Verbal Linguistics Intelligence and Self-Directed Learning in EFL Writing Problem Solving: A Study of Grit's Mediating Influence

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Abstract:

In EFL writing, the interplay of Verbal linguistic intelligence and self-directed learning, influenced by grit, is crucial for enhancing proficiency. This research aims to explore the intricate relationship between linguistic intelligence, independent learning, and the pivotal role of grit. A cross-sectional design was instituted, encompassing 228 participants, aged 20-25, from a renowned private university in Malang, Indonesia. The Grit Scale by Duckworth et al. (2007) gauged participants' perseverance, while tools grounded in Hayes and Flower's paradigms assessed self-directed Learning. Verbal-linguistic Intelligence was appraised using the MIDAS tool. The findings illuminate the intricate dynamics of Verbal linguistics Intelligence, self-directed learning, and grit in academic writing. Verbal Intelligence strongly correlated with the constructs, underscoring its cardinal role in academic writing and analytical capabilities. Grit emerged as a crucial mediator between Self-Directed Learning, Verbal Intelligence, and writing problem-solving strategies, presenting a promising avenue for targeted pedagogical interventions. This investigation bolsters the foundation of resilient educational assessment tools and magnifies the transformative potential of grit and linguistic prowess in sharpening analytical abilities. Further studies should expound upon these relationships across diverse landscapes, remaining mindful of inherent biases.

Keywords: academic writing, EFL, grit, SDL, verbal linguistics intelligence

1. INTRODUCTION

Developing practical writing skills is paramount in learning English as a Foreign Language (EFL) (Asmorowati et al., 2021; Raković et al., 2023). EFL learners face unique challenges as they strive to master the intricacies of English grammar and vocabulary and the art of expressing their thoughts and ideas coherently in a foreign language (Zhao, 2022; Yang et al., 2021). Writing, a multifaceted task, often requires learners to engage in problem-solving activities to overcome language barriers and create meaningful compositions (Budianto et al., 2022). This study investigates the intricate interplay between two pivotal factors influencing EFL writing - Verbal Linguistic Intelligence and Self-Directed Learning (Garavand et al., 2023; Haddaji, 2022). Moreover, it explores the mediating impact of grit within this complex relationship (Lee & Yuan, 2021; Solhi et al., 2023).

The field of EFL writing pedagogy has evolved significantly in recent years, with a growing emphasis on learner-centred approaches and self-directed Learning (Hsieh, 2022; Kim et al., 2022). In this context, grit has gained attention as a psychological trait that can significantly impact language learning and problem-solving abilities (Duckworth et al., 2007). Grit, commonly understood as the determination and enthusiasm for achieving long-term objectives, is crucial for academic achievement and honing skills like writing (Dewi et al., 2023; Duckworth, 2016).

Verbal Linguistic Intelligence, a component of Howard Gardner's Theory of Multiple Intelligences (Mehiri, 2020), refers to the ability to understand and manipulate spoken and written language ((Garavand, Azizifar, Gowhary, & Welidi, 2023); Intan et al., 2022). This intelligence type is especially relevant in EFL writing, where language mastery is central to effective communication (Depari, 2023; Handayani et al., 2021a 2021b). Integrating linguistic Intelligence with self-directed Learning can be a powerful combination, as learners with high linguistic Intelligence may be better equipped to navigate the complexities of writing autonomously (Raković et al., 2023; Intan et al., 2022).

Previous studies have explored the relationship between linguistic intelligence and language learning outcomes (Garavand et al., 2023; Intan et al., 2022). Garland et al. (2023) investigated the relationship between linguistic Intelligence and grammar performance, highlighting the potential impact of linguistic Intelligence on language proficiency. Similarly, Intan et al. (2022) examined how verbal-linguistic Intelligence influences students' English speaking skills when digital media is used as a teaching tool. These studies shed light on the significance of linguistic Intelligence in language-related tasks.

On the other hand, self-directed Learning has been identified as a crucial aspect of effective language acquisition (Alghamdi, 2021; Rezai et al., 2022). Students who take the initiative in their learning process tend to be more motivated and successful in language acquisition. The development of self-directed learning skills is particularly relevant in the context of the COVID-19 pandemic, which necessitated a shift toward remote and independent learning (Alghamdi, 2021; Kim et al., 2022).

Grit has been empirically established as an intermediary in the relationship between various variables and academic achievement (Lee & Yuan, 2021; Solhi et al., 2023b). It bridges individual characteristics and learning outcomes, including writing proficiency (Lee & Yuan, 2021; Solhi et al., 2023). Grit influences students' ability to persevere through writing challenges, persist in difficulties, and self-regulate their learning process (Hwang & Oh, 2021).

Numerous previous studies have examined the roles of linguistic Intelligence, self-directed Learning, and grit individually. For instance, the role of linguistic intelligence in grammar performance and speaking abilities has been explored (Garavand, Azizifar, Gowhary, & Welidi, 2023; Intan et al., 2022), while the importance of self-directed learning, especially in the backdrop of the COVID-19-induced shift towards distance learning, has been highlighted (Alghamdi, 2021; Kim et al., 2022a). Additionally, the psychological attribute of grit and its effect on language learning and problem-solving has been given attention in recent years (Duckworth et al., 2007; Solhi et al., 2023).

However, despite these insightful studies, there remains a conspicuous research gap. The comprehensive interaction and convergence of linguistic intelligence, self-directed learning, and grit within the specific context of EFL writing problem-solving is a dimension that has been relatively under-researched. While studies have individually touched upon these factors (Hsieh, 2022; Lee & Yuan, 2021; Dewi et al., 2023), a combined exploration elucidating the intricate dynamics and relationships among these elements in EFL writing is still wanting.

The primary objective of this study is to address this notable absence in the literature. It intends to delve deep into the intricate interplay of these elements, particularly emphasizing the consequential mediating influence of grit within EFL writing problem-solving. This endeavour promises to offer ground-breaking insights, carving a new pathway for future research and pedagogy in EFL writing instruction.

2. LITERATURE REVIEW

2.1 EFL Learners' Academic Writing Problem Solving

Academic writing is indispensable to English as a Foreign Language (EFL) education. Its importance emanates from consolidating the learner's language proficiency and furnishing the foundational scaffold to express complex ideas, craft arguments, and engage in scholarly discourse (Lee & Yuan, 2021). Academic writing, however, is a more complex endeavour. EFL learners often grapple with the intricacies of constructing coherent arguments, utilizing appropriate vocabulary, and maintaining cohesion while navigating a non-native language's nuances (Murtadho, 2021).

However, academic writing is more than just a manifestation of linguistic expertise. It requires an intricate interplay of cognitive skills, notably problem-solving. EFL learners often find themselves at a crossroads, decoding prompts, seeking apt references, and framing their responses aptly. Problem-solving becomes pivotal in such situations. The immersion of technology, such as virtual reality, in EFL pedagogy further underscores the need for EFL learners to hone their problem-solving prowess, as such platforms present distinct challenges and opportunities in the academic writing landscape (Chen et al., 2021).

Güner & Erbay (2021) illuminate the confluence between metacognitive skills and problem-solving, implying that EFL learners must be equipped with linguistic tools and strategies to introspect, evaluate, and iterate their writing processes. Indeed, the complexities of academic writing mandate a pedagogical approach that emphasizes problem-solving as a crucial meta-skill, synergizing with linguistic competencies to help EFL learners excel in their academic endeavours.

To bolster this paradigm, educators are increasingly turning towards innovative instructional methodologies. For instance, implementing Problem-Based Learning into EFL settings has been highlighted as a potential panacea to bridge the gap between linguistic proficiency and problem-solving acumen, preparing learners to face multifaceted writing challenges confidently and competently (Simanjuntak et al., 2021).

In summation, as the landscape of EFL academic writing continues to evolve, intertwined with technological advancements and shifting pedagogical paradigms, the emphasis on problem-solving as an essential companion to linguistic prowess becomes ever more pronounced. EFL learners can genuinely realize their academic writing potential through a harmonious melding of these skills.

2.2 Verbal Linguistic Intelligence in EFL Academic Writing

Verbal linguistic Intelligence refers to an individual's capacity to use words effectively in speaking and writing. This Intelligence encompasses thinking in words, using language for self-expression, and understanding the meaning of complex word structures and nuances in different contexts (Handayani et al., 2021). Further, linguistic Intelligence involves syntax, phonetics, semantics, and pragmatic language usage. Intan et al. (2022)elucidate how using digital media, particularly audio-visual aids, in the classroom can amplify the development of verbal-linguistic Intelligence, especially when enhancing students' speaking skills.

In academic writing, the role of verbal-linguistic Intelligence must be emphasized. Academic writing necessitates a profound understanding of language, clarity in expression, and the capability to present arguments coherently. Proficiency in verbal-linguistic Intelligence ensures that EFL learners can craft well-structured, coherent, and linguistically appropriate academic essays (Depari, 2023). Additionally, Zhao (2022) introduced how leveraging artificial intelligence technology, like Wordtune, can act as a digital assistant for EFL writers, emphasizing the importance of linguistic Intelligence in adapting to modern digital tools.

Numerous studies have investigated the nexus between verbal-linguistic Intelligence and academic writing proficiency. Handayani et al. (2021) investigated its influence on students' learning outcomes in English and found a significant correlation between heightened verbal-linguistic Intelligence and superior learning outcomes in English. Similarly, Garavand et al. (2023) explored the relationship between the linguistic Intelligence of EFL learners and their grammar performance, illustrating that those with pronounced linguistic Intelligence tend to outperform their peers. In a distinctive approach, Raković et al. (2023) engaged in a detailed exploration using trace data combined with linguistic scrutiny to anticipate the performance outcomes of learners engaged in a multi-text writing task, highlighting the pivotal role linguistic intelligence plays in such predictive models.

Verbal linguistic Intelligence is integral for practical language usage and comprehension. In academic writing, especially for EFL learners, it serves as a linchpin for clarity, coherence, and the articulation of ideas. Numerous empirical studies reinforce the connection between heightened verbal-linguistic Intelligence and improved academic writing proficiency.

2.3 Grit and its Relevance to Academic Writing Problem Solving

Grit may be described as the tenacious commitment and fervour towards extended aspirations. It encompasses sustaining effort and enthusiasm over prolonged periods in the face of adversities., setbacks, and plateaus in progress (Oxford & Khajavy, 2021). Notably, grit is about more than

just raw effort. Instead, it integrates resilience, aspiration, and self-regulation in pursuing objectives that could require prolonged periods, potentially spanning several months or years, to attain..

Grit plays a pivotal role in motivation and the achievement of long-term objectives. Individuals with high levels of grit demonstrate a stronger motivation to realize their objectives and are less likely to give up in the face of adversity (Lam & Zhou, 2022). This persistent nature of gritty individuals can be especially beneficial in challenging situations like academic writing, where setbacks and revisions are expected. Moreover, Dakin & and Flynn (2022) discussed the intersection of sports stories, grit, and resiliency, emphasizing that the enduring nature of grit often results in stories of triumph against the odds. Such resilience can be drawn upon as an analogy for students navigating the complexities of academic writing.

Various studies have found a strong correlation between grit and academic success. For instance, Lam and Zhou (2022) conducted a cross-cultural meta-analysis, which indicated a consistent association between grit and academic achievement across diverse cultures. Additionally, Lee (2022) discovered that grit and classroom enjoyment significantly impacted EFL learners' willingness to communicate. This is paramount in academic writing, as effective communication is at its core. In online Learning and collaborative writing, Liou and Chiang (2023) identified a relationship between online interaction, emotions, and EFL learners' grit, suggesting that grit's presence can enhance online learning experiences, particularly in collaborative settings.

Furthermore, the domain-specific aspect of grit, or L2 grit, signifies the dedication to learning a second language. Oxford & Khajavy (2021) emphasize that L2 grit might offer additional insights when considering academic writing in a foreign or second language context. Similarly, Solhi et al. (2023a) found associations between EFL students' L2 grit and their strategies to manage ennui and modulate affective responses, implying the broader implications of grit in academic writing pursuits.

In conclusion, grit is an essential component in academic writing and problem-solving. It offers the perseverance required to navigate challenges, facilitates motivation, and is significantly connected to academic achievement. Embracing grit in the academic writing process can be transformative for students and educators alike.

2.4 Learner Self-Directed Learning in Enhancing Academic Writing Skills

Self-directed Learning (SDL) has gained considerable traction, especially in teaching EFL. SDL allows learners to assume responsibility for their educational pursuits within the EFL context process, emphasizing independence and proactive involvement (Song, 2021; Schweder & Raufelder, 2021). Notably, autonomy becomes a crucial aspect of this learning paradigm. Autonomy in Learning, often seen as a subset of SDL, underscores the essence of learners having control over their educational trajectory. Such autonomy fosters confidence and cultivates a sense of responsibility and commitment towards their academic progression (Alghamdi, 2021; Hwang & Oh, 2021).

The drive towards self-directed Learning in academic writing is particularly significant, given the intricate nature of the writing process. Several studies have delved into the tangible effects of SDL on academic writing prowess. For instance, Vasu et al. (2022) found that integrating teacher feedback and self-assessment, pivotal components of SDL, markedly enhanced undergraduate ESL students' writing skills. This is echoed by Rezai et al. (2022) investigation into high school

students, where self-assessment reports showcased promising potential in honing writing abilities. Similarly, implementing innovative digital tools, like e-portfolios, allows learners to reflect on and improve their writing through a structured SDL approach (Song, 2021).

In the backdrop of the COVID-19 pandemic, the significance of SDL has further been spotlighted. With abrupt shifts to online learning platforms, students' ability to steer their Learning, especially in academic writing, has become paramount. The recent work by Gerard et al. (2022) underlines how self-directed science learning adapted to these challenges during the pandemic. Additionally, Kim et al. (2022) highlighted that the success of online Learning, which requires a great deal of autonomy, is closely tied to SDL, suggesting its pertinence across various academic subjects, including writing.

In summary, the trajectory of self-directed Learning within EFL contexts, particularly in honing academic writing skills, is promising. The confluence of learner autonomy, digital innovations, and the demands of modern educational landscapes ensures that SDL will remain an indispensable facet of effective Learning (Al-Adwan et al., 2022; Blaschke, 2021).

2.5 The Interplay between Verbal Linguistic Intelligence, Grit, and Self-Directed Learning

Verbal-linguistic Intelligence, central to the comprehension and articulation of spoken and written language, has been highlighted in academic outcomes, as shown by studies (Handayani et al., 2021). With the increasing significance of digital media, its relationship with improved speaking skills has also been explored (Intan et al., 2022).

Grit, characterized by perseverance and a steadfast commitment to long-term goals, has emerged as a crucial construct in educational studies. Research from Oxford & Khajavy (2021) and Mirza & Gottardo (2022) accentuate grit's role in various linguistic ventures and heterogeneous learning settings.

Moreover, self-directed Learning, epitomized by individual initiatives in recognizing learning requisites and sourcing materials, is linked with proficient problem-solving (Rini et al., 2022). It has been observed that academic self-efficacy serves as an intermediary function, connecting self-directed Learning to problem-solving capabilities (Hwang & Oh, 2021).

Academic writing, especially within problem-solving, remains a complex skill. investigations emphasize problem-based Learning's potency in refining problem-solving and scientific writing capabilities. Furthermore, the blend of metacognitive and critical thinking is essential for enhancing argumentative writing in EFL contexts (Murtadho, 2021). Integrating virtual reality into problem-based Learning has enhanced vocabulary acquisition and increased learner engagement, as highlighted by Chen et al. (2021). Simanjuntak et al. (2021)further stressed the advantages of integrating problem-based Learning with computer simulations.

Interestingly, grit's significance is also palpable in collaborative writing, particularly in virtual environments (Liou & Chiang, 2023). The narratives of sports, rich with grit's essence, can invigorate learners' resilience, as Dakin & Flynn (2022) suggested. Garland et al.'s (2023) studies highlighted the intricacies of linguistic Intelligence's significant impact on grammar proficiency, underscoring the vital role of verbal-linguistic Intelligence in scholarly writing.

Emerging interdisciplinary studies, such as those by Sinclair et al. (2021), are bridging cognitive studies with tech innovations, employing machine learning and trace data to forecast learner outcomes based on linguistic attributes. In synthesizing the above, it is evident that the

confluence of verbal-linguistic Intelligence, grit, and self-directed Learning forms a potent trinity in education. Their intertwined influence offers potential avenues for pioneering and potent pedagogical strategies.

3. RESEARCH METHODOLOGY

3.1 Research Design and Participants

This study employs a cross-sectional method, examining participants from the Department of English Education and English Literature at a Private University in Malang, Indonesia. The sample comprises 228 students aged 20 to 25, with a median age of 22.5 years. Within the sample, 138 participants identify as female, while 90 are male. This systematic classification of participants guarantees a representative sample, reflecting gender distinctions, age demographics, and academic heterogeneity.

3.2 Measures

3.2.1 Grit

In the investigation, the research team employed the "Grit Scale," a tool devised by (Duckworth et al., 2007) to delve into participants' steadfastness and enduring passion for achieving their long-term objectives. Selected due to its proven accuracy and consistency, the scale prompts participants to evaluate a set of statements using a Likert scale. After collecting the responses, their scores are averaged to deduce a definitive "grit score" for each participant. This methodological approach, thus, furnishes a detailed perspective on the depth of an individual's resilience, dedication, and unwavering commitment to their goals.

3.2.2 Self-Directed Learning

The instrument employed for assessing the self-directed learning aptitude among participants is a self-assessment questionnaire formulated by (Cheng et al., 2010). It assesses various aspects of self-directed Learning, and this includes components such as learning motivation (LM), planning and execution (PI), self-surveillance (SM), and interpersonal communication (IC). Respondents rate each item on a Likert scale, and higher scores indicate a higher level of self-directed learning ability. Preliminary testing is essential to ensure the instrument's reliability and validity before use in research.

3.2.3 Verbal Linguistics Intelligence

In assessing verbal-linguistic competencies, researchers employ the Multiple Intelligence Developmental Assessment Scale (MIDAS), rooted in Howard Gardner's theory of multiple intelligences. This evaluation targets cognitive domains, emphasizing linguistic capabilities (Alqatanani, 2017). Participants undergo a self-assessment, evaluating their proficiency in language-related tasks (Alqatanani, 2017; Filiz, 2020; Taniguchi et al., 2017). By collating these inputs, MIDAS portrays one's linguistic strengths. Alqatanani (2017) and Filiz (2020) highlight that the assessment delves deeply into essential areas such as Verbal Communication (VEC), Textual Analysis (RCV), and Language Adaptability (LLA) for a comprehensive understanding.

3.2.4 Writing Problem Solving

An instrument was designed based on the foundational studies of (Hayes, 2012) to gauge students' proficiency in addressing academic writing challenges. This assessment distinguishes a

student's ability to manoeuvre through the intricacies of writing, from conceptualization to final amendments. Responses are evaluated using a 1-5 Likert scale, culminating in an aggregate score. This aggregated metric signifies a student's confidence and effectiveness in managing writing challenges. It is imperative to note that this assessment is nested within a broader evaluative framework, necessitating nuanced score interpretation.

3.3 Research Procedures

Instruments were meticulously chosen and validated for the study. We enlisted 228 participants: 138 females and 90 males. Before participation, informed consent was secured, adhering to ethical guidelines. Participants received guidance on completing the instruments, emphasizing scoring clarity. Each was given 45 minutes for self-efficacy, academic engagement, verbal-linguistic Intelligence, and academic writing tools.

Once completed, forms were collected systematically. Data was then analyzed using AMOS software's structural equation modelling (SEM), examining the relationships among key variables. The results revealed insights into the mediating role of verbal-linguistic Intelligence between academic engagement, self-efficacy, and writing flow. The final report encapsulated the study's methodology, findings, and implications

4. RESULTS

4.1. Reliability and validity

This study assessed reliability using the Composite Reliability Measure (C.R.) and the Average Variance Extracted Measure (AVE) to determine construct reliability. Internal consistency was evaluated through Cronbach's Alpha coefficient. A reliable instrument typically exhibits a C.R. value ≥ 0.70, an AVE value ≥ 0.50, and a Cronbach's alpha value ≥ 0.70. Table 1 provides the outcomes of this reliability assessment.

Table: 1 Reliability and validity

Variables	Items	Loadings	Cronbach's Alpha	AVE	CR
Verbal Linguistics Intelligence	VEC	0.896	0.81	0.67	0.86
	RCV	0.6			
	LLA	0.928			
Self-Directed Learning	LM	0.878	0.81	0.51	0.80
	PI	0.59			
	SM	0.814			
	IC	0.509			
Grit	COI	0.742	0.7	0.53	0.7
	POI	0.715			
Writing Problem Solving	PLN	0.871	0.8	0.51	0.8
	WRT	0.634			
	REV	0.756			
	PS	0.56			

Table 1 provides insights into the reliability and validity of several research variables. Verbal Linguistics Intelligence demonstrates strong consistency with a Cronbach's Alpha of 0.81 and a notable C.R. of 0.86. Self-Directed Learning has a consistent alpha of 0.81 and a C.R. of 0.80. The Grit variable presents moderate consistency with an alpha of 0.7 and a C.R. of 0.7. Lastly,

Writing Problem-Solving reveals good internal consistency with an alpha of 0.8 and a C.R. of 0.8. Across all variables, the Average Variance Extracted (AVE) values hover around the 0.5 mark, indicating acceptable convergent validity. In essence, the research instruments utilized are both reliable and valid for the respective constructs they measure

4.2 The Correlation Coefficient Between Variables

Table 2 presents the correlation analysis between four variables: Verbal Intelligence (VI), Self-Directed Learning (SDL), Grit, and Writing Problem Solving (WPS). Verbal Intelligence (VI) is positively correlated with all the other variables. It has a moderate correlation with Self-Directed Learning (SDL) at 0.471, a slightly stronger correlation with grit at 0.508, and a correlation of 0.460 with Writing Problem Solving (WPS). Self-Directed Learning (SDL), in addition to its correlation with VI, also exhibits a strong correlation with grit at 0.545 and a moderate correlation with Writing Problem Solving (WPS) at 0.500. Grit shows a consistent moderate correlation with all the other variables. Besides its correlations, as mentioned above with VI and SDL, it correlates at 0.438 with Writing Problem Solving (WPS). Lastly, Writing Problem Solving (WPS) displays correlations ranging from 0.438 to 0.500 with the other three variables, indicating a moderate association level. In summary, all the variables in the study are positively and moderately correlated with one another, suggesting interrelatedness among them.

Tabel: 2 Correlation analysis between variables

Variables	1	2	3	4
1. VI	1	.471**	.508**	.460**
2. SDL	.471..	1	.545..	.500..
3. GRIT	.508..	.545..	1	.438..
4. WPS	.460..	.500..	.438..	1

4.3 Research Model Test

Table 3 and Figure 2 delve into the fit indices of the research's theoretical model. The model has a Chi-square value of 88.684 and an associated probability of .000, indicating statistical significance. The normalized chi-square, represented by Cmin/df, stands at 1.556, a generally acceptable value, pointing towards a decent model fit. The Root Mean Square Error of Approximation (RMSEA) registers at .049, implying a close fit, as values below 0.05 typically indicate an excellent model representation.

The Goodness of Fit Index (GFI) is .945, and the Adjusted Goodness of Fit Index (AGFI) is .912. Both these values approach 1, suggesting the model's commendable goodness of fit to the observed data. Moreover, the Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) come in at .979 and .985, respectively, both of which are close to the ideal value, further emphasizing the strong fit of the model. To sum up, the metrics in Table 4 collectively provide evidence supporting the appropriate fit of the theoretical model to the data collected in the study. It can be detailed in Figure 2.

Tabel: 3. fitness index of the theoretical model

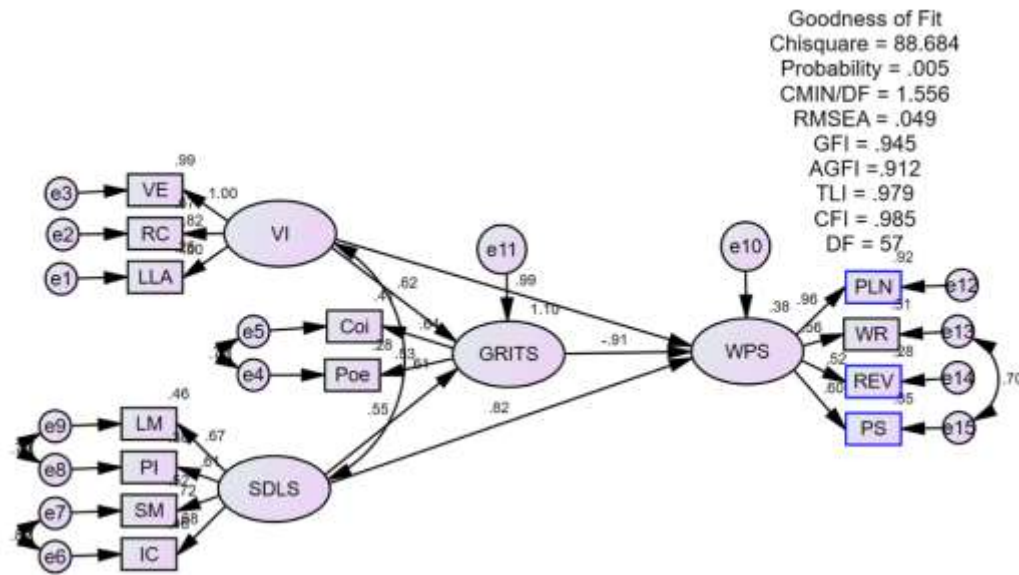| Research	df	Chi-square	Probability	Cmin/df	RMSEA	GFI	AGFI	TLI	CFI
Model	57	88.684	.000	1.556	.049	.945	.912	.979	.985

Figure: 1 Standardized path coefficients in research model

4.4 Path Coefficient of the Research Model

Table 4 presents the path coefficients for the research model, shedding light on the relationships among the variables. From Verbal Intelligence (VI) to Grit, a positive coefficient (β) of 0.623 indicates a strong relationship. This is statistically significant, with a Z-value of 4.649 and a p-value of 0.009. Similarly, VI has a profound positive impact on Writing Problem Solving (WPS) with a coefficient of 0.993, confirmed by a Z-value of 5.015 and a p-value of 0.012.

In the context of Self-Directed Learning (SDL), grit's a positive effect with a coefficient of 0.546, backed by a Z-value of 3.818 and a p-value of 0.012. SDL also positively influences WPS, evident from the coefficient of 0.824 and a high Z-value of 6.54, with the relationship being significant at a p-value of 0.005. Contrastingly, the path from Grit to WPS is negative, with a coefficient of -0.91. This negative association is statistically significant, with a Z-value of -3.82 and a p-value of 0.01. To sum up, the relationships between the variables are predominantly positive and significant, except for the inverse relationship between Grit and Writing Problem Solving.

Table: 4 Path coefficient of the research model

Path	β	S.E.	Z-value	Lower	Upper	P
VI→ GRIT	0.623	0.134	4.649	0.297	0.871	0.009
VI → WPS	0.993	0.198	5.015	0.553	1.351	0.012
SDL → GRIT	0.546	0.143	3.818	0.306	0.865	0.012
SDL → WPS	0.824	0.126	6.54	0.62	1.117	0.005
GRIT → WPS	-0.91	0.238	-3.82	-1.33	-0.42	0.01

4.5 Mediation Effect Test of Structural Model

Table 5 delves into the mediation effect within the structural model, specifically assessing how grit mediates the relationships between Verbal Intelligence (VI) and Writing Problem Solving (WPS), as well as between Self-Directed Learning (SDL) and WPS. The estimate for the path from VI through Grit to WPS is -0.57, with a standard error of 0.221. This relationship is statistically significant, evidenced by a Z-value of 4.791 and a p-value of 0.009. The confidence interval for this effect ranges between 0.134 and 0.354. Similarly, considering the path from SDL through Grit to WPS, the estimate is -0.5 with a standard error of 0.105. The statistical significance of this mediated relationship is supported by a Z-value of 3.145 and a p-value of 0.040, with the confidence interval extending from 0.053 to 0.010. Grit exhibits a notable mediating effect on the relationships between VI and SDL with WPS. Both mediated paths are statistically significant, indicating the critical role of grit in understanding the dynamics between these variables.

Table: 5 Mediation effect test of structural model

Path	Estimate	S.E.	Z-value	Lower	Upper	P
VI → GRIT →WPS	-0.57	0.221	4.791	0.134	0.354	0.009
SDL → GRIT → WPS	-0.5	0.105	3.145	0.053	0.010	0.040

5. DISCUSSION

The study's primary findings confirm the reliability and validity of the research constructs, exceptionally Verbal Linguistics Intelligence, Self-Directed Learning, Grit, and Writing Problem-Solving. These constructs exhibited consistent and reliable scores, with good convergent validity, which suggests that the measurement tools used in the study effectively capture the intended constructs. This observation is in line with recent studies emphasizing the importance of instrument reliability in measuring psychological constructs (Asmorowati et al., 2021; Sri Asmorowati et al., 2021; Raković, Iqbal, Li, Fan, Singh, Surendrannair, et al., 2023).

In terms of correlations among the constructs, Verbal Intelligence (VI) showed moderate positive correlations with Self-Directed Learning (SDL), Grit, and Writing Problem Solving (WPS). This observation, reaffirmed by Haddaji (2022) and Intan et al. (2022), underscores the intertwined nature of these constructs in educational settings. Additionally, SDL's relationship with grit and WPS suggests that self-initiated learning behaviors are closely related to perseverance and problem-solving abilities in writing, a perspective supported by Kim et al. (2022) in recent research.

The consistent moderate correlations that grit displayed with other variables are not surprising, given its documented importance in educational and psychological contexts, as illustrated by Duckworth et al. (2007) and Solhi et al. (2023). However, the unexpected inverse correlation between Grit and Writing Problem Solving offers an intriguing divergence from conventional understanding, highlighting the need for a more nuanced approach to these constructs, as some studies like Solhi et al. (2023) have recently pointed out.

One crucial aspect of the study was its exploration of the mediating role of grit. The results highlighted that grit was mediating in the relationships between Verbal Intelligence and Writing Problem Solving and between Self-Directed Learning and Writing Problem Solving. Grit may bridge cognitive abilities (such as verbal Intelligence) and problem-solving skills between self-

directed Learning and effective writing problem-solving (Schweder & Raufelder, 2021; Gholami et al., 2021). Such findings offer valuable insights into the complex interplay of these constructs in educational contexts.

Comparing these results with previous research, it is evident that they align with existing literature in various domains. For instance, the positive correlations between verbal Intelligence and self-directed Learning resonate with research emphasizing cognitive abilities' role in facilitating effective Learning (Zhao, 2022b). Similarly, grit's influence as a mediator aligns with the premise of recent studies that underscore its role in academic success and problem-solving (Moorhouse & Kohnke, 2021).

The significance of these findings for education and psychology cannot be overstated. They provide valuable insights into the factors influencing learning and problem-solving abilities, which can inform educational practices and interventions. Educators may consider integrating strategies to foster Grit and self-directed learning in their teaching methods, recognizing the potential benefits for students' problem-solving skills (Ulaywi, 2021). Additionally, the study's confirmation of measurement reliability and validity underscores the importance of using robust assessment tools in research and practice.

However, it is essential to acknowledge potential factors that could affect the interpretation of these results. One such factor is the study's sample composition. The characteristics of the participants, such as age, educational background, or cultural factors, may influence the observed relationships among the constructs (Kim et al., 2022). Additionally, the study employed self-report measures, which may introduce response biases and social desirability effects. Future research could benefit from using a more diverse sample and employing objective measures to mitigate these potential limitations (Blaschke, 2021).

In conclusion, the study's findings contribute significantly to understanding the interplay between verbal Intelligence, self-directed learning, grit, and writing problem-solving. They confirm the reliability and validity of these constructs, identify their interrelationships, and emphasize the mediating role of grit. These results align with existing research and hold implications for educational practices, highlighting the importance of fostering grit and self-directed Learning to enhance problem-solving skills. Nonetheless, researchers should consider sample characteristics and measurement limitations when interpreting these findings, and further investigations are warranted to delve deeper into the complexities of these relationships.

6. CONCLUSION

The recent research offers profound insights into the authenticity and robustness of primary constructs such as Verbal Linguistics Intelligence, Self-Directed Learning, Grit, and Writing Problem Solving. These elements consistently showcased their reliability within pedagogical and psychological domains, thus underscoring their paramount significance.

The study proffers a unique lens into their intricate interconnectedness by concurrently examining multiple constructs. Notably, Verbal Intelligence manifests a pronounced positive association with other constructs, spotlighting the pivotal role of verbal aptitudes in both scholastic achievement and nuanced analytical capacities. Furthermore, the prominence of grit as a mediating factor, especially in the connections between Self-Directed Learning, Verbal Intelligence, and Writing Problem Solving, suggests a compelling avenue for interventions. Such strategic initiatives could amplify learners' analytical competencies when centred around grit.

However, while interpreting the outcomes, factoring in respondents' cultural and situational nuances is vital. These variances could influence the broader implications of the findings. Additionally, the study's methodology, which hinges on self-reporting, might inadvertently introduce biases, like response or social desirability. Such biases pose challenges in ascertaining the absolute validity of the conclusions drawn.

In conclusion, the implications of this research are manifold. On the one hand, it aids in evolving resilient assessment tools in educational and psychological realms. Conversely, it accentuates the transformative potential of grit and verbal competencies in elevating analytical skills. Future endeavours in this domain would do well to explore these relationships across diverse demographics with a vigilant stance on potential biases.

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