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Validity and Reliability of the Intrinsic Motivation Inventory Subscales within a self-directed blended learning environment

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Abstract. Blended learning environments, where face-to-face and online learning are integrated, are gaining traction in education, offering opportunities for self-directed learning and intrinsic motivation. This study explores the validity and reliability of the Intrinsic Motivation Inventory (IMI) in a self-directed blended learning context. A cross-sectional design involving 651 final-year teacher students reveals high reliability in interest/enjoyment, competence, and autonomy subscales (Cronbach's alpha: 0.94, 0.94, 0.85, respectively). A confirmatory factor analysis (CFA) indicates a favourable model fit (TLI: 0.970, CFI: 0.975, RMSEA: 0.056), reinforcing the IMI's appropriateness in this setting. Factor loadings demonstrate convergent validity, which emphasises the importance of interest, competence, and autonomy in fostering intrinsic motivation. The use of convenience sampling and the exclusion of the belonging factor due to low reliability are identified as limitations in this study. Future research might explore the use of diverse populations, longitudinal studies, additional constructs, and qualitative insights. This study contributes to educational research by validating the IMI in self-directed blended learning, emphasising the need for engaging experiences, competence, and autonomy to enhance intrinsic motivation.

Keywords: Self-directed learning; blended learning; Intrinsic Motivation Inventory; open educational resources (OER); Validity; Reliability.

INTRODUCTION

Blended learning environments are progressively gaining prominence in education, a domain marked by rapid and dynamic evolution. These environments combine traditional face-to-face learning with online learning (Singh et al., 2021) and offer unique opportunities for promoting self-directed learning and fostering intrinsic motivation (Peng & Fu, 2021). The flexibility and accessibility of blended learning environments allow learners to take charge of their learning journey, deciding when, where, and how to engage with learning materials (Cobo-Rendón et al., 2021). This flexibility enhances the sense of autonomy, a critical factor in self-directed learning. Self-directed learning is a process in which individuals take on the primary responsibility for planning, initiating, and managing their learning. According to Knowles (1975:19), "[i]n its broadest meaning self-directed learning describes a process by which individuals take the initiative, with or without the assistance of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing

and implementing appropriate learning strategies, and evaluating learning outcomes". Self-directed learning fosters autonomy, motivation, and a lifelong commitment to learning, making it invaluable across various educational contexts, including formal education, workplace training, and personal development (Okwuduba et al., 2021). Intrinsic motivation is a vital component of self-directed learning, as it serves as an internal impetus, driven by personal interest and satisfaction (Schweder& Raufelder, 2024) It fosters proactive engagement, persistence, and a lifelong commitment to learning goals within an autonomous educational framework (Morris, 2019)

Intrinsic motivation has been extensively studied in various educational settings (Lepper & Malone, 2021; Bailey et al., 2021; Wu et al., 2020) due to its significant impact on student engagement, persistence and academic achievement. Intrinsic motivation is a powerful internal force that drives individuals to pursue objectives and participate in activities solely for the inherent enjoyment and satisfaction they offer, unaffected by external incentives or pressures (Malik et al., 2019). Intrinsic motivaton reflects a student's desire for mastery, innate curiosity, and a natural inclination toward exploration (Kibga et al., 2021). Intrinsic motivation thrives when individuals participate in enjoyable, self-directed, and competence-enhancing behaviours (Ryan & Deci, 2022). Intrinsically motivated individuals are driven by a sincere enthusiasm for the intrinsic rewards and challenges that activities offer, rather than external prodding, pressure, or rewards (Asarkaya & Akaarir, 2021). In education, intrinsically motivated students find personal satisfaction not only in the learning content but also in the learning process itself, making them more likely to exhibit self-directed learning tendencies (Dwilestari et al., 2021). The Intrinsic Motivation Inventory (IMI) (Deci & Ryan, 1985) emerges as a pivotal tool, recognised for its ability to evaluate intrinsic motivation. The IMI (Deci & Ryan, 1985) is a widely recognised instrument and has been used across various contexts, including Physical education (Cocca et al., 2022), psychology (Rasul & Schwaiger, 2023), Biology education (Gibbens, 2019), and Medical education (Niu et al., 2021). Ensuring the validation of a measure within a learning environment prior to its formal utilisation enhances the credibility and dependability of the ensuing assertions.

While many researchers refer to reliability statistics published for well-known psychometric scales, they often fail to conduct the necessary exploratory or confirmatory factor analyses, or other similar methods, to validate the use of these scales in their specific domain, population, or learning environment. This paper aims to examine the validity and reliability of the IMI subscales within a self-directed blended learing environment.

METHOD

In this quantitative research study, a cross sectional design was employed. This design was chosen to facilitate a descriptive quantitative analysis of the intrinsic motivation levels among final-year teacher students. The population in the study consisted of final-year teacher students enrolled for a general module about teaching, learning, and assessment, at a higher education institution. The participants were selected through convenience sampling where a total of 651 students provided consent to take part in the study. In this module, students were encouraged to be accountable for their own learning in a self-directed blended learning environment. In cooperative learning groups, they were expected to create open educational resources (OER) that consist of lesson plans, learning material and assesment activities that can serve as teaching resources for teachers in various subject domains and levels. After a peer-evaluation process these artifacts were published as resources for students or teachers in an open access repository. Following the completion of the semester course, the IMI questionnaire was administered.

The survey instrument employed in this study was the IMI, originally developed by Deci and Ryan (Deci & Ryan, 1985). An adapted version of the IMI was used in this study (Ostrow & Heffernan, 2018) and comprises four sub-scales, namely *interest/enjoyment*, *autonomy*, *belonging* and *competence*. This questionnaire is composed of 19 questions and is rated on a seven-point Likert scale. The questions related to each factor in this questionnaire are as follows: *Interest/enjoyment* (IE2, IE1, IE6, IE5, IE7); *competence* (C4, C5, C1, C3, C2); *autonomy* (A5, A3, A7, A4, A2, A1); and *belonging* (B6, B1, B8).

The reliability and validity of the scale

within an online mathematics platform was established by Ostrow and Heffernan (2018). The reliability of the questionnaire in the context of this research will be discussed in the following section.

The data analysis entails the use of quantitative descriptive statistics, reliability analysis and confirmatory factor analysis (CFA). To evaluate the validity of the measurement scales employed in the study, a CFA was conducted, assessing model fit, discriminant validity and convergent validity.

RESULTS AND DISCUSSION

Result

The reliability of the instrument is determined by calculating Cronbach's Alpha, which is used to determine the consistencey and stability of the instrument. A Cronbach's alpha coefficient exceeding 0.9 indicates a high level of internal consistency, and a range of $0.7 \leq \alpha < 0.9$ is considered acceptable (Hair, Wolfinbarger et al., 2017:168). However, the factor of *belonging* exhibited an α value of 0.52, necessitating its exclusion from subsequent statistical tests. Table 1 indicates the resultant Cronbach alpha values.

Table 1. Cronbach's alpha values

Variable	Number of Items	Cronbach's alpha values
IMI		
Interest	5	0.94
Competence	5	0.94
Autonomy	6	0.85

This indicates that the items of *interest/enjoyment*, *competence* and *autonomy* are reliable in the context of this study.

CFA functions as a model for testing theories by comparing the covariance matrix of sample data with the theoretical structure of the instrument, aiming to evaluate the extent to which the items in a given instrument effectively measure the intended constructs (Prudon, 2015). In this study, CFA was utilised, incorporating regression weights, correlations between constructs, and fit indices, to evaluate how well the study population's data aligns with the model proposed by the questionnaire designers. Regression weights measure the intensity of the association between a factor and its individual items, assessed in accordance with Cohen's criteria (small: 0.1, medium: 0.3, large: 0.5), gauge the relationships between factors. Fit indices, including the comparative fit index (CFI), root mean square error of approximation (RMSEA), and Tucker-Lewis Index (TLI), determine the model's overall fit. In this study, emphasis was placed on the RMSEA as an absolute fit index, and the CFI and TLI as incremental fit indices. The model fit statistics are presented in Table 2.

Table 2. Model fit statistics

Fit indices	TLI	CFI	RMSEA
Values in this study	0.970	0.975	0.056
Recommended values	>0.90	>0.90	<0.10

The results in Table 2 reveal that both the CFI and TLI values surpass the recommended threshold of 0.90, indicating a favorable model fit (Malhotra et al., 2017:807). The RMSEA, at 0.056, falls below the suggested threshold of < 0.10 (Hair et al., 2014:630 Lai, 2021), signifying an acceptable model fit.

Convergent validity, denoting a high correlation among items within a construct (Verbeij et al., 2021), was assessed by examining the factor loadings (Sujati & Akhyar, 2020). To establish convergent validity, factor loadings should exceed 0.5 and be statistically significant. Convergent validity is determined by high factor loadings that are statistically significant.

In the initial testing, four items of the questionnaire exhibited factor loadings below 0.5. Specifically, all three items under the *belonging* factor demonstrated factor loadings of 0.096 (B6), 0.250 (B1), and 0.452 (B8). Consequently, the *belonging* factor was excluded from further analysis. Additionally, item A1 under *autonomy* was excluded due to a factor loading of 0.159.

Table 3 provides the standardised factor loadings for the remaining items used to measure the study's constructs, along with corresponding standard errors (SE) and p-values denoting significance.

As seen in Table 3, the factor loadings for the items varied between 0.673 and 0.919, meeting the required threshold of 0.5 for all items (Hair et al., 2019). Moreover, all measurement items demonstrated significance at $p < 0.001$. Consequently, all subsequent

calculations within the present context were performed using the identified items in the questionnaire. It is recommended that, in future applications of this questionnaire within the context of a self-directed blended learning environment, the questions presented in Table 3 be utilised.

Table 3. Standardised factor loadings

Variable	Items	Standardised Factor Loading > 0.5	Standard Error	p-value*
IE				
	IE2 - This assignment was fun to do	0.910		
	IE1 – I enjoyed doing this assignment very much.	0.906	0.027	0.000
	IE6 – I thought this assignment was quite enjoyable.	0.828	0.032	0.000
	IE5 – I would describe this assignment as very interesting.	0.836	0.030	0.000
	IE7 – While I was doing this assignment, I was thinking about how much I enjoyed it.	0.873	0.031	0.000
COMP				
	C4 – I am satisfied with my performance on this assignment.	0.823		
	C5 – I was pretty skilled at this assignment.	0.916	0.036	0.000
	C1 – I think I am pretty good at this assignment.	0.919	0.036	0.000
	C3 – After working at this assignment for a while, I felt pretty competent	0.897	0.037	0.000
	C2 – I think I did pretty well at this assignment, compared to other students.	0.778	0.041	0.000
AUT				
	A5 – I did this assignment because I had no choice. (R)	0.886		
	A3 – I didn’t really have a choice about doing this assignment. (R)	0.898	0.032	0.000
	A7 – I did this assignment because I had to. (R)	0.843	0.033	0.000
	A4 – I felt like I had to do this assignment. (R)	0.673	0.036	0.000
	A2 – I felt like it was not my own choice to do this assignment. (R)	0.738	0.034	0.000

Discussion

The study's investigation into the validity and reliability of the IMI subscales within a self-directed blended learning environment offers significant insights and implications for educational research and practice. The findings contribute to the understanding of intrinsic motivation in self-directed learning contexts, particularly in blended learning environments that combine traditional and online methodologies. This discussion will interpret the findings, considering their implications, limitations, and directions for future research.

The results demonstrate high reliability for the subscales of *interest*, *competence*, and *autonomy*, as indicated by the Cronbach's alpha values. These findings align with the theoretical underpinnings of self-determination theory (Deci & Ryan, 1985), suggesting that learners in self-directed blended learning environments are motivated when they find the learning interesting, feel competent, and perceive a sense

of autonomy. This emphasises the importance of designing blended learning environments that nurture these elements to foster intrinsic motivation (Cheng et al., 2023; Mohd Saad et al., 2023).

In the context of educational practice, the study highlights the need for facilitators to focus on creating learning experiences that are engaging (*interest/enjoyment*), provide appropriate challenges and feedback (*competence*), and offer choices and control over learning activities (*autonomy*). For instance, incorporating interactive and gamified elements can enhance interest (Sailer & Sailer, 2021), while adaptive learning technologies can support competence by adjusting challenges to individual skill levels (Toukiloglou & Xinogalos, 2023). Additionally, allowing learners to choose learning paths or projects can enhance their sense of autonomy and self-directed learning (Schweder & Raufelder, 2022).

CONCLUSIONS AND SUGGESTIONS

While the study provides valuable insights, it is essential to recognise its limitations. Since convenience sampling was used, the generalisability of the findings is limited. Participants were final-year teacher students from a specific institution, which may not represent the broader population of learners in self-directed blended learning environments. Additionally, the exclusion of the *belonging* factor due to low reliability indicates a potential gap in the IMI's applicability in this context. *Belonging* is a critical aspect of learning environments, especially online, where social interaction is less organic (Mendoza & Venebles, 2023).

Future research should aim to address these limitations and expand understanding in several ways: (a) Broader Population Sampling: Studies should include diverse learner populations from different educational levels and backgrounds. This would enhance the generalisability of the findings; (b) Longitudinal Studies: To better understand how intrinsic motivation develops and changes over time in self-directed blended learning environments, longitudinal research is recommended. This could provide insights into the sustainability of motivation and the long-term effects of self-directed blended learning on learning outcomes; (c) Inclusion of Additional Constructs: Exploring other motivational and psychological constructs, such as self-efficacy, could provide a more comprehensive understanding of learner motivation in self-directed blended learning environments; (d) Comparative Studies: Comparing the IMI's effectiveness in purely online versus blended versus traditional learning environments could elucidate the unique motivational dynamics of each setting; (f) Qualitative Insights: Qualitative research, such as interviews or focus groups, could provide deeper insights into students' perceptions and subjective experiences regarding intrinsic motivation in self-directed blended learning environments.

In conclusion, this study contributes significantly to educational research by validating the IMI subscales in a specific context of self-directed blended learning. It underscores the importance of fostering *interest/enjoyment*, *competence*, and *autonomy* to enhance intrinsic motivation. By addressing the limitations and following the suggested future research directions, further advancements can be made in understanding and improving learner motivation in diverse educational settings.

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