Home-campus nexus: The shift to homebased smart e-learning

Jiang Na
East China Normal University, China

Corinne Jacqueline Perera
Shangrao Normal University, China

Zamzami Zainuddin
Universiti Malaya, Malaysia

This article outlines the trajectory of China's higher education and its strategy of pioneering a brand-new smart e-learning environment that has functionally molded China into a hybrid educational hub. This paper chronicles the almanac of China's offline campus education, depicting how it technologically evolved into an e-learning home-campus nexus. A sequential mixed-methods design was employed to shed light on students' readiness levels toward China's newly implemented smart e-learning platform for tertiary education. The psychometric analyses of the Smart e-Learning Questionnaire and other parametric statistical tests were performed using the Rasch measurement model. Overall, there is strong evidence to suggest that the in-depth qualitative interviews captured more nuanced accounts of the participants' perceived reasons for their moderate level of readiness towards their novel home-campus e-learning course delivery. Evacuated campuses and virtual lessons have become the cliched representation of this pandemic. It is critical that e-learning offerings be contextualised in practical ways to invigorate equitable teaching strategies that can improve e-learning and support the success of China's higher education learning model for the post-pandemic agendum.

Implications for practice or policy:

- This research investigated home-campus e-learning as a higher education learning model for the post-pandemic agendum.
- The homebased smart e-learning prototype proposed in this study is framed as a learning delivery modality for advancing the latitude of digital literacy among higher education students.
- The deployment of the next-generation 5G internet connectivity and the implementation of hybrid smart e-learning platforms, draw clear implications for policymakers and practitioners to model after these insightful strategies.

Keywords: homebased smart e-learning, education technology pedagogy, smart e-learning questionnaire, mixed methods, Rasch model

Introduction

In the wake of the COVID-19 pandemic, the whole world has been adversely impacted by the severity of the unprecedented global lockdown. The scale of this impasse has given rise to a global learning crisis, resulting disruptions in the education sector due to the closure of all forms of educational academes, moving all classes to web-based online lessons (Huang et al., 2020). Teaching and learning communities were compelled to move away from traditional classrooms and switch to online distance learning. Evacuated campuses left learning communities mimicking classroom settings through the web. Virtual lessons and a gamut of online platforms took precedence as the surrogate to classroom lessons. This resulted in the emergent home-campus nexus run over the web, earmarking the uptake of homebased smart e-learning and the launch of the flipped, e-learning teaching model in China.

Recent studies have endorsed the potential benefits of e-learning as an important learning modality for the continuance of academic pursuits during the pandemic disruptions (Al-Jedaiah, 2020; Ali, 2020; Choudhury & Pattnaik, 2020). However, at the onset of the pandemic, there was a lack of empirical research concerning e-learning in China (Turnbull et al., 2021). Given the limited e-learning research in China, this study fills the gap in research by providing empirical evidence on Chinese students' perceptions and readiness for change from traditional campus lectures to e-learning at home. This study explored student's readiness for this digital shift and examined their perceptions towards the online mode of instruction. The results of this study suggest that although educational technology pedagogy enables the accessibility of live streaming lectures from the comfort of students' homes, there are clearly varying perceptions among the students towards their virtual learning experience. These findings provide important insights for stakeholders to gain a better understanding of learners' perceptions of homebased smart e-learning recently implemented in China.

The following literature review section presents an account of China's largest education system bridging the digital divide between the technological breakthroughs of educational technology pedagogy and home-campus e-learning.

Literature review

The surge of e-learning in China

China is known for having the largest online education system and the highest number of higher education institutions in the world (Zhou et al., 2020). About a month and a half after the epidemic began, nearly 270 million students and 20 million teachers participated in online teaching and learning, making it the largest number of educational activities conducted online. During the pandemic, Dunrong and Jin (2020) reported that the unplanned educational disruptions affected its 2,688 higher education institutions due to their offline operational suspension. In line with these localised closures, China's Ministry of Education developed a smart virtual learning environment to transform physical classes to online spaces (Jiang et al., 2023). Online remote teaching and learning was unprecedented in the recorded history of China's education system. Their higher education modalities were traditional, face-to-face classroom lectures, and typically PowerPoint-aided (Thai et al., 2020).

Since the pandemic, there has been a surge in the popularity of e-learning in China. As the most populous country, Statista reported that China is also home to the world's largest population of internet users, with the Chinese internet population approximately 1.04 billion in 2022 (Statista, 2023). Mainly comprised of millennials and tech-savvy digital natives, these users grew up in the era of video games, computers, and smartphones. Based on this user profile, the growing popularity of e-learning, is likely to be adopted by the nascent group of technophiles in China.

The major disruptions in campus closures prompted China's Ministry of Education to set up 22 e-learning platforms, with 24,000 e-learning resources, to increase digital literacy among their community of teachers and learners (Dunrong & Jin, 2020; Huang et al., 2020; Zhang et al., 2020). These newly implemented cloud-based platforms offered the possibility of reshaping and advancing face-to-face classroom lessons into remotely accessible smart e-learning platforms. Chinese universities and colleges were swift to transform their lecturer-centric classroom lessons to digitally-hosted, on-screen lessons; a strategic homebased instructional modality for quarantined learners. This shift of flipping classrooms to homebased smart e-learning environment, has enabled China to navigate students' educational needs and their social demands in accordance with the new technology-enhanced milieu of the digital era. This digital stronghold bridged the gap between the burgeoning educational constraints brought on by COVID-19 and the need to establish educational continuity in China.

Educational technology pedagogy and home-campus smart e-learning

The evolving pandemic amplified the need to implement an adaptive smart e-learning system as an effective redress mechanism to mitigate the impact of school dismissals and closures; one that was

pluralistic and diverse in terms of fostering learning flexibility, enriching student learning, and provisioning seamless access to educational platforms. In effect, the pandemic underscored the need to accelerate the digital agenda by bridging the digital divide between the technological breakthroughs of educational technology pedagogy and home-campus smart e-learning. Transitioning into the world of smart e-learning may have been a new online reality for learners and educationalists, however these digital mediums and educational technologies were also able to bridge geographically separated communities, bringing them a host of digital affordances which cater for the emerging educational needs of learners.

The home-campus smart e-learning approach expressed in this study, is very similar to the evolutionary e-learning discovery referred to by Azorín (2020) as "the most brilliant supernova discovery ever made in the field of education" during the "symbolic time where the COVID-19 supernova is heralding the end of a largely obsolete education" (p. 381). Furthermore, home-campus smart e-learning has incited a technology-enabled pedagogical shift driven towards the hallmark of remote online pedagogy. In this study, home-campus smart e-learning is put forward as a pragmatic pedagogical framework useful for facilitating remote educational activity while provisioning real-time online learning experiences from home.

Research questions

Following the discussion on online schooling in higher education institutions and students' readiness for home-campus e-learning, the following research questions were formulated to guide this study:

- What are the respondents' agreement levels towards the items of the Smart e-Learning Questionnaire?
- What is the level of students' readiness on the adoption of home-campus e-learning in China's higher education institutions?
- Are there any significant differences in students' readiness for home-campus e-learning based on gender?
- Are there any significant differences in students' readiness for home-campus e-learning based on level of study?
- Are there any significant differences in students' readiness for home-campus e-learning based on e-learning time?

Methodology

This study assesses the readiness level of Chinese higher education students for the recently launched home-campus e-learning initiative in China. It employed a sequential mixed-methods research design that combined quantitative and qualitative probes. Part of this triangulated mixed-methods typology is an online questionnaire survey followed by a qualitative survey to examine how participants perceive their preferences for remote e-learning.

Survey design

The Smart e-Learning Questionnaire was administered online during the early stages of the pandemic when China's higher education institutions were challenged by the delivery of their curricular. Participants were emailed a URL link, where they could access the survey using any smart devices. The survey gathered 821 responses from home-quarantined Chinese students who were affiliated to 17 higher education institutions located across 7 provinces throughout China.

Participants

The participants were higher education students of Chinese nationality, aged between 17 and 26 years. Of the 821 responses received, 620 (75.5%) were female and 201 (24.5%) were male. The majority of the participants were in the 20-26 year age bracket (n = 228, 27.8%). Junior year had the highest number of

participants (*n* = 388, 47.2%), followed by sophomore (*n* = 237, 28.9%), freshman (*n* = 127, 15.5%), and senior year (*n* = 69, 8.4%).

Instrument development

The Smart e-Learning Questionnaire was developed for this research to assess students' readiness levels towards the homebased smart e-learning initiative implemented for China's higher education institutions. The Smart e-Learning Questionnaire was made up of 33 close-ended items grouped into four constructs: (a) perception of remote e-learning (8 items); (b) behavioural engagement (10 items); (c) cognitive engagement (7 items); (d) emotional engagement (8 items). A 5-point Likert-type scale was assigned as response options for each item based on the range, 5 (*strongly agree*), 4 (*agree*), 3 (*neither agree nor disagree*), 2 (*disagree*), and 1 (*strongly disagree*). The Smart e-Learning Questionnaire was translated to Mandarin and validated by bilingual (English-Mandarin) language experts in the field of education, in order to meet the language preferences of the Mandarin-speaking respondents. Subsequently a 3-step *back-translation* validation was performed to verify and validate the accuracy of the translations. The psychometric properties of this instrument were validated through an in-depth Rasch Model analysis using *Winsteps* v. 3.92.1. The statistical analyses of this study were underpinned by the philosophy of item response theory, with key concepts and fundamentals aligned with the Rasch model (Engelhard & Wang, 2021).

Reliability and separation indices

The person separation index (2.72) and item separation index (15.73) indicated in Table 1 rate the reliability of the Smart e-Learning Questionnaire by evaluating the respondents' latent trait (person abilities) and the items varying levels of difficulty. Logit is the unit measurement for latent traits and item difficulty measurement. According to Barnard (2001), the logit function (also known as log odds ratio) is the logarithm of the probability ratio of two odds. The odds ratio is technically defined as the odds of success (80% chance) accompanied by the odds of failure (20% chance) and that the log odd ratio is calculated as the probability of success/probability of failure. Logit measures generated through a Rasch analysis are interpreted as, the larger the logit measures, the higher is the levels of readiness for e-learning. Likewise, Boone (2016), confers that a higher person separation index indicates that there is a greater tendency for respondents to respond more congruously to the items. As for the separation index, Fisher (2007) asserts that a value equal to or greater than 3 logits, is an indication that there is a good spread of challenging items. With regards to the person reliability index, 0.88 logit is categorised as *good* by Azrilah (2011) and Sumintono and Widhiarso (2014). This infers that the respondents are consistent with their responses, while the item reliability index (1.00 logit), identified as *excellent* by Fisher (2007) indicates that the higher the value, the stronger is the relationship between the items and vice versa. In terms of inter-item consistency, the results of the reliability and separation indices infer that the Smart e-Learning Questionnaire is relevant to be administered to different groups of respondents of similar settings.

The Cronbach alpha value (0.91) was within the acceptable reliability range of 0.71 to 0.99, based on the reliability qualifying criteria outlined in Shroff et al. (2019). This indicates that the Smart e-Learning Questionnaire was an effective medium of measurement for this study. Another qualifying criterion is that the outfit mean square statistics for both person (1.02) and item (1.02) estimates were close to the expected perfect score of 1. Moreover, the significance of the chi-square statistic ($p < 0.01$), jointly reflected that the respondents' responses were consistent, logically connected, and congruous with the items.

Table 1
Summary statistics of person and item measures

	Person (logit)		Item (logit)
Separation	2.72		15.73
Reliability	0.88		1.00
Outfit mean square	1.02		1.02
Cronbach alpha		0.91	
Chi-square		64033**	
Unidimensionality (raw variance explained by measures)		40.2%	

** $p < 0.01$

The unidimensionality axiom within the Rasch model framework is an essential test to determine whether the instrument is measuring in one direction and that the items are clear and not confusing to the participants. According to Linacre (2011), when the raw variance explained by measures exceeds the threshold of 40%, unidimensionality is considered strong. In this study, the raw variance explained by measures (40.2%) denoted that the unidimensionality measure exceeded the threshold of 40%. When items demonstrate statistical goodness of fit with the Rasch model, the instrument is said to be unidimensional, thus supporting the instruments' construct validity.

Rating scale diagnostics

The rating scale analysis is another Rasch computational analysis used to analyse the participants responses towards the 33 items of the Smart e-Learning Questionnaire. Table 2 outlines the 5-category ratings of *strongly disagree* to *strongly agree*. The increasing values noted in both the observed average and Andrich threshold estimates are an indication that the respondents are able to distinguish between the response options of their choice. The step values between the Andrich threshold indices, showed no overlap in the 5-category ratings and that the item choices were fully understood by the respondents. Overall, the response category thresholds showed an increase across the rating scale and the spread across an appropriate range. Based on the reliability measures of both items and respondents, the Smart e-Learning Questionnaire was found to be a valid and reliable instrument suitable for measuring student's readiness levels for e-learning.

Table 2
Rating scale analysis

Category	Frequency	%	Observed average	Andrich threshold	Step
1 (*strongly disagree*)	1795	7	-0.98	None	-
2 (*disagree*)	3915	14	-0.43	-1.51	1.51
3 (*neutral*)	10113	37	0.13	-1.06	0.45
4 (*agree*)	7597	28	0.82	0.75	1.81
5 (*strongly agree*)	3673	14	1.33	1.82	1.07

Qualitative analyses

For qualitative probing, students and lecturers were invited to participate in focus groups discussions and interviews hosted via the online app, *Tencent Meeting*. Details of these scheduled interviews were sent via blind copy email to all willing participants who had volunteered to participate in further data collection. Qualitative data transcribed from these interviews and focus groups were analysed using thematic and discourse analyses. More information about qualitative findings is available under the subheading, 'Discussion on qualitative findings.'

Findings and discussion

The findings of this study revealed China's college students' perceptions of remote e-learning and their moderate level of readiness towards this newly implemented home-campus e-learning nexus. The results

of this study demonstrated that campus lockdowns had an impact on both students as well as their lecturers. The findings further revealed that this online mode of delivery had pre-empted the debate on the comparison between online and face-to-face delivery. The following sub-sections present the findings of the quantitative and qualitative results based on the research questions that underpinned this study.

Discussion on quantitative findings

The quantitative findings of this empirical study were derived from the conceptual underpinnings and application of the Rasch Measurement Model. In this psychometric model, survey items are evaluated using Rasch Winsteps, a program for instrument development. The quantitative results were derived from a combination of Rasch analyses elaborated in the sections below.

Item calibration and latent trait estimation

The Rasch model can validate the internal consistencies of a scale, by measuring the underlying latent trait of participants and differentiating the agreement levels of test items. Item calibration and person's latent trait estimation are among the major components of Rasch model's dichotomous scoring. Table 3 shows the 33 items ranked according to the students' levels of agreement towards the four sub-dimensions of homebased smart e-learning: perception of remote e-learning; behavioural engagement; cognitive engagement; and emotional engagement.

Table 3
Smart e-Learning Questionnaire item calibration

Participants' levels of agreement	Sub-dimensions of homebased smart e-learning			
	Perceptions of remote e-learning	Behavioral engagement	Cognitive engagement	Emotional engagement
Highly disagreeable	A7, A1, A3, A6, A8, A2	-	C1	D5, D4
Disagreeable	A5	B6, B2, B3, B1	C3	-
Agreeable	A4	B5, B10, B9	C2, C7, C5, C6, C4	D7, D3, D2
Highly agreeable	-	B4, B7, B8	-	D6, D8, D1

The 7 items (A7, A1, A3, A6, A8, A2, A5) in the *highly disagreeable* and *disagreeable* groups indicated that 21% of the participants were in disagreement about remote e-learning. This points to the participants' negative perceptions towards the homebased e-learning mode of study. On the contrary, 5 cognitive engagement items (C2, C7, C5, C6, C4) indicated that 15% of the respondents were cognitively engaged and agreeable to their homebased smart e-learning. Likewise, the 6 behavioural engagement items (B5, B10, B9, B4, B7, B8) and 6 emotional engagement items (D7, D3, D2, D6, D8, D1) were also inclined towards agreeing with this new mode of homebased smart e-learning. This indicated the behavioural engagement interests found among 18% of these student respondents. Likewise, another 18% of the respondents testified to being emotionally engaged and in agreement with their online learning platforms. Considering the impact that the pandemic had on their lives, it may be a reasonable inference to suggest that this new learning modality was a welcome move for the home-quarantined respondents, in terms of their cognitive, behavioural, and emotional engagement. These quantitative results were certainly not conclusive and would need to be further verified by the qualitative evidence.

Wright distribution map

The Wright map in Figure 1 presents each item's agreement levels mapped against the respondents' latent trait estimates. Figure 1 dispenses the dichotomous scoring of the Rasch model and allows better inferences to be made regarding item fit precision in relation to the respondents' trait estimates. The dichotomous data features the distribution of each item's agreement levels on the right side, ranging from *highly agreeable* (easiest item to endorse) at logit score -1.21 (Item B8), to *highly disagreeable* (most difficult item to endorse) at logit score +1.17 (Item A7). The respondents who experienced more difficulty in endorsing their agreement are located at the top of Figure 1, while those who found it easier to endorse their agreement are located at the bottom. The item distribution spread across a reasonable range of the

latent trait scale and reflected good item targeting. This means that the 33 items were fit, well-ordered and formidable at compartmenting the participants' agreement levels towards each of the four constructs of homebased smart e-learning.

Figure 1 also indicates that the person mean (*M* = 0.36; *SD* = 0.94) was higher than the item mean (*M* = 0.00; *SD* = 0.71). Generally, the respondent mean was higher than item mean, which showed that the sample participants' latent trait was above the standard item agreement level. As for the person spread, the person measure logit values indicated that 748 (91%) participants had person logit scores distributed within the range of -2 < *SD* > +2 where *SD* denotes standard deviation.

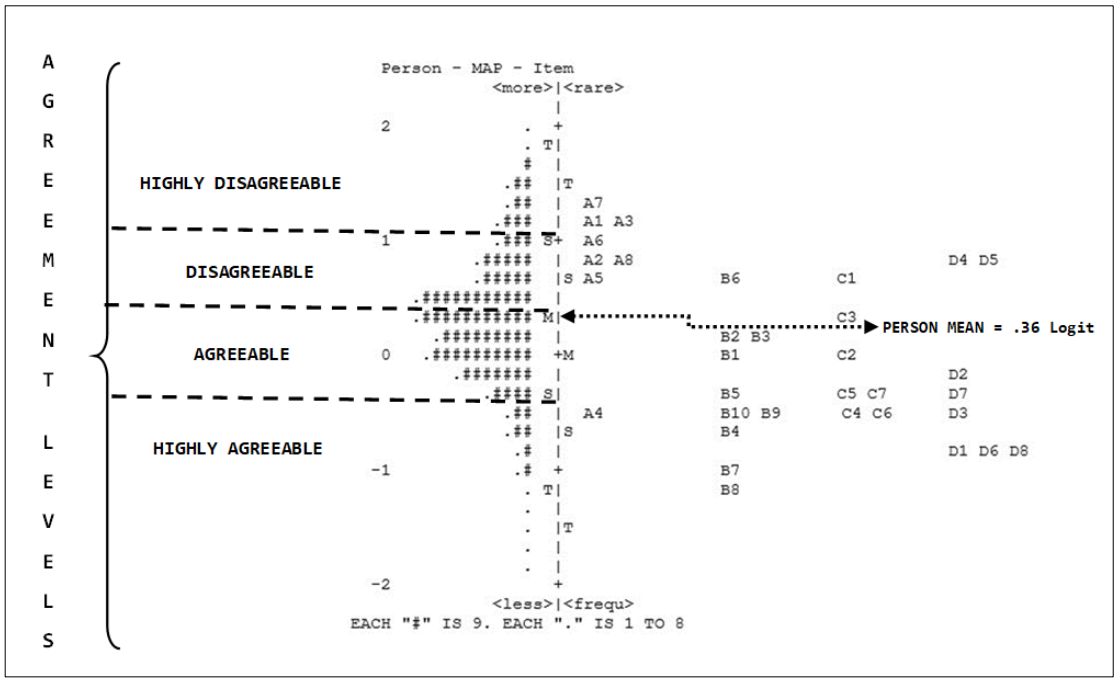

Figure 1. Wright map
Note. Each "#" = 9 respondents; each "." = 1 - 8 respondents; M = mean; S = 1 SD; T = 2 SD

Students' readiness levels towards homebased smart e-learning

Rasch model was further used to examine the participants' readiness levels based on an agreement logit scale. Their readiness levels were evaluated against three demographic subgroups, namely: (a) gender, (b) level of study, and (c) e-learning time. Table 4 shows the demographic variables of the 821 respondents and their levels of readiness towards homebased smart e-learning. The respondents' readiness levels are presented in person logit measures, and they range across 4 levels: very high (> +1.05); high (+1.05 – +0.32); moderate (+0.32 – -0.41) and low (< -0.41). In terms of gender, Table 4 indicates that 14% of the population (*n* = 112) showed very high levels of readiness (female *n* = 63; male *n* = 49); 36% (*n* = 297) showed high levels of readiness (female *n* = 235; male *n* = 62); 40% (*n* = 328) showed moderate levels of readiness (female *n* = 259; male *n* = 69); and 10% (*n* = 84) showed low levels of readiness (female *n* = 63; male *n* = 21). These findings were consistent with the results from other recent studies which found gender differences in the readiness levels of e-learning among college students of other higher education institutions (Bubou & Job, 2020; Formoso, 2018; Nyagorme, 2018).

Table 4
Participants levels of readiness based on gender, level of study and e-learning time

Demographic variables of participants (*N = 821)*		Levels of readiness for homebased e-learning (person logit measures)			
		Very high > +1.05	High (+1.05) – (+0.32)	Moderate (+0.32) – (-0.41)	Low < -0.41
Gender	Female (*n* = 620)	63 (10%)	235 (38%)	259 (42%)	63 (10%)
	Male (*n* = 201)	49 (24%)	62 (31%)	69 (34%)	21 (11%)
Level of study	First year	13	56	47	11
	Sophomore	42	77	92	26
	Junior year	49	134	164	41
	Senior year	8	30	25	6
E-learning time	Less than 1 hour	1	8	14	8
	1 - 2 hours	33	74	116	33
	2 - 3 hours	28	94	85	15
	More than 3 hours	50	121	113	28

Within the context, level of study, 69 first year students showed very high and high levels of readiness towards homebased smart e-learning; 119 sophomores showed very high and high levels of readiness; 205 junior year participants showed moderate to low levels of readiness; and 38 seniors showed very high and high levels of readiness. Similar outcomes were described in Hao (2016), whereby students' readiness levels for flipped learning were moderate, despite their varying education levels of study. As for investigating the time that the participants spent for e-learning purposes, it was discovered that 38% of the sample population (*n* = 312) spent more than 3 hours per day on online remote learning. Among these 312 sample respondents, 16% (*n* = 50) showed very high level of readiness for homebased e-learning; 39% (*n* = 121) showed a high level of readiness; 36% (*n* = 113) showed moderate level of readiness and 9% (*n* = 28) showed low level of readiness.

Differential item functioning analysis

A Rasch-based differential item functioning analysis was carried out to investigate for any evidence of differential item functioning present in the Smart e-Learning Questionnaire and to test for measurement invariance due to item biasness across demographic sub-populations. differential item functioning can cause bias and undermine instrument validity. The Mantel-Haenszel and Rasch-Welch statistical testings further tested for significant differences among the demographic variables under study. In an effort to ensure overall fairness and validity, the differential item functioning analysis examined construct equivalence across three of the following demographic subgroups: gender, level of study, and e-learning time. For purposes of analysis, the evidence of differential item functioning was based on the following criteria: Differential item functioning size > 0.5 logits; $t > 2.0$; $p < 0.05$ (Bond et al., 2020; Boone et al., 2014).

The first differential item functioning analysis explored whether item endorsement differed by gender. The results presented in Table 5 indicate that only 2 (6%) out of 33 items were flagged with differential item functioning incidence. As a rule, gender-based differential item functioning reflects the evidence of potential gender-criterion bias that produces significant differences in participants' responses.

Table 5
Gender differential item functioning results

Item	Statement	Differential item functioning measure		Differential item functioning contrast	Mantel-Haenszel	Rasch-Welch		
		Female	Male	(-0.5 < Differential item functioning contrast > 0.5)	Prob (< .05)	(-2 < t-statistic > +2)	*df*	Prob (< .05)
A4	I like to self-pace myself through the course.	-.56	-.06	-.50	.0031	-5.00	437	.0000
D5	I like it when the instructor asks me questions.	.88	.37	.51	.0000	5.24	428	.0000

Figure 2 is a graphic representation of gender differential item functioning which illustrates the potential impact of differential item functioning at both the item and scale levels. The dotted line drawn between square plot points, represents item difficulty in the male gender group, while the straight line drawn between circular-shaped plot points, represents item difficulty in the female gender group.

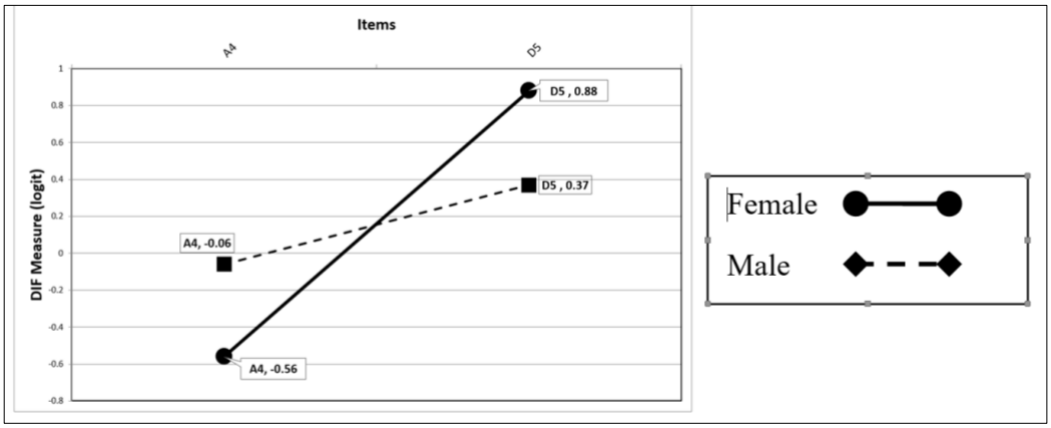

Figure 2. Differential item functioning by gender

Referring to Table 5 and Figure 2, the differential item functioning incidence for Item A4 (I like to self-pace myself through the course) showed negative differential item functioning measures for female (-0.56 logit) and male (-0.06 logit) respondents. This implied that both genders were agreeable to the flexibility of self-pace learning, which the newly implemented e-learning platform provides. However, compared to the male respondents, females tended to be more agreeable to self-pace learning. This finding is in accordance with the results of Rodríguez-Ardura and Meseguer-Artola (2021), whose study found that female students were more driven by positive emotions and that male students tended to be more functional and analytically driven. Comparably, Yow (2022) revealed that students' enjoyment of self-paced learning was reported to be beneficial in improving their academic performance. The results of Yow's (2022) study showed that students were comparatively more motivated and they studied better in a self-paced online learning environment. Meanwhile, in other studies, students discovered that their ability to self-pace their learning helped them optimise their learning experience (Dong et al., 2015; Gilboy et al., 2015; Hotle & Garrow, 2016).

As for Item D5 flagged with differential item functioning (I like it when the instructor asks me questions), the results in Table 5 and Figure 2 show that female respondents (+0.88 logit) indicated a stronger aversion to being questioned by their lecturers, compared to male respondents (+0.37 logit). The presence of differential item functioning typically indicates scale item bias. Some studies discuss the practical implications of eliminating items with differential item functioning (Scott et al., 2009). As for the differential item functioning incidences flagged by items A4 and D5, the authors make an empirical recommendation for future research directions that these biased items be eliminated from this study and possibly be replaced by items of more fitting estimates. As shown in Table 5 and Figure 2, the presence of differential item functioning implied that the male and female respondents did not have the same probability measures when endorsing items A4 and D5, despite possessing the same levels of agreement.

Another differential item functioning assessment was performed on two other subgroups, to examine whether the test items functioned differently by level of study and e-learning time. The differential item functioning evaluation revealed that there were no items found to function differently across level of study and e-learning time. In this case, the absence of DIF demonstrated that the variables, level of study and e-learning time, did not yield any significance (differential item functioning size < 0.5 logits; $t < 2.0$; $p > 0.05$). The absence of differential item functioning was an indication that there were no biased items detected. Equally, Ariffin et al. (2010) supported the premise that differential item functioning endorsement in instrument development is an indicator of instrument reliability. Therefore, test items which were free of DIF may be regarded as useful input for future test item development. The differential item functioning analysis carried out in this study was not merely to detect biased items, but also to identify the sub-populations having differential item functioning incidence. The authors further stipulate that future research should factor in the assumption of measurement invariance for further study on remote e-learning.

Qualitative data analysis

In-depth interviews conducted with students and their lecturers captured the context and important nuances of their perceptions regarding the home-campus e-learning course delivery. The qualitative interview data was subjected to a thematic analysis where themes were identified from the repeated patterns of data gathered from the interview responses. The broad themes and sub-themes which emerged are shown in Tables 6 and 7.

By way of thematic and discourse analyses, the qualitative data of this study was transcribed, analysed and coded using the qualitative analysis software, *Atlas.ti* (version 7.5.2). Focus group and interview data were captured as audio and video footages through China's *Tencent Meeting* online platform. These qualitative methods offer rich and nuanced evidence for further clarity in interpretation. As part of an interpretative epistemology, a linguistic textual analysis was performed to clarify and justify key aspects of selected text data to sum up the qualitative assessment through triangulated evidence and synthesis of the overall findings.

Discussion on qualitative findings

Based on the qualitative data findings, students' perceptions and their readiness towards online learning had a bearing on their individual perceived preferences towards online learning activities. The qualitative findings presented in Tables 6, 7 and 8 show the selection of themes and sub-themes that were derived from the participants responses regarding homebased smart e-learning. The following sub-sections present the qualitative findings derived from focus group online discussions held with students and lecturers who participated in this study. Selected excerpts were extracted from student focus group responses to map out some of the commonalities and differences discovered from both genders.

Male student participants perceptions of homebased smart e-learning

Table 6 shows some of the male focus groups responses regarding their perceptions of homebased smart e-learning experienced during their home quarantine period in China. The male focus group showed

evidence of their lack of enthusiasm towards homebased e-learning. Some of them also expressed their disinterest towards self-paced learning, for reasons like laziness, which perhaps pointed to their lack of enthusiasm for homebased online learning.

Table 6
Male focus groups perceptions of homebased smart e-learning

Themes	Sub-themes	Male focus groups	Sample quotes
Behavioural engagement	Lack of Enthusiasm	MFG 1	I don't have a quiet learning environment at home, so I don't enjoy learning online.
	Burdensome	MFG 2	There are too many assignments for me to do every day, so I can't self-pace my learning.
	Burdensome	MFG 4	It is difficult to balance my time. I am busy in front of the computer all day.
		MFG 7	Too many online courses to follow. Each subject has several videos. I have to listen to nearly ten courses. I cannot even finish watching the video lectures that some teachers upload online… really a lot of videos to watch.
		MFG 8	I have no time to prepare a reflection based on each of my subjects. It's too time consuming.
		MFG 9	It's very tiring…I have weekly online live lessons and each live class lasts for one to two hours. Then I need to do my homework … and in between I have to watch videos … some subject lecturers upload nearly 300 video clips.
		MFG 10	I wish the lecturers would not assign so much homework. I never have enough time to complete my homework.
	Lack of Enthusiasm	MFG 3	I definitely prefer traditional classroom teaching. When I'm at home, I tend to slack and feel lazy to participate in online study.
Emotional engagement	Neglect resentful	MFG 5	In classroom teaching, I'm used to constant supervision from my lecturers. But now with online teaching, the lecturer doesn't seem to pay personalized attention to the students because e-learning restricts teacher-student interaction and communication.
Behavioural and emotional engagement	Burdensome resentful	MFG 6	I feel pressured with the way teachers cram their lecture content into their online teaching sessions. I'm not sure how to do reflections.

Other studies have postulated that online learner-centric environments can offer students the flexibility of pacing out their daily learning schedules according to their preferred times (Killian & Woods, 2018; Kim et al., 2021; Nieuwoudt, 2020), based on the rationale that students have the capacity to navigate their online learning times at their own pace. In another empirical study from the Brandon Hall Group, it has been reported that the e-learning mode of study triggered a significant reduction in learning time by 40 to 60% compared to traditional classroom settings, because students have the flexibility to learn at their own pace (Ulukol, 2022). Our research provides similar evidence that supports students' flexibility in choosing their preferred learning times and the convenience they enjoy from e-learning. Some of the focus group responses, revealed the respondents' resistance towards having to sit through long hours of live lectures, watch numerous videos uploaded for each subject, complete and submit assignments online within a specified deadline, and prepare personalised reflections for each subject taught online.

The participants' general negative perceptions towards accepting their newly transformed homebased e-learning appear to have emanated from their individual learning preferences and not specifically the new e-learning, digital mode of study.

Female student participants perceptions of homebased smart e-learning

Table 7 shows selective quotes extracted from the female student focus group interview data. The female student respondents expressed mixed feelings about their online study. Some of their testimonies reflected feelings of skepticism towards their online mode of education. Similar findings in other studies showed evidence of the challenges students' face in having to attend to their daily responsibilities, fend for their family obligations, and cope with household chores while having to face the challenges of e-learning (Cofini et al., 2022; Gollwitzer et al., 2018). By comparison, the triangulated evidence from our mixed-methods study proved that both genders shared proximate views about their e-learning experience. However, the female student respondents appeared more receptive of homebased e-learning compared to the male participants. Their favourable responses suggested that the females in this study exhibited higher levels of readiness in their willingness to accommodate homebased smart e-learning as their new mode of study, compared to their male counterparts.

Table 7
Female students focus group perceptions of homebased smart e-learning

Themes	Sub-themes	Female focus groups	Sample quotes
Emotional engagement	Resentful	FFG 1	It is very challenging to balance my time between online classes and my housework.
		FFG 2	When I used to go to campus, that atmosphere is very good. I used to love studying but now I feel that taking online classes at home is very difficult. I feel like I'm wasting my youth.
		FFG 3	We have a lot of housework to do. We feel depressed that we can't cope with watching videos and having to wash clothes at home, and also cook.
	Satisfaction	FFG 8	When we study at home, we have more time to read books and listen to other instructors teach over the Internet, so that we can broaden our scope of knowledge.
Behavioural engagement	Convenience	FFG 4	I think there are advantages in taking up online courses at home during the home quarantine. We are free to organize our learning at our own time and convenience.
		FFG 6	We can watch the replay of the live broadcast whenever we are free.
	Flexibility	FFG 5	We can study subjects through weekly live broadcast and listen to the recorded lessons at any time or anywhere.
		FFG 7	We can self-pace the learning of subjects according to our own time and situation.

From this study, the authors predict that home-campus smart e-learning is likely to inform best practice. As in the evidence reported in Brasier et al. (2019) and Willems et al. (2019), the findings of this study will assume a pivotal role in contributing towards the sustainable growth of homebased smart e-learning in the digital learning era.

Lecturers' perceptions of homebased smart e-learning

During the focus group interviews with lecturers', they shared their personal experiences of the homebased smart e-learning mode of course delivery for China's higher education institutions. The lecturers' focus group interviews were in fact an opportune time for these lecturers to voice their concerns

over their new responsibilities in having to transition to educational technology pedagogy amid the pandemic crisis. By comparing offline and online modes of instructional deliveries, the lecturers shared their preferred method of teaching and the challenges they faced in having to comply to the regulatory Office of Academic Affairs.

The lecturers' comments shown in Table 8 serve as qualitative evidence of their preferred mode of face-to-face traditional classroom lecturing, rather than online remote lecturing. Their comments also underpin the theme of this study: the perception of remote e-learning.

Table 8
Lecturer focus groups preferred mode of instructional delivery

Themes	Sub-themes/ preferred mode of instructional delivery	Lecturers focus groups	Sample quotes
Perception of remote e-learning	Face to face traditional classroom lecturing	LFG 1	Compared to online teaching, I prefer offline teaching.
		LFG 2	I do not like teaching online because online teaching makes me feel very tired.
		LFG 3	Online teaching is so new for me. I'm not used to it and I find it is difficult to delve deeply into the topic. I prefer the traditional classroom lecturing … personally I feel that effective online teaching still has a long way to go.
		LFG 4	For online teaching, the workload is very heavy because lecturers have to prepare weekly assignments for their students, which is a directive from the office of academic affairs. This is compulsory for all lecturers to follow.
		LFG 5	I don't like teaching online. It is too dry and lacks teacher-student interaction.
		LFG 6	Our online classes and all academic-related online activities are monitored by the Office of Academic Affairs. For online teaching, the workload is very heavy because lecturers have to prepare weekly assignments for their students, which is a directive from the office of academic affairs. This is compulsory for all lecturers to follow.
		LFG 7	We are always under stress to make sure that we teach our students online for the correct number of hours and provide them relevant assignments to do after class. We also have to make sure that students complete their assignments on time so that we can mark and email it back to them.

Implication of findings

According to Bao (2020), the COVID-19 lockdown caused the closure of campuses throughout China, and this led to the massive, disruptive shift to online education in a matter of days. On the flip side however, this unprecedented crisis may be viewed as an opportune time for China to embrace educational

technology pedagogy and e-learning, as a means of overcoming the challenges of educational continuity and institutional sustainability.

The results of this study revealed striking similarities between the lecturers and student's views about their preferences for traditional face to face classroom lecturing, as opposed to online course delivery. From their comments, it was evident that the host of challenges described by student respondents did not develop from technical operational obstacles, but instead, most of them testified to having developed negative learning attitudes such as lack of self-discipline, concentration, tardiness and time management, for example:

> I'm not used to having online lessons at home. It makes me lazy and disinterested in my studies.
>
> It's difficult to discipline myself when I stay at home. I feel unmotivated and sleep most of the time.
>
> If I stay at home, I have to do a lot of housework every day, so I have no time to attend online classes.
>
> In college, I can concentrate during class, but not at home. Also, I dislike online classes.

The student focus group responses also indicated that most of these students lacked a discerning and teachable attitude. These respondents appeared to be vulnerable to online and offline distractions. During online study sessions, most of these students testified that they acceded to the temptation of surfing the web and were often distracted by social media popups and online gaming, for example:

> I am a gamer and spent most of my time on QQ with my friends.
>
> It's difficult for me to concentrate on my studies because I love to spend time chatting on WeChat.
>
> While my online lectures are going on, I prefer to watch TikTok videos because it is more interesting.

There were still other challenges faced by online learners such as their habitual tendency to procrastinate the completion of their assignments, for example:

> Since I stopped going to college, I have too many personal things to do at home, so I have no time to do my class assignment.

Due to the pandemic home quarantines, many students felt disconnected, isolated and deprived of the personalised support they used to receive from their lecturers during classroom interactions, for example:

> In classroom teaching, I'm used to constant supervision from my lecturers. But now with online teaching, the lecturer doesn't seem to pay personalized attention to the students because e-learning restricts teacher-student interaction and communication.

Among some of the key causes of students' offline distractions that detered them from participating wholly in online lessons included time-consuming tasks, such as household chores, family obligations, and their tardiness, fatigue, and laziness. To overcome these distractions, these students would need to make a conscious effort to develop their respective time management skills and ensure that they complete their household chores and daily tasks before lesson time. This may help reduce the tendency for students to absolve themselves from active participation in real-time synchronous online lectures. As for social media addictions and their temptation to resist engaging in online lessons, these students would need to restrain their digital addictions by actively logging-out from their online activities and any devices that could draw

their attention away from their online classes. Likewise, the following quotations serve as evidence of lecturers who testified to being challenged by their lack of online lecturing experience, non-conversant technical aptitude, and poor interaction with students, for example:

> I'm not confident of lecturing online. The setup is something totally new for me.
>
> Teaching online is so tiring for me. I find it difficult to get my students attention.
>
> Many of my students are not serious about online home study. I know they are not listening to my lectures because they are distracted by other online activities which they prefer to engage in.

This study showed evidence of a range of emotions expressed by students and lecturers regarding their perception towards this unprecedented shift from traditional campus lectures to online home-campus education. These findings revealed that the sudden switch to virtual, smart e-learning platforms did not seem to augur overly well with this group of participants. Most of them felt disconnected as a result of having to face big challenges in adapting to this virtual milieu: a totally new experience for lecturers and students alike. The participants of this study demonstrated much intolerance towards the home-campus nexus and the shift to homebased smart e-learning. In all likelihood, lecturers and students have been conditioned to their classroom lectures held within their campus grounds, to the extent where they feel reassured with their conventional classroom lessons and what is familiar to them. However, what remains at this stage, is for China to tenaciously forge ahead by attaching academia to the realities of integrating new technological advancements into their higher education curricula.

Conclusion

This study sought to evaluate the effectiveness of interactive e-learning, as reported by Bedenlier et al. (2020). Here, technology-enhanced education offers the potential to create borderless e-learning spaces that can mitigate time zone changes and increase the credibility of e-learning communities. In response to these new digital avenues and global lifestyle, China has embraced digitisation by adopting educational technologies and providing smart e-learning platforms exclusively for the benefit of its educational patrons (Zhang et al., 2020). Amid the pandemic woes, higher education learners have gained ubiquitous and equitable access to these e-learning platforms, yet remain poised for continued growth in technological literacy.

The findings of this study revealed the pressing need to identify innovative technology-based teaching practices that can meet learners' educational needs and expectations. For research directions related to academic innovation, the authors draw on extensive contemporary literature that combines the didactic concepts of blended learning and gamification. Overall, this study has provided significant academic perspectives for rethinking education and embracing home-campus e-learning as the new standard for inclusive, accessible, and equitable education for all learners. This study has championed a conversational feed about post-COVID education. China has redefined its home-campus nexus, as part of its post-pandemic agenda, flipping education from conventional face-to-face learning to homebased smart e-learning. The home-campus nexus, as a Chinese prototype for online delivery, has the potential to increase the digital literacy of China's higher education students and significantly promote the sustainable development of homebased. This study provided important takeaways for policymakers and practitioners to understand how home-campus smart e-learning can be framed as China's higher education model for the digital learning era.

Acknowledgements

The authors gratefully acknowledge all participants who freely participated in this research project. Special thanks are due to Dr Bambang Sumintono for his expertise and valuable discussions on Rasch

Model. This work was supported and funded by the Education Department of Jiangxi Province, China [Grant Number 19ZD066].

References

Al-Jedaiah, M. (2020). Knowledge management and e-learning effectiveness: Empirical evidence from Jordanian Higher Education Institutions. *International Journal of Emerging Technologies in Learning*. *15*(5), 50-62. http://dx.doi.org/10.3991/ijet.v15i05.11653

Ali, W. (2020). Online and remote learning in higher education institutes: A necessity in light of COVID-19 pandemic. *Higher Education Studies*, *10*(3), 16-25. https://doi.org/10.5539/hes.v10n3p16

Ariffin, S. R., Idris, R., & Ishak, N. M. (2010). Differential item functioning in Malaysian generic skills instrument (MyGSI). *Jurnal Pendidikan Malaysia (Malaysian Journal of Education*), *35*(1), 1-10. https://www.academia.edu/4949092/Differential_Item_Functioning_in_Malaysian_Generic_Skills_Instrument_MyGSI

Azorín, C. (2020). Beyond COVID-19 supernova. Is another education coming? *Journal of Professional Capital and Community*. *5*(3/4), 381-390. https://doi.org/10.1108/JPCC-05-2020-0019

Azrilah, A. A. (2011). *Rasch model fundamentals: Scale construct and measurement structure*. Integrated Advance Planning Sendirian Berhad.

Bao W. (2020). COVID-19 and online teaching in higher education: A case study of Peking University. *Human Behavior and Emerging Technologies*, *2*(2), 113–115. https://doi.org/10.1002/hbe2.191

Barnard G.A. (2001) "Logit", "Lod" and Log-Odds. *Rasch Measurement Transactions 14*(4), 785.

Bedenlier, S., Bond, M., Buntins, K., Zawacki-Richter, O., & Kerres, M. (2020). Facilitating student engagement through educational technology in higher education: A systematic review in the field of arts and humanities. *Australasian Journal of Educational Technology*, *36*(4), 126-150. https://doi.org/10.14742/ajet.5477

Bond, T., Yan, Z., & Heene, M. (2020). *Applying the Rasch model: Fundamental measurement in the human sciences*. (4th ed.). Routledge. https://doi.org/10.4324/9780429030499

Boone, W. J. (2016). Rasch analysis for instrument development: Why, when, and how? *CBE—Life Sciences Education*, *15*(4), 1-7. https://doi.org/10.1187/cbe.16-04-0148

Boone, W. J., Staver, J. R., & Yale, M. S. (2014). *Rasch analysis in the human sciences*. Springer. https://doi.org/10.1007/978-94-007-6857-4

Brasier, D. J., Melville, M., Hershock, C., & Rule, G. (2019). Pairing practice and feedback with animations optimizes student learning in online module. *Journal of Computer Assisted Learning*. *35*(6), 782-793. https://doi.org/10.1111/jcal.12388

Bubou, G. M., & Job, G. C. (2020). Individual innovativeness, self-efficacy and e-learning readiness of students of Yenagoa study centre, National Open University of Nigeria. *Journal of Research in Innovative Teaching & Learning*. *15*(1), 2-22. https://doi.org/10.1108/JRIT-12-2019-0079

Choudhury, S., & Pattnaik, S. (2020). Emerging themes in e-learning: A review from the stakeholders' perspective. *Computers & Education*, *144*(1), 103657. https://doi.org/10.1016/j.compedu.2019.103657

Cofini, V., Perilli, E., Moretti, A., Bianchini, V., Perazzini, M., Muselli, M., Lanzi, S., Tobia, L., Fabiani, L., & Necozione, S. (2022). E-learning satisfaction, stress, quality of life and coping: A cross-sectional study in Italian University students a year after the COVID-19 pandemic began. *International Journal of Environmental Research and Public Health*, *19*(13), 8214. https://doi.org/10.3390/ijerph19138214

Dong, Y., Wen, Y., Zeng, X., & Ji, Y. (2015). Exploring the cause of English pronoun gender errors by Chinese learners of English: Evidence from the self-paced reading paradigm. *Journal of Psycholinguistic Research*, *44*(6), 733-747. https://doi.org/10.1007/s10936-014-9314-6

Dunrong, B. & Jin, L. (2020). Temporary action or new model experiment? Teaching at Chinese universities in the time of COVID-19. [Special Issue]. *Higher Education in Southeast Asia and Beyond*. *102*(9), 18-20. https://ejournals.bc.edu/index.php/ihe/article/view/14605

Engelhard Jr, G., & Wang, J. (2021). *Rasch models for solving measurement problems: Invariant Measurement in the Social Sciences*. 187. Series: Quantitative applications in the social sciences. Sage Publications. https://us.sagepub.com/en-us/nam/rasch-models-for-solving-measurement-problems/book267292

Fisher, W. (2007). Rating scale instrument quality criteria. *Rasch Measurement Transactions*. *21*(1), 1095. https://www.rasch.org/rmt/rmt211m.htm

Formoso, D. B. (2018), Readiness of tertiary level students of holy angel university to enroll in online learning. *Liberal Arts Review*, *12*(23), 1-11. https://so04.tci-thaijo.org/index.php/larhcu/article/view/146829

Gilboy, M. B., Heinerichs, S., & Pazzaglia, G. (2015). Enhancing student engagement using the flipped classroom. *Journal of Nutrition Education and Behavior*, *47*(1), 109–114. https://doi.org/10.1016/j.jneb.2014.08.008

Gollwitzer, P. M., Mayer, D., Frick, C., & Oettingen, G. (2018). Promoting the self-regulation of stress in health care providers: An internet-based intervention. *Frontiers in Psychology*. *9*, 838. https://doi.org/10.3389/fpsyg.2018.00838

Hao, Y. (2016). Exploring undergraduates' perspectives and flipped learning readiness in their flipped classrooms. *Computers in Human Behavior*, *59*(1), 82–92. https://doi.org/10.1016/j.chb.2016.01.032

Hotle, S. L., & Garrow, L. A. (2016). Effects of the traditional and flipped classrooms on undergraduate student opinions and success. *Journal of Professional Issues in Engineering Education and Practice*, *142*(1), 1–11. https://doi.org/10.1061/(ASCE)EI.1943-5541.0000259

Huang, R., Tlili, A., Chang, T. W., Zhang, X., Nascimbeni, F., & Burgos, D. (2020). Disrupted classes, undisrupted learning during COVID-19 outbreak in China: Application of open educational practices and resources. *Smart Learning Environments*, *7*(19), 1-15. https://doi.org/10.1186/s40561-020-00125-8

Jiang, Y., Shang, J., & Jiao, L. (2023). Review of China's Online Education Policy, 1999–2022. ECNU Review of Education, 6(1), 155-182. https://doi.org/10.1177/20965311221099581

Killian, C. M., & Woods, A. M. (2018). Expanding learning opportunities in kinesiology through the use of flipped instruction. *Kinesiology Review*, *7*(4), 332-338. https://doi.org/10.1123/kr.2018-0046

Kim, D., Jung, E., Yoon, M., Chang, Y., Park, S., & Demir, F. (2021). Exploring the structural relationships between course design factors, learner commitment, self-directed learning, and intentions for further learning in a self-paced MOOC. *Computers & Education*, *166*. [104171]. https://doi.org/10.1016/j.compedu.2021.104171

Linacre, J.M., (2011). *A user's guide to Winstep Ministep Rasch-Model computer programs. Program Manual 3.73.0*. John M. Linacre. https://ia800607.us.archive.org/23/items/B-001-003-730/winsteps.pdf

Nieuwoudt, J. E. (2020). Investigating synchronous and asynchronous class attendance as predictors of academic success in online education. *Australasian Journal of Educational Technology*, *36*(3), 15-25. https://doi.org/10.14742/ajet.5137

Nyagorme, P. (2018). E-learning perceived usefulness, self-efficacy and attitude of distance learners and e-learning uptake at the college of distance education. *International Journal of Research in Engineering & Technology*, *6*(1), 15-26. https://ssrn.com/abstract=3125324

Rodríguez-Ardura, I., & Meseguer-Artola, A. (2021). Flow experiences in personalised e-learning environments and the role of gender and academic performance. *Interactive Learning Environments*, *29*(1), 59–82. https://doi.org/10.1080/10494820.2019.1572628

Scott, N. W., Fayers, P. M., Aaronson, N. K., Bottomley, A., de Graeff, A., Groenvold, M., Gundy, C., Koller, M., Petersen, M. A., & Sprangers, M. A. G. (2009). Differential Item Functioning in the EORTC QLQ-C30: A comparison of baseline, on-treatment and off-treatment data. Quality of Life Research, *18*(3), 381–388. http://www.jstor.org/stable/40302507

Shroff, R. H., Ting, F. S. T., & Lam, W. H. (2019). Development and validation of an instrument to measure students' perceptions of technology-enabled active learning. *Australasian Journal of Educational Technology*, *35*(4), 109-127. https://doi.org/10.14742/ajet.4472

Statista (2023). Number of internet users in China from 2018 to 2022 with a forecast until 2027. https://www.statista.com/statistics/278417/number-of-internet-users-in-china/

Sumintono, B. & Widhiarso, W. (2014). *Application of the Rasch model for social science research*. Trim Komunikata Publishing House.

Thai, N. T. T., De Wever, B., & Valcke, M. (2020). Face-to-face, blended, flipped, or online learning environment? Impact on learning performance and student cognitions. *Journal of Computer Assisted Learning*, *36*(3), 397-411. https://doi.org/10.1111/jcal.12423

Turnbull, D., Chugh, R., & Luck, J. (2021). Issues in learning management systems implementation: A comparison of research perspectives between Australia and China. *Education and Information Technologies, 26*. 3789–3810 https://doi.org/10.1007/s10639-021-10431-4

Ulukol, B. (2022). Online education and effects during Covid-19 Pandemic. *Broad Research in Artificial Intelligence and Neuroscience*, *13*(1), 534-545. https://doi.org/10.18662/brain/13.1/298

Willems, J., Farley, H., & Campbell, C. (2019). The increasing significance of digital equity in higher education: An introduction to the Digital Equity Special Issue. *Australasian Journal of Educational Technology*, *35*(6), 1-8. https://doi.org/10.14742/ajet.5996

Yow, H. Y. (2022). A case study of virtual anatomy museum: Facilitating student engagement and self-paced learning through an interactive platform. *International Journal of Information and Education Technology*. http://www.ijiet.org/vol12/1758-IJIET-4649.pdf

Zhang, W., Wang, Y., Yang, L., & Wang, C. (2020). Suspending classes without stopping learning: China's education emergency management policy in the COVID-19 outbreak. *Journal of Risk and Financial Management*. *13*(3), 55. https://doi.org/10.3390/jrfm13030055

Zhou, L., Wu, S., Zhou, M., & Li, F. (2020). 'School's out, but class' on', the largest online education in the world today: Taking China's practical exploration during the COVID-19 epidemic prevention and control as an example. *Best Evid Chin Edu*, 4(2), 501-519. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3555520

Corresponding author: Corinne Jacqueline Perera, jacquelineperera@gmail.com

Please cite as: Na, J., Perera, C. J., & Zainuddin, Z. (2023). Home-campus nexus: The shift to homebased smart e-learning. *Australasian Journal of Educational Technology, 39*(1), 125-142. https://doi.org/10.14742/ajet.6709