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Working memory and psychological resilience in South African emerging adults

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Abstract:	The role of cognitive factors, such as working memory, in psychological resilience has not been widely investigated, although a few studies tentatively suggest a positive association. Given the contextually embedded nature of resilience, sociocultural factors may also influence any relationship between working memory and resilience, and so a concurrent triangulation, mixed method design, located in a socioecological model, was employed to explore this relationship with South African emerging adults from disadvantaged circumstances. Thirty-eight participants completed biographical, working memory and resilience measures. Fourteen of these participants were also interviewed about the perceived role of working memory processes in resilient behaviours. The results suggest that working memory processes indirectly promote resilience-enabling behaviours, while the sociocultural environment also facilitates behaviours which engage working memory and foster resilience. These findings have implications for the development of cognitively-based, resilience-promoting interventions for young adults.

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Abstract

The role of cognitive factors, such as working memory, in psychological resilience has not been widely investigated, although a few studies tentatively suggest a positive association. Given the contextually embedded nature of resilience, sociocultural factors may also influence any relationship between working memory and resilience, and so a concurrent triangulation, mixed method design, located in a socioecological model, was employed to explore this relationship with South African emerging adults from disadvantaged circumstances. Thirty-eight participants completed biographical, working memory and resilience measures. Fourteen of these participants were also interviewed about the perceived role of working memory processes in resilient behaviours. The results suggest that working memory processes indirectly promote resilience-enabling behaviours, while the sociocultural environment also facilitates behaviours which engage working memory and foster resilience. These findings have implications for the development of cognitively-based, resilience-promoting interventions for young adults.

Keywords

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Psychological resilience is the ability to successfully overcome hardships that have the potential disrupt normative development or functioning (Masten, 2014). Of the resources that appear to be universal in promoting resilience, executive functioning has been least investigated (Curtis & Cicchetti, 2003). Executive functions are cognitive processes that enable the efficient coordination and control of thought and behaviour, such as planning, decision-making, impulse control, and working memory (WM; Diamond, 2013). There is limited research regarding executive functioning and resilience, generally, and particularly amongst emerging adults (i.e., 18-30 years; Burt & Paysnick, 2012). This is concerning because many developmental transitions (e.g. transitioning away from family, forming new relationships) occur over this time, which may increase vulnerability to risk (e.g. substance abuse, depression) making it important to understand the factors that influence resilience in this age group (Arnett, 2000; Burt & Paysnick, 2012).

Executive functioning may play an important role in resilience, given that effective problem-solving, decision-making and impulse control influence our sense of personal control over life. The effective operation of executive functions depends on WM (Jurado & Rosselli, 2007), and WM is positively implicated in learning, academic success and interpersonal skill (Baddeley, 2007). Thus, investigating the potential relationship between WM and resilience in young adults adds to our understanding of the cognitive skillset underlying resilience in this developmental period.

This study utilised a socioecological conceptualisation of resilience, namely the individual's ability to access, negotiate for, and share resources that promote wellbeing in a culturally meaningful manner, as well as the capacity of the socioecological environment to supply these resources (Ungar, Ghazinour, & Richter, 2013). Here, the socioecological environment refers to the nested, interdependent environmental systems of development (Bronfenbrenner, 1979). The resilience resources in these systems are either individual, relational or cultural/contextual (Ungar & Liebenberg, 2011), and they co-operate to mediate the effects associated with adversity (Masten, 2014). Working memory is an individual resource that may promote resilience by facilitating the ability to function effectively in the various socioecological systems. The executive function of WM, as conceptualised by Baddeley (2010), is a multicomponent capability with executive control abilities that manage the allocation of attention and manipulation of language-based and visuospatial information in immediate memory. It includes short-term storage of phonological/linguistic and visuospatial information, as well as active management of such information.

Working Memory and Resilience

Theoretically, WM should facilitate resilience by enabling individuals to organise and assimilate verbal and/or nonverbal information associated with adverse circumstances, to plan and make appropriate decisions to guide behaviour, and to regulate emotions,

thereby enabling the adaptation to and coping with adversity (Evans, Kouros, Samanez-Larkin, & Garber, 2016; Levens, Armstrong, Orejuela-Dávila, & Alverio, 2017).

Two studies have investigated the relationship between WM and resilience (Avci et al., 2013; Wingo, Fani, Bradley, & Ressler, 2010). Avci et al. (2013) found that WM was significantly and positively related to resilience for underprivileged American youth. Wingo et al. (2010) found that resilient African American adults from disadvantaged backgrounds had better nonverbal WM compared to less resilient participants, while verbal WM did not differ between resilient and vulnerable participants. This suggests a potential differential relationship between resilience and the components of WM. However, neither study provided a theoretical conceptualisation of WM; Avci et al. (2013) used a single measurement of WM, while Wingo et al. (2010) did not use a resilience measure with established psychometric properties, thus limiting the construct validity of measurements in these studies. This highlights the need for psychometrically sound research investigating how WM relates to resilience.

A few studies have implicated the broader construct of executive functioning in resilience (Masten, 2014). Conceptually, executive functioning should enable resilience as it facilitates effective problem-solving through the assessment of information and the flexible evaluation of potential courses of action to solve problems. It is implicated in both behaviour and emotion regulation, assisting the individual to control emotional

responses to adversity and respond appropriately in different contexts (Masten & Wright, 2010).

Empirically, there is indirect evidence that executive functioning promotes and is positively associated with resilience (Bonanno, Romero, & Klein, 2015; Cicchetti & Rogosch, 1997; Masten et al., 2012; Obradović, 2010; Wu et al., 2013). However, studies vary considerably in their operationalisation of resilience, often using indirect measures, such as school outcomes (Cicchetti & Rogosch, 1997), school adjustment criteria and/or psychopathology measures (Masten et al., 2012; Obradović, 2010). Furthermore, the samples comprised children and adolescents from developed, Western backgrounds, with the exception of Masten et al. (2012) and Obradović (2010), who sampled homeless children from the United States. Closer to our study, there is evidence that the executive functions of self-regulation, cognitive flexibility and problem-solving promote resilience in young, Black South Africans (SA) (Theron, 2017). This small body of research suggests a potential relationship between WM (which underlies executive functioning), and resilience.

Relevance for South Africa

Many SA adults bear the consequences of apartheid policies, which places them at risk for negative education outcomes (Spaull, 2015). Consequently, research into the cognitive resources implicated in resilience could have important implications for appropriate resilience-building initiatives. Such an investigation also contributes to

cross-cultural understandings of resilience-promoting resources which are often assumed to be universal and cross-culturally valid (Masten, 2014). However, these resources may not be identical across contexts (Ungar, 2011), since socioculturally-specific values influence resilience (Theron & Phasha, 2015). For example, how Black SA youths use their cognitive skills to resile is influenced by significant others, cultural values and access to quality education (Van Breda & Theron, 2018; Zulu, 2018).

Given the limited research about the role of WM in resilience, our study employed a mixed method approach to investigate the following research question: 'What is the role of WM in the resilience of SA emerging adults from disadvantaged circumstances?' WM is typically measured with psychometric tests (Baddeley, 2010), but such an investigation is limited as quantitative measures are unable to tap how WM may operate within the socioecological environment to promote resilience. Thus, a mixed method approach was adopted, where the quantitative phase focused on the question: 'Are the components of WM related to resilience for SA emerging adults?' The research questions that guided the qualitative phase of the study were: 'Do WM processes feature in these emerging adults' resilience accounts?' and 'Do sociocultural factors feature in these accounts?'

Method

A parallel-databases concurrent triangulation research design was used (Creswell & Plano Clark, 2011). This involved simultaneous quantitative and qualitative phases

which were equally prioritised, conducted separately, and compared and synthesised in the discussion (Creswell & Plano Clark, 2011).

Participants

A nonprobability, convenience, volunteer sample of 38 students from an English-medium, urban university (*M age*=24.52 years, *SD*=1.65 years, 21 females) participated in the quantitative phase. The power of this sample was .60 (.05 level of significance), with a moderate effect size (.35; Cohen, 1988). Fourteen of these participants also volunteered to continue with the qualitative phase (*M* age= 23.93 years, *SD*= 1.29 years, 7 females). Attempts were made to sample to saturation, but this was limited by time constraints and volunteer rates. Both samples were nested, as the qualitative phase drew on a subset of the sample from the quantitative phase (Cresswell & Plano Clark, 2011). Participants attended Quintile 3 public high schools, which service the poorest areas (Spaull, 2015), and none spoke English as a home language. As students at an English-medium, urban university, participants were test-wise, computer literate and proficient in English, the latter a prerequisite for enrolment at the university (Laher & Botha, 2012). Exclusion criteria were any self-reported issues that may negatively affect cognitive functioning, such as a history of drug or alcohol use, head injury or concussion, diagnosed psychiatric, learning or language disorders.

Instruments

Biographical questionnaire. This captured information regarding gender, age, home language and schooling for descriptive purposes.

The Automated Working Memory Assessment (AWMA; Alloway, 2007). This computerised test is based on Baddeley's (2010) WM model, and assesses both verbal and nonverbal components of short-term memory (STM) and WM. Each memory component (i.e., verbal STM, verbal WM, visuospatial STM and visuospatial WM) is assessed with three subtests. Verbal STM was assessed with Digit Recall, Word Recall and Non-Word Recall; verbal WM comprised Listening Recall, Counting Recall and Backward Digit Recall; visuospatial STM was evaluated with the Dot Matrix, Mazes Memory and Block Recall tasks, and visuospatial WM was assessed with the Odd-One Out, Mr. X and Spatial Span tasks (Alloway, 2007). Higher scores represent better performance (Alloway, 2007).

The AWMA has sound psychometric properties for UK youth (Alloway, 2007), appears valid for SA youth (Cockcroft, Wigdorowitz, & Liversage, 2019), is culturally fair, and not influenced by socioeconomic status (Cockcroft, Bloch, & Moolla, 2016).

The Resilience Research Centre Adult Resilience Measure (RRC-ARM; Ungar & Liebenberg, 2013). This paper-based, self-report measure of resilience-promoting resources is based on a socioecological framework of resilience (Ungar & Liebenberg, 2011, 2013). The RRC-ARM comprises section A (demographic questions), section B (optional community-site specific questions) and section C (the socioecological measure

of resilience; Ungar & Liebenberg, 2013). We replaced Section A with a more detailed biographical questionnaire and omitted Section B as it did not fit the purpose of the study. Section C has four options: two 28-item versions and two shorter versions comprising 12 items each. The long and short versions are available as either a 5-point Likert scale (1 = not at all; 5 = a lot), or a 3-point Likert-scale (No, Sometimes, Yes). The first version offers greater response variance and is suitable for participants with proficiency in English reading comprehension. Option one, Section C was used (28 items on a 5-point Likert scale). The 28 items comprise eight clusters, which represent three subscales of resilience resources: individual capabilities (personal skills, peer support and social skills clusters), relationships with important individuals (physical caregiving and psychological caregiving clusters), and contextual factors that promote a sense of belonging (spiritual, educational and cultural clusters). Higher scores indicate more resilience-enabling resources and thus greater potential for resilience.

The RRC-ARM is an adapted version of the Child and Youth Resilience Measure -28 (CYRM-28), with slightly reworded items suitable for adults. It was validated on a Canadian sample (individual subscale: $\alpha = .803$; relational subscale: $\alpha = .833$; contextual subscale: $\alpha = .794$; Liebenberg & Moore, 2018). In the current study, the internal consistency reliability of the total RRC-ARM was $\alpha =. 88$, and for the subscales: Individual Resources = .79, Relational Resources = .83, Contextual Resources =. 62.

Interview schedule. In the qualitative phase, a semi-structured interview was used comprising 12 questions informed by that of Ungar and Liebenberg (2011), and adapted based on the WM and resilience literature, to suit the current study. Example questions included: 'Can you tell me about the personal challenges that you have experienced in your life?', 'How would you describe the role that other people have played in helping you overcome these challenges?', 'What role has cultural values or religious beliefs played, in helping you overcome these challenges?'

Procedure

Participants were recruited through email and telephone, from a larger project investigating working memory in emerging adults from disadvantaged backgrounds. The participant information sheet indicated that the quantitative phase could be completed in person or online through LimeSurvey. Participants who volunteered only for the quantitative phase of the study received the link to the online measure (the demographic questionnaire and the RRC-ARM). Those who were willing to complete both phases were assessed and interviewed individually, with quantitative data collection taking place first, which took approximately 30 minutes. Thereafter, interviews were conducted individually for approximately one hour. Both phases were conducted in English by the first author.

Scores on the AWMA from an earlier component of the larger project were used in the quantitative phase, since WM ability remains stable from young adulthood (Hale et al., 2011).

Ethical Considerations

Ethical clearance was obtained from the University of the Witwatersrand's Human Research Ethics Committee (protocol number: MPSYC/16/001). Informed consent was obtained from participants at each phase of the study, with appropriate opportunities for withdrawal without prejudice. The principles of fairness, beneficence and non-maleficence were observed. Participants were compensated for their time and travel costs.

Data Analysis

For the quantitative phase, descriptive statistics and Pearson's product-moment correlations were calculated between the AWMA and RRC-ARM components.

For the qualitative phase, data were analysed by the first author using thematic analysis (Braun & Clarke, 2012). Since the research questions were exploratory, an experiential analytic approach was adopted. Coding was both inductive and deductive as it was driven by the data and guided by the WM literature (Braun & Clarke, 2012). Themes were reviewed by all authors prior to finalisation of the analysis.

Results

Quantitative Results

Descriptive statistics. The data was generally normally distributed. Table 1 shows raw score means and standard deviations for the WM and resilience measures.

[Table 1]

Correlations. Pearson's correlations were run between the WM scores, and the RRC-ARM subscales and question clusters to determine whether they were significantly related (Table 2). The slightly lower power meant that there was a possibility of Type II errors (Cohen, 1988).

[Table 2]

Significant negative correlations emerged between physical caregiving and Block Recall (r = -.332, p <. 05), nonverbal STM (r = -.320, p < .05), Spatial Recall (r = -.457, p < .01) and nonverbal WM (r = -.323, p < .05). Significant, weak, positive correlations were found between spiritual resources, and Digit Recall (r = .391, p < .05) and verbal STM (r = .321, p < .05).

Qualitative Results

Thematic analysis was used to search for resilience resources mentioned by participants. Working memory processes manifest in problem-solving behaviour, self-talk, developing action plans and evaluating information, and largely operate in an automated manner that is not always accessible to consciousness (Diamond, 2013). Such manifestations of WM guided the search for evidence of WM functioning in relation to participants' resilience. Two themes were identified: a) Participants' actions

related to WM and b) Systemic supports that bolstered WM functioning. (Participants are referred to by numerical pseudonyms, e.g. Participant 2).

Participants' actions related to WM. Three actions related to WM were identified as promoting participants' resilience, namely: self-talk, setting and focusing on goals, and finding multiple solutions to problems.

Self-talk as a resilience-promoting resource. Self-talk is the covert or overt speech addressed to oneself for the purposes of self-regulation (Vygotsky, 1986). It involves simultaneously working with, and organizing, information, thus drawing on verbal STM and executive control in WM (Wekerle, Waechter, & Chung, 2012). Participants used self-talk to regulate their behaviour and motivate themselves to overcome challenges. For example, Participant 7 stated: "… I reminded myself every day that, 'Okay. I'm here now. I can't go back. I have to keep moving forward', so just staying positive … it actually helped." Others used self-talk to reflect on their challenges. For example, Participant 9 reflected on the experience of failing, which they indicated was due to lack of time management, overwhelming workload and moving out of residence:

> …after failing [at university], I was, 'Okay, now you need to really, really, learn the work.'… when you fail something – a course – you know during the exam that, 'Okay, I've actually done bad here.' And at that instant, it is much easier to identify the factors why … And then, ja, so I'm not – I'm very aware of the reasons why…

> So, most of the time I – the failure is just - I don't take it badly, like, it's because I know the reason why.

This example shows self-talk to reflect on problems and generate solutions for these, and thus resile, corroborating evidence for self-talk as a resilience-promoting strategy (Wekerle et al., 2012).

Resilience promotion through setting and focusing on goals. The setting and execution of goals requires that information be held, evaluated, updated and stored in WM (Diamond, 2013). Participants reported setting and focusing on personal goals as a motivational strategy to overcome challenges, and thus promote resilience. For example, Participant 5 stated:

> … it [having a goal] is just something about looking forward to what you have to do that helps you to deal with what you are facing right now, because you know that if you don't deal with this then you are not going to get to work on that goal.

For some participants, the role of individual goals in promoting resilience was motivated by a desire to help others within their immediate, or wider social network. For example, Participant 14 said:

> …I want to be successful. I want to have a great career where there is a lot of growth and personal development and benefit for whatever organizations I will be working for, but at the end of the day I don't want to find myself or the people around me still

> in poverty. I want to get myself or the people around me whatever they need. … it [this goal] pushes me further…

Personal (Van Breda & Theron, 2018) and community-oriented goals (Mosavel, Ahmed, Ports, & Simon, 2015) have been identified as resilience-promoting resources for SA youth.

Finding multiple solutions to problems. The efficient functioning of executive control in WM (Baddeley, 2010) may promote resilience by enabling the generation and evaluation of multiple novel solutions to adverse circumstances (Williams, Suchy, & Rau, 2009). Problem-solving was a strategy employed by several participants, for example, Participant 2 reported generating and using these solutions for her academic challenges:

> "… I would go to my friend, 'I don't understand this, explain to me'. And they would explain it to me, and we write a test and we all pass, and it was good. …"
>
> "….being persistent works. Having a positive attitude when things don't look like they are doable but you still tell yourself you can do it- that also works. Prayer. That works. Hard work, that's important. That also works."

Some solutions to challenges were obtained from others in the participants' social networks. For example, Participant 2 sought help with academic challenges from friends. Similarly, Participant 12 reported overcoming her academic challenges: "…I just motivated myself…I studied harder. This time I read…I tried to seek for help,

because first year I didn't...I realized that I cannot actually pass on my own. I need to work with other people…"

Participants utilised both individual and social pathways to find multiple solutions to challenges, which promoted their resilience. The role of problem-solving in the resilience of Black SA youth appears to be dependent on support received from the socioecological environment (Theron, 2017; Van Breda & Theron, 2018).

Systemic supports that bolster WM functioning. There was evidence that broader systemic supports facilitated participants' behaviours which engaged WM and fostered resilience. Three subthemes were identified here: external encouragement of goal-directed behaviour, modelling of problem-solving, and externally-driven cognitive reappraisal of challenging circumstances.

External encouragement of goal-directed behaviour. Working memory processes underpin goal-directed behaviour (Diamond, 2013), while social networks encouraged participants to persist with goal-directed behaviour, despite challenging circumstances. For example, Participant 4 was experiencing academic and financial challenges, and stated: "…they [parents] would always encourage me …they'll just keep saying, 'You know what, keep on studying. Once you get educated, all will be well."

Similarly, Participant 8 mentioned that the support provided through his social spiritual networks (i.e. religious groups and gatherings) helped him to persist at

achieving his academic goals in the face of financial and familial challenges: "It [religion] - it really, I mean, being part of the group of people who really encourage you to stay academically excellent…" Comparably, educators' encouragement of goal-directed behaviour has been shown to promote the resilience of Black SA adolescent girls (Jefferis & Theron, 2017).

Modelling problem-solving. Participants' interactions with others who have faced similar challenges served to guide their problem-solving methods during challenging circumstances. Working memory processes transfer these external models to become internal cognitive guides that facilitate problem-solving actions (Vygotsky, 1986), and recall and update these guides (Baddeley, 2010). For example, Participant 14 said:

> … so talking about your day to day challenges, day to day emotions, there are people who have been in those kinds of situations so they have experienced them and they see things in more than one dimension so in a way they can guide me or show me.

Some participants drew on spiritual models. For example, Participant 11 indicated that, "…just seeing how other people in the Bible went through challenges which are weirdly similar to the things that I am going through… that really helps."

The external systemic resources that participants had access to thus exposed them to others who had faced similar challenges. These 'others' acted as models for

problem-solving during difficult circumstances, corroborating findings with resilient Black SA street youth (Malindi & Theron, 2010).

Externally-driven cognitive reappraisal of challenging circumstances. Working memory is implicated in the positive cognitive reappraisal of stressful events (Pe, Raes, & Kuppens, 2013), which promotes emotion regulation and resilience (Wu et al., 2013). Participants suggested that the support and encouragement received from their social networks enabled them to positively reappraise challenging circumstances. For example, Participant 2 indicated "…the support that I got from family and friends made me change an attitude, and let me be positive and do this..." Similarly, Participant 3 said: "...it was just that encouragement [from family] you know it was- you know it's like positive reinforcement..." This echoes findings regarding adaptive meaning-making and resilience amongst Black SA youth (Van Breda & Theron, 2018).

Discussion

Conceptually, WM processes should assist resilience-enabling behaviours. However, empirical evidence regarding this relationship is limited, particularly amongst emerging adults from non-Western contexts. Consequently, this study investigated the role of WM in the resilience of SA emerging adults from disadvantaged backgrounds. While the largely non-significant quantitative findings suggest that WM does not play a role in resilience of SA emerging adults, the qualitative findings suggest otherwise.

In the quantitative phase, a significant relationship emerged between one verbal STM measure (Digit Recall), and spiritual resilience resources. The role of this store in language learning (Baddeley, 2007) suggests that it assisted participants to engage in language-based spiritual activities that helped them to resile. This finding was echoed in the qualitative theme, modelling of problem-solving, where participants drew on spiritual models for guidance, and supported evidence that religion/spirituality promotes resilience for Black SA youth (Theron, 2017; Van Breda & Theron, 2018).

The other significant relationship between WM and resilience measures was a weak, negative correlation between physical caregiving resources and Block Recall (nonverbal STM) and Spatial Recall (nonverbal WM). This result is difficult to explain and could be a Type I error (false positive). The remainder of the WM and resilience scores were not significantly correlated (c.f. Avci et al., 2013; Wingo et al., 2010). While this may be due to the sample size or random errors in measurement, a possibility is that the contextually-reduced manner in which the AWMA evaluated WM.

The qualitative analysis was better able to capture the contextual factors that defined associations between WM and resilience. Three resilience-promoting themes were identified, namely self-talk, setting and focusing on goals, and finding multiple solutions to a problem. These actions reflect the operation of WM processes (cf. Alderson-Day & Fernyhough, 2015; Jurado & Rosselli, 2007), with goal-setting and problem-solving promoting the resilience of SA youth (Theron, 2017; van Breda &

Theron, 2018). The latter two subthemes also suggest that broader systemic contexts influence WM-related behaviours that promote resilience, as some participants' goal-directed and problem-solving behaviours were facilitated by micro- and macrosystemic factors (Bronfenbrenner, 1979), corroborating findings with Black SA youth (Theron, 2017; Van Breda & Theron, 2018).

Three further subthemes suggested that systemic supports facilitate WM actions that enable resilience. These were mesosystemic encouragement of goal-directed behaviour, modelling of problem-solving by verbal instructional and symbolic models within the social ecology, and positive cognitive reappraisal of challenging circumstances facilitated by others in the mesosystem (Bronfenbrenner, 1979). Systemic support facilitates the resilience of Black SA youth (Van Breda &Theron, 2018). Working memory was more indirectly involved in these subthemes, in that it is implicated in goal-directed behaviour, problem-solving and cognitive reappraisal (Diamond, 2013).

An integration of the quantitative and qualitative findings enables some understanding of the discrepant findings across the phases. The qualitative findings indicated that WM-related resilience processes are shaped by the sociocultural context, and so the largely non-significant quantitative findings may be related to the AWMA measurement of WM. As an individualistic measure of WM, the AWMA is unable to

tap the socially-driven, WM-related resilience processes that appeared to be most relevant.

Considering the qualitative and quantitative findings together, it is possible that a psychometric measure of WM may not be most appropriate for investigating its role in resilience. As reflected in the qualitative findings, this is because WM cannot be considered separately from the socio-ecological environment. In addition, dividing cognition into different components provides an artificial sense of how it actually works, and a more holistic approach may serve this purpose better.

Some of the limitations of the study include the cross-sectional design which prevented exploration of how resilience processes change over time (Theron, 2017) and the correlational design in the quantitative phase which prevented the drawing of causal conclusions. The lack of multivariate statistics and exploration of confounding variables are also limitations, as multiple variables may simultaneously influence resilience processes and these were not investigated (Ungar, 2011). Other limitations include the use of the RRC-ARM whose psychometric properties are still under investigation (Ungar & Liebenberg, 2013), the small sample size, the non-random sampling of a very specific group of individuals as this may have compromised the study's ecological validity and the generalisability of the quantitative findings, and the use of a nested sample as this may have compromised the validity of the mixed method findings (Creswell & Plano Clark, 2011).

Conclusion

The findings suggest that WM may facilitate the resilience of SA emerging adults from disadvantaged contexts, a relationship which appears to be influenced by the socioecological environment. This has implications for developing cognitively-based, resilience-promoting interventions for young adults from non-Western, developing contexts. Further research is needed that explores this relationship in a variety of sociocultural contexts.

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Table 1.

Descriptive Statistics for Working Memory and Resilience Variables (N=38)

	Mean	Standard Deviation	Range	
			Minimum	Maximum
AWMA Scores				
Digit Recall	33.34	5.82	24	49
Word Recall	25.53	4.03	19	36
Nonword Recall	16.08	3.48	9	23
Verbal short-term store	24.98	3.75	19	35
Listening Recall	15.79	3.47	12	24
Counting Recall	26.47	5.17	12	38
Backward Digit Recall	17.39	4.97	8	33
Verbal WM	19.89	3.79	13	29
Dot Matrix	30.66	6.03	18	47
Mazes Memory	28.89	4.26	19	40
Block Recall	30.03	5.05	18	44
Nonverbal short-term store	29.86	3.95	20	40
Odd-One-Out	27.08	5.58	18	42
Mr X	19.32	5.66	11	31

	Mean	Standard Deviation	Range	
			Minimum	Maximum
Spatial Recall	23.89	6.60	17	42
Nonverbal WM	23.43	4.91	15	35
RRC-ARM Subscales				
Individual Resources	46.87	5.32	35	55
Relational Resources	29.18	5.09	18	35
Contextual Resources	41.82	4.70	32	50
RRC-ARM Question Clusters				
Individual: Personal Skills	22.84	1.78	19	25
Individual: Peer Support	8.03	1.82	3	10
Individual: Social Skills	16.24	2.75	8	20
Relationships: Physical Caregiving	8.79	1.40	5	10
Relationships: Psychological Caregiving	20.39	3.98	12	25
Context: Spiritual	11.89	2.82	6	15
Context: Education	8.08	1.60	4	10

	Mean	Standard Deviation	Range	
			Minimum	Maximum
Context: Cultural	21.74	2.33	15	25

Table 2.

Pearson's Correlation Coefficients between AWMA and RRC-ARM scores (N=38).

	1. Digit Recall	2. Word Recall	3. Non-Word Recall	4. Verbal STM	5. Listening Recall	6. Counting Recall	7. Backward Digit Recall	8. Verbal WM	9. Dot Matrix	10. Mazes Memory	11. Block Recall	12. VS STM	13. Odd One Out	14. Mister X	15. Spatial Recall	16. VS WM	17. Individual	18. Relationships	19. Context	20. Personal Skills	21. Peer Support	22. Social Skills	23. Physical Caregiving	24. Psychological Caregiving	25. Spiritual	26. Education	27 .Cultural
1	1																										
2	.565**	1																									
3	.549**	.544**	1																								
4	.891**	.820**	.789**	1																							
5	.340*	.606**	.322*	.493**	1																						
6	.292	.374*	.205	.349*	.551**	1																					
7	.475**	.498**	.289	.514**	.598**	.494**	1																				
8	.444**	.573**	.318	.534**	.817**	.839**	.844**	1																			
9	.466**	.352*	.166	.419**	.487**	.379*	.317	.460**	1																		
10	.384*	.283	.420**	.431**	.326*	.188	.146	.249	.274	1																	
11	.448**	.237	.174	.371*	.251	.193	.425**	.350*	.609**	.215	1																
12	.566**	.382*	.309	.526**	.472**	.343*	.395*	.473**	.867**	.591**	.813**	1															
13	.404*	.470**	.251	.456**	.565**	.373*	.459**	.543**	.607**	.139	.596**	.613**	1														
14	.307	.388*	.010	.301	.472**	.356*	.142	.368*	.507**	.241	.408*	.519**	.443**	1													

15	.430**	.309	.196	.394*	.481**	.512**	.357*	.536**	.654**	.506**	.438**	.702**	.427**	.679**	1												
16	.464**	.466**	.187	.465**	.612**	.507**	.388*	.587**	.718**	.372*	.579**	.746**	.740**	.856**	.871**	1											
17	.143	.153	.182	.185	-.008	.063	-.104	-.019	-.116	.192	-.151	-.055	-.179	.174	.050	.022	1										
18	-.099	.060	-.042	-.043	-.064	.059	-.091	-.032	-.283	-.014	-.278	-.267	-.144	-.004	-.304	-.192	.441**	1									
19	.138	.047	.081	.113	-.069	.076	-.103	-.031	-.090	.140	-.154	-.061	-.120	.017	-.086	-.078	.654**	.661**	1								
20	-.002	.080	.150	.074	.091	-.036	-.143	-.051	-.071	.076	-.141	-.069	-.138	.225	.031	.048	.829**	.245	.541**	1							
21	.193	.219	.161	.228	.095	.156	.005	.102	.040	.265	-.050	.094	-.120	.240	.250	.159	.816**	.145	.496**	.693**	1						
22	.149	.096	.145	.156	-.137	.040	-.110	-.072	-.204	.143	-.166	-.123	-.174	.028	-.090	-.095	.841**	.591**	.576**	.484**	.452**	1					
23	-.190	.049	-.102	-.113	-.127	-.109	-.163	-.160	-.262	-.126	-.332*	-.320*	-.147	-.162	-.457**	-.323*	.249	.845**	.437**	.084	.034	.401*	1				
24	-.060	.059	-.018	-.015	-.037	.114	-.059	.015	-.269	.026	-.239	-.229	-.133	.052	-.228	-.133	.476**	.982**	.691**	.284	.174	.615**	.730**	1			
25	.391*	.188	.163	.321*	-.119	.141	.129	.084	.181	.175	-.006	.153	.018	-.111	.060	-.009	.359*	.320	.710**	.202	.253	.391*	.173	.349*	1		
26	-.145	-.116	.018	-.111	-.163	.133	-.245	-.097	-.300	-.090	-.208	-.273	-.222	-.048	-.209	-.196	.608**	.506**	.650**	.517**	.472**	.519**	.358*	.522**	.170	1	
27	-.097	-.054	-.047	-.084	.117	-.108	-.194	-.098	-.193	.130	-.160	-.120	-.110	.201	-.102	-.010	.460**	.589**	.699**	.485**	.364*	.326*	.422**	.606**	.098	.411*	1

Note. STM = short term memory, WM = working memory, AWMA scores = 1 to 16. RRC-ARM subscale scores = 17 to 19, RRC-ARM question clusters = 20-27.

* $p < .05$. ** $p < .01$.