

STUDENTS PREPAREDNESS FOR BLENDED LEARNING IN MALAYSIAN HIGHER EDUCATION: A DEMOGRAPHIC ANALYSIS

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ABSTRACT

This study investigates the level of e-learning readiness among students from diverse backgrounds at a prominent Malaysian higher education institution. Emphasizing a blend of face-to-face and online learning, the study gauges students' preparedness across six dimensions: technological skills, usage, availability, self-directed learning, computer efficacy, and attitudes toward blended learning. Using the Blended Learning Readiness Engagement Questionnaire (BLREQ) and analyzing results with the WINSTEPS Rasch model, the research explores demographic influences such as age, gender, ethnicity, field of study, and education level on e-learning readiness. The findings highlight significant demographic variations, suggesting that while students display basic readiness, improvements in areas like self-directed learning are needed. This research emphasizes the importance of understanding student diversity in readiness for e-learning, with implications for policy and practice in higher education.

Purpose: This study examines the readiness of students from diverse backgrounds for blended learning at a leading Malaysian higher education institution. With the transition towards a blended learning model, it is critical to understand students' preparedness, considering variations across demographic factors.

Methodology: The research employed a cross-sectional quantitative survey involving 366 undergraduate and postgraduate students. Data were collected using the Blended Learning Readiness Engagement Questionnaire (BLREQ) and analyzed through the Rasch model to ensure validity and reliability.

Findings: Results indicate that students possess basic technological skills for blended learning. However, significant differences were observed in readiness levels based on demographic factors such as gender, age, ethnicity, field of study, and level of education. Notably, younger students showed higher engagement with social media and mobile technology, while older students relied more on email communication.

Novelty: This study offers unique insights into how demographic factors influence blended learning readiness among students in a Malaysian higher education context, which is underrepresented in current literature.

Significance: The findings contribute to shaping effective blended learning frameworks and support systems that account for diverse student backgrounds. The study highlights areas needing attention, such as self-directed learning skills and technology accessibility, to foster successful blended learning adoption.

Significance: This study provides insights on students' readiness towards blended learning, particularly in the Malaysian context, discusses implications for blended learning practices in higher education institutions, and offers recommendations for future research.

Keywords: Readiness, Higher education, Demographic factors, Malaysia, Technological skills, Self-directed learning, Student diversity

INTRODUCTION

Over the last decade, higher education has undergone significant transformation, driven by rapid advancements in internet technologies and software (Tayebinik & Puteh, 2012). This shift has profoundly reshaped teaching and learning, particularly in the realm of distance education. New models, like e-learning, have gained popularity in universities, resulting in various comparative studies on e-learning versus traditional learning (Northey et al., 2015; Southard, Meddaug & Harris, 2015), evaluating learning outcomes (Bernard et al., 2014; González-Gómez et al., 2016; Ryan et al., 2016), and exploring e-learning's

advantages and limitations (Wang, 2010).

However, while e-learning offers flexibility, it may limit face-to-face interaction, leading to the rise of blended learning (Tayebnik & Puteh, 2012). This model merges online and face-to-face elements to create a hybrid learning experience (Azizan, 2010). Educators have rapidly embraced blended learning, recognizing its potential to enhance student engagement and improve outcomes (Lim & Morris, 2009).

Despite its potential, questions remain about student readiness for this blended approach. Students often face challenges transitioning from traditional to virtual classrooms (Sanchez-Gordon & Luján-Mora, 2014), and some institutions lack necessary infrastructure, like high-speed internet (Panyajamorn et al., 2018), while students may struggle with computer literacy and motivation (Garrison & Anderson, 2003).

LITERATURE REVIEW

E-Learning: Evolution and Adoption in Higher Education

E-learning, a mode of education delivered exclusively through internet-based and digital tools, has developed considerably since its inception. Originally designed to accommodate adult learners unable to attend traditional classes, e-learning has now become essential for students across diverse educational contexts (Moore et al., 2011). The expansion of e-learning platforms, including Massive Open Online Courses (MOOCs), has transformed access to education globally, offering flexible learning opportunities to a broad audience (Margaryan et al., 2015). In Malaysia, the introduction of e-learning began in the late 1990s, though it faced challenges related to infrastructure, student preparedness, and resistance to digital learning systems (Hussin et al., 2009; Azhari & Ming, 2015). Nevertheless, the flexible nature of e-learning has allowed it to overcome some barriers, gaining prominence in higher education due to its global reach and adaptability (Azhari & Ming, 2015). Despite its benefits, e-learning continues to be scrutinized regarding the quality of educational experiences it offers compared to face-to-face learning (Panyajamorn et al., 2018). Research shows that many students still prefer traditional learning methods due to

interpersonal engagement and direct communication (Paechter & Maier, 2010; Orton-Johnson, 2009).

Blended Learning: Integrating Digital and Classroom Experiences

Blended learning, combining face-to-face instruction with online education, has emerged as a promising approach in higher education (Graham, 2013). Recognizing its potential to enhance educational outcomes, Malaysia's Ministry of Education has integrated blended learning into the higher education curriculum through the Malaysian Education Blueprint 2015-2025, which advocates for up to 70% of programs to utilize this model (Watson, 2008; Malaysian Education Blueprint, 2015-2025). Malaysian higher education institutions, in response, have implemented Learning Management Systems (LMS) like Moodle and Blackboard to manage and support this mixed instructional method (Tayebinik & Puteh, 2012). LMS platforms have become central tools in delivering and organizing coursework, assignments, and communication between students and instructors (Martinez & Jagannathan, 2012; Pellas & Kazanidis, 2015). However, while blended learning is widely accepted, its effectiveness is often contingent upon students' digital readiness and the availability of supportive infrastructure (Embi et al., 2011; Drysdale et al., 2013).

Student Preparedness and Readiness for Educational Technology

Student readiness for blended learning and e-learning hinges on various factors, including digital literacy, self-directed learning skills, and positive attitudes toward technology (George et al., 2014; Rasouli et al., 2016). Research highlights that students' digital and self-regulated learning skills are critical for adapting to blended learning environments, especially as this model demands more independent engagement than traditional formats (Vaughan, 2007; Yukselturk & Bulut, 2007). Gender, age, and prior technology experience significantly influence students' readiness and comfort with e-learning (Howard, 2009; Harris et al., 2009). For instance, mature students may face fewer distractions in online settings but may require additional support in adapting to blended models that involve substantial technology use (MacKeogh, 2003;

Howard, 2009).

Furthermore, Malaysian studies indicate varying degrees of e-learning readiness based on demographic characteristics, such as ethnicity, socioeconomic status, and field of study (Lau & Shaikh, 2012). Students' readiness for digital learning is often linked to their previous exposure to technology and individual preferences for learning environments. Comprehensive assessment of these factors can provide educators and administrators with insights needed to tailor blended learning models to different student demographics, ultimately enhancing engagement and learning outcomes (Park, 2009; Harris et al., 2009).

RESEARCH QUESTIONS

Following the discussion on e-learning, blended learning in higher education institutions, and students' readiness for blended learning, two research questions guide this paper:

- (1) What is the level of students' readiness for blended learning in a leading Malaysian higher education institution?
- (2) Are there any significant differences in students' readiness for blended learning based on gender, age, ethnicity, field of study, and level of education?

METHODOLOGY

Participants

This study utilized a quantitative research design to evaluate students' preparedness for blended learning as a measurable variable through the administration of a questionnaire. A cross-sectional survey was conducted in November 2022, targeting students from a prominent public higher education institution in Selangor, Malaysia. The sample included 235 undergraduate students (64.21%) and 131 postgraduate students (35.79%), representing a range of academic disciplines. The study employed a convenience sampling method, with participants invited to respond via paper questionnaires directly distributed by the

researchers, as well as an online survey disseminated through the university's email system.

Prior to data collection, ethical clearance was obtained, ensuring that each participant provided informed consent to voluntarily participate. Anonymity and confidentiality were emphasized to protect participants' identities. This methodological approach enabled the research to systematically assess students' readiness, taking into account diverse academic backgrounds and levels of study within a single educational setting. The demographic composition of the respondents is detailed in Table 1 of the study. And anonymous. The demographic profile of the respondents is indicated in Table 1.

Table 1.

Demographic Profile of Respondents (N=366)

Demographics	Respondents	Percentage (%)
Gender		
Male	156	42.62
Female	210	57.38
Age		
19 years and below	88	24.04
20-29 years	176	48.09
30-39 years	59	16.12
40-49 years	34	9.29
50-59 years	8	2.19
Over 59 years	1	0.27
Ethnicity		
Malay	181	49.45
Chinese	95	25.96
Indian	36	9.84
Bumiputera	16	4.37
International	38	10.38
Level of Education		
Undergraduate	235	64.21
Postgraduate	131	35.79
Field of study		
Social sciences	186	50.82
Sciences	43	11.75
Technology	50	13.66
Nursing	87	23.77

Instrumentation and Data Collection

The instrument was designed to capture the demographic characteristics of respondents, including gender, age, ethnicity, level of education, and field of study (Table 1). This demographic profiling ensures that the study reflects a diverse sample and validates the relevance and robustness of the instrument .

The questionnaire utilized categorical and continuous variables, allowing for a detailed demographic overview. The purpose was to confirm diversity and representativeness among respondents and to support further psychometric analysis (Linacre, 2012; Bond & Fox, 2015).

One-dimensionality and Rating Scale Analysis

One-dimensionality refers to whether the items in the questionnaire assess a single latent trait. In this study, one-dimensionality was confirmed using the Rasch Model, where logit measures transform ordinal data into interval measures to assess person and item fit (Appendix 1). A good one-dimensionality index ensures that the items align with the instrument's intended constructs.

The rating scale analysis examines how well the categories used in the instrument differentiate between respondents (Appendix 2). In this case, demographic data in Table 1 demonstrates effective distribution across categories (e.g., gender and age), ensuring that the instrument can differentiate between different respondent traits (Fisher, 2007). A clear category ordering and progression between categories indicate a functioning rating scale.

Person Reliability and Item Reliability

Person Reliability

According to Table 2, the person reliability index is 0.94, which reflects a very high level of consistency in responses across the different individuals surveyed (Sumintono & Widhiarso, 2014). This reliability level confirms that the instrument can accurately differentiate between respondents based on their demographic traits. A person reliability score above 0.80 suggests that the instrument effectively distinguishes between diverse respondents, such as those from different age groups and educational levels (Bond & Fox, 2015).

Item Reliability

The item reliability index is 0.99, indicating that the items are consistent across different respondent groups. This high value suggests that the probability of respondents providing similar answers to the same items is very high, confirming the stability of the instrument (Bond & Fox, 2015). The item reliability score ensures that the questionnaire items define the latent variables clearly and are suitable for use in various respondent groups.

Cronbach Alpha

The Cronbach's alpha coefficient of 0.97 (Table 2) demonstrates a very high internal consistency. This score indicates a high level of agreement between the items and confirms that the questionnaire items measure the same underlying construct effectively. The alpha value suggests that the instrument is highly reliable for both grouped and individual item analysis, surpassing the accepted threshold of 0.70 (Sumintono & Widhiarso, 2014). This reliability reflects strong interaction between respondents and items, validating the robustness of the demographic instrument.

Person and Item Separation Index

The person separation index of 4.00 indicates that the instrument can reliably distinguish between respondents with varying abilities or characteristics. A separation index above 2.0 is considered good, confirming that the instrument can capture meaningful differences among individuals, such as age, education level, and field of study.

Similarly, the item separation index of 9.01 suggests that the items provide a wide range of difficulty or complexity (Boone et al., 2014). A higher item separation index reflects the instrument's capacity to capture diverse response patterns effectively. This ensures that the questionnaire items are well-distributed across different levels of the latent trait, further supporting the reliability of the instrument.

Table 2

Reliability of Person and Item

	Mean Logit (SD)	Separation	Reliability	Alpha Cronbach
<i>Person</i>	2.04 (1.67)	4.00	0.94	0.97
<i>Item</i>	0.00 (0.99)	9.01	0.99	

Data Analysis

This study employed SPSS version 25 for data analysis and WINSTEPS version 3.73 for Rasch model measurement. Descriptive statistics, comprising mean and standard deviation values, were employed to assess students' preparedness for blended learning. The mean score was expressed in a logit scale instead of a Likert scale, derived from the raw data score. Consequently, a higher logit score indicates greater student preparedness for blended learning.

Furthermore, Differential Item Functioning (DIF) analysis was employed to discern responses according to students' demographic characteristics (i.e., age, gender, ethnicity, field of study, and educational level). DIF analysis elucidates the various response types contingent upon demographic characteristic groupings, rendering it the most appropriate analytical method for the study's aims.

RESULTS

Students' Readiness for Blended Learning

Based on the findings in Table 3, students demonstrated a varied readiness for blended learning, with the overall readiness score at 2.32 (SD = 1.79), indicating moderate preparedness. Among the dimensions assessed, technology skills emerged as the strongest component, with a mean score of 3.63 (SD = 2.36),

suggesting that students are relatively well-equipped in technical competencies required for blended learning. This higher technology skill level aligns with prior research that links proficiency in digital tools to improved adaptability in blended learning environments (George et al., 2014).

The findings underline the need for educational institutions to emphasize areas beyond technology skills, particularly self-directed learning, which scored the lowest with a mean of 1.25 (SD = 1.55). This low score may indicate students' reliance on structured learning formats, aligning with observations from studies on the challenges faced by students in transitioning from traditional learning to self-paced blended learning settings (Rasouli et al., 2016). Emphasizing self-directed learning strategies within the curriculum could enhance student autonomy, potentially elevating overall blended learning readiness.

Table 3

Results of Students' Readiness for Blended Learning

	Mean	Std. Deviation
Readiness for Blended Learning (overall)	2.32	1.79
Technology Skills	3.63	2.36
Technology Availability	2.47	1.80
Computer and Internet Efficacy	2.38	1.93
Technology Usage	2.16	1.65
Self-directed Learning	1.25	1.55

Figure 1. Person DIF plot based on Age.

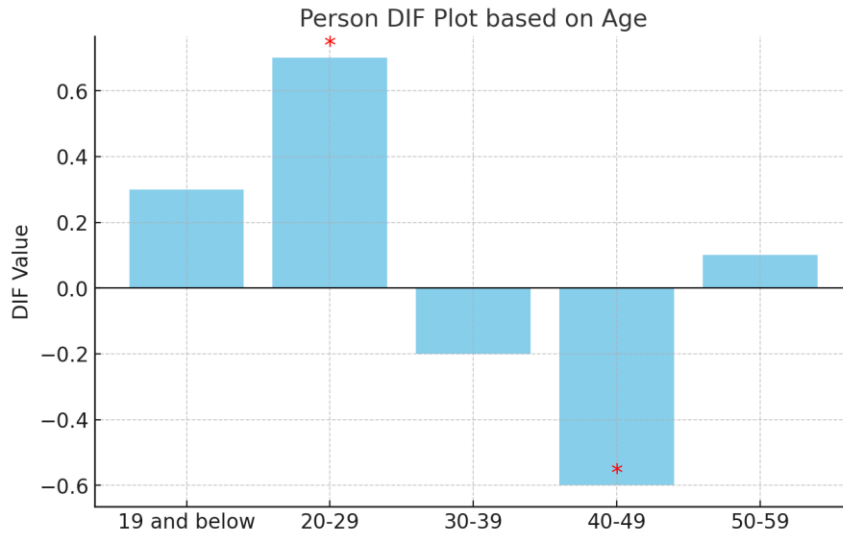


Figure 1. Person DIF Plot based on Age

This chart illustrates the differential item functioning (DIF) values across five age groups: “19 and below,” “20-29,” “30-39,” “40-49,” and “50-59 years.” Significant trends reveal that students aged 20-29 exhibit a positive DIF value, indicating their advantage in some learning behaviors. Conversely, students aged 40-49 show a negative DIF, possibly reflecting difficulties or reduced engagement. The chart emphasizes the varied learning patterns across age groups, with red markers highlighting significant differences.

Figure 2. Person DIF plot based on Gender.

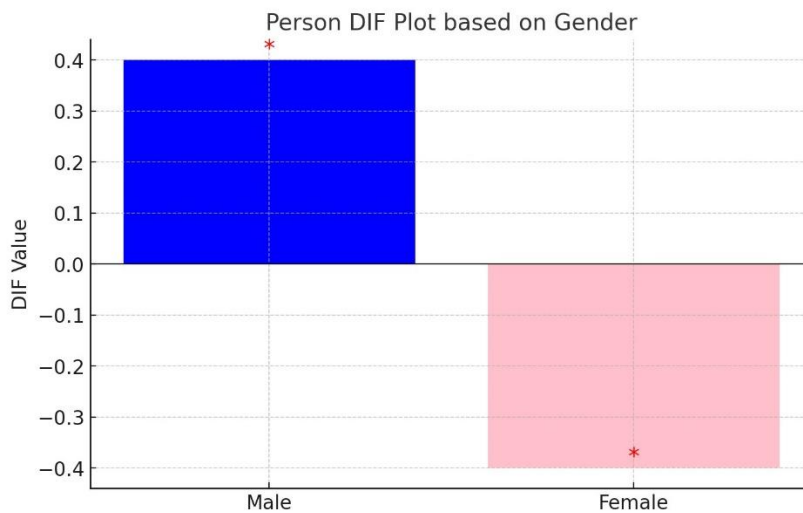


Figure 2: Person DIF Plot based on Gender

The DIF values for male and female students are depicted in this chart, with both genders showing significant trends. Males exhibit a positive DIF, suggesting stronger engagement in some activities, while females show a corresponding negative DIF. These gender differences could highlight disparities in preferences or behaviors, such as the tendency to use specific tools (e.g., mobile technologies) or approaches to learning. The red markers identify these significant patterns, aiding in quick interpretation of the results.

Figure 3. Person DIF plot based on Ethnicity.

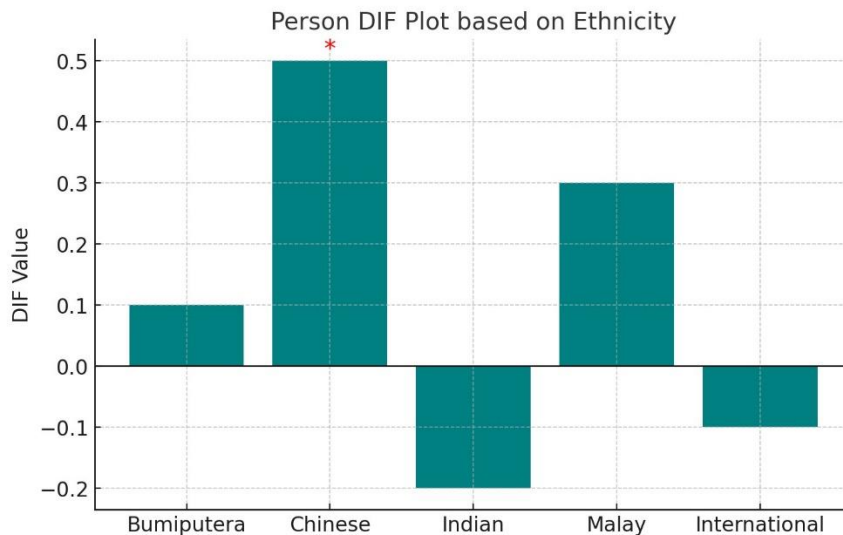


Figure 3. Person DIF Plot based on Ethnicity

This chart explores the DIF scores among students from five ethnic backgrounds: Bumiputera, Chinese, Indian, Malay, and international students. Notable significant trends include the Chinese students exhibiting a positive DIF, suggesting a stronger inclination toward certain behaviors or tools. Conversely, Malay students show slight negative DIF, indicating potential differences in preference or access to tools compared to their peers. The red markers on the bars underscore these key differences, enabling easy identification of significant disparities among ethnic groups.

Figure 4. Person DIF plot based on Field of Study.

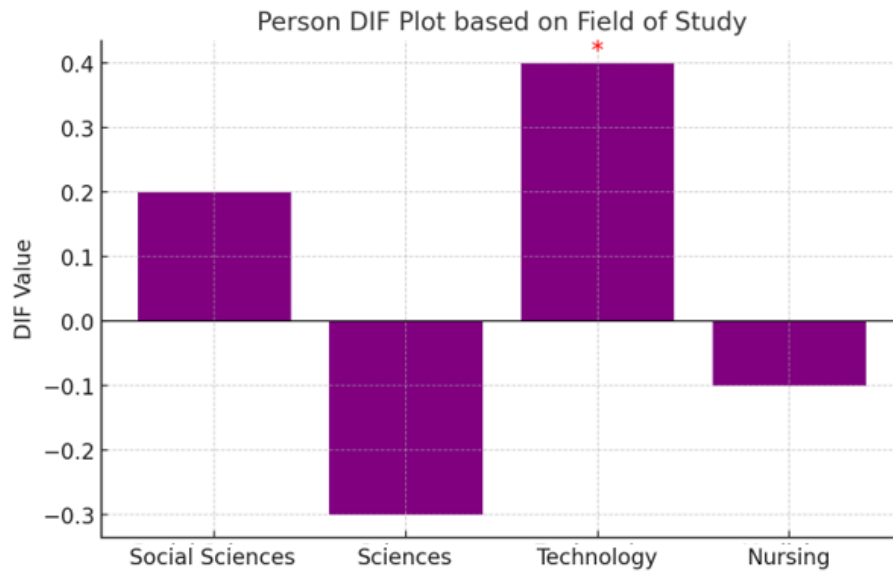


Figure 4. Person DIF Plot based on Field of Study

The chart presents the DIF values across four fields of study: Social Sciences, Sciences, Technology, and Nursing. Technology students display a positive DIF, suggesting their advantage in certain aspects, such as familiarity with tools or systems. In contrast, students from sciences exhibit a negative DIF, indicating potential challenges in their engagement. The findings suggest that students in different fields might have varying access to or interest in using digital tools and learning platforms. Significant patterns are marked in red, helping to emphasize these critical insights.

Figure 5. Person DIF plot based on Level of Education.

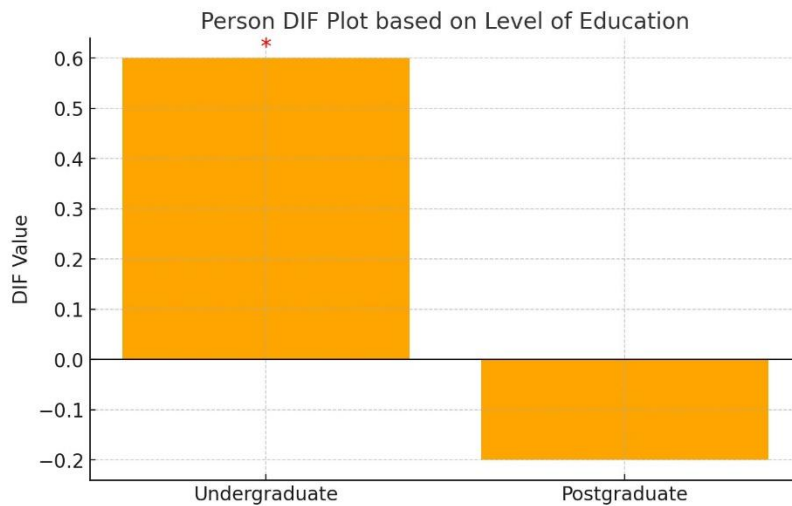


Figure 5. Person DIF Plot based on Level of Education

This chart compares DIF scores between undergraduate and postgraduate students. Undergraduate students show a significantly higher positive DIF, indicating stronger engagement or preference for certain activities, such as using mobile technologies or completing assignments online. Postgraduate students exhibit a slight negative DIF, possibly reflecting different priorities or approaches to learning. The red markers indicate areas where the differences are statistically significant, helping to pinpoint where educational levels impact student behaviors.

These five charts effectively highlight the differences among groups based on age, gender, ethnicity, field of study, and educational level, providing insights into how these factors influence student engagement and preferences

DISCUSSION

The findings affirm that students are generally ready for blended learning, but areas for improvement

remain. This section compares the results with relevant literature, explores the findings across various demographic groups, and evaluates whether the outcomes address the research questions effectively.

Comparison with Literature

The study corroborates with existing literature emphasizing the importance of technological skills and e-learning readiness. The high scores on technology skills align with studies by Rasouli et al. (2016), which suggest that digital natives are increasingly prepared to engage with technology-based learning environments. However, similar to previous findings, students exhibited lower self-directed learning readiness (Win & Wynn, 2015). This observation suggests that although students are comfortable with technology, they may still prefer structured, instructor-led learning environments.

The study also aligns with Azizan's (2010) research, which highlighted students' preference for traditional over online learning models. Self-directed learning, rated the lowest among the six readiness dimensions ($M = 1.25$, $SD = 1.55$), reflects challenges Malaysian students face in transitioning to autonomous learning, as suggested by Garrison and Anderson (2003). Additionally, technology availability and attitude scored moderately, indicating a need for further institutional support (Azhari & Ming, 2015).

Findings by Demographic Variables

The Differential Item Functioning (DIF) analysis revealed notable differences based on demographics. Gender differences are consistent with prior studies (Thorell et al., 2015), showing that female students use mobile technologies more frequently than males and excel in office software usage. Male students, however, showed more confidence in participating in online discussions, mirroring findings by Yau and Cheng (2012).

In terms of age, older students (aged 30 years and above) demonstrated more independence and preferred using email for communication, aligning with research by Islam et al. (2011). Conversely, younger students

(below 29 years) were more inclined to use instant messaging and social media platforms, highlighting a generation gap in technology use.

Ethnicity-based differences also emerged, with Chinese students participating less actively in blended learning activities compared to other ethnic groups. Similar trends were identified in Lau and Shaikh's (2012) study, which noted disparities in e-learning engagement among ethnic groups. Interestingly, Bumiputera students found using blended learning tools simpler but rarely engaged with online learning systems like Moodle.

Field of study further influenced the readiness dimensions, with social science students showing greater comfort with online discussions and recommending blended learning. However, nursing students expressed less confidence in using presentation software, despite studies (e.g., Robabi & Arbabisarjou, 2015) indicating otherwise. Technology students' frequent use of LMS platforms, coupled with science students' ability to handle multiple applications, confirms earlier findings that STEM students are generally more adept with technology (Rasouli et al., 2016).

Addressing the Research Questions

The study's findings answer both research questions effectively. The results confirm that students are, on average, ready for blended learning, as demonstrated by the overall positive readiness score (+2.32 logit, SD = 1.79). However, the varying degrees of readiness across the six dimensions—especially the low self-directed learning score—highlight areas requiring further development.

Furthermore, the DIF analysis provided evidence of significant differences in readiness based on gender, age, ethnicity, field of study, and level of education. These findings align with and expand upon previous studies. For instance, postgraduate students were more independent and used technology more effectively than undergraduates, supporting research by Rasouli et al. (2016). Similarly, the study reveals that undergraduate students were more likely to engage with mobile technologies, suggesting that younger

learners adapt to new learning tools more readily (Farley et al., 2015).

Conclusion

This study investigated the readiness of students from diverse backgrounds at a leading Malaysian higher education institution for blended learning, focusing on six dimensions: technological skills, technology availability, technology usage, self-directed learning, computer and internet efficacy, and attitudes towards blended learning. The results demonstrated that while students possess foundational technological skills necessary for successful engagement in blended learning environments, significant gaps remain in key areas such as self-directed learning and technology usage.

The findings highlight that demographic factor such as age, gender, ethnicity, field of study, and level of education significantly influence students' readiness for blended learning. For instance, younger students showed greater engagement with social media and mobile technology, while older students relied more on email communication, demonstrating the generational differences in learning preferences. Moreover, female students exhibited higher usage of mobile technologies and office software, whereas male students showed more confidence in participating in online discussions. Ethnicity also played a role in readiness, with Bumiputera students exhibiting a simpler approach to using learning tools compared to other groups. These findings underline the importance of considering demographic variations when designing blended learning initiatives.

The study's results provide valuable insights into the challenges faced by students in adopting blended learning, particularly regarding self-directed learning, which scored the lowest among all dimensions assessed. This highlights the need for educational institutions to foster autonomous learning skills through targeted interventions, such as incorporating self-regulated learning strategies into the curriculum.

Additionally, the moderate scores for technology availability and attitudes indicate that universities must ensure equal access to technological resources and foster positive attitudes towards blended learning among students.

Overall, this research offers significant contributions to the understanding of blended learning readiness among Malaysian higher education students, emphasizing the critical role of demographic factors in shaping learning experiences. The findings can help policymakers and educators develop tailored interventions to enhance student readiness and engagement in blended learning environments, thereby ensuring a more inclusive and effective educational experience. Future research should explore longitudinal studies to understand how readiness evolves over time, particularly as educational technologies and blended learning models continue to develop.

REFERENCES

- Abbas K, Masoud AM, Ali K. (2011). The role of readiness factors in Elearning outcomes: An empirical study. *Computers & Education*, 57(3):1919-1929.
- Aboderin, O. S. (2015). The challenges and prospects of e-learning in National Open University of Nigeria. *Journal of Education and Learning*, 9(3), 207-216.
- Al-Busaidi, K. A. (2013). An empirical investigation linking learners' adoption of blended learning to their intention of full e-learning. *Behaviour & Information Technology*, 32(11), 1168-1176.
- Alkhanak, S.A.K., & Azmi, I.A.G. (2011). Information technology usage and attitudes towards online resources – Students perspective. *African Journal of Business Management*, 5(7), 2582-2589.
- Anene, J., Imam, H., & Odumuh, T. (2014). Problem and prospect of e-learning in Nigerian universities. *International Journal of Technology and Inclusive Education*, 3(2), 320-327
- Azhari, F. A., & Ming, L. C. (2015). Review of e-learning practice at the tertiary education level in Malaysia. *Indian Journal of Pharmaceutical Education and Research*, 49(4), 248-257.
- Azizan, F.Z. (2010). Blended learning in higher education institution in Malaysia. *Proceedings of Regional Conference on Knowledge Integration in ICT, Selangor*, 454-466.
- Baldwin-Evans, K. (2006). Key steps to implementing a successful blended learning strategy. *Industrial and Commercial Training*, 38(3), 156-163.
- Bernard, M. B., Borokhovski, E., Schmid, R. F., Tamim, R. M., & Abrami, Ph. C., (2014). A meta-analysis of blended learning and technology use in higher education: from the general to the applied. *Journal of Computing in Higher Education*, 26(1), 87-122.
- Bond, T.G., & Fox, C.M. (2015). *Applying the Rasch Model, Fundamentals Measurement in the Human Sciences* (3rd edition). New York: Routledge.
- Boone, W.J., Staver, J.R., & Yale, M.S. (2014). *Rasch Analysis in the Human Sciences*. Dordrecht: Springer.
- Chu, R., & Tsai, C. C. (2009). Self-directed learning readiness, Internet self-efficacy and preferences towards constructivist Internet-based learning environments among higher-aged adults. *Journal of Computer Assisted Learning*, 25(5), 489- 501.
- Doiron, R., & Asselin, M. (2011). Exploring a new learning landscape in tertiary education. *New Library World*, 112(5/6), 222-235.
- Drysdale, J. S., Graham, C. R., Spring, K. J., & Halverson, L. R. (2013). An analysis of research trends in dissertations and theses studying blended learning. *The Internet and Higher Education*, 17, 90-100.
- El-Gayar, O., Moran, M., & Hawkes, M. (2011). Students' Acceptance of tablet PCs and implications for educational institutions. *Educational Technology & Society*, 14(2), 58–70.
- Embi, M. A., Abdul Wahab, Z., Sulaiman, A. H., Atan, H., Ismail, M., & Mohd Nordin, N. (2011). *e-Learning in Malaysian higher education institutions: Status, trends & challenges*.

- Kuala Lumpur, Malaysia: Department of Higher Education, Ministry of Higher Education Malaysia.
- Farley, H, Murphy, A, Johnson, C, Carter, B, Lane, M, Midgley, W, Hafeez-Baig, A, Dekeyser, S and Koronios, A. (2015). How do students use their mobile devices to support learning? A case study from an Australian Regional University. *Journal of Interactive Media in Education*, 14(1), 1–13.
- Fisher, W.P. Jr. (2007). Rating scale instrument quality criteria. *Rasch Measurement Transactions*, 21(1), 1095.
- Garrison, D. R., & Anderson, T. (2003). *E-learning in the 21st century: A framework for research and practice*. London and New York: RoutledgeFalmer
- Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *Internet and Higher Education*, 7(2), 95–105.
- George, P. P., Papachristou, N., Belisario, J. M., Wang, W., Wark, P. A., Cotic, Z., ... & Musulanov, E. M. (2014). Online eLearning for undergraduates in health professions: A systematic review of the impact on knowledge, skills, attitudes and satisfaction. *Journal of Global Health*, 4(1), 1-17.
- González-Gómez, D., Jeong, J. S., Rodríguez, D. A., & Cañada- Cañada, F. (2016). Performance and perception in the flipped learning model: an initial approach to evaluate the effectiveness of a new teaching methodology in a general science classroom. *Journal of Science and Education Technology*, 25(3), 450-459.
- Graham, C. R. (2013). Emerging practice and research in blended learning. In M. G. Moore (Ed.), *Handbook of distance education* (pp. 333–350). (3rd ed.). New York, NY: Routledge.
- Graham, C. R., & Robison, R. (2007). Realizing the transformational potential of blended learning: Comparing cases of transforming blends and enhancing blends in higher education. In A. G. Picciano & C. D. Dziuban (Eds.), *Blended learning: Research perspectives*. (pp. 83–110). Needham, MA: Sloan Consortium.
- Halverson, L. R., Graham, C. R., Spring, K. J., & Drysdale, J. S. (2012). An analysis of high impact scholarship and publication trends in blended learning. *Distance Education*, 33(3), 381– 413.
- Harris, P., Connolly, J., & Feeney, L. (2009). Blended learning: Overview and recommendations for successful implementation. *Industrial and Commercial Training*, 41(3), 155-163.
- Heidi, Y. J. T., & Neo, M. (2015). Exploring the use of authentic learning strategies in designing blended learning environments. *Journal of Science and Technology Policy Management*, 6(2), 127.

- Howard, S.B. (2009). The benefits of face-to-face interaction in the online freshman composition course. *Journal of Online Learning and Teaching*, 5(4), 685-697.
- Hussein, I. (2010). *Measuring students' e-readiness for e-learning at Egyptian faculties of tourism and hotels*. The 6th International Scientific Conference on E-Learning and Software for Education. Bucharest, Romania, 2010.
- Hussin H, Bunyarit F, & Hussein R. (2009). Instructional design and e-learning: Examining learners' perspective in Malaysian institutions of higher learning. *Campus-Wide Information System*, 26(1), 4-19.
- Ikolo, V. E., & Okiy, R. B. (2012). Gender differences in computer literacy among clinical medical students in selected Southern Nigerian Universities. *Library Philosophy and Practice (e-journal)*. 745.
- Islam, M. A., Abdul Rahim, N. A., Liang, T. C., & Momtaz, H. (2011). Effect of demographic factors on e-learning effectiveness in a higher learning institution in Malaysia. *International Education Studies*, 4(1), 112-121.
- Kaur, N. (2014). Teacher-Led Initiatives in Supporting Learner Empowerment among Malay Tertiary Learners. *Malaysian Journal of Learning and Instruction*, 11, 101-126.
- Kumar, A. (2017). E-learning and blended learning in orthodontic education. *APOS Trends in Orthodontics*, 7(4), 188.
- Lau, C. Y., & Shaikh, J. M. (2012). The impacts of personal qualities on online learning readiness at Curtin Sarawak Malaysia (CSM). *Educational Research and Reviews*, 7(20), 430-444.
- Lim, D. H., & Morris, M. L. (2009). Learner and Instructional Factors Influencing Learning Outcomes within a Blended Learning Environment. *Educational Technology & Society*, 12 (4), 282-293.
- Linarce, J.M. (2012). *A user's guide to Winsteps Ministeps Rasch- model computer programs* [version 3.74.0], Chicago IL: Winstep.com.
- Lopez-Perez, V.M., Perez-Lopez, C.M., & Rodriguez-Ariza, L. (2011). Blended learning in higher education: Students' perceptions and their relation to outcomes. *Computers & Education*, 56(3), 818-826.
- MacKeogh, K. (2003). *Student Perceptions of the use of ICTs in European Education: Report of a Survey*, Dublin City University, Dublin. Retrieved from: /www.oscail.ie/academic/ picture.php.

- Margaryan, A., Bianco, M., & Littlejohn, A. (2015). Instructional quality of massive open online courses (MOOCs). *Computers & Education*, 80, 77-83.
- Martinez, M. & Jagannathan, S. (2012). *Learning solution: Moodle: A low-cost solution for successful e-learning*. Retrieved from <http://www.learningsolutionsmag.com/articles/71/moodle-low-cost-solution-for-successful-e-learning>
- Moore, J.L., Dickson-Deane, C., & Galyen, K. (2011), E-Learning, online learning, and distance learning environments: Are they the same? *Internet Higher Education*, 14(2), 129-35.
- Mosadegh, H., Kharazi, K., & Bazargan, A. (2011). Conducting feasibility of e-learning in gas companies in Yazd province. *Journal of Science and Technology Information*, 3, 547-569
- Naresh, B., Reddy, B.S., & Pricilda, U. (2016). A study on the relationship between demographic factor and e-learning readiness among students in higher education. *Sona Global Management Review*, 10(4), 1-11.
- Northey, G., Bucic, T., Chylinski, M., & Govind, R., (2015). Increasing Student Engagement Using Asynchronous Learning. *Journal of Marketing Education*, 37(3), 171-180.
- Orton-Johnson, K., (2009). 'I've stuck to the path I'm afraid':exploring student non-use of blended learning. *British Journal of Educational Technology*, 40 (5), 837-847.
- Paechter, M., & Maier, B.. (2010). Online or face-to-face? Students' experiences and preferences in e-learning. *Internet and Higher Education*, 13(4), 292-297.
- Panyajamorn, T., Suthathip, S., Kohda, Y., Chongphaisal, P., & Supnithi, T. (2018). Effectiveness of E-learning design and affecting variables in Thai public schools. *Malaysian Journal of Learning and Instruction*, 15 (1), 1-34.
- Park, S.Y. (2009). An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. *Educational Technology and Society*, 12(3), 150-162.
- Pellas, N., & Kazandis, I., (2015). On the value of second life for students' engagement in blended and online courses: A comparative study from the Higher Education in Greece. *Education and Information Technologies*, 20(3), 445-466.
- Rasouli, A., Rahbania, Z., & Attaran, M. (2016). Students' readiness for E-learning application in higher education. *Malaysian Online Journal of Educational Technology*, 4(3), 51-64.
- Rhee, V. D., B., Verma, R., Plaschka, G. R., & Kickul, J. R. (2007). Technology readiness, learning goals, and eLearning: searching for synergy. *Decision Sciences Journal of Innovative Education*, 5(1), 127-149.
- Robabi, H., & Arbabisarjou, A. (2015). Computer literacy among students of Zahedan University of Medical Sciences. *Global Journal of Health Science*, 7(4), 136-142.
- Ryan, S., Kaufman, J., Greenhouse, J., Joel; She, R. and Shi, J., (2016). The effectiveness of blended online learning courses at the community college level. *Community College Journal of Research and Practice*, 40(4), 285-298.
- Salim, H., Lee, P. Y., Ghazali, S. S., Ching, S. M., Ali, H., Shamsuddin, N. H., Mawardi, M., Kassim, P. S. J. & Dzulkarnain, D. H. A. (2018). Perceptions toward a pilot project on blended learning in Malaysian family medicine postgraduate training: a qualitative study. *BMC medical education*, 18(1), 206.
- Seraji, F. (2013). Identification and categorising the skills needed for the virtual student. *Journal of Training and Learning Researches*, 2, 75-90
- Seraji, F., & Yarmohammadi, M. (2010). Preparation and readiness assessment validate incoming e-Learning courses. *Journal of Educational Measurement*, 2(32), 127-149.
- Shahnaz, S. M. F., & Hussain, R. M. R. (2016). Designing Instruction for Active and Reflective Learners in the Flipped Classroom. *Malaysian Journal of Learning and Instruction*, 13(2), 147- 173.
- Southard, S., Meddaugh, J., & France-Harris, A. (2015). Can SPOC (self-paced online course) live long and prosper? A comparison study of a new species of online course delivery. *Online Journal of Distance Learning Administration*, 18. Retrieved from <http://www.westga.edu/~distance/ojdla/>
- Sumintono, B., & Widhiarso, W. (2014). *Aplikasi Model Rasch untuk Penelitian Ilmu-Ilmu Sosial (edisi revisi)*

[Application of rasch modelling in social science research, revised edition]. Cimahi: Trimkom Publishing House.

Starenko, M., Vignare, K., & Humbert, J. (2007). Enhancing student interaction and sustaining faculty instructional innovations through blended learning. In A.G. Picciano and C.D. Dziuban (Eds.), *Blending Learning: Research Perspectives* (pp. 161- 178). Needham, MA: Sloan Consortium.

Tayebnik, M., & Puteh, M. (2012). Blended Learning or E-learning? *International Magazine on Advances in Computer Science and Telecommunications*, 3(1), 103-110.

Thorell, M., Fridorff-Jens, P. K., Lassen, P., Lange, T., & Kayser, L. (2015). Transforming students into digital academics: a challenge at both the individual and the institutional level. *BMC medical education*, 15(1), 48.

Vaughan, N. (2007). Perspectives on blended learning in higher education. *International Journal on E-Learning*, 6(1), 81-94.

Wang, M. J. (2010). Online collaboration and offline interaction between students using asynchronous tools in blended learning. *Australasian Journal of Educational Technology*, 26(6), 830-846.

Watson, J. (2008). *Promising practices in online learning: Blending learning: The convergence of online and face-to-face education*. North American Council for Online Learning.

Win, N.L., & Wynn, S.D. (2015). Introducing blended learning practices in our classrooms. *Journal of Institutional Research in South East Asia*, 12(2), 17-27.

Yau, H. K., & Cheng, A. L. F. (2012). Gender difference of confidence in using technology for learning. *Journal of Technology Studies*, 38(2), 74-79.

Yukselturk, E., & Bulut, S. (2007). Predictors for student success in an online course. *Journal of Educational Technology & Society*, 10(2), 71-83.

Appendix 1. One-dimensionality

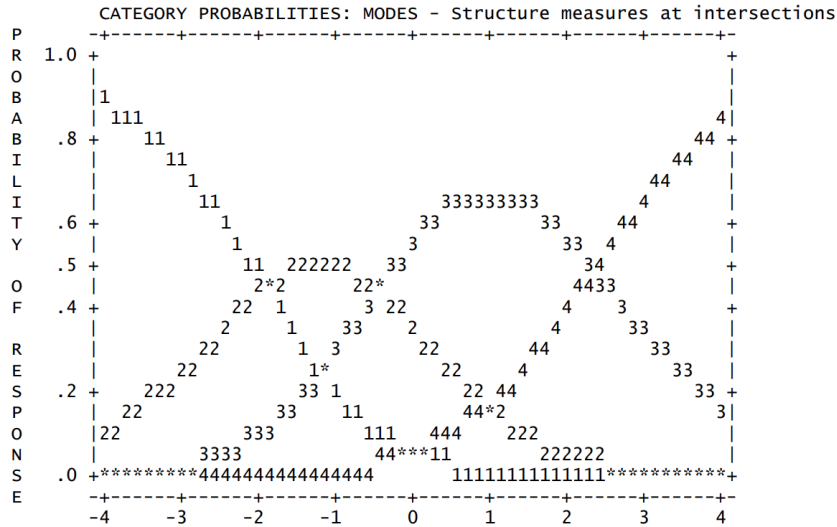
Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)
-- Empirical -- Modeled

Total raw variance in observations	=	105.0	100.0%	100.0%
Raw variance explained by measures	=	48.0	45.7%	47.2%
Raw variance explained by persons	=	23.8	22.7%	23.4%
Raw Variance explained by items	=	24.2	23.1%	23.8%
Raw unexplained variance (total)	=	57.0	54.3%	100.0% 52.8%
Unexplnd variance in 1st contrast	=	9.5	9.1%	16.7%
Unexplnd variance in 2nd contrast	=	4.3	4.1%	7.6%
Unexplnd variance in 3rd contrast	=	2.6	2.4%	4.5%
Unexplnd variance in 4th contrast	=	2.1	2.0%	3.7%
Unexplnd variance in 5th contrast	=	1.8	1.7%	3.1%

Appendix 2. Rating Scale Analysis

SUMMARY OF CATEGORY STRUCTURE. Model="R"

CATEGORY LABEL	OBSERVED SCORE	OBSVD COUNT	SAMPLE %	AVRGE	SAMPLE EXPECT	INFIIT MNSQ	OUTFIT MNSQ	ANDRICH THRESHOLD	CATEGORY MEASURE
1	1	558	3	-.79	-1.38	1.48	1.92	NONE	(-3.15)
2	2	2450	12	.32	.26	1.09	1.21	-1.90	-1.21
3	3	9126	44	1.34	1.48	.92	.81	-.46	1.00
4	4	8728	42	3.23	3.13	.90	.92	2.36	(3.50)



Appendix 3. Summary Statistics

SUMMARY OF 366 MEASURED (EXTREME AND NON-EXTREME) Person

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	184.9	57.0	2.04	.29				
S.D.	24.7	.0	1.67	.24				
MAX.	228.0	57.0	8.05	1.83				
MIN.	61.0	57.0	-4.90	.20	.28	-5.4	.14	-5.4
REAL RMSE	.40	TRUE SD	1.62	SEPARATION	4.00	Person	RELIABILITY	.94
MODEL RMSE	.38	TRUE SD	1.62	SEPARATION	4.28	Person	RELIABILITY	.95
S.E. OF Person MEAN = .09								

Person RAW SCORE-TO-MEASURE CORRELATION = .93
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .97

SUMMARY OF 41 MEASURED (NON-EXTREME) Item

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT		OUTFIT	
					MNSQ	ZSTD	MNSQ	ZSTD
MEAN	1041.1	321.0	.00	.10	.99	-.3	1.04	.3
S.D.	97.7	.0	.99	.01	.29	3.4	.42	3.6
MAX.	1197.0	321.0	2.48	.13	2.00	9.9	2.39	9.9
MIN.	749.0	321.0	-1.89	.09	.60	-5.6	.52	-4.2
REAL RMSE	.11	TRUE SD	.98	SEPARATION	9.01	Item	RELIABILITY	.99
MODEL RMSE	.10	TRUE SD	.98	SEPARATION	9.43	Item	RELIABILITY	.99
S.E. OF Item MEAN = .13								