ปัจจัยหลักที่ส่งผลต่อประสิทธิผลการเรียนรู้ด้วยตนเองของนักศึกษาในวิทยาลัยเทคนิคและอาชีวศึกษาหงเหอ มณฑลยูนนาน ประเทศจีน

Key Factors Influencing Autonomous Learning Effectiveness of Students at Honghe Vocational and Technical College, Yunnan Province, China

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บทคัดย่อ

นักศึกษาระดับอาชีวศึกษาจำนวนมากยังขาดทักษะการเรียนรู้ด้วยตนเองอย่างมีประสิทธิภาพ อันเป็นผลจากความแตกต่างด้านจิตวิทยาและปัจจัยประชากร ส่งผลให้ขีดความสามารถในการปรับตัวและศักยภาพในการเรียนรู้ตลอดชีวิตถูกจำกัด การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาว่าปัจจัยประชากร การเรียนรู้แบบกำกับตนเอง (Self-Regulated Learning: SRL) ความเชื่อมั่นในตนเอง (Self-Efficacy) และความเพียรพยายาม (GRIT) ส่งผลต่อประสิทธิผลการเรียนรู้ด้วยตนเองในกลุ่มนักศึกษาอาชีวศึกษาในประเทศจีนหรือไม่ ทั้งนี้ รายงาน *Learning to Be* ขององค์การยูเนสโก (UNESCO) ได้เน้นย้ำว่าการเรียนรู้แบบผู้เรียนเป็นศูนย์กลางและการเรียนรู้ด้วยตนเองถือเป็นปัจจัยสำคัญในการปรับตัวต่อการเปลี่ยนแป ลง [1] (UNESCO, 1972) ซึ่งเป็นรากฐานให้การเรียนรู้ด้วยตนเองกลายเป็นวาระสำคัญของการศึกษาระดับโลก [1] (UNESCO, 1972; [2] OECD, 2019) โดย SRL ช่วยให้ผู้เรียนสามารถบริหารจัดการแรงจูงใจและกลยุทธ์การเรียนรู้ของตนได้ [3] (Zimmerman, 2002; [4] Karabenick & Zusho, 2015) อีกทั้งพบว่าผู้ที่มีทักษะ SRL สูงย่อมมีผลลัพธ์ทางการเรียนรู้ที่ดีกว่า [5] (Berkhout et al., 2015) นอกจากนี้ ความเชื่อมั่นในตนเองยังส่งเสริมทั้ง SRL และการเรียนรู้ด้วยตนเอง [6] (Bandura, 1986; [7] Panadero, 2017) ในขณะที่ GRIT ซึ่งหมายถึงความพากเพียรและความหลงใหลต่อเป้าหมายระยะยาว ช่วยสนับสนุนการมีส่วนร่วมอย่างต่อเนื่อง [8] (Duckworth et al., 2007; [9] Credé et al., 2017) ทั้งนี้ ปัจจัยประชากร เช่น เพศและอายุ ก็มีอิทธิพลต่อคุณลักษณะดังกล่าวและผลลัพธ์ทางการเรียนรู้ [10] (Chen, 2020; [11] Huang, 2022) การเก็บข้อมูลดำเนินการโดยใช้วิธีสุ่มตัวอย่างแบบมีความน่าจะเป็นหลายขั้นตอน จากจำนวนนักเรียนทั้งหมด 6,770 คน ของวิทยาลัยอาชีวศึกษาและเทคนิคหงเหอ มณฑลยูนนาน ประเทศจีน ได้กลุ่มตัวอย่างจำนวน 400 คน ซึ่งมากกว่าขนาดตัวอย่างขั้นต่ำที่คำนวณโดยใช้สูตรของ Yamane [12] (Yamane, 1967) กำหนดไว้ที่ 378 คน ผลการวิเคราะห์ข้อมูลเชิงสถิติพบว่า เพศ สาขาวิชา และอายุ มีความแตกต่างอย่างมีนัยสำคัญทางสถิติต่อประสิทธิผลของการเรียนรู้ด้วยตนเอง ($p \approx .000$) นอกจากนี้ ผลการวิเคราะห์การถดถอยพหุคูณพบว่า SRL ความเชื่อมั่นในตนเอง และ GRIT ล้วนมีอิทธิพลเชิงบวกต่อประสิทธิผลของการเรียนรู้ด้วยตนเอง (p-value อยู่ระหว่าง .000 ถึง .008) ผลการศึกษานี้จึงเป็นหลักฐานเชิงประจักษ์ที่สามารถนำไปใช้เป็นแนวทางกำหนดกลยุทธ์ทางการศึกษา โดยเน้นการส่งเสริม SRL ความเชื่อมั่นในตนเอง

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และความเพียรพยายาม ผ่านแนวทางที่คำนึงถึงความแตกต่างรายบุคคล เพื่อสนับสนุนการเรียนรู้ตลอดชีวิตและการเตรียมความพร้อมด้านวิชาชีพอย่างมีประสิทธิภาพ

คำสำคัญ: การเรียนรู้แบบกำกับตนเอง ความเชื่อมั่นในตนเอง ความเพียรพยายาม ประสิทธิผลการเรียนรู้ด้วยตนเอง

Abstract

Many secondary vocational students lack effective autonomous learning skills due to psychological and demographic differences, limiting their adaptability and lifelong learning potential. This study examines how demographic factors, self-regulated learning (SRL), self-efficacy, and GRIT influence autonomous learning effectiveness among secondary vocational students in China. UNESCO's *Learning to Be* report highlighted student-centered, self-directed learning as essential for adapting to change [1] (UNESCO, 1972), establishing autonomous learning as a global educational priority [1] (UNESCO, 1972; [2] OECD, 2019). SRL enables learners to manage motivation and strategies [3] (Zimmerman, 2002; [4] Karabenick & Zusho, 2015), with stronger self-regulation linked to better outcomes [5] (Berkhout et al., 2015). Self-efficacy strengthens both SRL and autonomous learning [6] (Bandura, 1986; [7] Panadero, 2017), while GRIT—defined as perseverance and passion for long-term goals—supports sustained engagement [8] (Duckworth et al., 2007; [9] Credé et al., 2017). Demographic factors such as gender and age also influence these traits and learning outcomes [10] (Chen, 2020; [11] Huang, 2022). Using a multi-stage probability sampling method, 400 out of 6,770 students from Yunnan Honghe Vocational and Technical College were surveyed, exceeding the minimum sample size of 378 calculated using Yamane's formula [12] (Yamane, 1967). Statistical analyses showed significant differences in learning effectiveness by gender, major, and age ($p \approx .000$). Multiple regression revealed that SRL, self-efficacy, and GRIT all positively impact autonomous learning effectiveness (p-values ranging from .000 to .008). These findings offer empirical evidence to guide educational strategies, emphasizing the importance of fostering SRL, self-efficacy, and perseverance through personalized approaches that support lifelong learning and vocational readiness.

Keywords: Self-regulated Learning, Self-efficacy, GRIT, Autonomous Learning Effectiveness

Introduction

Autonomous learning has been emphasized globally since UNESCO's Learning to Be (1972), promoting student-centered education and lifelong learning to meet societal changes [1] (UNESCO, 1972). This vision aligns with 21st-century educational reforms, as seen in the OECD Learning Compass 2030 [2] OECD (2019). Closely linked is self-regulated learning (SRL), where learners actively manage motivation, strategies, and behaviors to achieve goals [3-4] (Zimmerman, 2002; Karabenick & Zusho, 2015). Through self-observation and adjustment, SRL bridges current abilities and desired outcomes [13] (Schunk & Greene, 2018). Reflecting these ideas, China's Ministry of Education introduced the "108 Curriculum" to promote

personalized learning and flexible self-planned activities, supporting lifelong learning [14] (Ministry of Education, 2014; [15] 2018; [16] Zhang et al., 2020; [17] Luan et al., 2023).

Research consistently shows SRL as central to autonomous learning effectiveness. Learners with strong self-regulation achieve better outcomes [5] (Berkhout et al., 2015), confirmed by [18] Dent & Koenka (2016) and [19] Broadbent & Poon (2015). Self-efficacy, or belief in one's capabilities [6] (Bandura, 1986), is another key factor enhancing motivation, strategy use, and persistence [7] (Panadero, 2017; [20] Wanet et al., 2012; [21] Usher & Pajares, 2008; [22] Klassen & Usher, 2010). GRIT, defined as perseverance and passion for long-term goals [8] (Duckworth et al., 2007), supports sustained learning efforts [23] (Duckworth & Quinn, 2009; [9] Credé et al., 2017; [24] Lam & Zhou, 2023). Demographic factors such as gender, age, and education background also influence autonomous learning through their effects on self-regulation, self-efficacy, and GRIT [10] (Chen, 2020; [11] Huang, 2022; [25] Chu et al., 2020; [26] Richardson et al., 2012).

In conclusion, autonomous learning effectiveness depends on SRL, self-efficacy, GRIT, and demographic variables. Understanding their interaction supports evidence-based educational strategies to nurture lifelong learners able to adapt in a dynamic world.

Objectives of the Study

1. To investigate the influences of demographic factors on Autonomous Learning Effectiveness.
2. To explore the influences of self-regulated learning on Autonomous Learning Effectiveness.
3. To inspect the influences of self-efficacy on Autonomous Learning Effectiveness.
4. To scrutinize the influences of GRIT (perseverance) on Autonomous Learning Effectiveness.

Research Framework

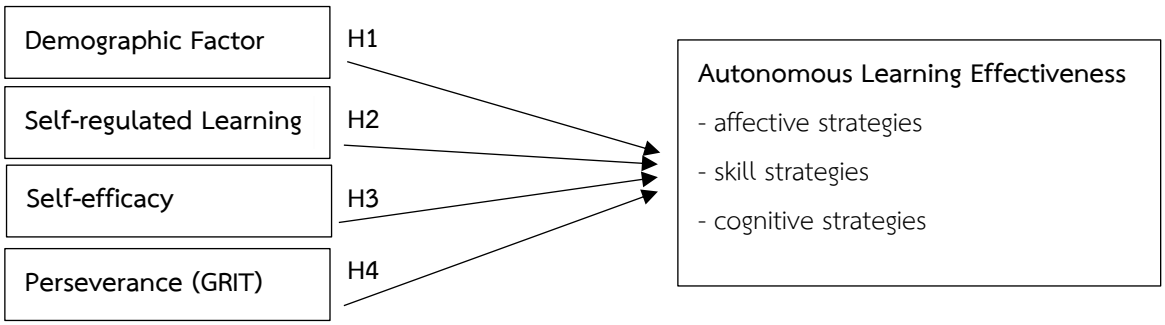


Figure 1 Research Framework

Research Hypotheses

H1: Differences in demographic factors result in differences in autonomous learning effectiveness.

H2: Self-regulated learning influences on autonomous learning effectiveness.

H3: Self-efficacy influences on autonomous learning effectiveness.

H4: Perseverance (GRIT) influences on autonomous learning effectiveness

Related Concepts and Theories

1. Self-Regulated Learning (SRL)

Self-regulated learning (SRL) is learners' active management of cognitive, emotional, behavioral, and contextual aspects of learning [27] (Šimić Šašić et al., 2023), including goal setting, planning, monitoring, and self-reflection [28] (Meece, 1994; [29] Bandura, 2004). It integrates cognitive strategies, metacognitive strategies, and prior knowledge [30] (Butler, 2022; [31] Carter Jr. et al., 2020). SRL enhances autonomous learning, academic performance, and engagement, with personal and contextual factors such as age, gender, and study habits influencing outcomes [32] (Robb, 2016; [33] Rovers et al., 2019; [34] Eom, 2019; [35] Hung, 2019; [36] Chen, 2020; [37] Chu et al., 2020). Evidence confirms SRL interventions consistently improve learning effectiveness across educational levels and domains [38] (Wolters and Brady, 2021; [39] Zhang, 2022; [40] Lin et al., 2023)),.

2. Self-efficacy

Self-efficacy is the belief in one's capability to execute actions and achieve goals [41] (Bandura, 1977; [42] 1997; [29] 2004). As a core construct in Social Cognitive Theory, it influences motivation, strategy use, persistence, and emotional regulation [43] (Schunk, 1989; [44] Zimmerman, 1995). Defined by magnitude, strength, and generality [42] (Bandura, 1997), self-efficacy develops through mastery, modeling, feedback, and emotional states. Empirical studies confirm its strong predictive power for learning performance and autonomous learning effectiveness across contexts [45] (Schunk, 1984; [46] Zimmerman & Bandura, 1994; [47] Wang, 2020; [48] Ding & Yeh, 2021; [49] Chen, 2016; [50] Hu, 2019; [51] Wu & Mo, 2019; [52] Song et al., 2021).

3. Perseverance, or GRIT

Perseverance, or GRIT, represents sustained passion and effort toward long-term goals despite challenges [53] (Li et al., 2020; [54] Duckworth, 2016). It comprises two dimensions—passion and perseverance—and is driven by interest, practice, purpose, and hope [54] (Duckworth, 2016). External factors such as family, peers, and supportive environments further reinforce persistence [8] (Duckworth et al., 2007). Empirical studies confirm GRIT's strong positive influence on self-efficacy, motivation, and learning effectiveness across contexts [55] (Credé, 2018; [56] Datu, 2017; [57] Lin, 2020; [58] Zhao et al., 2021; [59] Li et al., 2021), underscoring its role in fostering resilience and autonomous learning.

4. Autonomous Learning Effectiveness

Autonomous learning, or self-directed learning, empowers learners to take control of their education, fostering intrinsic motivation, critical thinking, and lifelong learning skills [60] (Ryan & Deci, 2000; [61] Garrison, 1997). Grounded in constructivist and self-determination theories, it is closely linked to self-regulated learning [62] (Loyens et al., 2008) and consistently predicts higher achievement [63] (Sitzmann & Ely, 2011). Effective autonomy involves goal-setting, planning, monitoring, and reflection [64] (Blaschke, 2012; [65] Wang et al., 2020; [66] Zhou, 2014), supported by self-efficacy and emotional resilience [67] (Boekaerts, 1997; [68] Zarrinabadi, 2021). Instructional strategies such as project-based and collaborative

learning further strengthen autonomy across cultural and vocational contexts [69] (Derakhshan, 2022; [70] Jiang et al., 2023; [71] Rawes & Renwick, 2023).

Methodology

This study investigates the effects of self-regulated learning, self-efficacy, and GRIT on autonomous learning effectiveness among secondary vocational students at Yunnan Honghe Vocational and Technical College. A conceptual framework and hypotheses were developed based on prior literature, and data were collected using a structured, pre-tested bilingual (English–Chinese) questionnaire to ensure clarity and validity. Content validity was confirmed through the Item-Objective Congruence (IOC) index by three experts (all exceeding 0.5), and reliability was verified using Cronbach's alpha coefficients above 0.7, indicating high internal consistency. The study adhered to ethical guidelines, national laws, and the approved research protocol (Reference No. R.867/2024), including informed consent. The target population comprised 6,770 students across three academic years, with a calculated sample size of 400 based on Yamane's formula and a 5% error margin. A multi-stage probability sampling method was applied—stratified by grade, proportionally allocated, and randomly selected within each stratum—while convenience sampling was also used to facilitate efficient data collection. Data were gathered via online surveys (Wenjuanxing, Jinshuju, and Tencent Survey) from January 10–31, 2025, allowing access through computers, tablets, or smartphones with integrated functions for logic jumps and WeChat connectivity. Both descriptive and inferential statistics were employed: frequency, mean, and standard deviation summarized the data, while independent samples t-tests, one-way ANOVA, and multiple linear regression tested hypotheses, examined group differences, and identified predictors of autonomous learning effectiveness.

Research Findings

1. Descriptive Statistics

The demographic analysis of the 400 respondents indicates that females slightly outnumber males, accounting for 53.75% compared to 46.25% of males. Regarding majors, sports training has the largest proportion at 37.00%, followed by Zisha pottery (26.00%), preschool education (19.50%), and firefighting (17.50%). In terms of age distribution, the majority are 15 years old (38.25%), followed by 16 years old (32.00%) and 17 years old (29.75%). Concerning grade levels, second-year students make up 34.00%, while first- and third-year students represent 33.25% and 32.75%, respectively.

Self-regulated learning is perceived positively among respondents, with prior knowledge rated as the most critical component (mean = 3.904), followed closely by self-efficacy (mean = 3.860) and metacognitive strategies (mean = 3.855). The overall mean for self-regulated learning is 3.873, indicating an agreement level that these factors are important for learning autonomy.

For self-efficacy, empathetic self-recovery ability emerges as the highest-rated characteristic (mean = 3.920), while internally directed self-efficacy is slightly lower (mean = 3.791). Overall self-efficacy is valued at 3.855, reflecting a general agreement among respondents regarding the importance of these traits in supporting autonomous learning.

Regarding GRIT, hope is identified as the most significant dimension (mean = 3.931), followed by interest (mean = 3.915), practice (mean = 3.888), and purpose (mean = 3.870). The overall GRIT score is 3.901, indicating that respondents generally agree on the importance of perseverance and resilience in learning.

Autonomous learning effectiveness is rated highly across all dimensions, with cognitive strategies receiving the highest mean score (3.962), followed by skill strategies (3.954) and affective strategies (3.892). The overall mean for autonomous learning effectiveness is 3.936, suggesting that respondents generally agree that these strategies effectively support self-directed learning outcomes.

2. Inferential Statistics

2.1 Differences in Demographic Factors Result in Differences in Autonomous Learning Effectiveness

Inferential analysis showed that gender, major, and age significantly affected autonomous learning effectiveness, while grade level did not. Female students demonstrated higher learning autonomy than males (t-test, $p < .001$). One-way ANOVA results revealed significant differences across majors and age groups (both $p < .001$), indicating these factors influenced learning autonomy. However, no significant difference was found by grade level ($p > .05$). Thus, gender, major, and age were key determinants, whereas grade level had no effect.

2.2 The Influence of Self-regulated Learning on Autonomous Learning Effectiveness

Table 1 The Results of Multiple Linear Regression of Self-regulated Learning on Autonomous Learning Effectiveness

Models	Unstandardized coefficients		Standardized coefficient	t-value	p-value
	B	Standard error	Beta (ß)		
(Constant)	.104	.109		.958	.339
Self-effective (X_1)	.067	.024	.074	2.820	.005**
Metacognitive Strategies (X_2)	.267	.033	.275	8.118	.000***
Prior Knowledge (X_3)	.651	.034	.634	19.061	.000***

Dependent Variable: Autonomous Learning Effectiveness (Y), **Note.** *p* < .05 (*), *p* < .01 (**), *p* **< .001 (*****).

The results obtained from the multiple linear regression (MLR) analysis of self-regulated learning on autonomous learning effectiveness are presented in Table 1. The multiple linear regression analysis revealed that all three components of self-regulated learning—prior knowledge, metacognitive strategies, and self-efficacy—significantly predicted autonomous learning effectiveness. Prior knowledge was the strongest predictor (B = 0.651, ß = 0.634, $p < .001$), followed by metacognitive strategies (B = 0.267, ß = 0.275, $p < .001$) and self-efficacy (B = 0.067, ß = 0.074, $p < .01$). The model accounted for approximately 78.2% of the variance in autonomous learning effectiveness (Adjusted $R^2 = 0.782$), indicating a strong explanatory power and highlighting the critical role of self-regulated learning in enhancing students' autonomy.

2.3 The Influence of Self-efficacy on Autonomous Learning Effectiveness

Table 2 The Results of Multiple Linear Regression of Self-efficacy on Autonomous Learning Effectiveness

Models	Unstandardized coefficients		Standardized coefficient Beta (ß)	t-value	p-value
	B	Standard error			
(Constant)	.021	.113		.189	.850
Internally Directed Self-efficacy (X_1)	.118	.031	.110	3.763	.000***
Empathetic Self-recovery Ability (X_2)	.884	.032	.812	27.665	.000***

Dependent Variable: Autonomous Learning Effectiveness (Y), **Note.** *p* < .05 (*), *p* < .01 (**), *p* **< .001 (*****).

The results obtained from the multiple linear regression (MLR) analysis of self-efficacy on autonomous learning effectiveness are presented in Table 2. The regression results demonstrated that self-efficacy significantly influenced autonomous learning effectiveness, with empathetic self-recovery ability emerging as the dominant predictor (B = 0.884, ß = 0.812, p < .001), while internally directed self-efficacy also had a significant but smaller effect (B = 0.118, ß = 0.110, p < .001). The model explained approximately 77.5% of the variance in autonomous learning effectiveness (Adjusted R^2 = 0.775), emphasizing that self-efficacy—particularly the empathetic self-recovery dimension—is a key determinant in fostering students' autonomous learning outcomes.

2.4 The Influence of GRIT on Autonomous Learning Effectiveness

Table 3 The Results of Multiple Linear Regression of GRIT on Autonomous Learning Effectiveness

Model	Unstandardized coefficients		Standardized coefficient Beta (ß)	t-value	p-value
	B	Standard error			
(Constant)	.074	.094		.791	.430
Interest (X_1)	.068	.024	.069	2.820	.005**
Practice (X_2)	.242	.042	.231	5.769	.000***
Purpose (X_3)	.322	.031	.331	10.253	.000***
Hope (X_4)	.358	.039	.385	9.162	.000***

Dependent Variable: Autonomous Learning Effectiveness (Y), **Note.** *p* < .05 (*), *p* < .01 (**), *p* **< .001 (*****).

The results obtained from the multiple linear regression analysis of GRIT on autonomous learning effectiveness are presented in Table 3. The analysis of GRIT components indicated that all four dimensions—hope, purpose, practice, and interest—significantly contributed to autonomous learning effectiveness. Hope was the most influential predictor (ß = 0.385, p < .001), followed by purpose (ß = 0.331, p < .001), practice (ß = 0.231, p < .001), and interest (ß = 0.069, p < .01). The GRIT model demonstrated the highest explanatory power among the three models, accounting for approximately 84.5% of the variance in autonomous learning effectiveness (Adjusted R^2 = 0.845). These findings suggest that learners'

perseverance, particularly their sense of hope, plays a critical role in enhancing their ability to learn autonomously.

Conclusion and Discussion

Based on descriptive analysis, most respondents were female, majoring in sports training, aged 15–16, and primarily second-year students. All measured variables had overall mean scores at the "agree" level, with prior knowledge leading in self-regulated learning, empathetic self-recovery ability in self-efficacy, hope in GRIT, and cognitive strategies in autonomous learning effectiveness, indicating generally positive student attributes in self-regulation, self-efficacy, GRIT, and learning autonomy. Inferential statistics showed that gender, major, and age influenced autonomous learning effectiveness, while grade did not. Multiple linear regression analysis revealed that all components of self-regulated learning, self-efficacy, and GRIT positively and significantly contribute to autonomous learning effectiveness.

1. Self-Regulated Learning

This study underscores self-regulated learning (SRL) as a key factor contributing to autonomous learning effectiveness among vocational students, particularly those majoring in sports training. Consistent with previous literature [72] (Bandura, 2004; [27] Šimić Šašić et al., 2023), SRL was reflected through students' use of prior knowledge, self-efficacy, metacognitive strategies, and motivational elements. The descriptive analysis identified prior knowledge as the most prominent SRL component, suggesting students actively utilize existing frameworks to manage learning tasks. Regression results confirmed that all SRL dimensions—self-efficacy, metacognitive strategies, and prior knowledge—positively influence autonomous learning effectiveness. This supports theoretical models proposed by [72] Bandura (2004), [73] Butler (2022), and [31] Carter Jr. et al. (2020), framing SRL as a dynamic process integrating cognitive, behavioral, emotional, and situational strategies. Empirical studies by [74] Robb (2016), [75] Rovers et al. (2019), and [76] Eom (2019) similarly demonstrated positive links between SRL strategies and academic outcomes. Cognitive strategies ranked highest among autonomous learning indicators, reinforcing [77] Wolters and Brady's (2021) meta-analytic conclusion that SRL interventions significantly enhance academic performance. Statistically significant differences in autonomous learning effectiveness based on gender, major, and age were observed, echoing findings by [78] Chen (2020) and [79] Lin et al. (2023). No differences were found based on grade level, likely due to the sample's age and experience range. Importantly, this study highlights the integrated nature of SRL with self-efficacy and GRIT, as dimensions such as empathetic self-recovery ability (self-efficacy) and hope (GRIT) significantly impacted learning effectiveness, supporting [80] Chu et al. (2020) and [81] Zhang (2022), who emphasized combining SRL with perseverance and emotional resilience factors.

2. Self-efficacy

This study identifies self-efficacy as a critical factor influencing autonomous learning effectiveness among vocational students. Empathetic self-recovery ability emerged as the most prominent self-efficacy dimension, indicating students' belief in their capacity to recover from setbacks plays a central role in maintaining learning motivation and performance. These findings align with [42] Bandura's (1997) framework, emphasizing magnitude, strength, and generality as essential self-efficacy components shaping learner

behaviors and resilience. Regression analysis confirmed that internally directed self-efficacy and empathetic self-recovery ability both positively affect autonomous learning effectiveness. This supports findings from [45] Schunk (1984), [46] Zimmerman and Bandura (1994), and more recent studies [82] (Chen, 2016; [83] Ding & Yeh, 2021; [47] Wang, 2020), reinforcing self-efficacy's direct and indirect effects through interaction with SRL strategies.

3. GRIT

This study confirms GRIT as a key psychological factor positively influencing autonomous learning effectiveness among vocational students. Among GRIT's four components—interest, practice, purpose, and hope—hope ranked highest, suggesting that resilience and optimism play especially important roles in sustaining learning engagement. This is consistent with [54] Duckworth's (2016) GRIT framework, where perseverance and passion for long-term goals are essential for overcoming academic challenges. Regression analysis shows that all GRIT dimensions significantly predict learning effectiveness, aligning with studies by [55] Credé (2018), [56] Datu (2017), and [57] Lin (2020), who emphasized perseverance as a stronger academic success predictor than passion alone, especially when paired with self-efficacy. Prior research also links GRIT to broader outcomes beyond academics. [58] Zhao et al. (2021) and [59] Li et al. (2021) identified associations between GRIT, self-efficacy, and reduced burnout, highlighting GRIT as both a personal trait and a socially influenced factor shaped by internal motivation and external support.

4. Demographic Factor

Research indicates that demographic factors such as gender, age, major, and grade can influence autonomous learning effectiveness, though their impacts vary. Gender differences have been observed, with studies showing that female students tend to employ more self-regulated learning strategies and report higher self-efficacy in managing their learning autonomously compared to males [84] (Zimmerman & Martinez-Pons, 1990; [85] Artino, 2008). Age also plays a role; older learners typically demonstrate stronger self-regulation and autonomous learning behaviors due to greater cognitive maturity and life experience [86] (Schunk & DiBenedetto, 2020; [87] Merriam & Bierema, 2013). Academic major influences autonomous learning effectiveness as well, with students in STEM or professional fields often engaging more actively in self-regulation than those in humanities, likely reflecting the structured nature of these disciplines [88] (Pintrich, 2000; [89] Broadbent & Poon, 2015). Regarding grade or year of study, findings are mixed: some research suggests that students in higher years develop better self-regulation and autonomy through accumulated experience [3] Zimmerman, 2002), while other studies find no significant differences across grades [90] (Kyndt et al., 2011), aligning with evidence that grade may not significantly affect autonomous learning effectiveness.

Suggestions and Recommendations

The comprehensive analysis of autonomous learning effectiveness, as influenced by demographic factors, self-regulated learning, self-efficacy, and GRIT, provides valuable insights for educational institutions and organizations seeking to foster a culture of effective autonomous learning. First, the variation in autonomous learning effectiveness across demographic factors such as gender and major underscores the

importance of tailored learning and development initiatives. Programs should be designed to accommodate diverse learner backgrounds and personal circumstances, such as implementing gender-sensitive materials, flexible learning schedules, and support systems for students from various majors. These strategies ensure equitable opportunities for development and help address the unique challenges faced by different learner groups. Second, the study highlights the significant positive impact of self-regulated learning and self-efficacy on autonomous learning effectiveness, emphasizing the need to cultivate these skills among learners. Educational and organizational programs should focus on training learners in goal setting, self-monitoring, and adapting strategies based on feedback, while also fostering confidence through success experiences, verbal encouragement, and role modeling. Such approaches can cultivate a proactive and resilient learning culture, equipping individuals to effectively manage their learning processes and motivating them to achieve higher learning outcomes. Third, the findings indicate that GRIT—comprising perseverance and passion for long-term goals—plays a crucial role in enhancing autonomous learning effectiveness. Initiatives aimed at developing GRIT, such as encouraging challenging yet achievable objectives, promoting a growth mindset, and supporting learners in overcoming setbacks, can strengthen persistence and commitment. By nurturing GRIT, institutions and organizations can help learners maintain sustained efforts, navigate challenges effectively, and remain dedicated to their long-term goals, thereby enhancing both their autonomous learning capabilities and overall personal and professional growth. Collectively, these implications suggest that a multifaceted approach addressing demographic needs, self-regulation, self-efficacy, and perseverance is essential for optimizing autonomous learning outcomes.

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