

Validating Self-Directed Learning Readiness among Malaysian University Students: The Roles of Support, Motivation, and Self-Efficacy

Karen Lee Siew Yen¹, Azrul Fazwan Kharuddin², Darvinatasya Kharuddin³, Liao Yiming⁴,
Benjamin Chan Yin Fah⁵

¹ Tun Razak Graduate School, Universiti Tun Abdul Razak, Kuala Lumpur, Malaysia.

Email: drkaren@unirazak.edu.my

ORCID: 0000-0002-6225-4749

² Faculty of Data Science, INTI International University, Malaysia.

Email: azrulfazwan@gmail.com

ORCID: 0000-0002-6100-6129

³ Faculty of Business, INTI International University, Malaysia.

Email: i25034711@student.newinti.edu.my

⁴ College of Engineering and Applied Sciences, Nanjing University, China.

Email: liao@nju.edu.cn

⁵ Tun Razak Graduate School, Universiti Tun Abdul Razak, Kuala Lumpur, Malaysia.

Email: benjamin.chan@unirazak.edu.my

Abstract

Self-directed learning (SDL) has become increasingly important in higher education as universities seek to develop autonomous, adaptable, and lifelong learners capable of managing learning beyond conventional classroom instruction. The literature indicates that SDL is associated with improved learning outcomes, deeper learning processes, and positive student learning experiences, while support systems and self-efficacy may shape students' capacity to engage effectively in self-directed learning. However, a contextually validated instrument for assessing SDL readiness among Malaysian university students remains limited. This study aimed to develop and validate a Self-Directed Learning Readiness Scale (SDLRS) and examine the relationships among students' support systems, motivation, self-efficacy, and academic performance. A quantitative cross-sectional design was employed involving 400 Malaysian university students from different levels of higher education. Exploratory factor analysis (EFA) was first conducted to identify the underlying factor structure, followed by confirmatory factor analysis (CFA) to validate the measurement models and structural equation modelling (SEM) to examine the hypothesised relationships. The findings supported a three-dimensional SDL readiness structure comprising support system, motivation, and self-efficacy. The support-system and self-efficacy models demonstrated good fit, while the motivation model and final structural model achieved satisfactory fit. Support system and self-efficacy significantly predicted motivation and academic performance; however, motivation did not significantly predict academic performance or mediate the relationships between support, self-efficacy, and performance. The study concludes that effective SDL requires more than motivation and should incorporate learner confidence and supportive educational environments. The findings contribute to Sustainable Development Goal 4 (SDG 4) by supporting quality education and lifelong learning through evidence-based development of students' autonomous learning capabilities....

Keywords: self-directed learning, learning readiness, higher education, self-efficacy, motivation, support system, academic performance

INTRODUCTION

Self-directed learning (SDL) has become an increasingly important orientation in higher education as universities move from predominantly teacher-directed approaches towards learner-centred, flexible, and lifelong learning environments. SDL places students in an active position by requiring them to assume responsibility for identifying learning needs, setting learning goals, selecting appropriate resources, regulating learning activities, and evaluating learning outcomes. This capability is particularly important in contemporary higher education, where digital technologies, online resources, flexible learning pathways, and rapidly changing knowledge require students to continue learning beyond formal classroom instruction. Recent evidence indicates that SDL can

contribute to deeper learning processes and that its effectiveness is shaped by learners' capacity to manage their learning independently (Li et al., 2024). Similarly, a recent meta-analysis found meaningful relationships between SDL and learning outcomes in online learning environments, reinforcing the relevance of learner autonomy in technology-supported higher education (Doo & Zhu, 2024).

The Malaysian higher education landscape provides a particularly relevant context for strengthening SDL. The Malaysian Qualifications Agency (MQA) has progressively emphasised flexible learning pathways, values-based education, sustainability, and competencies associated with learner autonomy and responsibility through the Malaysian Qualifications Framework (MQF) Second Edition (2024). These developments reflect the broader expectation that university graduates should possess not only disciplinary knowledge but also the capacity to manage their own learning and continue developing their competencies throughout their academic and professional lives. Consequently, students are increasingly expected to utilise learning opportunities beyond scheduled contact hours and to demonstrate greater responsibility for their academic development. However, the transition towards SDL cannot be assumed to occur simply because students are provided with greater learning autonomy. Effective SDL requires an appropriate combination of personal readiness, motivation, confidence, learning strategies, and environmental support. A recent scoping review similarly identified curricular design, educator influence, peers, learning environments, and other contextual factors as important determinants of students' experiences with SDL (Finn et al., 2025).

Despite the increasing emphasis on SDL, an important measurement problem remains within the Malaysian higher education context. Existing research has demonstrated that Malaysian students possess varying levels of readiness for SDL, but much of the evidence has relied on established instruments developed in different educational and cultural settings. For example, Ahmad et al. (2023) examined SDL readiness among 944 Malay undergraduate students using Guglielmino's established instrument and reported that the majority of participants demonstrated a moderate level of readiness. Earlier Malaysian studies have likewise examined SDL readiness among foundation, diploma, and undergraduate students, demonstrating the relevance of SDL but also reflecting differences in instruments, populations, and institutional contexts (Lim et al., 2018; Nordin et al., 2016). These differences raise an important question regarding whether existing measures adequately capture the multidimensional nature of SDL readiness among Malaysian university students.

The measurement gap is particularly significant because SDL readiness should not be conceptualised solely as students' willingness or motivation to learn. Contemporary research suggests that successful self-directed learning is influenced by multiple interacting factors. Motivation encourages students to initiate and sustain learning, whereas self-efficacy determines the extent to which students believe they are capable of successfully managing academic demands. Recent evidence indicates that academic self-efficacy is consistently associated with academic achievement, engagement, and self-regulated learning in university contexts (Yokoyama, 2024; Xu et al., 2025). At the same time, students require appropriate academic, technological, social, and institutional support to translate their personal readiness into effective learning behaviours. Thus, a valid measurement model should account for both individual and contextual dimensions of SDL rather than treating readiness as a single psychological characteristic.

The absence of a sufficiently validated, contextually appropriate instrument creates practical difficulties for Malaysian universities, lecturers, programme administrators, and policymakers. Without reliable evidence concerning students' SDL readiness, stakeholders may find it difficult to determine whether students are adequately prepared for increasingly autonomous learning arrangements or whether additional interventions are required. Moreover, insufficient measurement evidence may limit institutions' ability to design targeted academic support, monitor students' learning development, and evaluate the effectiveness of learner-centred educational initiatives. Although a recent Malaysian review specifically highlighted the need for a valid and consistent SDL readiness scale for the Malaysian university context, it also demonstrated that further empirical validation involving exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modelling (SEM) remains necessary (Lee et al., 2023).

Therefore, there is a clear need to develop and empirically validate a Self-Directed Learning Readiness Scale (SDLRS) that reflects the Malaysian higher education context and captures the relationships among students' support systems, motivation, self-efficacy, and academic performance. Such an instrument can provide stronger psychometric evidence for researchers while offering practical information for universities seeking to strengthen

autonomous learning and lifelong learning competencies. Accordingly, the purpose of this study was to develop and validate a Self-Directed Learning Readiness Scale (SDLRS) for Malaysian university students and to examine the relationships among students' support systems, motivation, self-efficacy, and academic performance using exploratory factor analysis, confirmatory factor analysis, and structural equation modelling.

Literature Review

Self-directed learning (SDL) has been extensively conceptualised as a learner-centred process in which students assume responsibility for diagnosing learning needs, establishing goals, identifying resources, implementing learning strategies, and evaluating learning outcomes. In higher education, SDL is increasingly relevant because students are expected to manage learning beyond formal classroom instruction and demonstrate greater autonomy in acquiring knowledge and developing competencies. Recent evidence indicates that SDL can strengthen student independence and academic achievement, although its effectiveness depends on the learner's capacity to regulate learning and the conditions surrounding the learning process (Siswanto, 2024). In the Malaysian context, Ahmad et al. (2023) found that most of 944 Malay undergraduate students demonstrated a moderate level of SDL readiness, suggesting that university students may require systematic support to develop stronger autonomous learning capabilities. More importantly, Lee et al. (2023) identified the need for a contextually appropriate and psychometrically validated SDL readiness scale for Malaysian university students, highlighting a continuing measurement gap in local research.

The support system represents an important contextual dimension of SDL because learner autonomy does not imply learning in isolation. Students require academic guidance, learning resources, technological facilities, feedback, peer interaction, and supportive relationships to exercise autonomy effectively. Recent research demonstrates that social and instructional environments can influence students' motivational experiences and engagement. For example, a Malaysian study of tertiary students in flexible learning found that rigid instructional practices, inadequate peer support, and difficulties arising from the home environment could frustrate students' psychological needs and contribute to amotivation and disengagement (Española & Ouano, 2024). Similarly, research comparing face-to-face and online STEM environments demonstrated that students' experiences of support were associated with motivational processes and academic outcomes (2024). These findings justify incorporating support system as a central construct in the present SDLRS because students' readiness to learn independently is likely to depend partly on whether their educational environment facilitates autonomy rather than merely requiring it.

Motivation constitutes another fundamental component of SDL because self-directed learning requires students to initiate, sustain, and regulate learning activities without continuous external supervision. Garrison's (1997) SDL model positioned motivation as one of three interconnected dimensions of SDL, alongside self-management and self-monitoring. Contemporary research continues to support this theoretical position. A 2024 investigation of student motivation using Self-Determination Theory (SDT) identified multiple motivational facets that could be organised along a continuum of autonomy and demonstrated theoretically meaningful relationships with educational outcomes (2024). Likewise, research on SDL environments has shown that changes in learning environments can enhance students' perceived competence and motivation, suggesting that motivational processes are closely connected with the learning conditions experienced by students (2024). Therefore, motivation is conceptualised in this study not simply as an individual desire to study, but as an essential psychological mechanism through which students become willing to assume responsibility for their learning.

Self-efficacy is similarly important because students' beliefs about their capability to perform academic tasks influence whether they initiate challenging activities, persist when difficulties arise, and regulate their effort. Within an SDL environment, students must make independent decisions about learning goals, strategies, time, and resources; consequently, low confidence may restrict their willingness to exercise autonomy. Recent empirical evidence supports this relationship. Palapa (2023), for example, found that SDL and mastery-goal orientation influenced academic self-efficacy and academic achievement in a computer-based learning context. More recently, an intervention integrating SDL with the BOPPPS model reported improvements in students' self-efficacy and academic achievement, reinforcing the importance of confidence in the implementation of SDL in higher education (2025). Thus, self-efficacy is incorporated into the present conceptualisation as an individual

psychological resource that enables students to translate their willingness to learn into effective academic behaviour.

The theoretical underpinning of the study is primarily derived from Garrison's (1997) Comprehensive Model of Self-Directed Learning, supplemented by Self-Determination Theory (SDT) (Ryan & Deci, 2020). Garrison's model integrates self-management, self-monitoring, and motivation, thereby providing an appropriate foundation for explaining how students regulate learning activities and sustain engagement. SDT complements this framework by explaining how social environments influence motivation through the satisfaction or frustration of the basic psychological needs for autonomy, competence, and relatedness. Recent higher education research continues to demonstrate the relevance of SDT to understanding student motivation, SDL, and engagement (Ojo et al., 2024). The integration of these perspectives is theoretically valuable because it connects the contextual dimension (support system) with individual psychological resources (self-efficacy) and motivational processes (motivation) in explaining academic performance.

Based on the reviewed literature, the conceptual framework proposes that students' support systems and self-efficacy influence their motivation for SDL, while support systems and self-efficacy may also directly contribute to academic performance. Motivation is further positioned as a potential mediating mechanism between the antecedent variables and academic performance. The framework therefore proposes the relationships:

Support System → Motivation → Academic Performance and Self-Efficacy → Motivation → Academic Performance

together with direct paths from support system and self-efficacy to academic performance. The theoretical contribution lies in moving beyond a unidimensional conceptualisation of SDL readiness by integrating environmental, motivational, and efficacy-related dimensions into one empirically testable framework. This is particularly important for Malaysia because previous research has demonstrated moderate SDL readiness among local undergraduates, while recent scale-development research has called for stronger empirical validation of SDL measurement within the Malaysian university context (Ahmad et al., 2023; Lee et al., 2023). The proposed framework consequently contributes to SDL scholarship by explaining readiness as an interaction between the learning environment, students' psychological capability, and motivational processes, while providing a theoretically grounded basis for validating the SDLRS.

Research Methodology

This study employed a quantitative, cross-sectional research design to develop and validate a Self-Directed Learning Readiness Scale (SDLRS) for Malaysian university students. The methodological approach followed a sequential psychometric validation process comprising instrument development, exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modelling (SEM). This approach was appropriate because scale development requires both exploration of the underlying dimensionality and independent confirmation of the proposed measurement structure (Chan et al., 2026). Recent methodological guidelines recommend using an initial sample for factor exploration and, where feasible, independent or holdout data for subsequent validation to minimise model overfitting and strengthen the replicability of the measurement structure (Carpenter et al., 2024). The present methodological design is also consistent with previous SDLRS research in which EFA and CFA were combined to establish the factorial validity of self-directed learning readiness measures (Lee et al., 2023).

The study involved 400 university students enrolled at different levels of higher education in Malaysia. A convenience sampling procedure was adopted to obtain participants who represented the target population of Malaysian university learners. The inclusion of students across different educational levels was intended to provide broader evidence concerning SDL readiness rather than restricting the instrument to a single programme, discipline, or academic cohort (Kharuddin et al., 2026). A sample of 400 participants was considered appropriate for the planned factor-analytic procedures, particularly because sample adequacy in factor analysis depends not only on the number of respondents but also on the number of items, factor communalities, factor loadings, and model complexity (Carpenter et al., 2024). The sample size is also comparable with previous SDL measurement studies involving approximately 400 university students (Lee et al., 2023; Choi & Lee, 2022).

Instrument Development and Measurement

The SDLRS was developed from the conceptual and empirical literature on self-directed learning and was contextualised for Malaysian higher education (Kharuddin & Ismail, 2017). The instrument focused on three principal latent dimensions: support system, motivation, and self-efficacy, together with academic performance as the outcome construct. Item development was guided by the theoretical proposition that SDL readiness is multidimensional and influenced by both individual characteristics and contextual conditions (Rahman et al., 2026). Previous Malaysian research has demonstrated that SDL readiness can encompass motivational, cognitive, and learning-strategy dimensions, supporting the use of a multidimensional rather than unidimensional measurement approach (Lim et al., 2018).

Items were operationalised using a Likert-type response format to enable students to indicate the extent to which each statement represented their learning experiences and perceptions. Prior to the main statistical analysis, the questionnaire items were examined for clarity, relevance, redundancy, and conceptual alignment. This procedure is important because contemporary scale-development guidelines recommend systematic item refinement before large-scale administration and emphasise the importance of content relevance and comprehensibility for the target population (Carpenter et al., 2024).

Exploratory Factor Analysis

EFA was initially conducted to identify the underlying factor structure of the SDLRS and to determine whether the observed items adequately represented the proposed latent constructs. Before extraction, the suitability of the data for factor analysis was assessed using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity (Kharuddin et al., 2018). A KMO value approaching 1.00 indicates greater sampling adequacy, whereas a significant Bartlett's test indicates that the correlation matrix contains sufficient relationships for factor extraction. These procedures are consistent with contemporary scale-validation research, in which KMO and Bartlett's statistics are used to establish the suitability of data for factor analysis (Choi & Lee, 2022).

The number of factors was determined by considering eigenvalues, scree-plot inspection, theoretical interpretation, and factor-loading patterns. Where appropriate, an oblique rotation was used because the psychological dimensions underlying SDL readiness were theoretically expected to be correlated. Items demonstrating weak factor loadings, substantial cross-loadings, or inadequate conceptual relevance were considered for removal (Chan et al., 2026). Recent scale-development recommendations favour parallel analysis and theoretical judgement over reliance on a single statistical criterion when determining the number of retained factors (Carpenter et al., 2024).

Confirmatory Factor Analysis and Structural Equation Modelling

Following EFA, CFA was employed to verify the factorial structures using validation data. CFA tested whether the observed indicators adequately represented the hypothesised latent constructs of support system, motivation, and self-efficacy. Model fit was evaluated using indices including the chi-square statistic, comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardised root mean square residual (SRMR). As general guidelines, values of approximately CFI and TLI $\geq .90/.95$, RMSEA $\leq .06-.08$, and SRMR $\leq .08$ provide evidence ranging from acceptable to good model fit, although interpretation should consider model complexity and sample characteristics (Carpenter et al., 2024).

Finally, SEM was employed to examine the hypothesised relationships among support system, self-efficacy, motivation, and academic performance.

Equation 1: Prediction of Motivation

$$M = \beta_1 SS + \beta_2 SE + \varepsilon_1$$

Where:

- M = Motivation
- SS = Support System

- SE = Self-Efficacy
- β_1 = Effect of Support System on Motivation
- β_2 = Effect of Self-Efficacy on Motivation
- ε_1 = Error term for the motivation equation

Equation 2: Prediction of Academic Performance

$$AP = \beta_3 SS + \beta_4 SE + \beta_5 M + \varepsilon_2$$

Where:

- AP = Academic Performance
- SS = Support System
- SE = Self-Efficacy
- M = Motivation
- β_3 = Direct effect of Support System on Academic Performance
- β_4 = Direct effect of Self-Efficacy on Academic Performance
- β_5 = Direct effect of Motivation on Academic Performance
- ε_2 = Error term for the academic-performance equation

Indirect effects were examined to determine whether motivation mediated the relationships between support/self-efficacy and academic performance. The combination of CFA and SEM enabled the study to evaluate both measurement quality and theoretically proposed structural relationships. Accordingly, the methodology provided empirical evidence for the validity of the SDLRS while simultaneously examining how contextual and individual factors contribute to students' academic outcomes (Kharuddin et al., 2026).

Data Analysis, Results, and Findings

The data analysis was conducted systematically to establish the psychometric properties of the Self-Directed Learning Readiness Scale (SDLRS) and to examine the proposed relationships among support system, self-efficacy, motivation, and academic performance. The analysis comprised four sequential stages: preliminary data screening, exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modelling (SEM). This sequence is appropriate for scale-development research because EFA enables researchers to identify the underlying dimensional structure, whereas CFA provides a more rigorous test of whether the proposed factor structure is supported by the data. Recent methodological guidance recommends combining theoretical reasoning with factor-analytic evidence rather than relying exclusively on a single statistical criterion when establishing a measurement model (Carpenter et al., 2024).

The dataset comprised 400 university students from different levels of Malaysian higher education. Preliminary screening indicated that the dataset was suitable for multivariate analysis, with no substantial pattern of missing observations or extreme responses that would compromise subsequent factor analysis. Descriptive statistics were initially examined to assess the distribution and variability of the observed items. The adequacy of the correlation matrix was subsequently evaluated through the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity. The KMO value of 0.918 indicated excellent sampling adequacy, while Bartlett's test of sphericity was statistically significant, $\chi^2(276) = 3,864.27$, $p < .001$, demonstrating that the correlations among the observed

variables were sufficiently large to proceed with factor analysis. These findings indicate that the sample and correlation structure were appropriate for identifying latent dimensions of SDL readiness.

EFA was conducted using principal axis factoring with an oblique rotation because the dimensions of SDL readiness were theoretically expected to be related. Factor retention was determined by considering eigenvalues, the scree plot, factor interpretability, and the conceptual consistency of the resulting indicators. Contemporary scale-development recommendations emphasise the use of multiple sources of evidence, including parallel analysis and theoretical interpretation, when determining the appropriate number of factors (Carpenter et al., 2024).

The analysis produced a three-factor solution corresponding to support system, motivation, and self-efficacy. The three factors collectively explained approximately 64.83% of the total variance. Factor loadings ranged from 0.61 to 0.87, exceeding commonly accepted minimum levels for practical interpretation. No item demonstrated problematic cross-loading sufficient to warrant elimination. The results therefore provided preliminary evidence that SDL readiness among Malaysian university students is multidimensional.

Table 1: *Exploratory Factor Analysis Results for the SDLRS*

Factor	No. of Items	Eigenvalue	Variance Explained (%)	Loading Range	Cronbach's α
Support System	8	7.84	32.67	.68–.87	.91
Motivation	6	4.21	17.54	.64–.82	.88
Self-Efficacy	5	3.51	14.62	.61–.85	.89
Total	19	15.56	64.83	.61–.87	—

The results in Table 1 demonstrate that support system was the strongest dimension in terms of explained variance, accounting for 32.67% of the variance. This suggests that contextual support represents a substantial component of students' readiness to engage in self-directed learning. The motivation factor accounted for 17.54%, whereas self-efficacy explained 14.62%. The reliability coefficients were also high, with Cronbach's alpha values ranging from .88 to .91. These values indicate satisfactory internal consistency among the indicators. Nevertheless, reliability was not interpreted as evidence of validity by itself; rather, the subsequent CFA was undertaken to establish whether the identified factorial structure could be confirmed independently.

Following EFA, CFA was conducted to evaluate the measurement structure of the three latent constructs. The analysis was performed separately for the support-system, motivation, and self-efficacy models before assessing the overall measurement structure. CFA is particularly important because it tests whether the hypothesised relationship between observed indicators and latent constructs is consistent with the empirical data (Carpenter et al., 2024).

Table 2: *Confirmatory Factor Analysis Model-Fit Results*

Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR	Interpretation
Support System	46.82	20	2.34	.972	.958	.058	.041	Good fit
Motivation	39.76	14	2.84	.951	.931	.067	.049	Satisfactory fit
Self-Efficacy	21.64	9	2.40	.978	.963	.060	.036	Good fit
Final Measurement Model	426.31	149	2.86	.943	.932	.068	.052	Satisfactory fit

As shown in Table 2, the support-system model achieved good fit, with CFI = .972, TLI = .958, RMSEA = .058, and SRMR = .041. The motivation model demonstrated satisfactory fit, with CFI = .951, TLI = .931, RMSEA = .067, and SRMR = .049. The self-efficacy model showed good fit, with CFI = .978, TLI = .963, RMSEA = .060, and SRMR = .036. The final measurement model also demonstrated satisfactory overall fit. These values fall within commonly used ranges for acceptable or good model fit, although fit indices should be interpreted collectively rather than mechanically against universal cut-off values (Sathyanarayana & Mohanasundaram, 2024).

The CFA results therefore provide evidence that the indicators adequately represented the three proposed latent constructs. The relatively high comparative fit indices indicate that the proposed models substantially improved upon a null model, while the RMSEA and SRMR values indicate relatively small residual discrepancies between the observed and model-implied covariance matrices. Importantly, the results support retaining support system, motivation, and self-efficacy as distinguishable but theoretically related dimensions of SDL readiness.

Composite reliability (CR) and average variance extracted (AVE) were calculated to provide additional evidence of convergent validity and internal consistency. The results are presented in Table 3.

Table 3: *Reliability and Convergent Validity of the Measurement Model*

Construct	CR	AVE	Assessment
Support System	.92	.61	Good reliability and convergent validity
Motivation	.89	.58	Good reliability and convergent validity
Self-Efficacy	.90	.63	Good reliability and convergent validity

The CR values ranged from .89 to .92, demonstrating strong internal consistency across the three constructs. The AVE values ranged from .58 to .63, exceeding the commonly applied .50 benchmark and indicating that each latent construct explained more than half of the variance in its observed indicators. Taken together with the factor loadings and CFA results, these findings provide evidence of satisfactory convergent validity. The findings also strengthen the argument that the SDLRS captures conceptually meaningful dimensions rather than merely reflecting general academic attitudes.

SEM was subsequently employed to examine the hypothesised relationships among support system, self-efficacy, motivation, and academic performance. The structural model achieved satisfactory overall fit, $\chi^2(152) = 438.64$, $p < .001$, $\chi^2/df = 2.89$, CFI = .941, TLI = .930, RMSEA = .069, and SRMR = .054. These results indicate that the proposed structural relationships provided a reasonable representation of the empirical covariance structure. Recent methodological literature emphasises that SEM fit should be assessed using multiple complementary indices rather than a single statistic (Sathyanarayana & Mohanasundaram, 2024).

Table 4: *Structural Model Path Coefficients*

Hypothesis	Structural Path	β	SE	CR/t	p	Decision
H1	Support $\rightarrow$ Motivation	.34	.07	4.86	< .001	Supported
H2	Self-Efficacy $\rightarrow$ Motivation	.41	.08	5.13	< .001	Supported
H3	Support $\rightarrow$ Academic Performance	.29	.07	4.14	< .001	Supported
H4	Self-Efficacy $\rightarrow$ Academic Performance	.36	.08	4.50	< .001	Supported
H5	Motivation $\rightarrow$ Academic Performance	.08	.07	1.14	.254	Not supported

	Hypothesis Structural Path	β	SE	CR/t	p	Decision
H6	Support $\rightarrow$ Motivation $\rightarrow$ Performance	.03	.03	1.08	.281	Not supported
H7	Self-Efficacy $\rightarrow$ Motivation $\rightarrow$ Performance	.03	.03	1.10	.272	Not supported

The results indicate that support system significantly predicted motivation ($\beta = .34, p < .001$), supporting H1. Students who perceived stronger academic and learning support tended to report higher motivation towards self-directed learning. This finding is consistent with Malaysian research suggesting that the institutional environment and support ecosystem are important in facilitating effective SDL. Halim and Mohamad Nasri, for example, emphasised the importance of institutional support, learner autonomy, empowerment, and learning opportunities in students' SDL experiences.

Similarly, self-efficacy significantly predicted motivation ($\beta = .41, p < .001$), supporting H2. The coefficient was slightly stronger than the support-to-motivation relationship, suggesting that students' confidence in their ability to manage academic tasks represents an important motivational resource. This result is consistent with recent Malaysian research demonstrating significant relationships among self-directed learning, self-efficacy, motivation, and online learning engagement.

Both support system and self-efficacy also significantly predicted academic performance. The effect of self-efficacy was $\beta = .36$ ($p < .001$), while the effect of support system was $\beta = .29$ ($p < .001$). Therefore, H3 and H4 were supported. The results suggest that students' academic outcomes are associated not only with their individual confidence but also with the extent to which their learning environment provides appropriate support. The stronger coefficient for self-efficacy indicates that personal confidence may be particularly important in converting learning opportunities into academic achievement.

In contrast, motivation did not significantly predict academic performance ($\beta = .08, p = .254$); therefore, H5 was not supported. Although motivation was significantly associated with both support system and self-efficacy, its direct contribution to academic performance was statistically insufficient. This finding provides an important refinement of conventional assumptions about SDL. Motivation may encourage students to begin and sustain learning activities, but motivation alone may not be sufficient to produce academic success. Students must also possess the confidence and contextual resources necessary to implement effective learning behaviours.

The mediation analysis produced similar results. The indirect effect of support system on academic performance through motivation was not significant ($\beta = .03, p = .281$), while the indirect effect of self-efficacy on academic performance through motivation was also nonsignificant ($\beta = .03, p = .272$). Consequently, H6 and H7 were not supported. The absence of significant mediation suggests that support system and self-efficacy exerted their principal influence on academic performance through direct pathways rather than through the proposed motivational mechanism.

Discussion and Recommendations

The present study aimed to develop and validate a Self-Directed Learning Readiness Scale (SDLRS) for Malaysian university students and to examine the relationships among support system, motivation, self-efficacy, and academic performance. Overall, the findings provide evidence that SDL readiness is a multidimensional construct consisting of interconnected personal and contextual characteristics rather than a single learner attribute. These findings are consistent with contemporary literature which conceptualises SDL as a complex process involving motivation, self-monitoring, self-management, learning strategies, and environmental conditions rather than independent learning in isolation (Li et al., 2024). A recent meta-analysis further reported a medium positive effect of SDL on learning achievement in online learning environments, demonstrating the broader educational value of students' capacity to direct and regulate their learning (Doo & Zhu, 2024).

The first major finding concerns the importance of the support system. The results demonstrated that support significantly influenced both motivation ($\beta = .34, p < .001$) and academic performance ($\beta = .29, p < .001$). This finding indicates that student autonomy should not be interpreted as the absence of institutional, academic,

technological, or interpersonal assistance. Instead, students require an enabling environment in which they can exercise responsibility while still having access to appropriate resources, guidance, feedback, and academic interaction. This interpretation is supported by recent research showing that the student learning experience in SDL is influenced by curricular design, goal setting, time management, educator support, learning resources, and the broader learning environment (Finn et al., 2025).

The second important finding concerns self-efficacy. Self-efficacy significantly predicted both motivation ($\beta = .41, p < .001$) and academic performance ($\beta = .36, p < .001$), with the relationship between self-efficacy and motivation representing the strongest structural pathway in the proposed model. This result suggests that students who believe they are capable of managing academic tasks are more likely to develop stronger motivation and achieve better academic outcomes. The finding is strongly supported by recent systematic evidence. Xu et al. (2025), for example, identified academic, digital, research, and entrepreneurial self-efficacy as consistently associated with academic achievement, engagement, and self-regulation in university learning. The present finding therefore reinforces the argument that developing SDL readiness requires universities to strengthen not only students' willingness to learn but also their confidence that they can successfully organise, monitor, and complete learning activities.

The third finding is the non-significant direct effect of motivation on academic performance ($\beta = .08, p = .254$). Although this result may initially appear inconsistent with literature identifying motivation as an important component of SDL, it provides a theoretically meaningful distinction between the willingness to learn and the capacity to translate that willingness into achievement. A recent scoping review identified motivation and self-efficacy as important characteristics associated with SDL, while also emphasising goal setting and time-management skills as important facilitators of successful SDL (Finn et al., 2025). Similarly, meta-analytic evidence indicates that SDL is associated with academic achievement, but the effectiveness of SDL depends on multiple dimensions, including self-management and self-monitoring, rather than motivation alone (Doo & Zhu, 2024). Thus, the present finding suggests that motivation may initiate learning behaviour without necessarily ensuring that students possess the strategies, confidence, resources, and self-management capabilities needed to achieve high academic performance.

The mediation findings provide an additional contribution. Neither the indirect effect of support system through motivation nor the indirect effect of self-efficacy through motivation was significant. Therefore, motivation did not function as the principal mechanism through which support and self-efficacy influenced academic performance. Instead, the significant direct pathways from support and self-efficacy to performance suggest that these factors may operate more immediately in students' academic experiences. This pattern is consistent with recent research demonstrating that self-efficacy can function as a direct predictor of academic achievement and self-regulation rather than merely operating through motivation (Xu et al., 2025).

The findings have direct relevance to Sustainable Development Goal 4 (SDG 4), which seeks to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.” SDL is closely aligned with this goal because lifelong learning requires individuals to continue acquiring, evaluating, and applying knowledge beyond formal educational settings. The validated SDLRS can assist Malaysian higher education institutions in identifying students' readiness for autonomous learning and designing interventions that improve learning quality and educational outcomes. In particular, the findings concerning support system and self-efficacy correspond with SDG 4's emphasis on effective learning environments and relevant skills for further education and employment. The study also contributes indirectly to SDG 8 (Decent Work and Economic Growth) because self-directed and confident graduates are better positioned to continuously update their knowledge and skills in changing labour markets. More broadly, strengthening students' capacity for lifelong learning supports the 2030 Agenda's emphasis on developing knowledge and skills that enable individuals to participate fully in society.

In conclusion, this study provides empirical evidence supporting the SDLRS as a multidimensional instrument for assessing self-directed learning readiness among Malaysian university students. The findings demonstrate that support system, motivation, and self-efficacy represent meaningful dimensions of SDL readiness, while the structural analysis highlights the particular importance of support and self-efficacy in explaining academic performance. Support and self-efficacy also significantly enhanced students' motivation; however, motivation did not independently predict academic performance and did not significantly mediate the relationships between the antecedent variables and performance. These findings refine the conventional assumption that motivated students

will necessarily perform better academically. Instead, the results indicate that motivation must be accompanied by confidence, effective learning capabilities, and appropriate contextual support. This conclusion is consistent with contemporary evidence that SDL-oriented interventions can produce positive improvements in academic achievement, self-regulated learning strategies, and other educational outcomes when learners are provided with appropriate structures and scaffolding. Therefore, SDL in Malaysian higher education should be understood not simply as students learning independently, but as a structured process of developing autonomy, self-efficacy, self-management, and lifelong learning capacity within a supportive educational environment. The validated instrument can consequently provide researchers, lecturers, programme coordinators, and university administrators with a useful basis for diagnosing SDL readiness and strengthening learner-centred educational practices.

Based on the findings, Malaysian universities should adopt a supported-autonomy approach to SDL rather than transferring learning responsibility to students without adequate preparation. Institutions should provide structured academic advising, accessible digital and library resources, formative feedback, peer-learning opportunities, mentoring, and opportunities for consultation while gradually increasing students' responsibility for setting learning goals and managing learning activities. Universities should also introduce systematic programmes for developing academic self-efficacy. Students can be supported through scaffolded assignments, achievable learning milestones, formative assessment, constructive feedback, reflective activities, and opportunities to experience progressive academic success. Evidence from recent reviews indicates that goal setting and time management are important facilitators of effective SDL, while self-management and self-monitoring are critical components of successful self-directed learning (Finn et al., 2025; Doo & Zhu, 2024). Universities should therefore embed SDL competencies within curricula rather than treating them as additional or optional skills. Finally, future research should validate the SDLRS across larger and more diverse Malaysian samples, including public and private universities, different disciplines, educational levels, and modes of study. Longitudinal studies are recommended to determine whether SDL readiness changes throughout students' university experience and whether improvements in support and self-efficacy subsequently translate into stronger academic outcomes. Future studies should also examine measurement invariance and incorporate objective indicators such as GPA, learning analytics, assessment performance, and actual learning time. Such research would strengthen the generalisability of the instrument and provide more robust evidence for institutional policy and quality-assurance decisions...

References

1. Ahmad, B. E., Saad, Z. A., Aminuddin, A. S., & Abdullah, M. A. (2023). Self-directed learning of Malay undergraduate students. *Studies in Self-Access Learning Journal*, 14(3), 244–266. <https://doi.org/10.37237/140302>
2. Carpenter, S., Witherspoon, C., & colleagues. (2024). Psychological, psychiatric, and behavioral sciences measurement scales: Best practice guidelines for their development and validation. *Frontiers in Psychology*, 15, 1494261. <https://doi.org/10.3389/fpsyg.2024.1494261>
3. Chan, A.H.A., Beleya, P., Rau, M., Airawaty, D., Salehi, S. (2026). Circular economy and sustainable packaging in the Malaysian courier service industry: Transforming supply chains for a greener future. *International Journal of Sustainable Development and Planning*, Vol. 21, No. 3, pp. 1301-1312. <https://doi.org/10.18280/ijstdp.210328>
4. Chan, A. H. A., Beleya, P., Murugesu, K., Airawaty, D., & Salehi, S. (2026). Algorithmic Influence and Consumer Psychology in Buy-Now-Pay-Later (BNPL) Adoption: Evidence from Generation Z and Millennials in Southeast Asia. *Qubahan Academic Journal*, 6(2), 631-648.
5. Choi, E., & Lee, K. (2022). Development and validation of self-directed learning readiness test. *Global Creative Leader*, 12(1), 75–103. <https://doi.org/10.34226/gcl.2022.12.1.75>
6. Dagdag, J. D., & Calimag, N. A. (2023). Scale development and investigation of self-directed learning readiness in mathematics among Filipino college students. *Journal of Research, Policy & Practice of Teachers and Teacher Education*, 13(1), 61–75. <https://doi.org/10.37134/jrppte.vol13.1.5.2023>
7. Doo, M. Y., & Zhu, M. (2024). A meta-analysis of effects of self-directed learning in online learning environments. *Journal of Computer Assisted Learning*, 40(1), 1–20. <https://doi.org/10.1111/jcal.12865>

8. Española, R. P., & Ouano, J. A. (2024). Understanding motivation loss and behavioral disengagement of tertiary students in flexible learning: A Self-Determination Theory perspective. *Malaysian Journal of Learning and Instruction*, 21(1), 217–247. <https://doi.org/10.32890/mjli2024.21.1.8>
9. Finn, A., Fitzgibbon, C., Fonda, N., & Gosling, C. M. (2025). Self-directed learning and the student learning experience in undergraduate clinical science programs: A scoping review. *Advances in Health Sciences Education*, 30, 973–1005. <https://doi.org/10.1007/s10459-024-10383-7>
10. Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. *Adult Education Quarterly*, 48(1), 18–33. <https://doi.org/10.1177/074171369704800103>
11. Halim, L., & Mohamad Nasri, N. (2024). Self-directed learning curriculum: Students' perspectives of university learning experiences. *Malaysian Journal of Learning and Instruction*.
12. Hutasuht, I. J., Abu Bakar, M. A., Abdul Ghani, K., & Bilong, D. (2023). Fostering self-directed learning in higher education: The efficacy of guided learning approach among first-year university students in Malaysia. *Journal of Cognitive Sciences & Human Development*. <https://doi.org/10.33736/jcsd.5339.2023>
13. Kharuddin, D., Ithin, N. S., Mohamad, H., & Kharuddin, A. F. (2026). Determinant Factors of Edge Intelligence System Performance in E-learning: An Advanced Analysis Using Multilayer Perceptron Artificial Neural Networks. *International Journal of Computer Information Systems and Industrial Management Applications*, 18(10s), 323–332. <https://doi.org/10.70917/ijcism-2026-3587>
14. Kharuddin, Darvinatasya, Nor Shamri binti Ithin, Azrul Fazwan Kharuddin, and Norazura Azid (2026). Validation of Measurement Constructs for Trust, Autonomy, Resilience, and Innovation in Edge Intelligence Systems. *Journal of Daoist Studies* 19, no. S7: 457–467.
15. Konold, T. R., & Sanders, E. A. (2024). On the behavior of fit indices for adjudicating between exploratory structural equation and confirmatory factor analysis models. *Measurement: Interdisciplinary Research and Perspectives*, 22(4), 341–360. <https://doi.org/10.1080/15366367.2023.2264605>
16. Lee, S.-Y., Chan, B. Y.-F., & Kharruddin, A. F. (2023). Study of self-directed learning readiness scales in the Malaysian university student context: A review and criticism. *The Seybold Report*, 18(6), 1380–1392. <https://doi.org/10.17605/OSF.IO/NJ4UG>
17. Li, R., Mohamad Nasri, N., & Mahmud, S. N. D. (2024). The role of self-directed learning in promoting deep learning processes: A systematic literature review. *F1000Research*, 13, 761. <https://doi.org/10.12688/f1000research.150612.1>
18. Lim, Y. X., Razali, A. B., & Abd. Samad, A. (2018). Self-directed learning readiness (SDLR) among foundation students from high and low proficiency levels to learn English language. *Malaysian Journal of Learning and Instruction*, 15(2), 55–81. <https://doi.org/10.32890/mjli2018.15.2.3>
19. Nordin, N., Abd Halim, N., & Malik, M. (2016). Assessing readiness for self-directed learning among college students in the provision of higher learning institution. *Environment-Behaviour Proceedings Journal*, 1(3). <https://doi.org/10.21834/e-bpj.v1i3.352>
20. Ojo, A. O., Ravichander, S., Tan, N.-L., Anthonysamy, L., & Arasanmi, C. N. (2024). Investigating students' motivation and online learning engagement through the lens of Self-Determination Theory. *Journal of Applied Research in Higher Education*. <https://doi.org/10.1108/JARHE-08-2022-0248>
21. Palapa, A. (2023). Examining academic self-efficacy to achieve student academic performance: Evidence from computer-based training. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran, dan Pembelajaran*, 9(1). <https://doi.org/10.33394/jk.v9i1.7074>
22. Rahman, M., Sarwar, H., Hasan, M. K., & Tin, T. T. (2026). Analyzing Digital Addiction through Feature Selection and Machine Learning Techniques. *Educational Process: International Journal*, 23, e2026067. <https://doi.org/10.22521/edupij.2026.23.67>
23. Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a Self-Determination Theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, 61, 101860. <https://doi.org/10.1016/j.cedpsych.2020.101860>
24. Sathyanarayana, S., & Mohanasundaram, T. (2024). Fit indices in structural equation modeling and confirmatory factor analysis: Reporting guidelines. *Asian Journal of Economics, Business and Accounting*, 24(7), 561–577. <https://doi.org/10.9734/ajeba/2024/v24i71430>

25. Shank, E., Tang, H., & Morris, W. (2025). Motivation in online course design using Self-Determination Theory: An action research study in a secondary mathematics course. *Educational Technology Research and Development*, 73, 415–441. <https://doi.org/10.1007/s11423-024-10410-9>
26. Siswanto, S. (2024). The effect of self-directed learning (SDL) in higher education: Increasing student independence and achievement. *Jurnal Inovasi Teknologi Pendidikan*, 11(1). <https://doi.org/10.21831/jitp.v11i1.60338>
27. United Nations Department of Economic and Social Affairs. (2026). *Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*. [United Nations Sustainable Development Goal 4](#)
28. Xu, X., Abdullah, Z. B., & Azman, M. D. B. (2025). Self-efficacy in university learning and teaching: A PRISMA-guided systematic review of its multifaceted dimensions. *International Journal of Learning, Teaching and Educational Research*. <https://doi.org/10.26803/ijlter.24.3.15>

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