


[Collection](#)
[Thesaurus](#)

[Advanced](#)
[Search Tips](#)
☐ Peer reviewed only ☐ Full text available on ERIC

ERIC indexes a wide variety of journal sources. The coverage of an approved journal source is determined by an examination of three to five current issues during the source review process, but may be updated at any time. Source coverage is defined as follows:

Comprehensively indexed journals contain an average of 80% or more education-related articles; ERIC creates a bibliographic record for all articles in every acquired issue.

Selectively indexed journals contain an average of 50-79% education-related articles and are critical to topic area coverage; ERIC applies a manual article-by-article selection process and indexes only the articles that conform to the standard and criteria outlined in the ERIC [selection policy](#).

The journals currently approved for indexing in ERIC are listed below. The availability of records for an issue is dependent on content provided by the publisher. Click on the hyperlink to see all indexed material from each journal. To view the journals by topic area, [click here](#). View this page as a [PDF](#).

[A](#) | [B](#) | [C](#) | [D](#) | [E](#) | [F](#) | [G](#) | [H](#) | [I](#) | [J](#) | [K](#) | [L](#) | [M](#) | [N](#) | [O](#) | [P](#) | [Q](#) | [R](#) | [S](#) | [T](#) | [U](#) | [V](#) | [W](#) | [X](#) | [Y](#) | [Z](#)

A

[Top](#)

[AASA Journal of Scholarship & Practice](#)
[About Campus](#)
[Academic Questions](#)
[Accounting Education](#)
[ACM Transactions on Computing Education](#)
[Across the Disciplines](#)
[Acta Didactica Napocensia](#)
[Acta Educationis Generalis](#)
[Action in Teacher Education](#)
[Action Learning: Research and Practice](#)
[Action, Criticism, and Theory for Music Education](#)
[Active Learning in Higher Education](#)
[Acuity: Journal of English Language Pedagogy, Literature and Culture](#)
[Administrative Issues Journal: Connecting Education, Practice, and Research](#)
[Adult Education Quarterly: A Journal of Research and Theory](#)
[Adult Learner: The Irish Journal of Adult and Community Education](#)
[Adult Learning](#)
[Adult Literacy Education](#)
[Adults Learning Mathematics](#)
[Advanced Education](#)
[Advances in Engineering Education](#)
[Advances in Health Sciences Education](#)
[Advances in Language and Literary Studies](#)
[Advances in Physiology Education](#)
[AERA Open](#)
[Africa Education Review](#)
[African Educational Research Journal](#)
[African Journal of Research in Mathematics, Science and Technology Education](#)
[Afterschool Matters](#)
[AILA Review](#)
[AILACTE Journal](#)

F[Top](#)

[Field Methods](#)
[Film Education Journal](#)
[FIRE: Forum for International Research in Education](#)
[First Language](#)
[Focus on Autism and Other Developmental Disabilities](#)
[For the Learning of Mathematics](#)
[Foreign Language Annals](#)
[FORUM: for promoting 3-19 comprehensive education](#)
[Frontiers: The Interdisciplinary Journal of Study Abroad](#)
[Frontline Learning Research](#)

G[Top](#)

[Gender and Education](#)
[Geographical Education](#)
[Geography Teacher](#)
[Georgia Educational Researcher](#)
[Georgia Journal of College Student Affairs](#)
[Gifted and Talented International](#)
[Gifted Child Quarterly](#)
[Gifted Child Today](#)
[Gifted Education International](#)
[GIST Education and Learning Research Journal](#)
[Global Education Review](#)
[Global Studies of Childhood](#)
[Globalisation, Societies and Education](#)

H[Top](#)

[HAPS Educator](#)
[Harvard Educational Review](#)
[Health Education](#)
[Health Education & Behavior](#)
[Health Education Journal](#)
[Health Education Research](#)
[Health Educator](#)
[High Ability Studies](#)
[High School Journal](#)
[Higher Education Evaluation and Development](#)
[Higher Education for the Future](#)
[Higher Education Forum](#)
[Higher Education Pedagogies](#)
[Higher Education Policy](#)
[Higher Education Politics & Economics](#)
[Higher Education Quarterly](#)
[Higher Education Research and Development](#)
[Higher Education, Skills and Work-based Learning](#)
[Higher Education Studies](#)
[Higher Education: The International Journal of Higher Education Research](#)
[Higher Learning Research Communications](#)
[Hispania](#)
[History Education Research Journal](#)
[History of Education](#)
[History of Education Quarterly](#)
[History of Education Review](#)
[History Teacher](#)
[Honors in Practice](#)
[HOW](#)
[Human Rights Education Review](#)
[Hungarian Educational Research Journal](#)

I[Top](#)

[i.e.: inquiry in education](#)
[IAFOR Journal of Education](#)
[IEEE Transactions on Education](#)



ISSN 1925-4741 (Print)
ISSN 1925-475X (Online)

Higher Education Studies

Vol. 13, No. 4 December 2023

Canadian Center of Science and Education®

CONTENTS

The Impact of College Students' Perceived Transformational Leadership on Learning Outcomes: The Serial Mediating Role of Academic Self-Efficacy and Achievement Goal Orientation	1
<i>Chang Liu, Jian-Hao Huang</i>	
Effects of Job Crafting on Job Engagement of College Teachers in Hebei Province, China	15
<i>Xiao-Na Liu, Yuan-Cheng Chang</i>	
Assessing Effects of Government Funding on University Policy- An Institutional Theory Perspective	25
<i>Richard J. Morris, John Munyui Muchira, Cathryn E. Dobrowolski</i>	
Experiential Learning Practices and Career Courses: Predictors of First Destination Outcomes	40
<i>Addye Buckley Burnell, Leslie A. Cordie</i>	
Advancing a Model for Enhancing Research Competencies among Non-Academic Staff in Northeast Thailand Higher Education Institutions	50
<i>Wuthikrai Pommarang, Songsak Phusee-orn</i>	
Enhancing Learning Achievement in Sentence Structure among Grade 8 Students using the GPAS 5 STEP Learning Management Model	59
<i>Thidarat Thongtum, Autthapon Intasena</i>	
Guidelines for Implementing the Ministry of Education's Digital Action Plan of Educational Institutions under the Foundation of the Church of Christ in Thailand	68
<i>Penwadee Maninoi, Phannaphat Kedprasit, Navaphol Praneet, Nirada Wechayaluck</i>	
Health Impact of Long Covid among Student Teachers, Kasetsart University	75
<i>Tharisara Chirasatienpon</i>	
Development of a Grit Measurement Scale for Thai Dramatic Arts Students	86
<i>Tanapot Posamak, Satayu Songchan, Nateethorn Narkprom, Nattapon Yoitha, Wuthikrai Pommarang</i>	
Synthesis and Model Development of Thai Undergraduate Dropout Risk Factors	94
<i>Timothy Scott, Poonpilas Asavisanu</i>	
Analysis of the Causes and Countermeasures of the Involution of Family Education in China	112
<i>Hexuan Wang</i>	
Creation of Educational Innovations through Cloud-based Constructivism and Connectivism Learning for Undergraduates	119
<i>Kanokrat Jirasatjanukul, Nuttakan Pakprod, Prueksa Dokkulab, Apatcha Changkwanyeeun, Thada Jantakoon, Rukthin Laoha</i>	
Improving Creative Problem-Solving Abilities of English Students through HyFlex Learning Management and Project-Based Learning	128
<i>Teeraporn Plailek, Teeraphat Kitjarak, Weerayuth Plailek</i>	

Development of a Grit Measurement Scale for Thai Dramatic Arts Students

Tanapot Posamak¹, Satayu Songchan¹, Nateethorn Narkprom², Nattapon Yotha² & Wuthikrai Pommarang³

¹ Nakhon Ratchasima College of Dramatic Arts, Nakhon Ratchasima, Thailand

² Faculty of Education, Phetchabun Rajabhat University, Phetchabun, Thailand

³ Faculty of Architecture, Urban Design and Creative Arts, Mahasarakham University, Mahasarakham, Thailand

Correspondence: Nattapon Yotha, Faculty of Education, Phetchabun Rajabhat University, Phetchabun, Thailand.
E-mail: Nattapon.Yot@pcru.ac.th

Received: September 4, 2023

Accepted: October 6, 2023

Online Published: October 7, 2023

doi:10.5539/hes.v13n4p86

URL: <https://doi.org/10.5539/hes.v13n4p86>

Abstract

The present study aimed to achieve two main objectives: 1) investigating the components and predictors of grit among Thai Dramatic Arts students, hereafter referred to as TDART students, in a Thai college; and 2) establishing and validating a grit scale specifically designed for TDART students. A total of three hundred and forty-five TDART students were selected using the Multi-stage Random Sampling method to participate in this study. The research instrument used was a grit measurement survey comprising 60 rating-scale items. Mean and standard deviation were employed for data analysis, and confirmatory factor analysis was used to assess construct validity. The findings revealed two distinct components of TDART students' grit: passion and perseverance, forming a five-dimensional structure for the scale. The grit scale exhibited strong reliability with a value of 0.946, and the power of discrimination (r^{xy}) ranged from 0.247 to 0.586. The results indicated acceptable construct validity for the grit scale, as evidenced by goodness of fit indices meeting criteria (Chi-Square=23.768, $df=23$, $\chi^2/df=1.033$, $p\text{-value}=0.417$, CFI=1.000, TLI=1.000, RMSEA= 1.000, and SRMR=0.028).

Keywords: confirmatory factor analysis, construct validity, grit, measurement, predictor

1. Introduction

Grit refers to an individual's passion and perseverance in pursuing work and fulfilling responsibilities with the aim of achieving personal objectives, even in the face of potential setbacks and challenges (Roberts, 2009; Suzuki, Tamesue, Asahi, & Ishikawa, 2015; Thaler & Koval, 2015). Grit is a crucial factor contributing to an individual's success, characterized by passion, perseverance, and a willingness to take risks.

Grit has two major predictors: passion and perseverance. Passion can be classified into five subcategories: love and faithfulness in related fields, concentration for a goal, desire, eagerness, and achievement motivation. Perseverance can be subcategorized as tolerance, effort, ability to overcome obstacles, and determination (Duckworth, Peterson, Matthews, & Kelly, 2007; Stoltz, 2014). As a result, this study utilized Duckworth et al. (2007) and Stoltz's (2014) frameworks for grit components because they align with the educational context and the characteristics of TDART students.

According to Duckworth and Gross (2014), grit surpasses other predictive variables for achievement, such as intellect and emotion, highlighting its significance. Interestingly, grit doesn't always correlate with intelligence. Individuals with high intelligence tend to give up more easily in the face of difficulties compared to those with grit (Duckworth et al., 2007). This aligns with a study's results, which revealed that success in life hinges not solely on intelligence but also on personal qualities and non-cognitive skills (Heckman, Malofeeva, Pinto, & Savelyev, 2009). Grit can be measured in various ways, including self-assessment forms and questions about daily life situations.

As revealed by an external quality assurance (EQA) report conducted on academic institutions within Thailand's Ministry of Culture, students' performance in general curriculum subjects has fallen below expectations, and there is a concerning increase in dropout and transfer rates. These problems are linked to students' lack of unwavering attitudes and resilience (Posamuk, 2017), which are directly associated with two major predictors of

criteria, displaying discriminating power ranging from 0.247 to 0.586.

The measurement form's reliability was tested and found to be acceptable, with a Cronbach's α of 0.946.

Confirmatory Factor Analysis was executed to affirm the content validity of the TDART students' grit scale. The results are detailed in Tables 1-4.

Table 1. Correlation Coefficients (r) of Predictors for Gritty in TDART Students

	LFR	CFG	DES	EAG	ACH	TOL	EFF	DET	ABI
LFR	1.000								
CFG	0.544	1.000							
DES	0.553	0.451	1.000						
EAG	0.619	0.536	0.646	1.000					
ACH	0.559	0.460	0.554	0.622	1.000				
TOL	0.341	0.495	0.581	0.542	0.447	1.000			
EFF	0.601	0.581	0.677	0.628	0.636	0.573	1.000		
DET	0.667	0.594	0.693	0.748	0.686	0.586	0.818	1.000	
ABI	0.659	0.572	0.679	0.766	0.653	0.498	0.784	0.885	1.000

KMO= .924, Bartlett's Test of Sphericity: Approx. Chi-Square=2406.831, df=36, P=.000

Note. All correlation coefficients are statistically significant at the 0.05 level.

Table 1 displays the correlation coefficients (r) for the nine predictors of gritty among TDART students, ranging from 0.341 to 0.885. These coefficients indicate a statistically significant positive relationship, with a strength of 0.05, between two continuous variables. The statistical assessment of the relevance of the data used in the analysis of grit components was conducted. The Kaiser-Meyer-Olkin (KMO) result yielded a high score of 0.924, indicating a very high level of relevancy. To further assess the relationship among the variables, Bartlett's Test of Sphericity was employed. The test, which utilized the Chi-Square statistic, yielded a result of 2406.831, with a corresponding p-value of 0.000. This result indicates a strong linear relationship among the variables at a statistically significant level of 0.05.

Table 2. Second-Order Confirmatory Factor Analysis of Gritty Predictors among TDART Students

Major Components	Subcomponents	Factor Loading (λ_y)	Standard Error (SE λ_y)	Level of Significance (Z)	Reliability (R^2)
PAS	LFR	0.872	0.015	58.141	0.760
	CFG	0.862	0.014	59.740	0.743
	DES	0.894	0.015	58.139	0.799
	EAG	0.911	0.014	66.458	0.830
	ACH	0.619	0.019	32.140	0.383
PER	TOL	0.966	0.017	56.883	0.933
	EFF	0.875	0.011	82.539	0.765
	DET	0.850	0.009	91.078	0.722
	ABI	0.950	0.009	107.175	0.903

As depicted in Table 2, the factor loadings varied between 0.619 and 0.966, with corresponding standard errors ranging from 0.009 to 0.019. Additionally, the Z-test demonstrated a statistically significant distinction among all variables at a significance level of 0.01. Furthermore, the reliability values, indicated by squared multiple correlations (R^2), ranged from 0.383 to 0.933.

Table 3. Second-order Confirmatory Factor of Passion and Perseverance of TDART Students

Major Components	Factor Loading (λ_y)	Standard Error (SE λ_y)	Level of Significance (Z)	Reliability (R^2)
PAS	0.813	0.018	46.079	0.661
PER	0.803	0.012	66.245	0.645

(Construct reliability: ρ_c) = 0.790, (Average variance extracted: ρ_v) = 0.653

Based on Table 3, the factor loadings for passion and perseverance of TDART students were 0.813 and 0.803,

grit: passion and perseverance. Consequently, the researchers of this study were compelled to develop a measurement scale for TDART students to assess their level of grit. The resulting data can provide valuable insights for addressing students' issues and improving their academic achievements.

For this study, the assessment of grit was approached through a psychometric lens, emphasizing the measurement of internal behaviors. In light of this, it is valuable to explore the grit of TDART students, who navigate a distinctive educational environment. Furthermore, the study aims to, firstly, investigate the components and predictors of grit among TDART students, and secondly, develop and validate a grit scale specifically for TDART students.

2. Method

2.1 Participants and Sampling Procedures

The study was conducted among a population of 3,475 TDART students who were enrolled in the second semester of the academic year 2022 at Bunditpatanasilpa Institute, an academic institution under the Ministry of Culture of Thailand. The sample size was determined using an observation-to-variable ratio of 1:10 (Hair, Anderson, Tatham, & Black, 1998). Using the multi-stage random sampling method, a research sample of 345 TDART students was selected.

2.2 Research Instruments

The research instrument comprised 60 items using a five-point categorical rating scale, divided into two parts. Part 1, Passion, included 32 items measuring Love and Faithfulness in related fields (7 items), Concentration for Goal (6 items), Desire (7 items), Eagerness (5 items), and Achievement Motivation (7 items). Part 2, Perseverance, comprised 28 items measuring Tolerance (6 items), Effort (9 items), Determination (6 items), and Ability to overcome obstacles (7 items).

To establish and validate the research instrument, the researchers followed these steps. Firstly, determined the purpose of the grit measurement scale for TDART students. Next, studied concepts, theories, and related research to analyze the components and predictors of grit among TDART students. Subsequently, identified the components and predictors of gritty among TDART students and defined the operative definition of gritty. Then, formulated 80 questions based on the definition of each predictor of gritty, utilizing a five-point categorical rating scale. These questions constituted the measurement form, assessing the two major components of TDART students' grit. Additionally, distributed the measurement form to 5 experts in the field to ensure content validity. Among the 80 items, 73 met the selection criterion as the IOC values of each item ranged from 0.5 to 1.00. Afterward, conducted a trial with 60 non-participant students, revealing item total-correlations ranging from 0.247 to 0.586, and a Cronbach's α of 0.946 for internal consistency. Finally, employed confirmatory factor analysis to assess construct validity. The results indicated acceptable validity based on the criteria of goodness of fit indices: (Chi-Square=23.768, $df=23$, $\chi^2/df=1.033$, $p\text{-value}=0.417$, CFI=1.000, TLI=1.000, RMSEA= 1.000, and SRMR=0.028).

2.3 Data Collection and Data Analysis

To gather the data, the following methodological steps were undertaken. Firstly, the researchers obtained permission and cooperation from Bunditpatanasilpa Institute to conduct the research. They informed the participants about the research objectives and specified the date and time for data collection. Secondly, to prevent potential loss of subjects and incomplete responses, extra measurement forms were prepared and distributed to the student participants. Thirdly, the data collection process was concluded by October 2022. Next, the measurement forms were meticulously preserved, and responses were carefully reviewed for completeness. Only fully completed forms were included in the scoring and subsequent statistical analysis, adhering to predetermined criteria. Then, content analysis was employed to analyze the components and predictors of gritty, while Item total-correlations were utilized to determine the discriminating power of individual items. Lastly, the reliability and validity of the grit scales were assessed through Confirmatory Factor Analysis and Cronbach's α .

3. Results

The findings unveiled two core components of TDART students' grit: passion and perseverance. Passion encompassed 5 predictors, namely Love and faithfulness in related fields (LFR), Concentration for Goal (CFG), Desire (DES), Eagerness (EAG), and Achievement Motivation (ACH). Perseverance consisted of 4 predictors: Tolerance (TOL), Effort (EFF), Determination (DET), and Ability to overcome obstacles (ABI).

Regarding the content validity of the grit scale for TDART students, the average Item-Objective Congruence (IOC) value for all items ranged from 0.60 to 1.00. Out of a total of 73 question items, 60 met the selection

respectively. The standard error of passion was 0.018 and that of perseverance was 0.012. The Z-test showed a statistically significant difference between all variables at the level of significance of 0.01 and the reliability values (Squared multiple correlations: R^2) ranged from 0.661 and 0.645. The values of construct reliability and average variance extracted were 0.790 and 0.653, respectively.

Table 4. Second-order Confirmatory Factor of Passion and Perseverance of TDART Students

Fit Indices	Value	Criterion	Interpretation
Chi-Square	23.768	-	-
df	23	-	-
Relative Chi-Square	1.033	$\chi^2/df < 2.00$	Good fit
p-value	0.417	$p > .05$	Good fit
CFI	1.000	$CFI > .95$	Good fit
TLI	1.000	$TLI > .95$	Good fit
RMSEA	1.000	$RMSEA < .05$	Good fit
SRMR	0.028	$SRMR < .05$	Good fit

Table 4 provides insights into the goodness of fit indices for the TDART students' measurement scale. The indices, including χ^2/df , Relative Chi-Square, p-value, CFI, TLI, RMSEA, and SRMR, reflect the fitness of the scale. Additionally, the values of construct reliability and average variance extracted affirm the internal consistency of the measurement scale. Notably, the statistically significant factor loadings of all predictors of TDART students' gritty underscore the scale's robustness. With demonstrated internal consistency and construct validity, the measurement scale, comprising a range of predictors, effectively represents the gritty of TDART students, as illustrated subsequently in Figure 1.

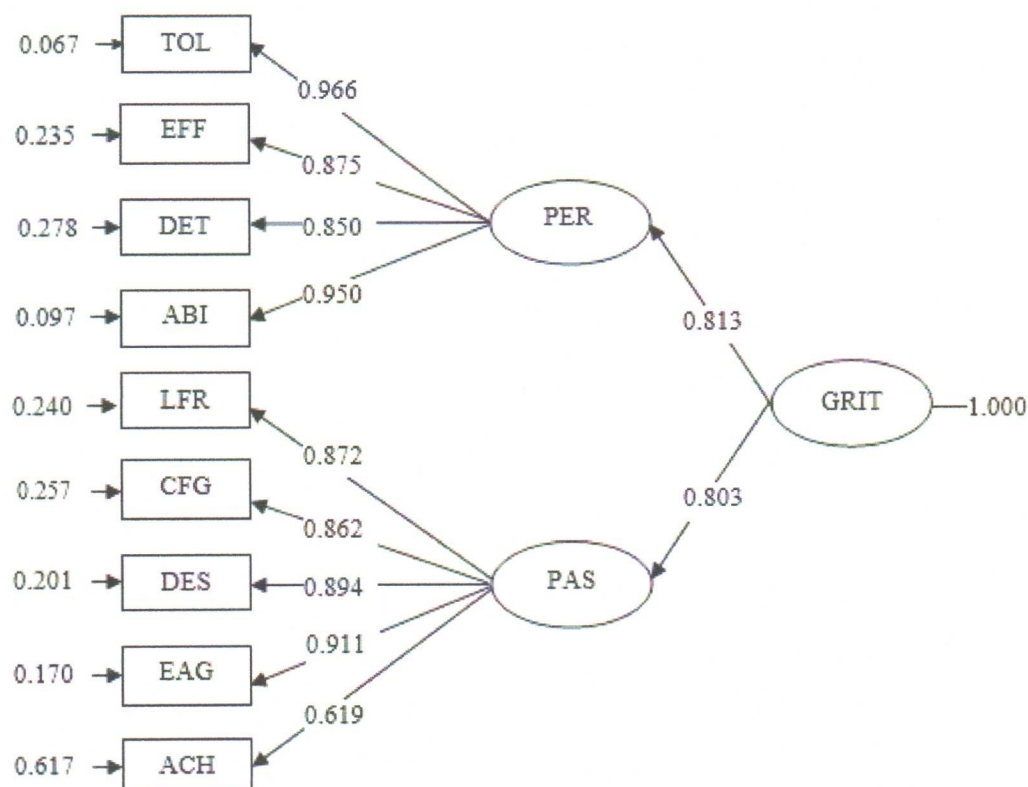


Figure 1. Illustrating Second-Order Confirmatory Factor Analysis of the GRIT Model

Chi-Square= 23.768, df= 23, χ^2/df = 1.033, p-value = 0.417, CFI= 1.000, TLI = 1.000, RMSEA= 1.000, SRMR = 0.028

The study identified two primary components of grit among TDART students: passion and perseverance. Passion encompassed five predictors: Love and faithfulness in related fields, Concentration for Goal, Desire, Eagerness,

and SRMR.

Like the current study, several previous research endeavors aimed at developing educational measurement scales have adopted two essential steps. The first step involves studying concepts, theories, and related research to analyze the components and predictors of grit among their respective participants. The second step entails engaging field experts in the establishment and validation of the measurement scale to ensure its content validity. Furthermore, these studies assessed the measurement scales' discriminating power, reliability, and construct validity using the Pearson correlation coefficient, Cronbach's alpha, and confirmatory factor analysis, respectively. For instance, Gioia, Isquith, Guy, and Kenworthy (2015) designed an educational measurement scale to gauge the predictive capabilities of self-management or executive functions in children aged 5-18 years old. Furthermore, Archwarin (2018) developed a measurement scale and established a criteria for mathematical giftedness among Grade 9 students. To evaluate the reliability of both the measurement scale and its individual items, the Index of Item-Objective Congruence (IOC) and Classical Test Theory (CTT) were employed, respectively. The assurance of construct validity was accomplished through confirmatory factor analysis (CFA). Additionally, Pipattadorn (2017) developed a measurement scale to evaluate the competence of executive officers in Thailand's basic education schools, following the country's accession to the ASEAN community. The scale underwent reliability testing, and a norm was established, rooted in the national vision and the essential competencies required for ASEAN academic directors. Lastly, Theinwimonchai (2019) created a measurement scale to evaluate desirable traits of honesty in students from Grades 4 to 6. The scale's psychometric properties were verified through content validity, t-tests to determine the question items' discriminatory power, Cronbach's alpha to assess reliability, and the Pearson correlation coefficient to establish construct validity.

5. Recommendations and Suggestions for Further Research

The measurement scale employed in our present study for TDART students demonstrated a high reliability value of 0.946 and exhibited robust structural validity. This outcome underscores the scale's ability to effectively measure student grit. Therefore, it is recommended that academic institutions with student populations sharing similar characteristics as those in our study consider employing this measurement scale for their own student assessment. By doing so, valuable insights can be gained, leading to the identification of potential guidelines for fostering further student development.

In this study, TDART students from Buditpatanasilpa Institute, under the Ministry of Culture of Thailand, were selected as the research population. If this measurement scale is to be employed for assessing students from diverse academic institutions or levels, it is advisable to undertake a separate validation process.

This grit measurement scale comprised 9 predictors and encompassed 60 question items, reflecting the perceptions of TDART students and the importance they attribute to each predictor of grit. Academic institutions are encouraged to utilize this grit measurement scale to gain insights for reevaluating their strategies and fostering educational enhancements.

Future researchers aiming to develop and validate new grit measurement scales should consider various variables, including education levels and the geographical locations of academic institutions. Expanding empirical data in these aspects could contribute to tailoring more appropriate and effective educational strategies.

To develop grit measurement scales, future research should employ a range of data collection methods, including interviews, SWOT analysis, and situation tests. Additionally, involving various informants such as friends and parents would provide a more comprehensive and concise empirical data set.

Providing students with education and training on grit can significantly enhance their potentials and overall personal development.

Acknowledgments

Not applicable

Authors contributions

Not applicable

Funding

Not applicable

Competing interests

Not applicable

and Achievement Motivation. Perseverance included four predictors: Tolerance, Effort, Determination, and Ability to overcome obstacles.

The grit measurement scale for TDART students exhibited a five-dimensional structure, comprising 60 items. The items demonstrated good discriminating power, ranging from 0.247 to 0.586, and the Cronbach's α value was 0.946, indicating high internal consistency. The validation process yielded statistically significant results at a significance level of 0.01. Construct reliability and average variance extracted values were 0.790 and 0.653, respectively.

The grit scale's construct validity was confirmed through goodness of fit indices (Chi-Square=23.768, $df=23$, $\chi^2/df=1.033$, $p\text{-value}=0.417$, CFI=1.000, TLI=1.000, RMSEA=1.000, and SRMR=0.028). In conclusion, the measurement scale exhibited sound internal consistency and construct validity, aligning with the researchers' initial hypotheses.

4. Discussion

The exploration of TDART students' gritty involved an in-depth review of pertinent theories and research. In addition, interviews were conducted with field experts to enhance our understanding. The development and validation of the grit measurement scale were guided by four critical methods, as suggested by Johnstone (1981):

1. Defining Predictors of Gritty: This initial step encompassed the clear definition of the key predictors contributing to gritty.
2. Selecting Predictors of Gritty: The predictors were thoughtfully selected, considering both theoretical relevance and empirical evidence.
3. Integrating Variables with Appropriate Predictors: Variables were meticulously matched with suitable predictors, forming the foundation of a comprehensive measurement scale.
4. Assigning Weight to Variables: Each variable's significance was meticulously evaluated, and corresponding weights were assigned to align with the predictors.

These methods were integral to the validation of the grit scale, which was further confirmed through second-order confirmatory factor analysis. This approach aligns with Wiratchai and Wongvanich's assertion (1998) that the validation process holds the key to assessing the quality of the measurement scale.

Construct validity assessment entails using empirical data to either test and support research hypotheses or theories. This process necessitates researchers to define measurable components and predictors guided by relevant theories. Subsequently, empirical data assessment validates their alignment with the pre-established grit measurement scales.

The validation of the grit measurement scale revealed elevated Cronbach's α values for each aspect of the scale. The question items within these aspects exhibited significant variance, indicating substantial variability among the respondents. According to Kanjanawasee (2005), variance is often considered a measure of reliability, implying that high variance is typically associated with high reliability.

To assess the structural validity of the grit measurement scale, a confirmatory factor analysis was conducted. Given that each characteristic consists of sub-components, and each sub-component contains predictors and question items, a second-order confirmatory factor analysis was employed in this study. Firstly, the correlation between the question items in the measurement scale and those in the assessment form was examined. Secondly, a significance value of 0.00 for Bartlett's Test of Sphericity was applied to determine whether the correlation between predictors and question items significantly differs from an identity matrix, at a significance level of 0.05. The KMO test was also performed with a threshold greater than 0.5 to establish the correlation among question items and ascertain their suitability for further component analysis (Wiratchai, 1999). Based on the analysis, the results of Bartlett's Test of Sphericity and the KMO test were satisfactory, indicating the suitability of the model. Furthermore, the confirmatory factor analysis was conducted to determine the factor loading of each question item. This loading indicates the extent to which the values of the sub-components of each predictor change and the predictive values represent the proportionate value of the covariance between the question items and the sub-components. This process was also applied in the analysis of the second-order confirmatory factor analysis, which aimed to ascertain the level of the sub-components within the given predictor.

Based on the findings, the question item displaying the highest R^2 value, representing the squared multiple correlations, will have the strongest discriminatory power compared to others within the same component. Furthermore, the grit scale exhibited conceptual relevance and was developed using emerging empirical data, meeting the criteria of goodness of fit indices, which include Chi-Square, df , χ^2/df , $p\text{-value}$, CFI, TLI, RMSEA,

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

Open access

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

References

- Archwarin, C. (2018). *The Development of Mathematical Giftedness Tests for Grade 9th Students in The Eastern Region* (Unpublished doctoral dissertation). Burapha University, Chonburi, Thailand.
- Duckworth, A., & Gross, J. J. (2014). Self-Control and Grit: Related but Separable Determinants of Success. *Current Directions in Psychological Science*, 23(5), 319-325. <https://doi.org/10.1177/0963721414541462>
- Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and Passion for Long-term Goals. *Journal of Personality and Social Psychology*, 92(6), 1087-1101. <https://doi.org/10.1037/0022-3514.92.6.1087>
- Gioia G. A., Isquith P. K., Guy S. C., Kenworthy L. (2015). *Behavior Rating Inventory of Executive Function®*, Second Edition (BRIEF®2). Lutz, FL: PAR Inc.
- Hair, J. F., Jr., Anderson, R., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis*. New Jersey: Upper Saddle River, Prentice-Hall.
- Heckman, J., Malofeeva, L., Pinto, R., & Savelyev, P. (2009). *The effect of the Perry Preschool Program on the cognitive and non-cognitive skills of its participants* (Unpublished manuscript). University of Chicago, Department of Economics.
- Johnstone, J. N. (1981). *Indicators of Education Systems*. London: The Anchor Press.
- Kanchanawasri, S. (2005). *Classical Test Theory*. Bangkok: Chulalongkorn University Press.
- Pipattadorn, C. (2017). *A Development of a Management Competency Test for The Basic Education School Director in Thailand to Enter Aseanization Era* (Unpublished doctoral dissertation). Burapha University, Chonburi, Thailand.
- Posamuk, T. (2017). *Developing a Model to Enhance Grit on College of Dramatic Arts Students, Bunditpatanasilpa Institute, Ministry of Culture* (Unpublished doctoral dissertation). Mahasarakham University, Mahasarakham, Thailand.
- Roberts, Y. (2009). *Grit: the Skills for Success and How They are Grown*. London: The Young Foundation.
- Stoltz, P. G. (2014). *Grit-The New Science of What it takes to Persevere Flourish Succeed*. United States of America: Climb Strong Press, Inc.
- Suzuki, Y., Tamesue, D., Asahi, K., & Ishikawa, Y. (2015). Grit and Work Engagement: A Cross-sectional Study. *PLoS ONE*, 10(9), Article e0137501. <https://doi.org/10.1371/journal.pone.0137501>
- Thaler, L. K., & Koval, R. (2015). *Grit to Great: How Perseverance, Passion, and Pluck Take You from Ordinary to Extraordinary*. New York: Crown Business.

- Theinwimonchai, W. (2019). *Scale Development of Desirable Characteristics in Honesty for Grade 4-6 Students in Phra Nakhon Si Ayutthaya Province* (Unpublished doctoral dissertation). Burapha University, Chonburi, Thailand.
- Wiratchai, N. (1999). *LISREL model: Statistical analysis for research*. Bangkok: Chulalongkorn University Press.
- Wongwanich, S., & Wiratchai, N. (1998). *Analyzing the Academic Rankings of Asian Universities*. Bangkok: Seven Printing Group