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Explainable AI Analysis of Grit, Academic Hope, and Persistence in Iranian EFL Students

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A B S T R A C T

Objective: The objective of this study was to examine the predictive roles and relative importance of grit and academic hope in explaining academic persistence among Iranian EFL students using explainable artificial intelligence techniques.

Methods and Materials: This study employed a cross-sectional correlational design with a sample of Iranian EFL learners enrolled in language institutes and university language centers in Tehran. Participants completed standardized self-report measures assessing grit (perseverance of effort and consistency of interests), academic hope (agency and pathways), and academic persistence. Data were analyzed using supervised machine learning models suitable for psychological tabular data, with academic persistence specified as the outcome variable and grit and academic hope components as predictors. Model performance was evaluated using explained variance and error-based indices. To ensure interpretability, explainable AI methods, specifically SHapley Additive exPlanations (SHAP), were applied to identify global and local feature contributions and to clarify the direction and magnitude of predictor effects.

Findings: The machine learning model explained a substantial proportion of variance in academic persistence, indicating strong predictive performance. Explainable AI analyses revealed that academic hope–agency was the most influential predictor of persistence, followed by perseverance of effort, academic hope–pathways, and consistency of interests. Higher levels of agency beliefs and perseverance of effort were associated with higher predicted persistence scores, while consistency of interests showed a comparatively weaker contribution. The results demonstrated non-linear and differential effects of motivational components on persistence, highlighting individual variability in predictor influence.

Conclusion: The findings indicate that academic persistence among Iranian EFL students is primarily driven by agency-based hope and sustained effort, and that explainable AI provides a powerful framework for uncovering nuanced motivational mechanisms beyond traditional linear models.

Keywords: *Explainable artificial intelligence; grit; academic hope; academic persistence; EFL learners; motivational psychology*

1. Introduction

In recent years, the field of educational psychology has witnessed a growing interest in understanding the non-cognitive and motivational factors that sustain learners' engagement and long-term success, particularly in demanding learning contexts such as foreign language acquisition. Among these factors, grit, academic hope, and persistence have emerged as central constructs for explaining why some learners continue to invest effort and remain resilient despite challenges, setbacks, and slow progress. This line of inquiry has been further invigorated by advances in artificial intelligence, which enable researchers to move beyond traditional linear models and explore complex, non-linear relationships among psychological variables in a transparent and interpretable manner. Explainable artificial intelligence (XAI) offers a powerful methodological framework for uncovering not only whether certain variables predict academic outcomes, but also how and to what extent they do so, thereby aligning predictive accuracy with theoretical interpretability (Fowler, 2025; Torres et al., 2025).

Grit, commonly defined as perseverance and passion for long-term goals, has been extensively studied as a key predictor of academic engagement, achievement, and well-being across educational levels and cultural contexts. Research consistently demonstrates that students with higher levels of grit are more likely to sustain effort over time, regulate their learning behaviors, and cope effectively with academic stressors. In adolescent and university populations, grit has been linked to self-regulated learning, reduced burnout, and stronger academic engagement, highlighting its relevance for demanding learning trajectories (Ibrahim et al., 2025; kang & Kim, 2025; Lee & Chung, 2025). In the context of language learning, where progress is often gradual and requires prolonged commitment, grit appears particularly salient. Studies focusing on EFL and second language learners have shown that gritty students tend to demonstrate higher engagement, better academic performance, and greater psychological well-being, even when facing linguistic anxiety or limited immediate rewards (He et al., 2024; Tang & Zhu, 2024).

Despite this growing body of research, grit is increasingly viewed not as a monolithic trait but as a multidimensional construct whose components may function differently across contexts. Alternative grit models and psychometric investigations suggest that perseverance of effort and consistency of interests may not contribute equally to academic outcomes, and that their predictive power can vary depending on cultural, educational, and disciplinary factors (Mateo, 2024; Uribe-Moreno et al., 2024). Empirical evidence from diverse educational systems indicates that perseverance-related aspects of grit are often more strongly associated with persistence and achievement than interest consistency, especially in structured academic environments (Barrientos, 2025; Noronha et al., 2024). These findings underscore the need for analytic approaches capable of disentangling the relative contributions of grit dimensions rather than treating grit as a single aggregated score.

Alongside grit, academic hope has been identified as a foundational motivational construct that shapes students' goal-directed behavior and long-term academic trajectories. Rooted in Snyder's cognitive theory of hope, academic hope encompasses agency thinking, or the perceived capacity to initiate and sustain action toward goals, and pathways thinking, or the perceived ability to generate effective strategies for goal attainment. Research consistently demonstrates that students with higher academic hope exhibit stronger motivation, greater academic vitality, and enhanced persistence, even in the face of obstacles (Abri et al., 2025; Panahi et al., 2023). In both general education and specialized learning contexts, academic hope has been linked to academic achievement, psychological well-being, and adaptive coping strategies, highlighting its central role in sustained academic functioning (Hansen et al., 2023; Raeisi, 2025).

In language learning contexts, academic hope plays a particularly critical role, as learners must continually envision future proficiency and maintain confidence in their ability to improve over time. Studies conducted in EFL settings indicate that hopeful students are more likely to persist in language study, invest in self-regulated learning strategies, and remain engaged despite communicative difficulties or slow progress (Henry, 2023; Tang & Zhu, 2024). Furthermore, academic hope has been shown to interact with other motivational constructs, such as optimism, academic aspiration, and grit, suggesting that its effects on persistence are both direct and indirect (Panahi et al., 2023; Tammeh et al., 2025). These complex interrelationships call for integrative analytical frameworks capable of modeling multiple predictors simultaneously while preserving theoretical clarity.

Academic persistence itself constitutes a central outcome variable in educational research, reflecting students' sustained commitment to learning tasks and long-term educational goals. Persistence has been conceptualized as a

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behavioral manifestation of motivation and self-regulation, encompassing continued effort, task completion, and resistance to dropout tendencies. In the language learning literature, persistence is widely recognized as a prerequisite for successful attainment, given the cumulative and time-intensive nature of language acquisition (Henry, 2023). Empirical studies have demonstrated that persistence is influenced by a constellation of motivational, emotional, and cognitive factors, including grit, hope, self-efficacy, and sense of belonging (Hansen et al., 2023; Soleimani et al., 2023). However, much of the existing research relies on linear statistical models that may oversimplify these relationships and obscure individual-level variability.

Recent methodological advances have opened new avenues for addressing these limitations through the application of machine learning and artificial intelligence in educational research. Machine learning models are particularly well suited for capturing non-linear patterns, interaction effects, and complex dependencies among psychological variables. Nevertheless, a major criticism of such models lies in their "black box" nature, which can limit theoretical interpretability and practical applicability. Explainable AI seeks to overcome this limitation by providing tools that reveal how specific features contribute to model predictions, thereby bridging the gap between predictive performance and psychological theory (Fowler, 2025; Torres et al., 2025). In motivational and educational psychology, XAI approaches enable researchers to identify not only which variables matter most, but also how their effects vary across individuals and contexts.

Although the application of explainable AI in education is still emerging, recent studies suggest its considerable potential for advancing theory-driven insights. Research integrating motivational constructs with predictive modeling has demonstrated that XAI can illuminate nuanced patterns of influence, such as differential effects of grit dimensions or conditional contributions of hope-related beliefs (Groza & Tofan, 2024; Obeng et al., 2025). These approaches are particularly valuable in culturally specific contexts, where motivational dynamics may differ from those observed in Western educational systems. In this regard, the Iranian EFL context represents an important yet underexplored setting for applying explainable AI to psychological constructs related to persistence and motivation.

Iranian EFL learners often face unique structural and motivational challenges, including high-stakes examinations, limited authentic exposure to English, and strong societal expectations regarding academic success. Prior research conducted in Iran has highlighted the importance of motivational resources such as academic hope, future orientation, and adaptive self-regulation for sustaining engagement under these conditions (Norouzi, 2024; Rahmani et al., 2024). Studies focusing on academic persistence and well-being in Iranian students further emphasize the role of identity, aspiration, and psychological resilience in maintaining long-term commitment to learning (Abri et al., 2025; Soleimani et al., 2023). However, there remains a lack of integrative research that simultaneously examines grit, academic hope, and persistence using advanced analytical techniques capable of capturing their complex interrelations.

Moreover, existing studies in both Iranian and international contexts tend to examine grit or hope in isolation, or to model their effects using traditional regression or structural equation approaches. While these methods have yielded valuable insights, they may not fully capture the heterogeneity of learners' motivational profiles or the non-linear mechanisms through which these constructs influence persistence. Explainable AI offers a promising alternative by allowing researchers to model multiple predictors concurrently while retaining interpretability at both the global and individual levels (Groza & Tofan, 2024; Obeng et al., 2025). Such an approach aligns well with contemporary calls for more nuanced, data-informed, and context-sensitive analyses in educational psychology.

In light of these considerations, the present study seeks to contribute to the literature by integrating grit, academic hope, and persistence within an explainable AI framework in the context of Iranian EFL education. By doing so, it responds to recent theoretical and methodological calls for combining robust predictive modeling with transparent interpretation, thereby enhancing both scientific understanding and practical relevance. Drawing on prior empirical findings regarding grit, hope, and persistence across diverse educational settings (Barrientos, 2025; Hansen et al., 2023; He et al., 2024), this study positions itself at the intersection of motivational psychology and explainable machine learning, with a specific focus on EFL learners in Tehran.

The aim of this study was to examine the predictive roles of grit and academic hope in explaining academic persistence among Iranian EFL students using explainable artificial intelligence techniques.

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2. Methods and Materials

2.1. Study Design and Participants

The present study adopted a cross-sectional, correlational design with an explanatory machine learning framework to investigate the relationships among grit, academic hope, and persistence in Iranian learners of English as a Foreign Language (EFL), with a particular emphasis on model interpretability. The study population consisted of upper-intermediate to advanced EFL students enrolled in private language institutes and university language centers in Tehran. Participants were selected using a multistage cluster sampling approach, whereby several institutes from different districts of Tehran were first identified and intact classes were then invited to participate. Inclusion criteria included being between 18 and 30 years of age, having at least two years of formal English language instruction, and currently being enrolled in an EFL course. Students with self-reported neurological or severe psychological disorders were excluded to avoid confounding effects on motivational and cognitive variables. A total sample of adequate size for machine learning modeling was targeted to ensure stable training and testing of predictive models, and participation was voluntary with informed consent obtained prior to data collection. All procedures were conducted in accordance with ethical standards for research involving human participants, including confidentiality, anonymity, and the right to withdraw at any stage without penalty.

2.2. Measures

Grit was measured using the Short Grit Scale (Grit-S), originally developed by Duckworth and Quinn in 2009 as a refined version of the original Grit Scale introduced by Duckworth et al. in 2007. The Grit-S is a self-report instrument designed to assess individuals' sustained passion and perseverance toward long-term goals. It consists of 8 items distributed across two subscales: Perseverance of Effort and Consistency of Interests, with each subscale comprising four items. Responses are recorded on a five-point Likert scale ranging from strongly disagree to strongly agree, with higher scores indicating higher levels of grit. Negatively worded items are reverse-scored prior to computing total and subscale scores. The Grit-S has been widely used in educational and second language research, and previous studies have consistently reported acceptable to strong internal consistency, as well as satisfactory construct and convergent validity across diverse cultural contexts, including EFL populations.

Academic hope was assessed using the Academic Hope Scale, adapted from Snyder's Hope Theory framework, originally proposed in 1991 and later operationalized in academic contexts. This scale conceptualizes hope as a cognitive-motivational construct composed of two interrelated components: agency thinking, reflecting students' perceived capacity to initiate and sustain goal-directed actions, and pathways thinking, referring to perceived ability to generate workable routes toward academic goals. The academic version of the scale typically contains 8 items, evenly divided between the agency and pathways subscales. Items are rated on a Likert-type scale, most commonly ranging from one to five, with higher scores representing stronger levels of academic hope. Total academic hope scores are computed by summing or averaging item responses after ensuring correct scoring direction. Prior empirical research has confirmed the factorial validity of the scale, as well as its reliability and predictive validity for academic engagement, achievement, and persistence-related outcomes in student populations.

Persistence in language learning was measured using an Academic Persistence Scale specifically adapted for educational settings to capture sustained engagement and continued effort despite academic challenges. This instrument was developed in the early 2000s within the broader literature on motivation and self-regulated learning and has since been applied in language learning research. The scale typically includes between 10 and 15 items assessing students' tendencies to continue studying, complete assignments, and remain committed to learning goals even when experiencing difficulty or reduced immediate rewards. Responses are collected using a Likert-scale format, with higher scores indicating stronger academic persistence. Composite scores are calculated after reverse-scoring negatively phrased items where applicable. Previous validation studies have demonstrated acceptable internal consistency coefficients and supported the scale's construct validity through associations with motivation, achievement, and retention indicators.

2.3. Data Analysis

Data analysis was conducted in several sequential stages, integrating traditional statistical preprocessing with explainable artificial intelligence techniques. Initially, data were screened for missing values, outliers, and distributional

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assumptions, and descriptive statistics were computed to summarize participant characteristics and main study variables. Following preprocessing, supervised machine learning models were developed to predict academic persistence as the target variable using grit subscales and academic hope components as predictor features. Algorithms suitable for tabular psychological data, such as gradient boosting machines and random forest models, were trained and evaluated using cross-validation procedures to minimize overfitting and enhance generalizability. Model performance was assessed using standard metrics including coefficient of determination and error-based indices. To address the interpretability of the predictive models, explainable AI techniques were employed, most notably SHapley Additive exPlanations (SHAP), which enabled both global and local interpretation of feature contributions. These analyses allowed for the identification of the relative importance of grit and academic hope dimensions in predicting persistence, as well as the direction and magnitude of their effects at the individual level. All analyses were conducted using established statistical and machine learning software environments, ensuring reproducibility and transparency of the analytic process.

3. Findings and Results

The initial analysis focused on describing the central tendency and variability of grit, academic hope, and persistence, as well as examining preliminary distributional properties. Table 1 presents the means, standard deviations, observed score ranges, and intercorrelations among the core variables included in the study. This table provides an essential descriptive foundation for understanding the relative levels of each construct in the sample and their bivariate associations prior to model-based analysis.

Table 1

Descriptive Statistics and Correlations Among Study Variables

Variable	Mean	SD	Minimum	Maximum	1	2	3	4	5
1. Perseverance of Effort	3.72	0.68	1.75	5.00	—				
2. Consistency of Interests	3.45	0.71	1.50	5.00	0.41	—			
3. Academic Hope – Agency	3.89	0.64	2.00	5.00	0.53	0.38	—		
4. Academic Hope – Pathways	3.76	0.66	1.88	5.00	0.49	0.35	0.62	—	
5. Academic Persistence	3.81	0.59	2.10	5.00	0.58	0.44	0.61	0.57	—

As shown in Table 1, Iranian EFL students reported moderately high levels of all three psychological constructs. Among grit components, Perseverance of Effort demonstrated a higher mean score than Consistency of Interests, indicating that sustained effort toward long-term goals was more salient than stability of interests in this sample. Academic hope components also showed relatively high mean values, with Agency marginally exceeding Pathways, suggesting that students perceived themselves as more confident in initiating goal-directed action than in generating multiple routes to achieve those goals. Academic persistence exhibited a high mean and comparatively lower variability, reflecting a generally strong tendency toward sustained engagement in language learning. Correlational analyses revealed that all associations were positive and of moderate magnitude. Academic persistence was most strongly correlated with Academic Hope–Agency and Perseverance of Effort, while Consistency of Interests showed weaker, though still meaningful, associations with all variables. These patterns provided initial empirical support for the hypothesized interconnections among motivational and perseverance-related constructs and justified their inclusion in subsequent predictive modeling.

The next stage of analysis examined the performance of the explainable machine learning models in predicting academic persistence based on grit and academic hope components. Table 2 reports the predictive accuracy indices for the final selected model after cross-validation, including explained variance and error-based metrics. This table demonstrates the overall effectiveness of the model in capturing variance in persistence scores.

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Table 2

Predictive Performance of the Machine Learning Model for Academic Persistence

Metric	Value
R^2 (Explained Variance)	0.48
Root Mean Squared Error (RMSE)	0.37
Mean Absolute Error (MAE)	0.29

As presented in Table 2, the final predictive model accounted for approximately 48% of the variance in academic persistence, indicating a substantial explanatory capacity given the psychological nature of the predictors. The relatively low RMSE and MAE values suggest that the model's predictions deviated only modestly from observed persistence scores, supporting the robustness and stability of the trained algorithm. These findings indicate that grit and academic hope, when jointly modeled using non-linear machine learning techniques, provide a strong basis for predicting persistence in Iranian EFL learners. Importantly, the level of explained variance exceeded what is typically reported in purely linear models within motivational research, highlighting the added value of machine learning approaches for capturing complex psychological relationships.

To further unpack how individual predictors contributed to the model's performance, feature importance values derived from explainable AI analyses were examined. Table 3 presents the global importance rankings of the predictor variables based on SHAP values, reflecting each feature's average contribution to the prediction of academic persistence across all participants.

Table 3

Global Feature Importance for Predicting Academic Persistence Based on SHAP Values

Predictor	Mean Absolute SHAP Value	Importance Rank
Academic Hope – Agency	0.42	1
Perseverance of Effort	0.36	2
Academic Hope – Pathways	0.31	3
Consistency of Interests	0.19	4

The results displayed in Table 3 reveal a clear hierarchy among predictors. Academic Hope–Agency emerged as the most influential feature, indicating that students' beliefs in their capacity to initiate and sustain effort toward academic goals played a central role in determining persistence. Perseverance of Effort ranked second, underscoring the importance of sustained effort and resilience in long-term language learning. Academic Hope–Pathways also contributed meaningfully, suggesting that the ability to generate alternative routes toward goals supports persistence, albeit to a slightly lesser degree than agency beliefs. Consistency of Interests demonstrated the lowest importance, indicating that maintaining stable interests over time was less critical for predicting persistence in this EFL context compared to effort- and agency-related dimensions. These findings suggest that dynamic, action-oriented motivational beliefs outweigh static interest stability in sustaining engagement in language learning.

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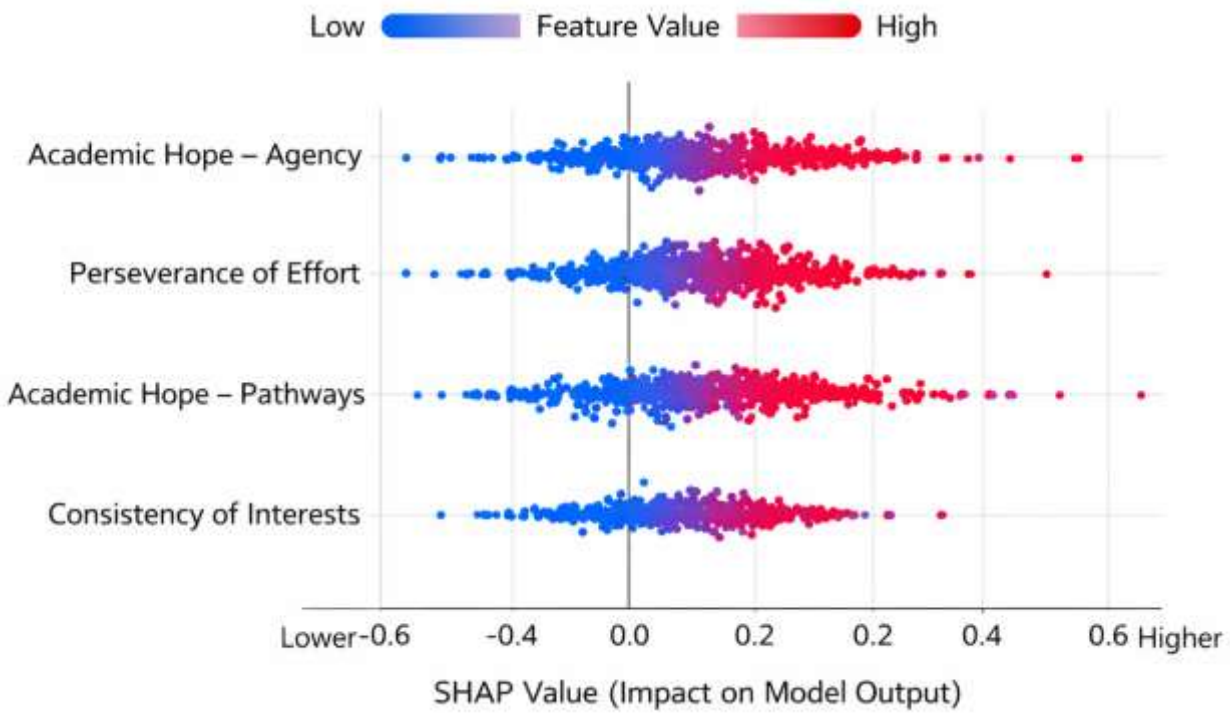
Figure 1

SHAP Summary Plot for Feature Contributions to Academic Persistence



The SHAP summary plot illustrated in Figure 1 provides a visual representation of both the magnitude and direction of each predictor's effect on academic persistence. The figure shows that higher values of Academic Hope–Agency and Perseverance of Effort consistently contributed to higher predicted persistence scores, while lower values of these variables were associated with reduced persistence. Academic Hope–Pathways exhibited a similar but slightly more dispersed pattern, indicating individual differences in how pathway thinking influenced persistence across students. In contrast, Consistency of Interests displayed a narrower impact range, reinforcing its comparatively weaker role in the predictive model. Collectively, the figure complements the tabular findings by demonstrating how explainable AI methods can move beyond accuracy metrics to offer psychologically meaningful insights into the mechanisms underlying academic persistence in Iranian EFL learners.

4. Discussion

The present study aimed to examine the predictive roles of grit and academic hope in explaining academic persistence among Iranian EFL students using an explainable artificial intelligence framework. The findings provide both substantive and methodological contributions to the literature by demonstrating that motivational constructs, when analyzed through interpretable machine learning models, offer a nuanced understanding of persistence that extends beyond traditional linear approaches. Overall, the results indicated that grit and academic hope jointly accounted for a substantial proportion of variance in academic persistence, with clear differences in the relative importance of their subcomponents. These findings are discussed below in light of existing empirical and theoretical work.

One of the most salient findings of the study was the strong predictive role of academic hope, particularly the agency component, in explaining academic persistence. The explainable AI analyses consistently showed that students' beliefs in their capacity to initiate and sustain goal-directed action exerted the greatest influence on persistence outcomes. This finding aligns closely with hope theory, which conceptualizes agency as the motivational engine that drives sustained effort toward valued goals. Prior empirical studies have repeatedly demonstrated that academic hope is positively associated with academic vitality, engagement, and achievement, especially in contexts characterized by high demands and long-term goal pursuit (Abri et al., 2025;

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Hansen et al., 2023). In Iranian educational settings, where learners often face competitive pressures and delayed rewards, agency beliefs may play a particularly central role in maintaining persistence. The present findings extend this literature by showing that, even when considered alongside grit dimensions, academic hope–agency remains the most influential predictor of persistence.

The prominent role of academic hope–agency also supports and extends earlier findings indicating that hopeful students are better equipped to cope with academic challenges and setbacks. Research on Iranian student populations has shown that hope-enhancing interventions can significantly improve academic motivation, hardiness, and goal orientation (Norouzi, 2024; Raeisi, 2025). Similarly, studies conducted in other cultural contexts have highlighted the centrality of hope-related beliefs for sustaining long-term engagement, particularly among students from demanding or under-resourced educational environments (Hansen et al., 2023). By employing explainable AI techniques, the present study demonstrates that these effects are not merely statistically significant but also practically substantial, as reflected in the magnitude of agency-related contributions to model predictions.

The second most influential predictor of academic persistence in this study was perseverance of effort, one of the core components of grit. This finding is consistent with a growing body of research suggesting that perseverance, rather than consistency of interests, is the more functionally relevant dimension of grit in academic contexts. Empirical studies across secondary, tertiary, and professional education have shown that perseverance of effort is strongly linked to sustained engagement, reduced burnout, and persistence under adversity (Fowler, 2025; Ibrahim et al., 2025; Lee & Chung, 2025). In language learning contexts specifically, perseverance has been identified as a key factor enabling learners to tolerate ambiguity, cope with communicative anxiety, and continue investing effort despite slow progress (He et al., 2024; Henry, 2023). The present findings corroborate these results and further demonstrate, through explainable AI, that perseverance of effort exerts a consistent positive influence on persistence across individuals.

Importantly, the relative importance of perseverance of effort over consistency of interests observed in this study echoes recent psychometric and conceptual critiques of grit. Alternative grit models and cross-cultural validations have questioned the universal relevance of interest consistency, particularly in structured educational systems where curricula and learning goals are externally defined (Mateo, 2024; Uribe-Moreno et al., 2024). In such contexts, students may persist not because their interests remain unchanged, but because they develop the capacity to exert sustained effort in pursuit of long-term academic objectives. Findings from studies conducted in Asian and Middle Eastern contexts similarly suggest that effort-based perseverance is more predictive of academic outcomes than interest stability (Barrientos, 2025; Tammeh et al., 2025). The present study reinforces this perspective by showing that consistency of interests played a comparatively minor role in predicting persistence among Iranian EFL learners.

Academic hope–pathways also emerged as a meaningful, though secondary, predictor of persistence. This component reflects students' perceived ability to generate alternative routes toward goal attainment, particularly when initial strategies prove ineffective. Previous research has demonstrated that pathways thinking supports adaptive problem-solving, resilience, and academic self-regulation (Abri et al., 2025; Panahi et al., 2023). In EFL contexts, where learners frequently encounter obstacles such as comprehension difficulties or limited exposure opportunities, the ability to identify alternative learning strategies may facilitate continued engagement. The present findings suggest that while pathways thinking contributes to persistence, its impact is somewhat less pronounced than that of agency beliefs and perseverance of effort. This pattern aligns with prior studies indicating that agency-related motivation often serves as the primary driver of sustained academic behavior, while pathways function as supportive cognitive resources (Hansen et al., 2023; Tang & Zhu, 2024).

Beyond the substantive findings, the methodological contribution of this study warrants particular attention. By employing explainable artificial intelligence techniques, the study was able to move beyond simple statements of association and provide detailed insights into how different motivational components contribute to persistence at both global and individual levels. Previous research using traditional regression or structural equation modeling has provided valuable evidence for the roles of grit and hope, but such approaches often assume linearity and homogeneity of effects. In contrast, explainable AI allows for the identification of non-linear patterns and differential feature contributions, offering a more nuanced understanding of motivational dynamics (Groza & Tofan, 2024; Torres et al., 2025). The present study demonstrates that explainable AI can be meaningfully integrated with psychological theory,

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thereby addressing concerns about the interpretability of machine learning models in educational research.

The findings also resonate with recent work emphasizing the interconnected nature of motivational constructs. Studies examining grit in relation to academic engagement, motivation, and self-regulated learning suggest that grit often operates in conjunction with other psychological resources rather than in isolation (kang & Kim, 2025; Obeng et al., 2025). Similarly, academic hope has been shown to interact with optimism, aspiration, and sense of belonging in shaping persistence and achievement (Hansen et al., 2023; Panahi et al., 2023). By modeling grit and hope simultaneously, the present study provides empirical support for integrative frameworks that conceptualize persistence as the outcome of multiple, interacting motivational processes.

In the specific context of Iranian EFL education, the findings have important implications. Language learning in Iran is often characterized by exam-oriented instruction, limited communicative exposure, and high parental and societal expectations. Under such conditions, students' internal motivational resources become particularly critical for sustaining long-term engagement. Prior Iranian studies have highlighted the roles of academic identity, hope, and resilience in promoting persistence and well-being (Norouzi, 2024; Soleimani et al., 2023). The present study extends this literature by showing that grit and academic hope are not only relevant but also differentially influential, with agency beliefs and perseverance of effort playing central roles. This nuanced understanding can inform both theory and practice in Iranian EFL settings.

5. Conclusion

Overall, the discussion of results suggests that academic persistence among Iranian EFL learners is best understood as a function of dynamic motivational processes rather than static traits. Grit and academic hope contribute to persistence in distinct yet complementary ways, and their relative importance can be effectively captured through explainable AI methodologies. These findings support calls for more integrative, theory-informed, and methodologically innovative approaches to studying motivation and persistence in language learning and broader educational contexts (Henry, 2023; Torres et al., 2025).

6. Limitations & Suggestions

Despite its contributions, the present study is subject to several limitations that should be acknowledged. First, the cross-sectional design precludes causal inferences regarding the relationships among grit, academic hope, and persistence. Second, the reliance on self-report measures may have introduced response biases, such as social desirability or common method variance. Third, the sample was limited to EFL students in Tehran, which may restrict the generalizability of the findings to other regions or educational contexts. Finally, although explainable AI enhances interpretability, model outcomes are still dependent on the quality and scope of the input variables included in the analysis.

Future studies could address these limitations by employing longitudinal designs to examine how grit and academic hope influence persistence over time. Expanding the sample to include learners from different regions, educational levels, and instructional contexts would also enhance generalizability. Additionally, incorporating qualitative data or behavioral indicators of persistence could complement self-report measures and provide richer insights. Future research might also explore the integration of additional psychological constructs, such as self-efficacy or language anxiety, within explainable AI frameworks to further elucidate the motivational mechanisms underlying persistence.

From a practical perspective, the findings suggest that educational interventions aimed at enhancing academic persistence should prioritize the development of students' agency beliefs and perseverance of effort. Language instructors and curriculum designers can foster these qualities by setting attainable long-term goals, emphasizing progress over perfection, and providing structured opportunities for sustained effort. Counseling and support programs may also benefit from incorporating hope-based strategies that strengthen students' confidence in their ability to initiate and maintain goal-directed action. Together, such practices can contribute to more resilient and persistent EFL learners.

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Declaration of Interest

The authors of this article declared no conflict of interest.

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Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this article.

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