INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT
OPEN ACCESS JOURNAL
Vol 14, Issue 3, (2025) E-ISSN: 2226-6348

Enhancing Competency Readiness in Game Design Education: A Rasch Analysis of the Anim4Games Self-Learning Module

Wan Nor Raihan Wan Ramli[1], Wong Yoke Seng[2*], Tan Wee Hoe[3]
[1]Faculty of Computing, Arts and Creative Industries, Universiti Pendidikan Sultan Idris (UPSI), 35900 Tanjong Malim, Perak, Malaysia, [2*]Faculty of Computing & Meta-Technology, Universiti Pendidikan Sultan Idris, 35900 Tanjong Malim, Perak, Malaysia, [3]Faculty of Social Sciences and Liberal Arts, UCSI University, Kuala Lumpur Campus, 56000 Cheras, Malaysia
Email: P20161000042@siswa.upsi.edu.my, tanwh@ucsiuniversity.edu.my
Corresponding Author Email: yswong@meta.upsi.edu.my

DOI Link: http://dx.doi.org/10.6007/IJARPED/v14-i3/26387

Published Online: 28 August 2025

Abstract
This study investigates the effectiveness of the Anim4Games Self-Learning Module in improving knowledge, digital skills, and competency readiness among first-year game design students at Universiti Teknologi MARA (UiTM). A quasi-experimental pretest–posttest design was employed with 64 students, divided into an Experimental Group (EG) and a Control Group (CG). Data were analyzed using the Rasch model procedures, complemented by Wright maps for visual interpretation. Results revealed significant improvements in the EG across all three constructs: in-game animation knowledge, digital skillset creation, and competence readiness. Person reliability values (0.97–0.98) and Cronbach's alpha (0.98) indicated high internal consistency. The Rasch model highlighted item difficulty, stability, and meaningful shifts in student ability distributions. Findings affirm the module's effectiveness in bridging skills gaps in game design education and underscore the value of Rasch analysis as an evaluative tool.
Keywords: Rasch Analysis, Self-Learning Module, Game Design Education, Competency Readiness

Introduction

Animation skills are increasingly vital in game design education, yet many students lack the readiness to apply foundational animation knowledge in real-time game environments. To address this, the Anim4Games Self-Learning Module was designed to scaffold 2D animation knowledge and digital skills while fostering competency readiness. This module aims to bridge the gap between theoretical understanding and practical application, ensuring students develop the necessary proficiencies for dynamic game development pipelines. This initiative responds to the evolving demands of the game industry, which increasingly requires graduates with robust digital competencies and the ability to integrate diverse skill sets efficiently (Development of a Leadership and Management Mod, 2024).

Traditional evaluation methods often fail to capture nuanced shifts in individual competencies. The Rasch measurement model provides a robust framework by placing item difficulty and learner ability on the same interval scale (Sumintono & Widhiarso, 2014). Using stacking and racking analysis, it is possible to measure learning gains and the stability of assessment items (Wright, 2003). This study applies Rasch analysis to determine how the Anim4Games module influences undergraduate students' knowledge, skills, and readiness.

Methodology

Research Design

A quasi-experimental pretest–posttest design was implemented, comparing an Experimental Group (EG, n=32) and a Control Group (CG, n=32). Both groups completed pre-entry and post-exit assessments. The experimental group received the Anim4Games Self-Learning Module, while the control group engaged in traditional classroom instruction. This design directly compared the module's impact against conventional teaching methods on student learning outcomes and intrinsic motivation (Li, 2018). The intervention period spanned one academic semester, providing sufficient time for the module's effects to manifest and for comprehensive data collection. Quantitative data were collected to ensure a comprehensive evaluation of the module's effectiveness and to capture the multifaceted nature of learning within the game design curriculum.

Participants

Participants were first-year Creative Game Design students at UiTM Puncak Alam. Their diverse backgrounds included graphic design, mass communication, fine arts, computer science, and architecture. A total of 64 students were selected and divided into two groups: an experimental group of 32 students who utilized the Anim4Games module and a control group of 32 students who received conventional instruction. No significant differences were observed between the groups regarding gender and age, ensuring a balanced baseline for evaluating the module’s impact (Park et al., 2019). This homogeneity ensured that any observed post-intervention differences could be primarily attributed to the intervention rather than confounding demographic variables. To assess the effectiveness of the module, a structured questionnaire was designed, which evaluated student feedback and performance across six parameters: Familiarity, Performance, Ability, Time, Reference, and Attitude (Manan et al., 2022).

Given the limited number of first-year students enrolled in the Creative Game Design Program, the experiment spanned two consecutive semesters. This approach was taken to ensure a sufficient sample size for the nonequivalent group design that is as similar as possible to compare the Experimental Group (EG) and the Control Group (CG). The Experimental Group (EG) and the Control Group (CG) were carefully 283 matched before the experiment began. This matching process is important to ensure that the two groups are as similar as possible before experimenting. Levene's Test was employed to verify that the variances in the two groups were similar (a concept known as homogeneity of variances). This statistical verification confirmed the homogeneity of variances, thereby strengthening the validity of subsequent comparative analyses.(Al-Marzouki et al., 2005; Glass, 1965; Raaijmakers et al., 2007; Wright, 2009)

Table 1
Levene's Test on pre-test score for Experiment Group (EG) and Control Group (CG)

Source	*DF*	*Sum of Square*	*Mean Square*	*F-value*	*P-value*
Group (between-group)	1	3913.089	3913.089	1.2391	0.2699
Error (within group)	62	195790.9388	3157.9184		
Total	63	199704.0278	3169.9052		

Legend:
DF = Degree of Freedom
F-value = The calculated F-value for the test.

Intervention
The EG received the Anim4Games Self-Learning Module, a structured digital resource emphasizing in-game animation concepts, digital skillset creation, and competency readiness exercises. The CG followed the standard curriculum. The module integrated interactive lessons, practical exercises, and self-assessment tools to promote self-directed learning and immediate application of learned concepts (He, 2017). Conversely, the control group followed a curriculum based on traditional lecture-based instruction and assignments, without access to the specialized self-learning module (Manan et al., 2022). This comparative approach allowed for a direct assessment of the Anim4Games module's efficacy in fostering practical animation skills and enhancing overall competency readiness in game design.

Table 2
The evaluation processes undergone by the Control Group (CG) and the Experimental Group (EG).

	Pre-Entry	Treatment	Post-Entry	Difference
Experimental Group (EG)	M_1	X	M_2	Pre-M_1, Post-M_2
Control Group (CG)	M_1	→	M_2	Pre-M_1, Post-M_2

Legend:
M_1 = Measurement conducted before the learning
M_2 = Measurement conducted after the learning
X = The use of Anim4Games Self-Learning Module

Instrumentation and Analysis
Assessments comprised validated items measuring three constructs: (1) in-game animation knowledge, (2) digital skillset creation, and (3) competency readiness. Responses were analyzed with Winsteps 3.69.1.11 using the Rasch model. Key analyses included reliability and separation indices, as well as Wright maps. The Rasch model can see the interaction between items and persons at the individual level through the Wright map. The Wright map places people and items hierarchically according to the person's abilities and item difficulty, allowing for a visual representation of how well the assessment items align with the range of participant abilities(Komalasari, 2018; Wright, 1977). Based on the potential possessed by the

Rasch model, this study can analyze students' competencies in animation for game topics using a rating scale through the Wright map. This comprehensive analytical approach facilitated a nuanced understanding of participant performance and item functioning, thereby identifying areas of strength and areas requiring further instructional refinement.

Results

This section details the findings from the quasi-experimental study, presenting the statistical analyses of the pre-test and post-test data to evaluate the impact of the Anim4Games Self-Learning Module on student learning outcomes and intrinsic motivation. The subsequent subsections delineate the quantitative results, encompassing descriptive statistics, inferential analyses, and specific insights derived from the Rasch model, to provide a robust evidence base for the module's effectiveness.

Reliability and Validity

The statistical analysis showcases the instrument's high reliability in measuring both person and item constructs with significant internal consistency. The slight increase in person separation indicates an improvement in distinguishing participants' abilities. Nonetheless, the observed decrease in item reliability and separation during the posttest warrants further investigation to uncover underlying causes, such as a potential ceiling effect or the homogenization of participant responses over time.

Table 3
Statistics of the instrument items (N=52)

	Pretest	*Posttest*
Raw variance explained by measures	58.6%	58.9%
Unexplained variance	<15%	<15%
Cronbach's alpha (KR20)	0.98	0.98
Person reliability	0.97	0.98
Person separation	6.02	6.61
Item reliability	0.92	0.86
Item separation	3.33	2.51

Stacking and Racking Findings

The EG demonstrated a more significant improvement across all areas compared to the CG, as evidenced by the higher differences in mean scores. This could suggest that the intervention or treatment provided to the EG effectively enhanced learners' competencies in these areas. The most minor improvement within the CG was in competence-readiness, which could indicate that while the control group did improve, they did not gain as much in this area without the specific interventions the EG received. These conclusions would support the effectiveness of the educational or Self-learning interventions applied to the EG, particularly in fostering competence readiness. However, it is essential to consider other factors that might have contributed to these results, such as the initial differences between the groups and any external factors that may have influenced the outcomes.

Table 4
Mean pre-test and post-test scores for in-game animation knowledge, digital skill set creation, and competence-ready.

		Pre-test mean score	Post-test mean score	Difference
In-game animation knowledge	EG	4.74	6.46	1.72
	CG	5.65	6.70	1.05
Digital skillset creation	EG	4.18	5.84	1.66
	CG	4.68	5.95	1.27
Competence-ready	EG	3.56	5.4	1.84
	CG	5.23	5.92	0.69

Wright Map Insights
The provided Wright map appears to be a graphical representation of a Rasch model analysis, a specific Item Response Theory (IRT) form. It compares the distribution of a person's abilities (which could be the proficiency of individuals in a particular skill or knowledge area) with item difficulties on the same scale. Upon comparing the EG and CG, it is noticeable that the EG has a higher concentration of 'X's towards the upper end of the scale, implying that individuals in this group generally possess higher abilities. In contrast, the CG demonstrates a broader distribution of 'X's, including more individuals at the lower end of the scale, suggesting a greater variability in abilities within this group.

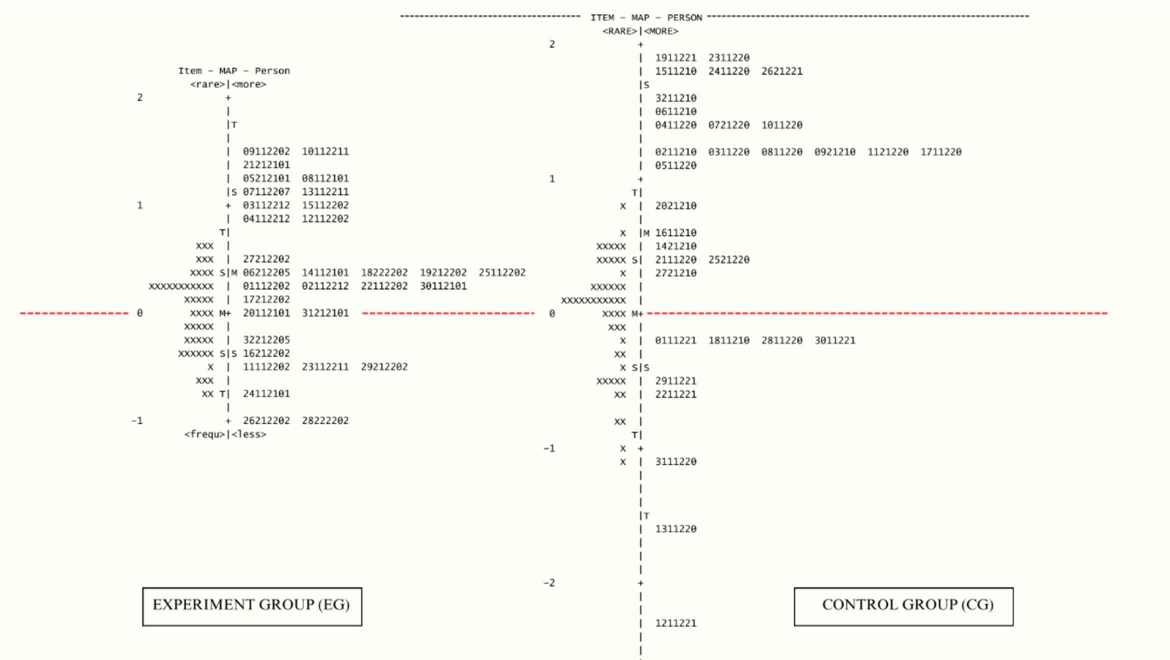

Figure 1: The differences in student ability between the Experiment Group (EG) and Control Group (CG) are represented on the Wright Map

Discussion

The Rasch analysis confirms the positive impact of the Anim4Games module on student competencies. Compared to CG, EG showed higher improvements across all constructs, reinforcing the module's role in bridging foundational to application skills in game design.

Stacking and racking analysis validated the learning gains while monitoring item performance. These findings support the integration of self-learning modules in higher education to supplement traditional curricula, aligning with the principles of Competency-Based Education (CBE). The Rasch model further ensured precise measurement beyond classical test theory.
The observed improvements in self-confidence among students following module engagement further underscore the module's positive influence, aligning with findings that highlight the importance of learning outcomes. However, one study highlighted the importance of balancing entertainment and learning to ensure the effectiveness of educational games (Fiorella et al., 2018) (Manan et al., 2022).

Conclusion

The Anim4Games Self-Learning Module significantly enhanced in-game animation knowledge, digital skillset creation, and competency readiness among first-year game design students. Rasch analysis provided robust evidence of reliability, validity, and learning progression. Future research should explore scaling the module across institutions and refining assessment items to address ceiling effects.

Furthermore, longitudinal studies could assess the module's long-term impact on professional development and career trajectories, while comparative studies could investigate its efficacy across diverse cultural and educational contexts (Jagušt et al., 2018). Additionally, future iterations of the module could incorporate more advanced simulation scenarios and integrate peer-to-peer assessment mechanisms to provide a more comprehensive evaluation of competence, moving beyond self-reported data (Development of a Leadership and Management Mod, 2024). These advancements would enable a more granular understanding of skill acquisition and application in complex, realistic scenarios, aligning with the growing demand for robust, verifiable competencies in the rapidly evolving game design industry.

References

Al-Marzouki, S., Evans, S., Marshall, T., & Roberts, I. (2005). Are these data real? Statistical methods for the detection of data fabrication in clinical trials. *BMJ*, *331*(7511), 267. https://doi.org/10.1136/bmj.331.7511.267

Development of a leadership and management mod. (2024). https://doi.org/10.1186/s12909-024-06004-x.pdf

Fiorella, L., Kuhlmann, S., & Vogel-Walcutt, J. J. (2018). Effects of Playing an Educational Math Game That Incorporates Learning by Teaching. *Journal of Educational Computing Research*, *57*(6), 1495. https://doi.org/10.1177/0735633118797133

Glass, G. V. (1965). Evaluating Testing, Maturation, and Treatment Effects in a Pretest-Posttest Quasi-Experimental Design. *American Educational Research Journal*, *2*(2), 83. https://doi.org/10.3102/00028312002002083

He, A. (2017). Overcoming Barriers to Engagement with Educational Video Games for Self-Directed Learning: A Mixed-Methods Case Study. *arXiv (Cornell University)*. https://doi.org/10.48550/arxiv.1710.04491

Jagušt, T., Botički, I., & So, H. (2018). Examining competitive, collaborative and adaptive gamification in young learners' math learning. *Computers & Education*, *125*, 444. https://doi.org/10.1016/j.compedu.2018.06.022

Komalasari. (2018). Evaluating Instrument Quality: Rasch Model – Analyses of Post Test of Curriculum 2013 Training. *Jurnal Ilmiah Kanderang Tingang*, *9*(1), 67. https://doi.org/10.37304/jikt.v9i1.7

Li, L. (2018). Using game-based training to improve students' assessment skills and intrinsic motivation in peer assessment. *Innovations in Education and Teaching International*, *56*(4), 423. https://doi.org/10.1080/14703297.2018.1511444

Manan, M. S. A., Wang, X., & Tang, X. (2022). Innovating Animation Teaching System: An Experimental Survey on the Integration of Design Thinking and Creative Methods for Animation Education in China. *Open Journal of Social Sciences*, *10*(3), 379. https://doi.org/10.4236/jss.2022.103028

Park, J., De, L., Yi, M. Y., & Santhanam, R. (2019). GAMESIT: A gamified system for information technology training. *Computers & Education*, *142*, 103643. https://doi.org/10.1016/j.compedu.2019.103643

Raaijmakers, M., Koffijberg, H., Posthumus, J. A., Hout, B. van, Engeland, H. van, & Matthys, W. (2007). Assessing performance of a randomized versus a non-randomized study design. *Contemporary Clinical Trials*, *29*(2), 293. https://doi.org/10.1016/j.cct.2007.07.006

Wright, B. D. (1977). SOLVING MEASUREMENT PROBLEMS WITH THE RASCH MODEL. *Journal of Educational Measurement*, *14*(2), 97. https://doi.org/10.1111/j.1745-3984.1977.tb00031.x

Wright, C. S. (2009). *Testing Homogeneity of Variance*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2953900