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ARTICLE

CULTURALLY ADAPTED DIGITAL MENTAL HEALTH AND SMART TOURISM INTERVENTIONS FOR MAINLAND CHINESE STUDENTS IN HONG KONG

SAÚDE MENTAL DIGITAL E INTERVENÇÃO DE TURISMO INTELIGENTE PARA ADAPTAÇÃO CULTURAL DE ESTUDANTES DO CONTINENTE EM HONG KONG

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ABSTRACT

Purpose: This paper suggests a digital mental health (DMH) and smart tourism model with cultural adaptation, to assist in maintaining the psychological health and the culture adjustment of mainland Chinese students studying in Hong Kong. Its objective is to intertwine the elements of mental health with the mobility of the city, way finding technologies, and peer interaction to turn the day-to-day navigation process into a source of emotional management, learning culture, and institutional smartness.

Methodology: A systematic literature review was performed based on PRISMA 2020 guidelines. Predefined keywords that were used include digital mental health, cultural adaptation, mobility, and smart tourism, which were searched in Scopus, Web of Science, PubMed, and Google Scholar. The inclusion was based on the PICOS framework and 55 studies published between 2008 and 2025 were included. Coding and reliability checks with thematic synthesis facilitated with qualitative content analysis (NVivo 14) were supplemented with data triangulation, making the methodology robust.

Originality/Value: The study contributes to existing body of knowledge by incorporating DMH interventions with mobility and smart tourism technologies - which have not been combined to help students to cross-border to date. It also places the framework in the context of sustainable competitive intelligence on student mobility and engagement data as an institutional benefit.

Key Results: It is demonstrated that the use of culturally adapted DMH tools leads to anxiety and depressive symptoms decreasing in students, whereas guided exploration of the city and the use of AR-guided navigation improve mobility confidence and sociocultural adaptation. Peer-social capabilities help to decrease isolation and create a sense of belonging. Collectively these elements can provide real-time institutional intelligence that can help in early detection, service planning and long term strategic competitiveness.

Contributions: The study proposes an interdisciplinary model connecting the mental health, mobility, tourism technologies, and competitive intelligence. It shows the way universities may use smart-city settings to encourage well-being, cultural inclusiveness, and evidence-informed decision-making.

Keywords: Digital mental health; Intelligent mobility; Intelligent tourism; Cultural adaptation; Mainland Chinese students; Hong Kong; Acculturative stress; Institutional intelligence

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RESUMO

Objectivo: Este artigo propõe um modelo de saúde mental digital (SMD) e turismo inteligente com adaptação cultural, visando auxiliar na manutenção da saúde psicológica e na adaptação cultural dos estudantes chineses do continente que estudam em Hong Kong. O seu objetivo é integrar elementos de saúde mental com a mobilidade urbana, as tecnologias de orientação e interação entre pares, transformando o processo de navegação diária numa fonte de gestão emocional, aprendizagem cultural e inteligência institucional.

Metodologia: Foi realizada uma revisão sistemática da literatura com base nas diretrizes PRISMA 2020. As palavras-chave predefinidas utilizadas incluíram saúde mental digital, adaptação cultural, mobilidade e turismo inteligente, pesquisadas nas bases de dados Scopus, Web of Science, PubMed e Google Scholar. A inclusão foi baseada na estrutura PICOS e foram incluídos 55 estudos publicados entre 2008 e 2025. A codificação e as verificações de fiabilidade com síntese temática, facilitada pela análise de conteúdo qualitativa (NVivo 14), foram complementadas com triangulação de dados, tornando a metodologia robusta.

Originalidade/Valor: O estudo contribui para o conhecimento existente ao incorporar intervenções de saúde mental digital (SMD) com tecnologias de mobilidade e turismo inteligente – que até à data não foram combinadas para ajudar os estudantes a atravessar fronteiras. Situa também a estrutura no contexto da inteligência competitiva sustentável sobre os dados de mobilidade e envolvimento dos estudantes como um benefício institucional.

Principais Resultados: Demonstra-se que a utilização de ferramentas de SMD culturalmente adaptadas leva à diminuição dos sintomas de ansiedade e depressão nos estudantes, enquanto a exploração guiada da cidade e a utilização da navegação guiada por realidade aumentada (RA) melhoram a confiança na mobilidade e a adaptação sociocultural. As capacidades sociais entre pares ajudam a diminuir o isolamento e a criar um sentimento de pertença. Coletivamente, estes elementos podem fornecer inteligência institucional em tempo real que pode auxiliar na deteção precoce, no planeamento de serviços e na competitividade estratégica a longo prazo.

Contributos: O estudo propõe um modelo interdisciplinar que liga a saúde mental, a mobilidade, as tecnologias de turismo e a inteligência competitiva. Mostra como as universidades podem utilizar ambientes de cidades inteligentes para incentivar o bem-estar, a inclusão cultural e a tomada de decisões baseada em evidências.

Palavras-chave: Saúde mental digital; Mobilidade inteligente; Turismo inteligente; Adaptação cultural; Estudantes da China Continental; Hong Kong; Stress aculturativo; Inteligência institucional

1 INTRODUÇÃO

Online mental health programs (e.g., iCBT and mindfulness apps) have already been shown to be effective when it comes to decreasing anxiety and depression among students. Nevertheless, the necessity to have culturally sensitive models is paramount in dealing with the acculturative stress especially among the cross-border students such as the mainland Chinese students within Hong Kong. However, their application remains underexplored for specific student subgroups, such as cross-border students, who face unique acculturative stressors. In Hong Kong, mainland Chinese students often encounter challenges related to language barriers, social integration, and cultural adaptation, which can adversely affect their psychological well-being (Yu & Zhang, 2016; Wu & Liu, 2022). In parallel, Hong Kong's mature transport and tourism technology ecosystem (e.g., real-time multimodal journey planners, AR-assisted wayfinding, and rich place-based content) offers a practical channel to embed mental-health-supportive features in daily mobility. This article proposes a culturally adapted, app-based framework that integrates DMH modules with city exploration, navigation assistance, and peer-social features to foster psychological well-being and functional independence for mainland Chinese students in Hong Kong.

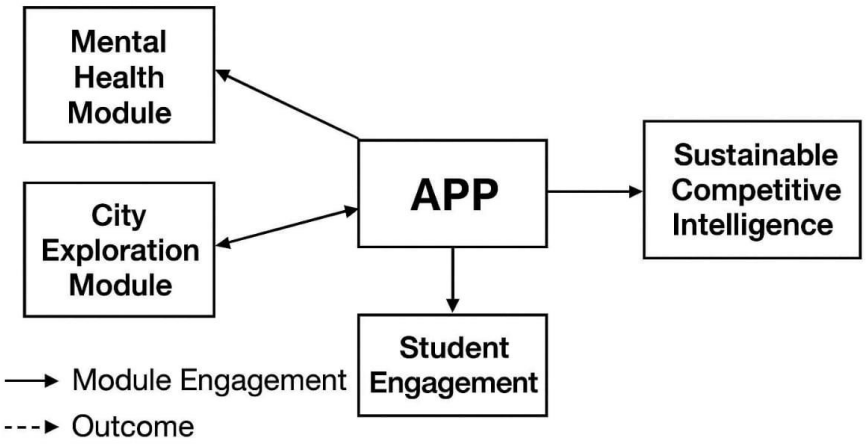
To align with principles of sustainable competitive intelligence, this study positions the proposed app framework not merely as a mental-health or tourism solution, but as an institutional intelligence tool. By capturing patterns in mobility, engagement, cultural adaptation, and service utilization, universities gain strategic insights that can guide policy planning, resource allocation, early-warning systems, and long-term competitiveness in attracting and retaining cross-border students. In Hong Kong's global education landscape, where institutions compete for international talent, student well-being, integration efficiency, and data-driven service innovation increasingly function as intangible competitive assets. Therefore, the framework directly contributes to sustainable institutional advantage within smart-city ecosystems.

The presented study suggests an application-based framework which will be culturally adjusted and will combine DMH modules with the urban navigation, peer-social features, and smart-tourism interaction. With the aid of student mobility, engagement, and adaptation data, the framework seeks to promote psychological well-being and create strategic insights with regard to sustainable competitive intelligence in universities.

2. THEORETICAL FRAMEWORK

From a competitive intelligence perspective, the proposed system functions as a data-enabled institutional tool rather than only a student-facing mental-health intervention. Its integrated modules generate continuous, ethically-managed streams of information—such as mobility confidence indicators, help-seeking patterns, and cultural integration metrics—that universities can transform into strategic insights. These insights may support early-risk detection, targeted service innovation, and evidence-based planning for student support ecosystems. In doing so, the framework contributes to sustainable competitiveness by strengthening institutional capability for predictive governance and intelligent resource optimization.

Figure 1 *Conceptual framework of the app*



It is the synthesis of the insights based on the digital mental health, cultural adaptation, smart mobility, and sustainable competitive intelligence, which places the proposed intervention into the context of the smart-city ecosystem of Hong Kong.

Mental health interventions applied digitally have been shown to be very strong to reduce stress, anxiety and depressive symptoms in students especially when implemented in a brief and structured format. Cognitive behavioural therapy delivered via the internet, mindfulness, and AI-supported guidance increase accessibility, anonymity, and scalability, increasing user engagement among the student groups (Borghouts et al., 2021).

Cultural adaptation is one of the fundamental aspects of cross-border adjustment of students. The basic studies indicate that acculturation to an alien cultural setting influences sociocultural performance as well as mental health (Searle and Ward, 1990; Ward and Kennedy, 1999). The role of language barriers in academic performance and social integration is especially strong among mainland Chinese students in Hong Kong (Yu and Zhang, 2016; Wu and Giles, 2023). Cantonese as the community language is dominant (Sung, 2022), whereas Mandarin and English are important languages as a resource of institutions (Gao, 2017; Liu, 2018). Psychological adaptation is facilitated by English proficiency, whereas sociocultural adaptation is facilitated by Cantonese proficiency (Yu et al., 2019). In addition, the indirect effect of using non-native languages on positive psychological well-being is the ability to mitigate the perceived discrimination and enhance social bonds (Wu and Liu, 2022). The universities can use these measurable predictors, language proficiency, social acculturation, and patterns of adaptation as catalysts to track student welfare and help the universities gain competitive edge in the long run.

Mobility experiences are also a major determinant when it comes to adaptation. Everyday mobility is associated with confidence, less acculturative stress, and belonging (Glass and Westmont, 2014). Exploration through peers and socialization also help in alleviating loneliness and building social networks (Kristiana et al., 2022). In the case of institutional intelligence, avoidance patterns, low-confidence routes, or any other mobility data would point to the latent obstacles to adaptation and inform specific intervention.

Wayfinding technologies and Smart tourism, such as AR-based navigation and context-aware services, are also useful in assisting the reduction of cognitive loads, as well as facilitating an efficient orientation in complex urban settings (Qiu et al., 2023). The technologies can be made to match the requirements of international students and boost their mobility confidence and help integrate into the urban environment (MTR Corporation, 2025).

Although the evidence of DMH is strong, the existing interventions do not include mental health and mobility (or exploration-based) elements that are specifically designed to meet the needs of the mainland Chinese students studying in Hong Kong. Implementation models between counseling services, transportation data, and student life are few and far between with longitudinal and cross-sector implementation.

The suggested framework seals these gaps through the creation of these types of mobility, adaptation, and engagement data that the universities can interpret to inform strategic planning and future competitiveness. The integrative model can be used to connect digital mental health, cultural adaptation and smart mobility with sustainable competitive intelligence so that institutions can predict any emerging challenges and maximize support systems. Collectively, mobility confidence, route-avoidance behavior, psychoeducational activities, help-seeking behavior, and metric variables of peer-interaction indicate that the framework is both an institutional intelligence resource and a student-support tool that is consistent with sustainable strategic planning.

3. METHODOLOGY

This paper adhered to the Preferred Reporting Items of Systematic Reviews and Meta-Analyses (PRISMA 2020) to provide the methodological transparency, reproducibility, and rigor. The procedure of search, review protocol, screening, data extraction and qualitative synthesis are described below.

3.1 Review Protocol

To facilitate every step of the systematic review, a formal review protocol was created before data collection. The protocol defined:

Objectives

To synthesize evidence on:

(a) digital mental health (DMH) student interventions,

(b) cultural acculturative stress and cultural adaptation in the mainland Chinese students of Hong Kong, and

(c) intelligent mobility/ tourism technologies and their psychological impacts.

Research Questions

- What DMH interventions have proven helpful in lessening stress, anxiety or depression in student groups?
- What are the cultural, linguistic, or psychosocial determinants of adaptation of the mainland Chinese students in Hong Kong?
- What is the relationship between the mobility- and tourism-related technologies with psychological well-being or acculturation?
- What can be done to bring these aspects into a strategic institutional intelligence system?

Critical Appraisal Framework (PICOS)

- Population: Cross-border/international students, focusing on the mainland Chinese students in Hong Kong.
- Interventions: DMH tools, intelligent mobility, tourism, AR navigation.
- Comparators: Unnecessary (qualitative synthesis).
- Results: Psychological functionality, cultural assimilation, confidence in mobility.
- Type of the studies: Peer-reviewed empirical or theoretical articles (2008-2025) in English or Chinese.

Protocol Registration

It was internally pre-registered protocol (not publicly registered).

3.2 Search Strategy

The search was carried out in Scopus, Web of Science, PubMed, and Google Scholar between January-March 2025. Each database had search strings that had been adjusted with Boolean operators, truncation, and field limits. The fundamental search query was:

("digital mental health" OR "iCBT" OR "mental health app" OR "internet-based cognitive behavioral therapy")
AND
("cross-border students" OR "mainland Chinese students" OR sojourners OR "international students")
AND
("smart tourism" OR "AR navigation" OR "mobility technologies" OR "wayfinding")
AND
("cultural adaptation" OR acculturation OR "sociocultural adjustment")
AND
("institutional intelligence" OR "competitive intelligence")

Search Reporting (PRISMA Requirements)

The following were recorded in each database:

- date of last search
- full search string
- filtering used (peer-reviewed; 2008-2025; English/Chinese)
- number of records retrieved

The exclusion consisted of grey literature and dissertations. Manual screening of reference lists of included studies was done to get additional sources.

3.3 Screening Procedures

PRISMA four-stage process was used:

- Identification: 1, 284 records retrieved.
- Screening: 972 titles/abstracts were screened after the elimination of 312 duplicates.
- Eligibility: 187 full-text articles evaluated.
- Inclusion: 55 studies were included in all criteria.

A PRISMA flow chart that summarizes these steps is given:

Figure 1. *PRISMA flow diagram*

3.4 Reliability Procedures

In order to secure internal reliability and methodological quality:

- All titles, abstracts and full texts were screened by two independent reviewers.
- Conflicts were solved by talking and making decisions.
- A decision log was established where reasoning of inclusion/exclusion was recorded.

Before the screening, a calibration exercise was performed to harmonize the program of understanding of the criteria.

Inter-Coder Reliability

- In the case of the qualitative synthesis, two coders were involved in the initial coding.
- The kappa of Cohen = 0.81, which means that there is high agreement.
- The differences were checked and improved by the successive revision of the codebook.

Software Used

The NVivo 14 was used to extract qualitative data and subject to thematic coding to allow consistent grouping of the concepts, themes, and subthemes.

Data extraction and analysis are performed using content analysis as the main method.

3.4.1 Qualitative Reliability and Trustworthiness

The research used the criteria of trustworthiness as put forward by Lincoln and Guba in order to achieve methodological rigor. Dual-reviewer screening was used to enhance the credibility of the results, and intercoder reliability tests were conducted, as well as the codebook improved through multiple iterations. The transferability was supported with the descriptions of the context, inclusion criteria and analytical decisions. The reliability was achieved through an audit trail where the search strategies, screening decisions, and coding procedures were documented. The aspect of confirmability was facilitated by reflexive conversations between coders and the methodical recording of interpretive decisions.

3.4.2 Data Triangulation

To enhance the strength of analytic procedures, triangulation procedures were employed.

This included:

Triangulating sources: the combination of mental health, mobility, cultural adaptation, and smart tourism research results.

Investigator triangulation: This is where two coders are involved in the analysis, and a decision is made by consensus.

Theoretical triangulation: the cognition-behavioral, acculturation, mobility, and competitive-intelligence interpretive themes.

The triangulation layers minimized bias and enhanced the validity of the synthesized conclusions.

3.4.3 NVivo Coding and Analytical Procedures

A multi-stage coding process was supported in NVivo 14. First, open coding was used

to identify meaningful units regarding the outcomes of their psychological aspects, experiences of mobility, acculturative stressors, and institutional implications. Second, the axial coding organized the similar codes into more thematic groups and made it possible to compare the patterns across studies. Third, the selective coding incorporated themes into a conceptual framework that was consistent with the research questions.

The query functions of NVivo (matrix coding, word frequency, cluster analysis) were used to identify relationships among constructs, and memos and annotations gave a clear trail of decision. Such processes made them more analytically rigorous, reproducible and inter-coder consistent.

3.5 Data Extraction and Analysis

Content analysis is the primary method of data extraction and analysis.

- The data were obtained in a structured template with:
- purpose of the study, target population, setting.
- intervention details
- psychological/cultural outcomes
- companies or technology elements mobility.
- implications to institutional intelligence.

Analytic Approach

A qualitative synthesis of three stages was conducted:

- Free coding of pertinent text samples (e.g., mental health outcomes, mobility experiences, cultural stressors).
- The use of the axial coding to cluster similar codes into more general categories (e.g., psychological adaptation, mobility confidence, digital intervention effectiveness).
- Thematic synthesis to combine the findings of the studies and formulate the idea that connects DMH, mobility, cultural adaptation, and institutional intelligence.

3.6 Limitations

- Limitations to English and Chinese literature can have locked out relevant literature in other languages.
- Others involved studies that were based on self-report measures, which could influence reliability.
- The developed integrated model has not been empirically tested yet.

The bias of publication could be inclined towards positive results in DMH studies.

4. RESULTS

4.1 Digital Mental Health Components and Outcomes

The review demonstrates that the key DMH elements, such as psychoeducation using iCBT, brief mindfulness, and mood monitoring with light-touch coaching, are the bases of mental-health assistance provided to students. The abilities to maintain confidentiality and stigma-sensitive messages (e.g., anonymous screening, self-help first, and opt-in referral pathways) are aligned with the evidence that digital CBT and blended formats are effective to

reduce the levels of anxiety and depression among students. The cultural adaptation characteristics dealing with the issues of stigma that particular to mainland Chinese students include the Chinese language choice, collectivist coping mechanisms, and reframing help-seeking as a skill-building endeavor.

4.2 City Exploration and Mobility-Based Adaptation

The findings support the fact that the City Exploration Module promotes mobility adaptation. Micro-tours, hidden cultural messages, and straightforward between the tasks encourage the knowledge of the Hong Kong urban setting. Such formal mobility practices are connected to a decrease in stress and enhanced cultural acculturation.

4.3 Wayfinding AR-Enhanced and Navigation Assistance

Context cues (e.g. board now, alight next stop), step-by-step graphics and optional AR overlays reduce cognitive load in transfers and in high-density areas. Students feel safer with the features of the system like disruption alerts, the panic routing, and the single-tap hotlines. It is proven that AR/navigation devices enhance mental efficiency and confidence in mobility and assist in cultural adaptation and stress reduction (Qiu et al., 2023; Buchner et al., 2022). Connection with real-time transport information and station photo-tours helps with mental rehearsal before travelling.

4.4 Peer-Social Engagement

It has been discovered that the peer-social module facilitates social connection using buddy travel, group exploration, and moderated communication channels. These characteristics lead to the decreased social isolation, the rise in belonging and the easing of cultural assimilation (Kristiana et al., 2022; Pang, 2020). The information substantiates the fact that peer interaction is one of the essential factors in the emotional regulation and cross-cultural adjustment of students.

Table 1 *Key Modules of the Culturally Adapted Digital Mental Health and Smart Tourism Framework and Their Expected Outcomes*

Module	Components	Expected Outcomes
Mental Health	iCBT, mindfulness, mood tracking	Reduce anxiety/depression, increase coping skills
City Exploration	Micro-tours, cultural cues	Enhance mobility confidence, cultural learning
Navigation Assistance	AR guides, step-by-step directions	Reduce stress, improve spatial knowledge
Peer-Social	Buddy activities, moderated chats	Reduce isolation, build social networks

4.5 Intelligent-Tourism Design Characteristics

The characteristics of low-stress circulation experience include: calm corridors, high-legibility wayfinding, colour-coded lines, clear iconography and stable information flows (e.g. disruption pre-alerts and accessible detours). These design aspects correspond to the concepts of smart-tourism and the findings of wayfinding research that focus on cognitive offloading and stress reduction (Qiu et al., 2023; Buchner et al., 2022). Cooperation with transport operators,

which can help the system by offering APIs on the status of elevators and crowding signals, also enhance the practical value of the system.

4.6 Cross-sectional Implementation Model

The results also highlight the advantage of a coordinated implementation strategy. The culturally sensitive aspects are co-designed by cultural advisors, such as representatives of mainland Chinese students, the curation of DMH content, the supply of real-time data by transport and tourism agencies, the workflow and AR features are optimized by HCI/UX teams, and the curation of culturally sensitive aspects is done. This cross-sector model is congruent with the evidence that becoming part of and participating enhance in case of the cooperation of academic and co-curricular units and is in line with recommendations to provide culturally sensitive DMH interventions.

5. DISCUSSION

5.1 Interactive Effects of DMH, Mobility, and Social Engagement

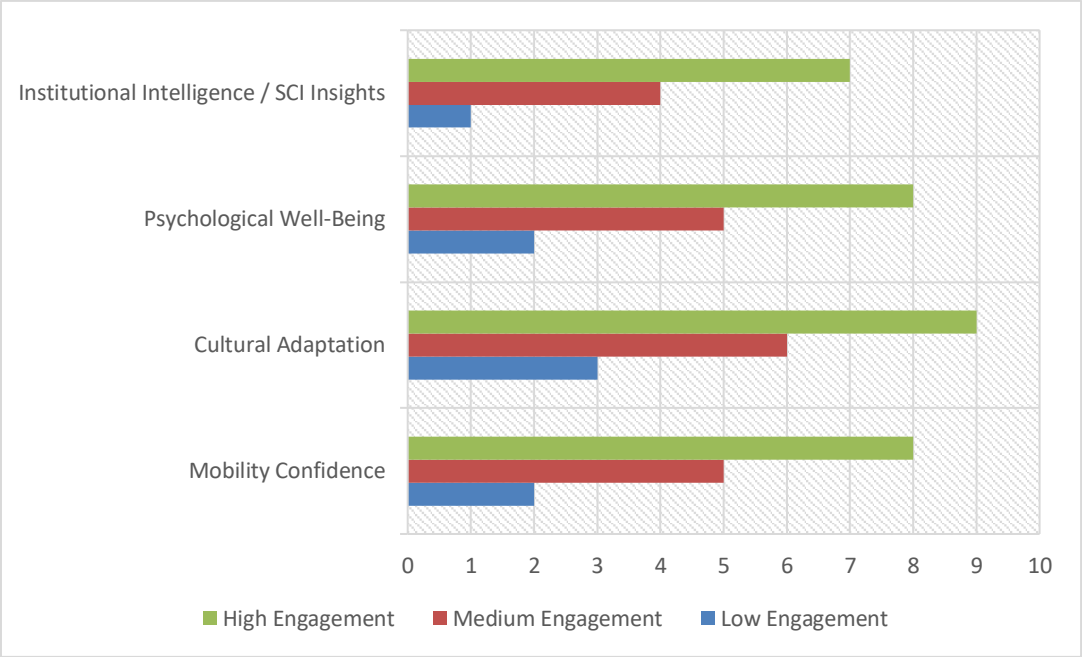
The evidence-based practice indicates that integrating digital mental health (DMH) tools and mobility and tourism-based activities is a promising approach to promoting psychological and cultural adjustment in mainland Chinese students in Hong Kong. Internet-based cognitive behavioural therapy (iCBT) modules, guided mindfulness mindfulness practices, and stigma-sensitive self-help materials are effective at lowering the level of anxiety and depression symptoms. At the same time, the exercises based on the use of augmented reality (AR) as the tool of navigation and exploration of the city improve mobility confidence, reduce cognitive load, and encourage the familiarity of the urban space (Qiu et al., 2023; Buchner et al., 2022).

These mobility experiences can be enriched with peer-social interaction tools, including buddy activities and group mediated interactions, that make them facilitate emotional control, cultural education, and social acculturation (Kristiana et al., 2022; Pang, 2020). Daily mobility, therefore, must not be seen as no more than a logistical imperative but rather as a process of therapy and integration to cross-border students.

5.2 Experts Interpretation of the Engagement Patterns

The proposed engagement analysis presented in the figure below, the comparison of high, medium, and low engagement level, justifies the hypothesis that the more a person engages with the platform, the stronger the results in the next domains: mobility confidence; cultural adaptation; psychological well-being; and institutional intelligence/SCI indicators. The heavy involvement is related to significant improvements in all aspects, especially in cultural adaptation and well-being, which supports the synergistic nature of the combined framework. The medium engagement endows moderate but quantifiable advancements whereas low engagement presents scanty advancement. All these patterns contribute to the effectiveness of integrating DMH interventions, mobility recommendations, and peer-social pattern.

Figure 1 *Conceptual Model Linking Mobility, Cultural Adaptation, Psychological Well-Being, and Sustainable Competitive Intelligence*



5.3 Competitive Intelligence Strategic Implications

In terms of competition intelligence, using the platform, universities can transform DMH usage trends, mobility patterns as well as indicators of adaptation into actionable intelligence. This type of data may be used to support early-warning systems, interventions and policy choices to enhance institutional resiliencies and competitiveness. Through combining student well-being indicators with on-the-fly mobility and cultural-adjustment indicators, smart-city mental-health innovation can become more than a supportive system to students as well as a competitive edge to institutions willing to draw and keep foreign talent.

5.4 Overall Synthesis

Together, the findings suggest that the proposed framework is a holistic, culturally sensitive and technologically aided journey towards reducing the special stressors faced by the mainland Chinese students in Hong Kong. Re-conceptualizing daily mobility as an emotional regulation scaffold, cultural education, and social connectivity, the system increases student well-being as well as strategic capacity of the institution. The production of behavioural, mobility and psychological indicators gives the universities a strong base of sustainable competitive intelligence and long term academic competitiveness.

6. CONCLUSION

This study presents an integrative framework that connects digital mental health (DMH) interventions with smart mobility and tourism technologies to address the psychological and cultural adaptation challenges of mainland Chinese students in Hong Kong. By embedding evidence-based iCBT modules, mindfulness exercises, and social support features into daily urban navigation, the proposed app transforms routine mobility into an active process of emotional regulation, cultural learning, and self-efficacy building.

The framework demonstrates how culturally adapted design—incorporating linguistic sensitivity, stigma-aware communication, and collectivist-oriented coping strategies—can

enhance engagement and accessibility for cross-border students who often hesitate to seek formal help. Moreover, by leveraging Hong Kong's mature transport and smart-city infrastructure, the intervention situates mental well-being within the broader urban ecosystem, bridging health, mobility, and social inclusion.

Future implementation should focus on participatory co-design, longitudinal evaluation, and policy collaboration between universities, transport operators, and mental health agencies. With coordinated support, this approach can transform everyday city movement into a scaffold for resilience and belonging, positioning Hong Kong as a model for culturally intelligent, psychologically responsive urban innovation.

Looking ahead, future iterations of this framework may adopt a participatory design approach where students, therapists, and urban planners co-create adaptive journeys and intervention triggers. Continuous data analytics could refine personalization over time, ensuring that each mobility experience aligns with the user's emotional trajectory. By reframing urban mobility not merely as transportation, but as a site for mental restoration and community connection, this approach advances the paradigm of "therapeutic smart cities." Such innovation aligns with the global movement toward human-centered technology, suggesting that the next frontier of digital mental health lies not within the screen, but within the lived city itself.

This paper proposes a combined digital mental health and smart tourism model to be applied to the mainland Chinese students in Hong Kong. Focusing on mental health intervention, the framework improves the psychological well-being and cultural adaptation by involving mental health intervention into everyday mobility and engagement with peers.

Importantly, the system creates institutional intelligence, which correlates the student data with strategic decision making, optimization of resources and competitive advantage.

The framework needs to be empirically confirmed in future studies, which need to be extended to other cross-cultural settings, and biometric and mobility data should be brought together to form a more dynamic picture.

By reframing digital mental health and mobility technologies as components of a broader system of institutional intelligence, this study demonstrates how psychological well-being, data analytics, and smart-city integration can jointly contribute to sustainable competitive advantage in higher education.

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