, 2017; Nienaber & Martins, 2014, 2015). Whether at an individual or organisational level, EE has been shown to strengthen organisational performance and provide a competitive advantage (Meskelis & Whittington, 2020; Nienaber & Martins, 2014, 2015). Employee engagement has been both theoretically and empirically associated with key work outcomes, largely because of employees' strong emotional connection to their workplace (Kompaso & Sridevi, 2010; Thomas, 2019; Wefald et al., 2011). Studies have linked EE to lower employee turnover, greater job commitment and satisfaction, increased productivity, improved client satisfaction and stronger financial performance (Ansari, 2021; Martins, 2015; Thomas, 2019; Wefald et al., 2011). This aligns with findings that a highly engaged workforce is essential for organisational success, as engaged

individuals are enthusiastic, committed and actively contribute to achieving company goals (Meskelis & Whittington, 2020). Conversely, low engagement can lead to higher turnover rates and negative workplace behaviours such as bullying, harassment and fraud (Ansari, 2021; Mvuyana et al., 2025). Addressing and improving EE are therefore crucial for sustaining organisational effectiveness (Meskelis & Whittington, 2020).

Given the importance of EE, extensive research has been dedicated to identifying the key factors that drive it (Chamorro-Premuzic et al., 2018; Young et al., 2018). What influences the differences in enthusiasm, motivation and energy that individuals bring to their jobs? Traditionally, studies have focused on external elements such as job roles, organisational culture and leadership quality. While these contextual factors play a significant role, employees' perceptions of their job, manager and workplace are also shaped by their personal characteristics (Chamorro-Premuzic et al., 2018). Before EE became a focal point, many managers already considered motivation to be an innate trait that employees possessed – something they specifically looked for when hiring. This explains why two employees can have vastly different levels of engagement despite working under similar conditions and why organisations consistently seek individuals who demonstrate strong ambition, energy and commitment regardless of their circumstances (Chamorro-Premuzic et al., 2018). This raises an important but often overlooked question: to what extent is EE simply a reflection of personality traits? (Chamorro-Premuzic et al., 2018; Young et al., 2018). Some researchers suggest that engagement may be an innate characteristic that employees bring to their roles, rather than something shaped by organisational structures and management practices (Meskelis & Whittington, 2020). This perspective has sparked interest in understanding the link between personality traits and EE, particularly in how it affects hiring, talent management and recruitment strategies. Identifying which traits are most closely associated with high levels of energy and commitment could help organisations select employees who are naturally inclined to engage in their work. Consequently, further research is essential to pinpoint the personality traits most strongly linked to EE (Ansari, 2021; Chamorro-Premuzic et al., 2018). Personality traits have long been recognised as a key factor in predicting workplace outcomes (Wefald et al., 2011). They shape how individuals perceive and respond to different situations, influencing their reactions to work environments and helping to explain employee behaviour (Handa & Gulati, 2014; Mohanty, 2016). Research suggests that certain personality traits make individuals more likely to be engaged in their work, impacting their emotional commitment, job satisfaction and likelihood of staying with an organisation. Additionally, selecting employees based on performance-related personality traits could improve the chances of fostering a highly engaged workforce (Handa & Gulati, 2014; Wefald et al., 2011).

Researchers have also explored how biographical characteristics influence various organisational factors. Studies have examined the role of race, age and marital status in shaping employees' turnover intentions (Du Plooy & Roodt, 2013), as well as how age, gender and marital status affect engagement levels (Douglas & Roberts, 2020; Makumbe et al., 2025; Shukla et al., 2015). Additionally, research has highlighted the impact of age, tenure and education on organisational citizenship behaviour (Mitonga-Monga et al., 2017), while other studies have linked age to job demands, workplace anxiety and psychological resilience (Magwegwe & Sithole, 2024). Furthermore, the relationship between employee career attitudes and organisational citizenship behaviour has been found to be influenced by both gender and age (Joshi et al., 2021). These findings demonstrate the significant role that personal attributes play in workplace dynamics.

While previous studies have established a positive correlation between personality traits and EE (Ansari, 2021; Arora & Adhikari, 2013; De Mello e Souza Wildermuth, 2008; Handa & Gulati, 2014; Ongore, 2024; Thomas, 2019), they primarily explored the direct connection between these variables without examining the moderating influence of biographical characteristics such as age and gender. This gap presents a significant limitation, as individual differences in personality expression and motivational drivers may vary depending on age and gender, thereby influencing the strength and nature of the personality trait – EE relationship. Understanding how age and gender shape the relationship between personality traits and EE is essential, as it could offer valuable insights for management and practitioners. Specifically, it may help determine whether employees with different personality profiles, ages and genders exhibit varying levels of EE, requiring tailored approaches to their management.

A significant challenge faced by workplaces worldwide is addressing ageism, which has emerged as a critical factor influencing Human Resource Management (HRM) policies and practices (Douglas & Roberts, 2020; Makumbe et al., 2025). Additionally, the growing presence of women in roles historically dominated by men has introduced new dimensions to how work engagement is experienced across genders (Bosch et al., 2012). As a result, management and Human Resource (HR) practitioners need insights that can help shape targeted strategies for different age groups and genders regarding the connection between personality traits and EE. Specifically, they must consider whether the relationship between personality traits and EE remains consistent for different age groups and genders. If it fluctuates, it is crucial to determine the stage in adulthood and the gender for which this association is strongest, as well as when and for whom it begins to weaken.

Gender differences in personality traits and workplace experiences have also been documented. Women, on average, score higher on certain personality traits than men, and these may influence how personality traits translate into engagement (Fitzenberger et al., 2022). Joshanloo (2023) also highlighted the need for gender-sensitive approaches

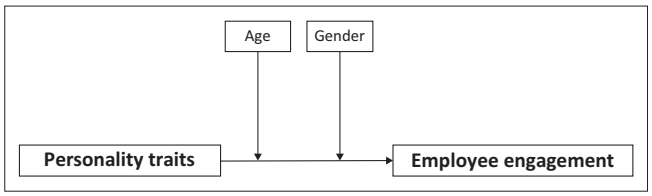


**FIGURE 1:** Conceptual framework of the study.

to psychological well-being and engagement. Bleidorn et al. (2021) proposed a contextualist perspective, suggesting that personality traits interact with situational and demographic factors to shape behaviour. This framework supports the notion that age and gender moderate the relationship between personality traits and EE. Incorporating these moderators into engagement models allows for a more nuanced understanding of individual differences and enhances predictive accuracy (Bleidorn et al., 2021).

This study seeks to provide insights into the moderating role of age and gender on the personality trait-EE link to better understand the dynamics involved in this relationship. Consequently, the conceptual model presented in Figure 1 will guide the research.

This conceptual model suggests that the relationship between personality traits and EE is not static but moderated by age and gender. For instance, the positive effect of certain personality traits on EE may be stronger in older employees because of increased self-regulation and goal orientation. Similarly, the impact of certain personality traits may vary by gender, with different social expectations and workplace dynamics influencing engagement outcomes (Bleidorn et al., 2021; Fitzenberger et al., 2022; Joshanloo, 2023).

Understanding the moderating role of age and gender in the personality trait–EE relationship will offer valuable theoretical and practical insights. Theoretically, it challenges static personality trait models and supports dynamic, context-sensitive approaches. Practically, it enables management and HR practitioners to design targeted engagement strategies that reflect the diverse needs of their workforce.

A further consideration making this study important is that organisations are compelled to comply with the legal and regulatory requirements related to diversity, equity and inclusion (DEI) (Chua, 2024). Diversity, equity and inclusion policies must promote fairness and equal opportunity across all demographic groups and enhance EE and well-being by cultivating a sense of belonging (Chua, 2024). Research shows that diverse teams outperform homogeneous ones in problem-solving and creativity and that employees are more likely to engage when they feel valued and included, making DEI a critical driver of EE (Chua, 2024). This study, which examines how age and gender moderate the relationship between personality traits and EE, directly contributes to understanding how individual differences intersect with broader DEI goals.

Additionally, today's workforce spans five generations: Traditionalists, Baby Boomers, Generation X, Millennials and Generation Z (Picagli, 2024). Each cohort brings unique values, communication styles and expectations to the work environment, which influence how employees engage with their work and respond to leadership, culture and organisational policies (Picagli, 2024). This study's focus on age as a moderator is especially relevant, as it can reveal how generational identity shapes the impact of personality traits on EE. Understanding these dynamics helps organisations tailor engagement strategies that resonate across age groups, thereby enhancing overall performance and retention (Perry, 2023).

### Research purpose

The purpose of this study is to determine the moderation effect of age and gender on the relationship between personality traits and EE.

## Literature review

The literature review will discuss the trait approach to personality, questionnaires used to measure personality traits, the concept of EE, the relationship between personality traits and EE and the moderation effect of age and gender on this relationship.

### The trait approach to personality

The trait theory of personality underpins the psychometric approach to personality assessment, suggesting that personality comprises a constellation of traits that vary in degree across individuals (Cervone & Pervin, 2022; Masoga, 2013; McAdams & Olson, 2010). These traits offer a dispositional framework for understanding psychological individuality and represent core attributes that influence behavioural tendencies (Cervone & Pervin, 2022; McAdams & Olson, 2010). Furthermore, they account for individual differences in affective, cognitive and behavioural domains, as well as in behavioural styles and are generally regarded as relatively stable over time (Cervone & Pervin, 2022; Gerber et al., 2012; Moerdyk, 2015). Although genetic factors significantly contribute to the development of personality traits, these traits are also subject to developmental change across the lifespan, following normative trajectories (Gerber et al., 2012; Hudson et al., 2012).

According to Thomas (2019) and Cervone and Pervin (2022), the historical development of the trait approach in personality research can be attributed to foundational contributions by theorists such as Allport, Murray, Cattell and Goldberg. Bouchard and Loehlin (2001) contended that trait theorists have demonstrated a more rigorous commitment to the empirical measurement of personality constructs compared to other theoretical orientations. This is supported by Wood et al. (2009), who stated that personality traits have remained one of the most extensively examined dimensions of personality over the past five decades. In contemporary

personality psychology, traits are widely regarded as the fundamental components underpinning psychological individuality (Cervone & Pervin, 2022).

## Personality in the work situation

In organisational settings, research is oriented towards examining personality with the objective of understanding outcomes and psychological processes relevant to work. Personality in the workplace is both a psychological construct and a practical tool for understanding behaviour, motivation and performance (Ritz et al., 2023). Personality is operationalised in the work situation by turning abstract traits into measurable, observable behaviours (Greenwood, 2023). In work contexts, the operationalisation of personality is mainly done through psychometric assessments. Questionnaires such as the Big Five Personality Test (Truity, 2025), the 16 Personality Factor Questionnaire (16PFQ), Fifth Edition (Cattell et al., 1993) and the Occupational Personality Questionnaire (OPQ32r) (Saville et al., 1984) are used to assess individual traits. These assessments assist with employee selection, team building, training and development and career counselling and coaching (Greenwood, 2023). The design of these assessments is informed by trait-based models identified by psychologists as particularly relevant to workplace effectiveness (Ritz et al., 2023). Additionally, personality is also operationalised by using behavioural indicators. Here personality is inferred from consistent patterns in decision-making, communication style, conflict resolution and adaptability (Greenwood, 2023).

Understanding how personality traits are operationalised and expressed at work enables organisations to design roles, teams and leadership strategies that align with individual strengths, ultimately enhancing performance and satisfaction. Additionally, personality also has a broader organisational impact by influencing how employees shape and respond to organisational culture. It affects aspects such as risk tolerance, strategic thinking and ethical judgements, by either enhancing team synergy or creating friction (Kumar, 2023).

## Employee engagement

In the context of 21st-century organisations, EE has emerged as a critical determinant of both individual and organisational performance, contributing significantly to competitive outcomes such as profitability, growth, productivity, organisational stability, employee retention and customer loyalty (Macey & Schneider, 2008; Meskelis & Whittington, 2020; Nienaber & Martins, 2014; Thomas, 2019; Wefald et al., 2011). Furthermore, EE has been identified as a key factor in enhancing employee satisfaction and overall organisational success (Gupta & Sharma, 2016; Meskelis & Whittington, 2020; Popli & Rizvi, 2016; Thomas, 2019) while also supporting the development of an organisation's competitive advantage (Nienaber & Martins, 2014; Sahoo & Sahu, 2009; Shuck & Wollard, 2010; Thomas, 2019). Additionally, EE is widely regarded as a foundational element for cultivating organisational excellence and is instrumental in fostering a high-performance culture that drives long-term success (Sahoo & Sahu, 2009; Wefald et al., 2011).

Modern organisations increasingly regard employees as valued contributors rather than merely as workers, emphasising the cultivation of positive relationships, the recognition of individual talent and potential and the provision of meaningful and enriched work experiences (Sahoo & Sahu, 2009). A primary factor that undermines organisational productivity is the presence of employees who are disengaged and lack purposeful involvement in their tasks (Sahoo & Sahu, 2009). However, Macey and Schneider (2008) highlighted the inherent difficulty in cultivating and sustaining a genuinely engaged workforce.

Despite the conceptual ambiguity and inconsistent definitions surrounding the concept of EE (Gupta & Sharma, 2016; Nienaber & Martins, 2014; Shuck & Wollard, 2010), there is general consensus among scholars that EE reflects adaptive behaviour purposefully oriented towards achieving or surpassing organisational objectives. Shuck and Wollard (2010, p. 103) defined EE as 'an individual employee's cognitive, emotional, and behavioural state directed toward desired organisational outcomes'. This perspective is reinforced by Nienaber and Martins (2015), who describe EE as encompassing both individual and organisational dimensions, wherein employees exhibit enthusiasm and deep involvement in their work, leading them to take proactive steps that support and enhance the organisation's goals and reputation. Building on this conceptualisation, Nienaber and Martins (2014) developed a theoretical framework and the Employee Engagement Questionnaire (EEQ), specifically designed for the South African context (Thomas, 2019). Their model draws from established EE theory and is grounded in the framework proposed by Macey and Schneider (2008). The EE framework and corresponding EEQ comprise six dimensions that span the individual, team or departmental and organisational levels. The EEQ was subsequently validated by Nienaber and Martins (2015), who identified six key factors contributing to the overall construct of EE: (1) customer service, (2) immediate manager, (3) organisational commitment, (4) organisational satisfaction, (5) strategy implementation and (6) team level. For the purposes of this study, the conceptualisation of EE and the measurement instrument developed and validated by Nienaber and Martins (2014, 2015) will be employed (Thomas, 2019).

## The relationship between personality traits and employee engagement

A substantial body of research has established a positive association between personality traits and EE. Arora and Adhikari (2013), employing the 16PFQ, identified a significant positive correlation between personality traits and EE within the Indian ITC sector. Similarly, Shukla et al. (2015) reported that all factors of the Big Five personality model were significantly related to EE in the same sector, with personality

traits accounting for approximately 25% of the variance in engagement levels. Expanding on this, Young et al. (2018) conducted a meta-analysis encompassing 114 independent samples ($N$ = 44224) and found that nearly 50% of the variability in EE could be attributed to personality traits – particularly positive affect, proactivity, conscientiousness and extraversion. These findings suggest that individuals who are optimistic, proactive, diligent and sociable are more likely to exhibit higher levels of engagement at work. Ansari (2021) further corroborated these findings in a study of mid-level employees in an Indian ITC firm, demonstrating a positive relationship between the Big Five traits and EE. In a separate meta-analysis, Fukuzaki and Iwata (2022) confirmed that all five traits of the Big Five Factor Model were significantly associated with work engagement. More recently, Hubbell (2024) reported positive correlations between the Big Five personality traits and EE in various industries in the US, while Ongore (2024) reported a positive relationship between the Big Five personality traits and EE among university staff in Turkey.

### The moderating role of age and gender on the relationship between personality traits and employee engagement

To date, no empirical studies have been identified that explore the moderating effects of age and gender on the relationship between personality traits and EE. Existing research has predominantly concentrated on examining the direct association between these two constructs (Ansari, 2021; Arora & Adhikari, 2013; Fukuzaki & Iwata, 2022; Hubbell, 2024; Ongore, 2024; Shukla et al., 2015; Young et al., 2018), without considering the potential influence of biographical variables such as age and gender. Consequently, the following section reviews literature that investigates the impact of age and gender on related constructs.

Du Plooy and Roodt (2013), in their investigation of a diverse workforce comprising operational and specialist employees up to middle management within a large South African information and communication technology company, found that age did not significantly moderate the relationship between work engagement (a construct closely related to EE) and turnover intention. In a separate study conducted among employees from various South African companies, Williamson and Geldenhuys (2014) and Thomas (2019) reported that gender moderated the relationship between work engagement and life satisfaction, with male employees exhibiting higher levels of life satisfaction when engagement levels were elevated. Shukla et al. (2015), in their research within the Indian ITC sector, explored the influence of age and gender on engagement levels. Their findings indicated gender-based differences in EE scores, while no significant differences were observed across age groups. However, this study assessed only the direct effects of these variables and did not examine their potential moderating roles. Similarly, Douglas and Roberts (2020), in a study conducted among employees of a US-based private sector organisation supporting the aviation and aerospace industry, found that individuals aged 50 years and above reported higher levels of EE compared to their younger counterparts. Again, this study also focused solely on the direct relationship between age and engagement, without addressing age as a moderating factor.

### Hypothesis formulation

From the literature review, the following research hypotheses were formulated for this study:

**H1:** Age moderates the relationship between personality traits and EE.

**H2:** Gender moderates the relationship between personality traits and EE.

## Research design

### Research approach

This study employed a quantitative, non-experimental research design to examine the moderating effects of age and gender on the relationship between personality traits and EE. Secondary data were sourced from individuals within the Health Division of a financial organisation who had completed the OPQ32r for selection purposes between 2016 and 2018 (Thomas, 2019). These data were subsequently matched with primary data collected from the same individuals through the administration of an EEQ. To address the research purpose, multiple moderation regression analyses were conducted.

### Research method

#### Research participants

The study population comprised 516 employees within the Health Division of a financial institution. From this population, a random sample of 200 employees was selected, of whom 124 agreed to participate in the study. The demographic profile of the respondents indicated that the majority identified as African (41.1%), female (73.4%) and held specialist roles (32.3%). Most participants were between the ages of 23 and 39 years (71.8%), possessed a Grade 12 qualification (29.8%) and had between one year and 5 years of service within the organisation (46%) (Thomas, 2019).

#### Measuring instruments

Biographical questionnaire: A biographical questionnaire was designed and utilised to collect information on the participants regarding their race, gender, position in the organisation, age, educational level and years of service in the organisation (Thomas, 2019).

The occupational personality questionnaire 32r: Personality traits were assessed using the OPQ32r (SHL, 2022), a revised and more concise version of the original OPQ32 developed by Saville et al. (1984). The 32-item OPQ32r

measures three overarching personality domains relevant to workplace behaviour: (1) *Relationships with People*, encompassing traits such as persuasiveness, assertiveness, independence, sociability, affiliation, social confidence, modesty, democratic orientation\ and empathy; (2) *Thinking Style*, which includes attributes such as data rationality, evaluative thinking, behavioural focus, conventionality, conceptual reasoning, innovation, preference for variety, adaptability, future orientation, attention to detail, conscientiousness and rule adherence and (3) *Feelings and Emotions*, comprising traits such as emotional stability, anxiety, resilience, optimism, trust, emotional control, energy, competitiveness, achievement orientation and decisiveness (Joubert & Venter, 2013).

The OPQ32r employs a forced-choice response format, requiring respondents to evaluate sets of three statements and select the one that most accurately reflects their typical behaviour, as well as the one that least reflects it (Joubert & Venter, 2013). In a 2006 study involving a South African sample of 87 males and 99 females across various racial groups, the OPQ32r demonstrated reliability coefficients ranging from 0.69 to 0.93, with a median reliability of 0.85. Joubert and Venter (2013) also reported that multiple South African studies have further supported the construct and criterion validity of the instrument. In a subsequent study, Joubert et al. (2015) reported reliability coefficients between 0.67 and 0.92 across the three core personality domains, while Van den Berg (2016) found Cronbach's alpha values ranging from 0.64 to 0.76, indicating moderate to high internal consistency. Based on this evidence, the OPQ32r was deemed a reliable and valid instrument for assessing personality traits in the present study (Thomas, 2019).

In the present study, the OPQ32r was selected for four primary reasons. Firstly, participants had previously completed the OPQ32r as part of organisational assessments, making it ethically and practically appropriate to utilise existing data (Joubert & Venter, 2013). Secondly, the study aimed to expand the methodological landscape by introducing a workplace-specific instrument into a domain traditionally dominated by general personality frameworks such as the Big Five or 16PF models (Tussey, 2023; Zaidi et al., 2013). This approach allows for cross-instrument comparison, testing whether established personality trait–EE relationships hold when assessed through a different lens. Thirdly, it also contributes to the literature by examining the moderating effects of age and gender using an instrument designed to reflect occupational behaviour, potentially yielding more contextually grounded insights. Fourthly, the OPQ32r is backed by strong psychometric foundations, including item response theory and normative scoring. It has been shown to predict job performance and employee behaviour effectively across various industries (Blignaut & Ungerer, 2014).

The *Employee Engagement Questionnaire*: Employee engagement was assessed using the EEQ, a 50-item self-report instrument developed within the South African context by Nienaber and Martins (2014). The EEQ is designed to measure engagement at both the individual and organisational levels. In a subsequent validation study, Nienaber and Martins (2015) administered the EEQ to a South African sample comprising 1073 participants drawn from sectors including finance, insurance, manufacturing, services, wholesale and retail, as well as government. The authors reported satisfactory internal consistency, with Cronbach's alpha coefficients ranging from 0.90 to 0.95. To establish construct validity, confirmatory factor analysis and structural equation modelling were employed, confirming a six-factor model as the most appropriate representation of the data. The study also provided evidence of both discriminant and convergent validity. The EEQ evaluates six dimensions of EE: customer service, immediate manager, organisational commitment, organisational satisfaction, strategy implementation and team level. Responses are recorded on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Given its demonstrated reliability and validity, the EEQ was deemed an appropriate instrument for measuring EE in the present study (Thomas, 2019).

### Research procedure

Authorisation to conduct the study within the Health Division of the participating financial organisation was granted by the division's executive. As part of a prior internal assessment process for selection purposes, employees within the Health Division had completed the OPQ32r. Following the receipt of ethical approval, the Head of the in-house Assessment Centre consented to release the OPQ32r assessment data, contingent upon the written consent of the respective employees. With the support of the Human Resources Manager, the researcher obtained a comprehensive list of employees within the Health Division. From this list, a random sample of 200 employees was selected to be invited to participate in the study. The in-house Assessment Centre Manager verified the availability of OPQ32r assessment results for these selected individuals. Subsequently, the employees were contacted via email and invited to participate in the study. The email communication included a detailed explanation of the study's purpose and scope, along with instructions for completing both the Biographical Questionnaire (BQ) and the EEQ. Participants were informed that, by signing the informed consent form, they would be authorising the Assessment Centre Manager to release their OPQ32r results to the researcher. A total of 124 employees consented to participate, thereby constituting the final research sample. These participants completed the BQ and EEQ and returned the signed consent forms and completed questionnaires to the researcher via email. To ensure confidentiality and protect participants' identities, unique codes were used to match each respondent's biographical data with their OPQ32r and EEQ results. The collected data were compiled into an Excel spreadsheet and subsequently provided to a statistician for analysis (Thomas, 2019).

## Statistical analysis

Descriptive statistics in the form of means and standard deviations were generated to describe the sample from the data gathered from the BQ and to analyse the responses to the OPQ32r and EEQ. Cronbach's alpha coefficients were calculated to determine the reliability of the OPQ32r and EEQ, while Pearson's product moment correlation coefficients were calculated to determine the statistical relationship between the three OPQ32r personality traits and an overall EE score. Two multiple regression moderation analyses were conducted to determine the moderation effect of age and gender on the relationship between the three personality traits and EE (Thomas, 2019). As suggested by Wu and Zumbo (2008), all continuous moderator variables were mean centred before being entered into the regression analysis to eliminate the problems of non-essential multicollinearity between the independent and moderation variables. A cut-off point to determine the statistical significance of results was set at $p \leq 0.05$, where the 0.05 level of significance indicates that the relationship is significant (Aithal & Aithal, 2020). To evaluate the practical effect size of correlations, the proposed benchmarking by Lakens (2022) was used where $r < 0.20$ = very small, $0.20 \leq r < 0.50$ = small, $0.50 \leq r < 0.80$ = medium and $r \geq 0.80$ = large. The guideline by Kraft (2018) was also considered who suggested that research is starting to propose that effect sizes between 0.20 and 0.25 are considered substantial enough to be considered of practical value.

## Ethical considerations

Ethical clearance to conduct this study was obtained from the University of South Africa, Department of Industrial and Organisational Psychology Research Ethics Committee, with reference number: ERC 2018_CEMS/IOP_002. Written informed consent was obtained from participants before proceeding with the research, and this included their right to withdraw from the study at any time. Confidentiality and privacy of the participants were always maintained as the questionnaires were anonymous to protect the identity of participants, and data were stored on a password-protected server and computer.

# Results

## Descriptive and reliability statistics

Table 1 indicates the number of items per dimension, means, standard deviations and Cronbach's alpha reliability coefficients for both measuring instruments.

Table 1 indicates that all three OPQ32r personality traits, all six EE dimensions and the overall EEQ score had high internal consistency scores (Thomas, 2019), above the acceptable level of 0.70 proposed by Babbie (2021). The results for the OPQ32r confirm previous reliability research, which found that the OPQr had high reliabilities for all three personality traits (Joubert & Venter, 2013; Joubert et al., 2015; Van den Berg, 2016). The results for the EEQ confirm previous reliability research, which found adequate reliability scores for the six EEQ dimensions (Nienaber & Martins, 2015).

## Correlations

The correlations between the three personality traits measured by the OPQ32r and an overall EE score are shown in Table 2 (Thomas, 2019). These results indicate that the only statistically significant relationship was between the *feelings and emotions* personality trait and an overall EE score, with the practical effect being small (Lakens, 2022) but still significant according to Kraft (2018). Although various studies reported a positive relationship between personality traits and EE (Ansari, 2021; Arora & Adhikari, 2013; Fukuzaki & Iwata, 2022; Hubbell, 2024; Ongore, 2024; Shukla et al., 2015; Young et al., 2018), these studies all used either

**TABLE 2:** Correlations between the three personality traits as measured by the occupational personality questionnaire and an overall employee engagement questionnaire score.

| Variables | Overall EE score |
|---|---|
| Relationship with people | 0.06 |
| Thinking style | 0.10 |
| Feelings and emotions | 0.25** |

*Source*: Thomas, C. (2019). *The relationship between personality and employee engagement in a financial institution in South Africa*. Unpublished Master's dissertation, University of South Africa

EE, employee engagement.

** Correlation is significant at the 0.01 level (two tailed)

**TABLE 1:** Descriptive statistics and Cronbach's alpha for the Occupational Personality Questionnaire and Employee Engagement Questionnaire obtained for this study ($N$ = 124).

| Variables | No. of items | Mean | SD | α |
|---|---|---|---|---|
| **Personality traits** | | | | |
| Relationship with people | 10 | 5.16 | 0.77 | 0.82 |
| Thinking style | 12 | 5.42 | 0.73 | 0.89 |
| Feelings and emotions | 10 | 5.41 | 0.57 | 0.89 |
| **Employee engagement dimensions** | | | | |
| Customer service | 6 | 3.68 | 0.55 | 0.96 |
| Immediate manager | 7 | 3.82 | 0.92 | 0.94 |
| Organisational commitment | 6 | 4.10 | 0.70 | 0.90 |
| Organisational satisfaction | 9 | 3.87 | 0.74 | 0.94 |
| Strategy implementation | 10 | 3.47 | 0.64 | 0.88 |
| Team level | 12 | 4.10 | 0.67 | 0.96 |
| **Overall EE score** | 50 | 3.84 | 0.52 | 0.97 |

*Source*: Thomas, C. (2019). *The relationship between personality and employee engagement in a financial institution in South Africa*. Unpublished Master's dissertation, University of South Africa

SD, Standard deviation; α, Cronbach's alpha.

the 16PFQ or The Big Five Personality Factors Questionnaire to measure personality. No studies could be found that investigated the relationship between personality traits as measured by the OPQ32r and EE against which to compare these results (Thomas, 2019).

## Multiple regression moderation analysis: Main and interaction effects

Two multiple regression moderation analyses were conducted to examine the moderating effect of age and gender on the relationship between the three personality traits (relationship with people, thinking style and feelings and emotions – as measured by the OPQ32r) and EE (as measured by an overall EEQ score). Hierarchical multiple regression analysis was used to test the hypotheses, entering variables in sequential blocks to assess incremental variance explained by moderators. Specifically, Block 1 included the OPQ32r personality traits as predictors of EE; Block 2 introduced the biographical moderators (age and gender) and Block 3 added the interaction terms (personality × age, personality × gender) to test moderation effects. This approach allowed the examination of both main effects and interaction effects while controlling for potential confounding influences.

The results of the first multiple regression moderation analysis to examine the moderating effect of age on the relationship between the three personality traits and an overall EE score are indicated in Table 3. Results indicate that the overall model was insignificant ($F = 1.90_{(7)}$; $p = 0.08$) and explained only 5% of the variance in EE (adjusted $R^2 = 0.05$). Table 3 also indicates that there were no statistically significant main effects between age and the three personality traits on EE (age: $\beta = 0.20$; SE = 0.10; $t = 0.90_{(116)}$; $p = 0.40$; relationship with people: $\beta = -0.11$; SE = 0.10; $t = -1.03_{(116)}$; $p = 0.31$; thinking style: $\beta = 0.10$; SE = 0.07; $t = 0.70_{(116)}$; $p = 0.50$; feelings and emotions: $\beta = 0.21$; SE = 0.11; $t = 1.70_{(116)}$; $p = 0.10$). This indicates that age and the three personality traits are insignificant predictors of EE.

Table 3 also indicates that there were no statistically significant interaction effects between the three personality traits and age on EE (relationship with people and age: $\beta = -0.40$; SE = 0.20; $t = -1.90_{(116)}$; $p = 0.07$; thinking style and age: $\beta = 0.11$; SE = 0.14; $t = 0.60_{(116)}$; $p = 0.58$; feelings and emotions and age: $\beta = -0.12$; SE = 0.23; $t = -0.46_{(116)}$; $p = 0.65$). This indicates that the relationships between the three personality traits and EE were not moderated by age. No similar studies exist, which investigated the moderation effect of age on the relationship between the three personality traits as measured by the OPQ32r and EE against which to compare these results.

The results of the second multiple regression moderation analysis to examine the moderation effect of gender on the relationship between the three personality traits and an overall EE score are indicated in Table 4.

Table 4 indicates that the overall model was insignificant ($F = 1.96_{(7)}$; $p = 0.10$) and explained only 5% of the variance in EE (adjusted $R^2 = 0.05$). Table 4 also indicates that the main effect of gender ($\beta = -0.04$; SE = 0.10; $t = -0.30_{(116)}$; $p = 0.80$), relationship with people ($\beta = 0.20$; SE = 0.10; $t = 0.20_{(116)}$; $p = 0.84$) and thinking style ($\beta = 0.20$; SE = 0.10; $t = 1.41_{(116)}$; $p = 0.16$) on EE were all statistically insignificant. Only the main effect of *feelings and emotions* ($\beta = 0.22$; SE = 0.10; $t = 2.10_{(116)}$; $p = 0.04$) on EE was significant. This indicates that the *feelings and emotions* personality trait (relaxed, worrying, tough-minded, optimistic, trusting, emotionally controlled, vigorous, competitive, achieving and decisive) is a significant predictor of EE.

Table 4 also indicates that the interaction effect of gender and relationship with people ($\beta = 0.01$; SE = 0.14; $t = 0.03_{(116)}$; $p = 0.10$) and gender and feelings and emotions ($\beta = -0.13$; SE = 0.20; $t = -0.71_{(116)}$; $p = 0.50$) on EE were statistically insignificant. Only the interaction effect of gender and *thinking style* on EE ($\beta = 0.50$; SE = 0.14; $t = 2.31_{(116)}$; $p = 0.02$) was statistically significant. This indicates that the relationship between the *thinking style* personality trait (data-rational, evaluative, behavioural, conventional, conceptual, innovative, variety-seeking, adaptable, forward-thinking, detail-conscious, conscientious and rule-following) and EE was different for men and women. This relationship is illustrated in Figure 1, indicating that men reported a stronger relationship between the personality dimension of thinking style and EE than women.

No similar studies exist which investigated the moderation effect of gender on the relationship between the three personality traits as measured by the OPQ32r and EE against which to compare these results.

**TABLE 3:** Moderation analysis of age on the relationship between personality and employee engagement.

| Effect | Estimate | SE | *β* | *df* | *t* | *p* | 95% Confidence interval | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Constant | 3.90 | 0.05 | 0.00 | 116 | 75.10 | 0.00 | 3.80 | 4.00 |
| Age (23–39 + 40–56) | 0.10 | 0.10 | 0.20 | 116 | 0.90 | 0.40 | -0.11 | 0.30 |
| Relationship with people | -0.10 | 0.10 | -0.11 | 116 | -1.03 | 0.31 | -0.22 | 0.07 |
| Thinking style | 0.05 | 0.07 | 0.10 | 116 | 0.70 | 0.50 | -0.10 | 0.20 |
| Feelings and emotions | 0.20 | 0.11 | 0.21 | 116 | 1.70 | 0.10 | -0.04 | 0.41 |
| Age (23–39 + 40–56) × Relationship with people | -0.30 | 0.20 | -0.40 | 116 | -1.90 | 0.07 | -0.60 | 0.03 |
| Age (23–39 + 40–56) × Thinking style | 0.10 | 0.14 | 0.11 | 116 | 0.60 | 0.58 | -0.20 | 0.36 |
| Age (23–39 + 40–56) × Feelings and emotions | -0.10 | 0.23 | -0.12 | 116 | -0.46 | 0.65 | -0.55 | 0.34 |

Note: Model summary - $R^2$ (0.10), Adjusted $R^2$ (0.05); ANOVA - Sum-of-squares (3.30), degrees of freedom (7), $f$ (1.90), $p$-value (0.08).

$R^2$, $R$-squared value; Adjusted $R^2$, adjusted $R$-squared value, *df*, degrees of freedom; $F$, $F$-value, $p$, significance; SE, standard error; $\beta$, standardised coefficient; $t$, $t$-value.

**TABLE 4:** Moderation analysis of gender on the relationship between personality and employee engagement.

| Effect | Estimate | SE | *β* | *df* | *t* | *p* | 95% Confidence interval | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Lower | Upper |
| Constant | 3.83 | 0.05 | 0.00 | 116 | 74.60 | 0.00 | 3.73 | 3.94 |
| Gender (male + female) | -0.03 | 0.10 | -0.04 | 116 | -0.30 | 0.80 | -0.23 | 0.20 |
| Relationship with people | 0.01 | 0.10 | 0.20 | 116 | 0.20 | 0.84 | -0.13 | 0.20 |
| Thinking style | 0.10 | 0.10 | 0.20 | 116 | 1.41 | 0.16 | -0.04 | 0.24 |
| Feelings and emotions | 0.20 | 0.10 | 0.22 | 116 | 2.10 | 0.04 | 0.01 | 0.40 |
| Gender (male + female) × Relationship with people | 0.01 | 0.14 | 0.01 | 116 | 0.03 | 0.10 | -0.30 | 0.30 |
| Gender (male + female) × Thinking style | 0.33 | 0.14 | 0.50 | 116 | 2.31 | 0.02 | 0.10 | 0.62 |
| Gender (male + female) × Feelings and emotions | -0.13 | 0.20 | -0.20 | 116 | -0.71 | 0.50 | -0.50 | 0.24 |

Note: Model summary - $R^2$ (0.12), Adjusted $R^2$ (0.05); ANOVA - Sum-of-squares (3.43), degrees of freedom (7), $f$ (1.96), $p$-value (0.10).
$R^2$, $R$-squared value; Adjusted $R^2$, adjusted $R$-squared value; $df$, degrees of freedom; $F$, $F$-value; $p$, significance; SE, standard error; $\beta$, standardised coefficient; $t$, $t$-value.

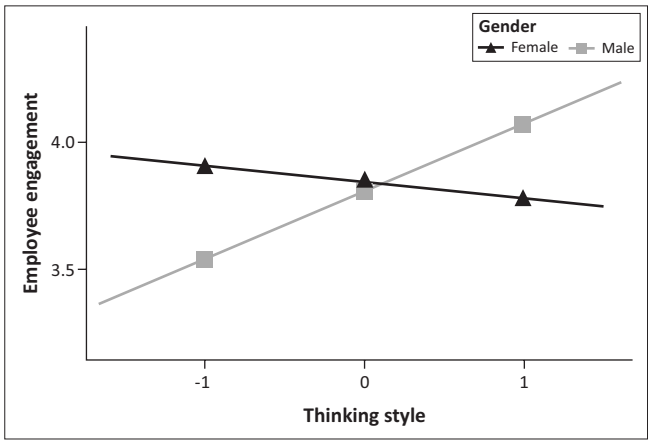


**FIGURE 2:** Graphic illustration of the moderating effect of gender on the relationship between the thinking style personality trait and employee engagement.

# Discussion

## Outline of the results

The purpose of this study was to determine the moderation effect of age and gender on the relationship between personality traits and EE. Specifically, the stated hypotheses were as follows:

**H1:** Age moderates the relationship between personality traits and EE.

**H2:** Gender moderates the relationship between personality traits and EE.

As far as the researchers are aware, this is the first study to explore how age and gender might influence this relationship.

## Descriptive statistics and correlations

Results indicate that both the OPQ32r and EEQ have high internal consistency and are reliable instruments for measuring personality traits and EE. Regarding correlations, only one of the three personality traits assessed by the OPW32r (feelings and emotions) had a statistically significant relationship with an overall EE score ($r = 0.25$, $p < 0.01$; small practical effect) (Thomas, 2019). These results diverge from prior research that has consistently reported significant positive correlations between personality traits and EE. Studies conducted across various countries and industries have identified such relationships using alternative personality assessment tools, including the 16PFQ and the Big Five Personality Factor Questionnaire (Ansari, 2021; Arora & Adhikari, 2013; Fukuzaki & Iwata, 2022; Hubbell, 2024; Ongore, 2024; Shukla et al., 2015; Young et al., 2018). A key distinction lies in the methodological approach: unlike this study, which employed the OPQ32r to assess personality traits, the aforementioned studies utilised either the 16PFQ or the Big Five Personality Factors framework. The present findings suggest that when personality traits are measured using the OPQ32r, the previously established significant relationships between personality traits and EE may not necessarily hold.

## The moderating effect of age

Hypothesis 1 proposed that age would moderate the relationship between personality traits and EE. However, the findings of the present study do not support this hypothesis. These results contradict the findings of Topino et al. (2021), who investigated the moderation effect of age on the relationship between conscientiousness, a trait within the Big Five personality framework, and job satisfaction, a construct conceptually related to EE, in an Italian study. Their study found that age significantly moderated this relationship, with stronger associations observed among younger and middle-aged employees, and weaker associations among older employees. Conversely, the current findings align with those of Makumbe et al. (2025), who reported that age did not significantly moderate the relationship between organisational engagement, a construct analogous to EE and employee performance in a study involving healthcare professionals in Zimbabwe, although personality traits were not included as variables in their analysis. The present study thus suggests that the relationship between personality traits and EE remains consistent across different age groups. Notably, no other studies were identified that specifically examined the moderating effect of age on the relationship between personality traits and EE.

Despite the expectation that age would moderate the relationship between personality traits and EE, several factors could explain the lack of moderation. While generational groups may exhibit divergent values and preferences, empirical evidence reveals a notable convergence in what drives engagement. Brough et al. (2023) found that across Baby Boomers, Generation X, Millennials and

Generation Z, factors like meaningful work, recognition and autonomy were consistently valued. This suggests that personality traits linked to these drivers may influence engagement irrespective of age. Lyons and Kuron (2014) argued that many studies on generational differences suffer from methodological inconsistencies, making it difficult to detect true age-based moderation effects. They caution that generational labels often oversimplify complex individual differences, and that chronological age alone may not capture meaningful variation in workplace behaviour. This view is supported by Gateley (2025), who stated that the assumption that generational cohorts differ significantly in workplace behaviour is often overstated, with research indicating that generational stereotypes lack support and can obscure more meaningful individual differences. Furthermore, Sammarra et al. (2022) emphasised that perceived age-related treatment and relational age – defined as how old one feels or is perceived relative to others – may be more influential than chronological age in shaping engagement. These nuanced conceptualisations of age were not incorporated into this study and could account for the absence of a detected age moderation effect. Additionally, Christian et al. (2011) identified personality traits as consistently strong predictors of EE across diverse organisational contexts, often outweighing demographic variables like age. This may account for another reason for the lack of significant age-related moderation effects observed in the present study. Adding to this, Gateley (2025) reported that when employees occupy roles that align with their personality traits, engagement tends to be high regardless of age. This supports the suggestion by Beri and Gulati (2021) that personality-job congruence may serve as a more relevant predictor of EE than age.

Although this study did not find any age-related differences in the direct relationship between personality traits and EE, prior research has consistently reported strong, positive associations between age itself and these two variables (Ansari, 2021; Arora & Adhikari, 2013; Fukuzaki & Iwata, 2022; Hubbell, 2024; Ongore, 2024; Shukla et al., 2015; Young et al., 2018). These divergent findings underscore the importance of considering individual dispositions in the investigation of EE antecedents. They also highlight the value of employing interactive models that examine the moderating role of age in the personality–EE relationship. Furthermore, these interactive models should be expanded to include other moderating variables, particularly situational factors, which may also influence the relationship between personality traits and EE.

## The moderating effect of gender

Hypothesis 2 states that gender would moderate the relationship between personality traits and EE. The results of this study provide limited support for this hypothesis. Specifically, gender was found to moderate the relationship between only one of the three personality traits assessed, namely *thinking style*, described as being data-rational, evaluative, behavioural, conventional, conceptual, innovative, variety-seeking, adaptable, forward-thinking, detail-conscious, conscientious and rule-following and EE. This moderation effect indicated that the relationship between the personality trait of thinking style and EE was stronger among male than female participants. In particular, males who scored highly on the thinking style trait were more likely to exhibit higher levels of EE compared to their female counterparts. However, gender did not moderate the relationship between the other two personality traits, namely *relationship with people* and *feelings and emotions,* and EE. This suggests that the strength of the relationship between these two personality traits and EE remains constant across genders. Therefore, the moderating effect of gender appears to be specific to the thinking style trait, with no significant gender-based variation observed for the other two personality traits.

Several plausible explanations could account for the absence of gender as a moderating variable in the relationship between the personality traits of *relationship with people* and *feelings and emotions* and EE. Although conventional gender stereotypes posit that women are generally more emotionally expressive and interpersonally oriented, contemporary empirical findings suggest minimal gender-based variation in how these traits influence workplace engagement. For instance, Reissová et al. (2019) reported comparable levels of engagement across male and female employees, implying that emotional and relational traits may exert a similar influence on EE irrespective of gender. Moreover, gender differences in emotional expression may be attenuated within professional settings because of organisational norms and the demands of emotional labour. As Taylor et al. (2021) argued, workplaces often necessitate emotional regulation aligned with role expectations, which can diminish the impact of gendered emotional tendencies on engagement outcomes. A further explanation, grounded in social exchange theory, posits that EE is fostered through perceptions of fairness, support and reciprocity – relational constructs that are valued across genders. Consequently, traits associated with interpersonal relationships and emotional sensitivity may enhance EE similarly for both men and women (Khodakarami & Dirani, 2020). In the South African organisational context, Steyn and Grobler (2013) observed that while gendered behavioural patterns are influenced by both cultural and biological factors, men and women demonstrate comparable levels of investment in workplace relationships. They also noted that emotional expressiveness does not necessarily result in divergent engagement outcomes. Thus, despite prevailing stereotypes suggesting greater emotional and relational orientation among women, empirical evidence indicates that these traits contribute to EE in a largely gender-neutral manner. This convergence may be attributed to factors such as emotional labour expectations, organisational culture and the universal value placed on interpersonal dynamics within the workplace.

The only study identified as relevant for comparative purposes with the results of the present research is that

of Williamson and Geldenhuys (2014) although their investigation did not focus on the moderating role of gender in the relationship between personality traits and EE. Instead, their study examined gender as a moderator in the relationship between work engagement, a construct closely related to EE and life satisfaction across various South African organisations. Their findings contract the results of this study regarding the moderating effect of gender, as they found a significant moderating effect of gender: male participants reported higher levels of life satisfaction when experiencing high work engagement, whereas female participants exhibited lower levels of life satisfaction as their work engagement increased.

### Practical and theoretical implications

Practically, implications are that caution is advised when employing the OPQ32r to assess personality traits in relation to EE, as more robust and valid findings may be achieved through the use of alternative instruments such as the 16PFQ or the Big Five Personality Factors Questionnaire (Thomas, 2019). Furthermore, the current evidence suggests that age and gender should not be relied upon as determinants for predicting variations in EE among individuals with differing personality profiles. This underscores the limited utility of developing HRM strategies that are tailored solely on the basis of age or gender distinctions.

Theoretical implications are that the study contributes to the understanding of EE by introducing the OPQ32r as an alternative to the traditionally dominant Big Five and 16PF models. By doing so, it expands the methodologies available for personality research in organisational contexts and evaluates the extent to which personality–engagement associations hold across different measurement instruments. This aligns with calls in the literature for greater construct diversity and contextual relevance in personality assessments used in engagement research (Albrecht & Marty, 2020). Additionally, the study also challenges assumptions embedded in engagement theory regarding the role of biographical moderators. While age and gender are frequently included in engagement models, the findings suggest that their moderating influence may be negligible when personality traits are accounted for. The findings also reinforce the notion that EE is best understood as a motivational construct, shaped by personality traits rather than demographic categories. This supports emerging theoretical models that conceptualise engagement as a manifestation of core human motives, such as autonomy, mastery and relatedness (Pincus, 2023). By grounding engagement in personality rather than demographics, the study contributes to conceptual clarity in a field often criticised for definitional ambiguity (Saks & Gruman, 2021).

### Limitations and recommendations

This study is subject to several limitations. Firstly, the research was conducted within a single division of a financial organisation in South Africa, which restricts the generalisability of the findings to other organisational contexts and sectors (Thomas, 2019). Secondly, the absence of prior studies examining the moderating effects of age and gender on the relationship between personality traits and EE, specifically using the OPQ32r as the personality assessment tool, limited the ability to compare and contextualise the results. Thirdly, the study employed a random sample of 124 employees, which may be considered relatively small; a larger sample size could have yielded more comprehensive insights and enhanced the robustness of the findings (Thomas, 2019). Fourthly, the study did not control the additional biographic variables assessed (race, roles, educational qualifications and tenure) in the regression analyses, which could have affected the internal validity of the statistical model and the accurate interpretation of the relationships among variables.

Firstly, the recommendation is to replicate this study across different organisational contexts to enable comparative analysis and enhance the generalisability of the findings. Secondly, it is recommended that future research examines the moderating effects of age and gender on the relationship between personality traits and EE using alternative personality assessment instruments, such as the 16PFQ or the Big Five Personality Factors Questionnaire, which may yield different outcomes from those observed in this study. Thirdly, future investigations should explore the moderating influence of additional biographical variables beyond age and gender, as well as situational factors, on the personality–EE relationship.

## Conclusion

The OPQ32r and EEQ demonstrated acceptable levels of internal consistency, supporting their reliability for assessing personality traits and EE within the context of a financial organisation in South Africa. However, when personality traits are assessed using the OPQ32r, the relationship between these traits and EE does not appear to be strongly established. Moreover, the findings indicate that neither age nor gender significantly moderate the relationship between personality traits and EE when the OPQ32r is employed as the personality assessment instrument.

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## Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

## CRediT authorship contribution

Candace Thomas: Data curation, Project administration, Writing – original draft. Benjamin H. Olivier: Supervision, Writing – review & editing. All authors reviewed the article, contributed to the discussion of results, approved the final version for submission and publication and take responsibility for the integrity of its findings.

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## Data availability

The data that support the findings of this study can be made available by the corresponding author, Benjamin H. Olivier, upon a motivated request.

## Disclaimer

The views and opinions expressed in this article are those of the authors and are the product of professional research. They do not necessarily reflect the official policy or position of any affiliated institution, funder, agency or that of the publisher. The authors are responsible for this article's results, findings and content.

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