

Grit Research: A Review and Prospects

Yu Huang¹, Si Yi^{2,*}

¹School of Education and Psychological Science, Sichuan University of Science and Engineering, Sichuan Zigong 643000, China

²School of Education and Psychological Science, Sichuan University of Science and Engineering, Sichuan Zigong 643000, China

* Corresponding Author

Abstract

This article reviews the relevant research on grit, and discusses its measurement, predictive role, influencing factors, intervention research, curriculum, and future prospects. Grit, as an individual's psychological qualities of perseverance in long-term goals and lasting interest, has a significant impact on personal development and success. By looking at the literature, grit is thought to not only positively predict a large number of positive psychology or behaviors, but also to alleviate the negative emotions of individuals. The structure of grit has evolved from a two-factor structure to a multi-factor structure. Effective grit interventions include growth mindset course intervention, group support intervention, mindfulness intervention, etc. The grit course has been developed by researchers at home and abroad, and it can effectively improve the level of grit. In the future, grit research should choose more suitable scales, pay attention to the particularity of the environment, and increase the steps and frequency of tracking measurements.

Keywords

Grit, grit quality, review.

1. Introduction

In 2007, American scholar Duckworth conducted a psychological study on grit and defined grit as "maintaining an enduring passion and perseverance for long-term goals"[1]. Although it is a foundational study of the concept of grit, it provides a theoretical basis for subsequent educational practice. Foreign research on grit has been extensive and relatively mature, but domestic research has only begun in recent years. As a positive psychological quality, grit has shown its value and influence in many ways: it promotes personal growth and progress at the individual level, and when individuals face difficulties, they will also show perseverance and strong adaptability, such as individuals will constantly adjust their cognition, emotions and behaviors to fight difficulties, and maintain a positive attitude when they are frustrated[2]; grit also plays an important role in shaping good relationships and creating a positive environment, studies have shown that an individual's grit can also unconsciously affect the grit of others, and it can also shape good interpersonal relationships and create a positive environment[3]; in addition, from a macro social perspective, the popularization and deepening of grit will help build a learning society, promote the dissemination and sharing of knowledge, promote the development of lifelong education, and promote the overall development and progress of society.

Therefore, this paper systematically and comprehensively reviews the current status of grit research, including its concept and structure, measurement tools, role, influencing factors, interventions etc., which not only summarizes the current academic research results,

but also provides new ideas for educators to optimize teaching strategies and promote student development, and provides new guidance for the practice in the fields of psychological counseling and career development. In the long run, these ideas and guidance play an important role in promoting the progress and development of the whole society.

1.1. The Concept and Structure of Grit

Duckworth first proposed "grit" in 2007, defining it as passion and persistence in long-term goals, and also believed that the two layers of consistency of interest and perseverance constitute grit[1], and then he also used confirmatory factor analysis to test the theoretical higher-order factor structure of grit[4], and this higher-order model (consisting of two first-order factors and one second-order factor) showed a good fit. However, many researchers have questioned the fact that grit is a higher-order structure composed of two lower-order aspects[5], because they have found that the perseverance dimension is a better predictor of achievement than the interest dimension or overall grit. This structure emphasizes that the combination of interest and perseverance is the key to success in achieving long-term goals, although there is some controversy, its interpretation of goal adherence makes it an important theory in positive psychology and pedagogy. In the future, researchers can further explore its internal mechanisms and cross-cultural applicability.

Later, some researchers also believe that grit has cultural differences. Datu used qualitative research to investigate how grit works in a collectivist environment (Philippines), and found that "adaptability to situations" is also one of the constituent structures[6], adaptability emphasizes the ability of individuals to flexibly adjust their own circumstances and cope with changes in the pursuit and achievement of long-term goals, and individuals with high levels of grit are more likely to adapt to new or unexpected environments encountered in the process of achieving long-term goals. However, the factor composition of the overall triple grit model was not tested in his study, only the correlation of the structure was studied. Although there are some limitations, the three-factor structure explains the psychological composition and mechanism of grit more comprehensively than the two-factor structure, for example, on the basis of the three-factor structure, it can try to predict students' academic adaptability, and can consider improving students' grit level by cultivating students' adaptability in educational interventions.

With the deepening of the research on grit in China, Xiaona Li et al. believe that grit is a psychological quality to maintain unswerving interest in meaningful and valuable long-term goals and make unremitting efforts to achieve them, including four dimensions: perseverance, interest stability, belief firmness, and situational adaptability[7]. Through case interviews and qualitative analysis of research subjects, it proposes the dimension of belief firmness, which refers to the degree to which individuals assume that they can achieve long-term goals[8]. However, this structure needs to be further studied and tested to determine its fit.

By reviewing the literature on the structure of grit, it is found that its structure needs to be further clarified, and the existing measurement tools are difficult to effectively distinguish between the dimension of "perseverance and effort" and the dimension of "consistency of interest", and most of them reflect perseverance. Moreover, the characteristics of the cultural context can also affect the structure of the grit, for example, individuals in a collectivist background will prioritize collective goals and adjust or change individual goals according to collective needs.

1.2. Measurement of Grit

Most of the measures for grit were based on or adapted from two scales developed by Duckworth et al. However, with the in-depth study of grit by later researchers, considering the particularity of the research object, cross-cultural differences, and new views and thoughts on

the theoretical structure of grit, the original scale could not meet the needs of measurement, so new scales began to appear.

1.2.1. Original Grit Scale

Based on the two-factor structure of grit, Duckworth et al. developed the Original Grit Scale[1], which is divided into two dimensions, perseverance and consistency of interest, each with six items, and measures American adults over 25 years of age with different levels of education. Since then, domestic scholar Na Xie and others have revised the Chinese version of the scale for adults and found that it has high reliability and validity[9]. Moreover, this scale is also applicable to a wide range of people, and can be used to measure the grit level of military academy students[10], teenagers[11], and disadvantaged students[12] (students from poor families, students from divorced families, left-behind students, and students who are bullied on campus).

1.2.2. Short Grit Scale

Duckworth et al. re-validated and analyzed the Original Grit Scale, and deleted four unrelated items and finally revised it to Short Grit Scale[4]. It has been proven to have a high internal consistency, resulting in better measurement results compared to the former. Later, the researchers translated and revised it in different cultural contexts, and the German[13] and Spanish[14] versions appeared, and the reliability and validity of the test were also in line with the measurement standards. Wei Liang et al. found that the Chinese version of the Short Grit Scale is a reliable measurement tool to evaluate the grit level of professional or college athletes in China[15]. In addition, Wenli Liu et al. found that this scale can also provide a reasonable explanation for the differences in family socioeconomic status and cross-time differences in adolescents' grit level[16].

1.2.3. Triarchic Model of Grit Scale

Disabato et al. conducted a global survey of more than 7,000 participants from seven continents (excluding Antarctica) and found that the previous grit scale had a low internal consistency coefficient in non-Western collectivist countries[17]. Based on qualitative research, Datu et al. developed the Triarchic Model of Grit Scale with 10 items and three factors[6], which takes into account the importance of situational adaptability for individuals in the context of collectivist culture, therefore adds a new dimension of situational adaptability, and shows good reliability and validity in the measurement of a sample of Filipino students. On the basis of this scale, Junya Qiao developed a questionnaire suitable for measuring the grit quality of rural junior high school students, which included three dimensions: effort persistence, interest stability and situational adaptability, with a total of 23 items[18]. Later researchers also found that the Triarchic Model of Grit Scale could also be used to measure the level of grit of cadets[19] and Chinese teenagers[20].

1.2.4. Oviedo Grit Scale

Postigo Álvaro et al. researched and validated the Oviedo Grit Scale to assess grit in a Spanish-speaking environment[21]. The researchers evaluated the structure of the grit based on the theories of Duckworth et al. and the Short Grit Scale. There are 10 items on this scale, which are scored on a five-point scale, all of which are scored in the positive direction. The Oviedo Grit Scale is then tested to be one-dimensional in nature, and the scores it produces have good reliability and validity indicators. Haidong Liu et al. revised this scale in Chinese[22], and found that the scale has good reliability and validity, and also has the equivalence of cross-gender measurement and cross-age measurement.

1.2.5. 14-item Grit Self-report Scale

With the deepening of research on grit in China, researchers began to explore the localization measurement of grit, and Xiaona Li believed that the grit questionnaire abroad was not suitable

for local use, and Junya Qiao's grit questionnaire was compiled on the basis of rural junior high school students, which had certain limitations. Therefore, Xiaona Li et al. developed a 14-item Grit Self-report Scale suitable for adolescents, which includes three dimensions: perseverance, interest consistency, and firm belief[23], which have been tested with good reliability and validity, and can be used as an effective measurement tool in later adolescent grit studies.

2. The Role of Grit

2.1. Effect on Positive Psychology and Behavior

Individuals with a high level of grit are able to put in unremitting efforts in their studies and life, maintain their enthusiasm for their interests, and give full play to their potential. Grit has been shown to significantly positively predict success and performance[5], and it can also positively predict a large number of other positive psychology or behaviors.

2.1.1. Effect on Positive Psychology

Relevant foreign studies have found that the grit of college students can be positively correlated with academic performance through mediating factors such as self-efficacy and achievement goal orientation[24]. Individuals with high levels of grit can make unremitting efforts to pursue and achieve goals, thereby gaining a sense of accomplishment and promoting their life satisfaction[25], and the perseverance dimension in grit also has a significant positive impact on college students' professional satisfaction[26]. The use of e-learning grit by graduate students had a significant positive impact on self-efficacy and self-perceived performance[27].

Relevant domestic research has found that training officers and soldiers in grit can improve the overall mental health level of the troops, thereby enhancing combat effectiveness[28]. Individuals with high levels of grit recognize that their abilities can grow and are willing to work continuously toward them, resulting in positive self-evaluation and affirmation[29]. Teachers' self-efficacy and grit are positively correlated with their mental health, and teachers' enthusiasm can also indirectly affect their mental health through the mediating role of grit[30]. If middle and high school students possess high levels of grit, then their adaptability and satisfaction in school life are also high[31]. Grit is positively correlated with the self-esteem and self-identity of junior high school students[32], and it can also positively predict the life satisfaction of urban migrant children[33]. Grit can not only directly and positively predict the critical thinking of senior medical students[34], but it and resilience can also predict the differences in happiness among 64.5% of Chinese medical students, and these differences are significant[35].

2.1.2. Effect on Positive Behavior

Some studies in China have found that there is a significant positive correlation between the perseverance dimension of grit and academic performance, but there is no significant correlation between the consistency dimension of interest and academic performance[36], and the same result has been found in the grit-related research of primary and secondary school students[37], that is, the perseverance and effort dimension of grit has a greater impact on academic performance than the interest consistency dimension, which shows that learning is a long-term process, and students want to achieve good academic performance, perseverance is often more important than interest. For researchers, the quality of academic grit has a significant positive predictive effect on their innovation performance[38]. Grit as a psychological factor motivates individuals to continue to develop and also plays an important role in teachers' personal professional development and success[39].

A longitudinal study abroad found that there was a significant positive relationship between students' academic achievement and grit[40]. Different outcomes may vary depending on the

subject and study environment, and studies have shown that the interest consistency dimension of online education students' grit can predict their academic success[41].

2.2. Effect on Negative Psychology and Behavior

Grit can also slow down an individual's negative emotions or behaviors, play a positive role in the individual's mental health, and can help the individual to be positive, and has also found that grit is an important moderating mechanism between the relationship between social support and internalization problems[42].

2.2.1. Effect on Negative Psychology

The results of relevant foreign studies show that grit is an important protective factor to prevent burnout[43]. A study of students enrolled in universities in Singapore showed that the negative consequences of a high GPA on burnout were exacerbated when individuals performed lower on grit, while a combination of higher grit passion and a high GPA was associated with lower burnout[44]. And grit plays a resilient role in school burnout in adolescents, with high levels of grit slowing down depressive symptoms when adolescents are experiencing high school burnout[45]. Grit is also a protective and non-negligible factor between loneliness and academic stress[46]. A short-term longitudinal study of emerging bilingual primary school students showed that grit was a moderator and not protective at high stress, but still protected at low stress[47]. Grit can help individuals maintain a sustained effort and cope with setbacks and challenges to a certain extent, allowing them to navigate stressors that can lead to burnout[48]. Studies have also found that people with higher levels of grit perceive stress lower, which may lead to improved quality of life[49]. A longitudinal study of grit, post-traumatic growth, and life satisfaction among students in grades 6-12 during the COVID-19 pandemic found that students with high levels of grit may also see pandemic-related adversity as an opportunity for growth[50]. A survey of the relationship between mental health literacy and psychological symptoms of 178 college students in South Korea showed that mental health literacy can affect psychological symptoms through grit[51], so it is necessary to intervene in the mental health literacy and grit of college students to improve their mental health.

Relevant domestic studies have found that the higher the level of grit in junior high school students, the more they can improve the buffering effect of academic encouragement and school connection on depression[52]. Grit of left-behind youth also plays a moderating role in the relationship between peer support and depression[42]. A study of more than 2,000 junior high school students in China found that grit could significantly moderate the relationship between school burnout and depression[45]. Improving the grit quality of patients with multimorbid coexistence can help them develop positive psychological qualities[53]. Moreover, the grit level of migrant children can alleviate the negative effects of social exclusion on their school adaptation[54].

2.2.2. Effect on Negative Behavior

A foreign study of college students found that grit was a protective regulator of the relationship between post-traumatic stress symptoms and suicidal tendencies[55]. Studies on the protective factors of suicide have found that grit and gratitude can enhance the sense of meaning in life and indirectly buffer suicide[56].

Domestic studies have found that adolescents with low levels of grit who lack school engagement are more likely to have problematic online behaviors[57]. The grit level of high school students can significantly negatively predict their academic procrastination, and grit can also moderate the relationship between future time insight and academic procrastination[58]. Previous studies have also shown that the use of grit curriculum training to intervene in school bullying among junior high school students can reduce bullying[59].

It can be seen from the literature at home and abroad that grit has a negative predictive effect on negative emotions and a positive predictive effect on positive emotions, indicating that its impact on emotions has cross-cultural and cross-group consistency. However, there are several problems in previous studies: First, there is a lack of testing the relationship between grit dimensions and variables, and most studies evaluate the relationship between grit and other variables based on the total score of grit. Second, there is a lack of research on grit in different contexts, and the effects of grit may have different effects in different environments.

3. Factors Influencing Grit

3.1. Social Support and Parenting Styles

Some studies in China have found that when students are in a self-supporting environment (teacher-owned, peer-supported, and parental-supported), it is conducive to cultivating their grit quality[60]. Positive parenting styles by parents will promote the formation of grit qualities in students[61]. For example, a tolerant and understanding parenting style can promote the cultivation of middle school students' academic interest and sense of academic meaning, thereby improving their academic grit quality[62], while authoritarian parenting style can produce the opposite result[63]. Mindfulness parenting can positively predict adolescent grit through the mediating effect of basic psychological needs[64]. From the perspective of intergenerational transmission, the total grit score and the two dimensions of parents can positively predict the total grit score and each dimension of junior high school children[65]. In schools, when students feel the equal and respectful teacher-student relationship, the peer relationship of mutual assistance and friendship, and the orderly curriculum and the appropriate competitive pressure, they may obtain positive resources from the classroom, so as to cultivate individual grit quality[29]: for example, the physical education teacher provides independent support[66], the individual forms a good peer relationship under the independent support of peers[67], and a good class relationship[68] (including student-student relationship and teacher-student relationship) is conducive to the development of individual grit quality.

Foreign studies have found that the attachment of individuals to their parents is related to the higher degree of grit in adolescence[69], and it is found that the grit of parents affects the grit of offspring from the role of parenting behavior on the intergenerational co-change of grit[70]. As an individual grows, interpersonal relationships in schools also affect their grit: for example, a good positive teacher-student relationship can positively predict grit[71], a recent three-year longitudinal study found that changes in teacher-student relationships can predict changes in the level of grit within an individual[72], such as when teachers and students establish positive connections, the knock-on effect is powerful, can improve students' abilities, and make them stick to long-term goals. In addition to teacher support, research has also found that interpersonal resources play an important role in reinforcing grit in school contexts[73].

3.2. Future-oriented Factors

Grit represents an individual's continued enthusiasm and persistence in long-term goals, and after reviewing the existing literature, researchers have found that factors that point to the future will have an impact on grit, such as growth mindset and future time insight.

The relevant domestic literature finds that relative academic grade can have an impact on grit through the chain mediating effect of mastery-approach goal[74]. Based on the perspective of intellectual plasticity, a two-year large-scale longitudinal study of more than 5,000 Chinese primary school students found that growth mindset predicted the increase of individual grit level[75]. Similarly, the growth mindset of college students can also significantly affect the level of grit[76], and the future self-continuity of college students can also positively predict grit, and future time insight has an important mediating role between future self-continuity and grit[77].

A foreign study on the differences between individuals with a low level of growth mindset and a high level of growth mindset found that the former had a significantly lower grit score than the latter[78], indicating that the growth mindset is very important to grit. Individuals with high grit levels do not deviate from their goals and tend to pursue unsolvable problems without time constraints, but not when they have time constraints, and people with high grit tend to be more flexible in achieving their goals[79]. And hopefully, it can also predict a higher level of grit for college students[80].

4. Grit Intervention Study

4.1. Growth Mindset Courses

Growth mindset course intervention is an effective means to improve the quality of individual grit, and researchers at home and abroad have designed growth mindset courses to intervene in grit.

Alan et al. adopted the intervention of growth mindset courses to improve the grit level of primary school students[81]. Its focus is on three ideas that are interrelated with grit: growth mindset, perseverance in failure, goal setting, its interventions emphasize the role of effort in improving skills and achieving goals, the importance of constructive explanations for failure, so perseverance and goal setting are important, and teachers are also encouraged to emphasize the role of effort in daily classroom practice. Jiayi Peng, a domestic scholar, designed a series of growth mindset courses to enhance the grit quality of junior high school students[82]. Focusing on inspiring students to recognize that the brain is malleable, and that intelligence and abilities can be developed through hard work, and to establish a growth mindset, the researchers used Dweck and his team's intervention project as a reference, combined with the content of the curriculum framework developed by Beijing Normal University, and designed the main body of the design includes understanding the growth mindset, brain plasticity, positive attitude in the face of failure, social support, and the internalization and application of the growth mindset. Hongyu Liao arranged the curriculum through psychological metaphors, based on evidence-oriented teaching design, and adopted the classroom training mode of growth mindset and the integration of multiple teaching methods, and developed a curriculum suitable for junior high school students[83]. It is closely related to the connotation, influencing factors and significance of academic grit, through exploring interests, making plans and focusing on goals, making unremitting efforts, overcoming difficulties and setbacks, and continuing to maintain passion. The results showed that the grit level of the students was improved by the growth mindset course intervention.

Although the two scholars in China intervened in grit from the perspective of growth mindset, the former designed the curriculum around the growth mindset to implicitly improve students' grit, while the latter directly designed the course with the theme of academic grit to improve students' grit level. So the growth mindset course can effectively improve the grit level of the individual. In future intervention research, researchers should improve and optimize the growth mindset curriculum on the basis of their predecessors, explore more internal mechanisms of growth mindset and grit, and propose richer and more novel curriculum designs to effectively intervene to improve individual grit levels. In the future, researchers can also try to design interventions based on variables related to a growth mindset. For example, studies have shown that growth mindset and self-efficacy can co-mediate the positive impact of the self-supporting environment on their grit quality[60], so researchers can design courses related to growth mindset and self-efficacy, and create a self-supportive environment for students to improve their grit level.

4.2. Language Classroom Model for Structured Reading Activities

Carla et al. used a language classroom model of structured reading activities to enhance the grit and critical thinking skills of 10-year-olds in rural Chile[84]. The main activities of the model are reading the text in class, and the steps include: turning interest into enthusiasm (allowing students to feel how the characters in the text turn interest into enthusiasm), purpose-oriented perseverance (students answer three questions with the aim of motivating them to develop their grit beyond the content itself, including allowing students to fully understand and take interest in the text; the text is combined with realistic similar situations; feel the story and make an emotional connection with it), provide support and feedback (the teacher asks the class two questions to stimulate their metacognition, what have you learned today? The second question is based on the article, and the teacher gives overall feedback at the end, highlighting the good and the areas for improvement), and developing fun activities (to promote children's language development and enrich the learning process). The results of the study showed that this intervention could enhance grit and critical thinking in primary school students.

In future studies, researchers can do further research to generalize the results to different cultural backgrounds and expand the age groups of the participants.

4.3. Intervention of Group Auxiliary Activities

Through a review of the available literature, group counseling activities have also been widely used by researchers to improve individual grit levels.

Based on the theory of positive group psychological counseling and the related theories of grit structure, Huimin Jiang designed a program to improve the grit level of secondary vocational students[85]. In the intervention stage, members are guided to have a preliminary and in-depth understanding of grit, set personal goals and make plans, carry out positive attribution, time management, transform unreasonable emotions, and break the mindset. Based on Duckworth's grit theory, positive mental health education theory, group dynamics theory and social learning theory, Zhongzhe Dong has developed a structured group counseling program to improve the grit level of junior high school students[86], from the initial understanding of grit quality, to the combination of one's own interests and career planning with the establishment of long-term goals, from resisting external temptations and controlling one's own emotions to cultivate students' self-control, and guide students to face setbacks and build self-confidence. Based on the theory of positive personality, the three-dimensional theory of academic grit (determination, concentration, persistence) and the theory of interpersonal communication, Qiange Hu formulated an academic grit group auxiliary intervention program for 24 high school students with moderate test anxiety level[87], which adopted direct intervention and indirect intervention, the former was based on the three-dimensional theory of academic grit, to improve their determination, concentration and persistence, so that they could have a direct feeling of academic grit, and guide them to think about how to improve their academic grit level. The latter indirectly improves students' academic grit level by improving their academic self-concept and academic self-efficacy. According to Duckworth's grit two-factor structure, goal hierarchy framework theory and grit-related books, Siyuan Zhong also carried out grit group counseling intervention activities for junior high school students[88], and the first part of the intervention focused on "consistency of interest" to guide students to explore and confirm their interests and set long-term goals, and the middle part focused on "perseverance and hard work" to inspire students to know that perseverance and hard work are very important in the process of achieving goals and master the method of deliberate practice. The final session helps students correctly understand setbacks and failures and form a positive attitude towards them. In later tests, these interventions in grit group tutoring can improve students' grit levels.

There may be the following problems in the group-assisted activities of existing grit interventions: researchers focus more on the perseverance dimension of individual grit and

ignore the interest dimension, and do not follow up on the delay effect of the intervention activities, and the scope of the study is small.

4.4. Mindfulness Interventions

Ruiying Zhang designed the mindfulness curriculum to enhance the academic grit of high school students[89], and designed the curriculum around mindfulness-based cognitive behavioral therapy, including regular weekly classroom learning and daily after-class check-in exercises, which help students understand mindfulness to learn and feel mindfulness, use technology to regulate their emotions, and finally integrate mindfulness into daily learning and life. Mindfulness intervention was tested to improve students' academic grit level, and the effect was remarkable.

For this study, the mindfulness intervention had the problem that the number and intensity of the participants' self-practice at home were difficult to ensure, which may affect the effectiveness of mindfulness training.

4.5. I CAN Intervention

In a pilot study in 2023, Hermundur et al. proposed an "I CAN intervention" to improve grit and self-efficacy[90], based on theories such as neurogroup selection theory, deliberate practice, and brain science, which first emphasized the importance of repetition to strengthen brain networks, and then extended to the importance of grit and deliberate practice for achievement. It examined the effects of a 35-40 minute online intervention on the beliefs of 38 Norwegian university students in "I CAN". After testing and post-testing eight weeks later, it was shown that this preliminary study could effectively improve the level of grit. Hermundur et al. then applied a novel "I CAN" intervention to intervene in grit and growth mindset in 15-year-olds in Norway[91]. Researchers are based on theories based on the development of intellectual abilities and changing beliefs. Interventions that focus on the part of the brain emphasize the three most important aspects that adolescents need to remember, namely: that you can achieve more than you realize if you put in enough effort, that you can overcome challenges if you put in the effort, and that self-confidence and positive focus are the keys to success. It mainly includes: explaining how the combination of the inside of the brain provides a good foundation for learning, common themes in mindset interventions (e.g., brain plasticity messages), the importance of deliberate practice, an introduction to neuroplasticity, inspirational stories that develop adolescents' ability to overcome challenges and setbacks, illustrating an individual's potential for improvement, short games or activities, and creating personal "reminder notes". The I CAN intervention was found to be beneficial to the improvement of individual grit levels, but there was a gender difference, and the increase in grit was more significant in men than in women.

From the existing literature, Hermundur sigmundsson et al. adjusted the I CAN intervention in the pilot study of the grit of college students according to the actual situation of adolescents. The new I CAN protocol was used to intervene in adolescents' grit, and the results of both studies showed that the I CAN intervention was beneficial in improving individual grit levels. But there were some problems with the study: gender differences in the study, and whether the intervention could be applied to students from different cultural backgrounds.

4.6. STEAM-GAAR Field Learning Model Enhanced GRIT

Wannaporn et al. designed a grit intervention through the STEAM-GAAR Field learning model[92], which is a learning model that combines STEAM education (science, technology, engineering, arts, and mathematics) with G (gamification), A (animation), AR (augmented reality), and Field (space utilization) to improve individual grit levels. It connects gamification, animation, AR and grit's intrinsic factors such as interests, exercises, goals, and hopes to build a STEAM-gaar Field learning model to enhance grit. Interests can be created using gamification,

animation, and augmented reality; Hopefully, it can be created with animation; Practices can also be created using gamification, animation, and augmented reality. The researchers believe that the model should also contain four elements, one of which is the input factor: expected learning outcomes, learning objectives, teacher analysis, student analysis, content analysis, environment analysis, and learning management plan. The second element is the STEAM-GAAR Field learning process: investigation through games, discovery through AR games, connection through animation and games, creation through game animation and AR, and reflection through the field of knowledge exchange. Element 3 is the assessment of learning outcomes and grit, through the teacher's observation and assessment form. Element 4 is the analysis of feedback. This model focuses on motivating students to learn through gamification, animation, and AR to improve their grit skills.

There may be cultural differences or difficulties in implementing this intervention model. In future research, researchers need to put it into practice in education to validate, while also taking into account the cultural background of the learner.

5. Grit Course

With the deepening of grit research, many researchers at home and abroad have developed courses related to grit to improve the level of grit of individuals.

5.1. Abroad Grit Courses

Through the review of the previous literature, it can be seen that the research on "grit" in foreign countries is earlier than in China, and researchers have developed related courses based on the research related to "grit".

In 2013, the United States released the document "Promoting Grit, Tenacity, and Perseverance: Critical Factors for Success in the 21st Century", which emphasized the importance of non-cognitive grit, and also stated that grit is a good quality for individuals to achieve success, and teachers should cultivate grit qualities in students. Therefore, the relevant departments advocate the integration of grit related content into the curriculum or classroom to cultivate students' willpower.

In 2021, Sinclair et al. developed a grit curriculum designed to improve the grit of a rural public high school student in the Midwest[93], with the goal of helping students improve their grit by utilizing multiple achievement motivation theories. Based on attribution theory, goal setting theory, self-control theory, self-efficacy theory and growth mindset theory, the curriculum principle is the construction of the attribution retraining process, including the following points: first, to create frustration and cultivate students' grit spirit of not being afraid of failure; The second is attribution training, which inspires students to believe that they can make changes. The third is a unit writing task, one is grit-based poetry writing, and the other is a narrative essay related to the theme, writing an essay to the college admissions committee about a new skill they have learned, describing the process and time of perseverance; the fourth is to guide students to study hard to achieve continuous effort and self-control; Finally, guide the students to rewrite the assignment and ask them to spend at least one tutorial session to reorganize the material, or to make necessary changes to their work to improve it, so as to lead them to realize that they must put in extra effort to be rewarded. There may be the following problems with this course: it is culturally different and not suitable for direct use in countries with other cultural backgrounds; The scope of the study was too small, and it only designed and implemented a grit curriculum around students in a particular school.

5.2. Domestic Grit Courses

Most researchers in China will design and implement mental health courses based on Duckworth's grit theory to improve students' grit level.

Boyang Dong designed a grit course for first-year high school students[94] based on Duckworth's grit theory, positive psychology theory, rational emotive theory, social learning theory, and other theoretical foundations, focusing on passion, self-control, perseverance, and resilience as the content of the course. Yongyan Dong's curriculum design, based on Duckworth's relevant grit theory, revolves around interests, practice, purpose, hope, and growth mindset, including understanding the essence of grit and stimulating the intrinsic motivation to cultivate grit qualities[95], exploring interests and hobbies, setting future goals, understanding deliberate practice and formulating plans, cultivating self-control, recognizing a growth mindset, turning stress into motivation, and facing and embracing setbacks. Zhenglian Su's course is specifically designed for cultivating grit, starting from Duckworth's definition[96], and includes not only an overall grit course but also a focus on the two dimensions of grit: perseverance and interest consistency. The training course for secondary vocational students has undergone three rounds of teaching, and after each round, students in the intervention class were interviewed for feedback, along with a comparative analysis of pre- and post-test data from both the experimental and control classes, allowing for reflection on the current round of courses, formulation, and improvement of the next round of plans, finally, after the practice concludes, the entire process is analyzed to evaluate the overall effectiveness of the intervention. Yaqun Xu mainly designed the course based on the two dimensions of grit (perseverance and interest consistency) and the four connotations (perseverance and frustration, passion and self-control)[97], firstly, let students know the quality of grit, evaluate their own grit level, then find interests and goals, and finally improve concentration, self-control, and frustration resistance, so as to improve the quality of grit. According to the development characteristics of primary and secondary school students' academic grit, Kehui Liao developed the standard of academic grit integration curriculum[98], which focuses on vertical integration, the transition of academic grit courses in different grade levels, and the implementation and effect test of the curriculum. Its curriculum design concepts include: positive psychological orientation, growth mindset training, psychological metaphors, etc. The results of the study show that the above curriculum design can enhance students' grit level.

In view of the existing grit courses, there may be the following problems: foreign grit courses may not be suitable for direct use in China, from the perspective of domestic grit courses, first, there is a lack of follow-up test steps or times, and it is difficult to test whether the course has a long-term effect on the improvement of grit level, and the second qualitative evaluation part lacks the relevant evaluation of the course by experts or peer teachers, which affects the improvement of the subsequent courses, and thirdly, most of the studies only involve the design of the curriculum, and there is a lack of an integrated grit curriculum system from the aspects of groups and counseling, the fourth academic grit course can improve the academic grit level of students in the middle and high school experimental group, but the applicability of the integrated curriculum standard of academic grit in this study remains to be tested.

6. Prospects

6.1. Choose a more appropriate grit scale

Through the review of the previous literature, with the deepening of grit research, more and more scales have begun to appear from Duckworth's Original Grit Scale in 2007 to the present. The reliability, validity, and scope of application of the scale will also vary with different environments and subjects, and researchers have gradually shifted from the translation and revision of the original scale to the development of their own scale according to their own research needs. Therefore, in future research, researchers should select or compile a grit scale that is more suitable for the research based on the research object and cultural background.

6.2. Pay attention to the analysis of environmental particularity

A review of the previous literature suggests that individuals in different settings may have different levels of grit. For example, most studies have shown that grit positively predicts student academic achievement, but a study by John Dale Mateo on online learning found that perseverance did not directly affect academic performance[99], that alignment of interests had a negative impact on time management, and that perseverance had a positive impact on metacognitive skills, time management, and persistence, highlighting the complexity of the factors that affect academic performance in online learning environments. In future research, researchers should pay attention to exploring the role and differences of grit dimensions (perseverance, consistency of interests) in different environments (e.g., militarized management, online learning, etc.), and consider using structural equation models to compare students' data in different environments.

6.3. Increase the steps and frequency of tracking measurements

Through the review of the relevant literature of grit intervention, it can be seen that some investigators do not conduct follow-up measurement or only perform a follow-up measurement when testing the effect of the intervention after the implementation of the intervention, which may lead to the bias of the intervention effect. Therefore, in future intervention studies, the investigator should add the step of follow-up measurement after the implementation of the intervention, and can also consider increasing the number of follow-up measures and testing the intervention effect multiple times to rule out the impact of timeliness on the study.

6.4. The internal structure of grit needs to be further determined

Through the review of the relevant literature of grit, it is found that its structure needs to be further determined. It is difficult for the existing measurement tools to effectively distinguish between the dimensions of "perseverance" and "consistency of interest", and most of them reflect perseverance. Moreover, the research objects of different cultural backgrounds also affect the structure of the grit, for example, individuals in a collectivist background will prioritize collective goals and adjust or change individual goals according to collective needs. In addition, research on grit interventions will design courses or group support based on the internal structure of grit, and will also test the effectiveness of the intervention. Therefore, it is important to explore the structural elements within grit in future research.

6.5. Added a relationship test with each dimension of grit

By examining the relationship between the dimensions of grit and the variables, it is possible to gain new perspectives or find out the specific reasons for the research object. For example, the results of a study of military medical students conducted by Yan Zhang et al. showed that the interest consistency dimension of grit is negatively correlated with life satisfaction[100], which is different from the results of Yumin Liu et al.[101], and its analysis may be caused by the special military camp environment of medical students. Therefore, in future studies, researchers should examine the relationship between the intrinsic structure of grit and other variables in this study to gain new perspectives.

7. Conclusions

Grit, as a psychological quality that maintains a lasting passion and unremitting efforts for long-term goals, plays a significant role in individual development, academic achievement, mental health. This article, through a systematic review of the research on the conceptual structure, measurement tools, influencing factors, intervention measures, and curriculum development of grit, draws the following conclusions: Firstly, the structure of grit has gradually evolved from the initial two-factor model (interest and perseverance) to a multi-structural model (such as

the addition of situational adaptability, belief firmness, etc.), reflecting its cultural adaptability and complexity. Future research needs to further verify the stability of the grit structure under different cultural backgrounds and explore its internal mechanisms. Secondly, the measurement tools for grit have become increasingly diverse, evolving from the initial Original Grit Scale and Short Grit Scale to the three-factor scale (TMGS) that adapts to different cultural backgrounds and localized scales (such as the 14-point Grit self-report Scale). Future research should select appropriate measurement tools in combination with the characteristics of the research subjects, or develop more targeted scales based on local culture. Thirdly, grit has a significant positive predictive effect on positive psychology and behavior, and can also buffer negative emotions. The effects of different dimensions of grit may also vary. Future research needs to deeply explore the relationship between each dimension and other variables to reveal more detailed mechanisms of action. Fourth, grit is influenced by multiple factors such as social support, parenting styles, and growth mindset. In future research, more in-depth exploration of these influencing factors is still needed. Finally, in terms of grit intervention research and courses, the steps and frequency of follow-up measurements should be increased, the influence of timeliness on research should be excluded, and grit courses suitable for localization should be explored.

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