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Mobile Reference Needs of Undergraduate Social Science Majors: A Comparative Study

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Abstract: Mobile learning has recently attracted significant attention from academia and the public. It attracts universities from around the world due to its ease of use and accessibility. A survey was conducted to collect data from undergraduate students of three social sciences majors: journalism, politics and public administration, and sociology, at a comprehensive university in Hong Kong. Results indicate that respondents are willing to use mobile apps for academic study, searching for information, and accessing learning materials. However, the three student groups showed significant differences in reference needs, reflecting their different focus on reading learning materials to enrich their knowledge and fulfill course requirements. Suggestions were offered to enhance the m-learning system and improve students' learning experiences. Despite extensive scholarly research on behaviors, perceptions, and benefits of m-learning, scant studies have investigated students' reference needs for self-learning in the smartphone era, across diverse majors, and in an ever-changing technological landscape. This research offers guidance for mobile app development professionals and educators in understanding the key factors influencing students' intentions to use m-learning.

Keywords: mobile learning; library reference needs; quantitative research; social sciences students

1. Introduction

Mobile learning (m-learning) is a current educational strategy integrating contemporary educational technology, e-learning, and distance learning via wireless mobile devices such as smartphones and tablets, allowing learning anytime, anywhere [1–5]. M-learning can encourage learning in universities worldwide due to its ease of use and accessibility, allowing learners to study more effectively within a shorter time frame and providing additional support to current learning approaches [6,7].

Apart from these advantages, the system also has limitations and challenges, such as small screens, high technological skill requirements, and wireless connectivity issues [3,8,9]. Web resources and apps may not be supported or displayed nicely on all mobile devices [10]. Although it creates barriers for users to adopt m-learning, rapidly advancing technologies are gradually overcoming these limitations [8,9,11].

As students' learning experiences and current usage may be influenced by various factors, including mobile technological advancements, learning environments, and classroom encouragement, there is a need to investigate students' preferences and attitudes toward m-learning. Furthermore, as students from different majors have varying learning needs [2,5,8,12], it is necessary to investigate their preferences at the level of each major within the same faculty.

While some recent studies have focused on students from healthcare, business, performance arts, and library and information sciences, there are scant studies that cover the mobile learning and information needs of social



science students. To this end, a survey was conducted to collect feedback from social science students regarding their viewpoints and experiences with m-learning at a comprehensive university in Hong Kong.

Reference needs are defined in this study as students' academic information requirements for coursework and self-learning, expressed through the types of reference materials they seek, how frequently they access them, and the main channels they rely on (such as categories of mobile applications and digital services). These reference needs are distinct from general mobile learning activities such as communication or online discussion, which are reported separately as part of overall mobile learning usage.

This study is grounded in prior research on mobile learning in higher education, students' academic information seeking, and mobile reference access. The literature review synthesizes these areas and then introduces the Technology Acceptance Model (TAM) to frame factors related to adoption.

We use TAM because it is a widely used and parsimonious framework for explaining technology adoption in higher education and mobile learning contexts. TAM focuses on perceived usefulness and perceived ease of use and is commonly extended with attitude and social influence, which aligns with our survey measures. While other models such as UTAUT and the Theory of Planned Behavior include additional factors (for example, facilitating conditions), TAM provides a clear baseline for interpreting adoption patterns and comparing results with prior m-learning studies.

2. Literature Review

Mobile learning in higher education is commonly understood as an extension of e-learning through portable devices that support access to learning resources across time and location. Prior research has examined its educational benefits, technical constraints, and the conditions that shape student adoption across disciplines.

2.1. Mobile Learning Adoption in Higher Education

Mobile learning (m-learning) is a subset of electronic learning (e-learning). The two learning approaches use the same software, but the development settings and hardware differ. In development, m-learning adopts a specialized format for delivering content to mobile devices. E-learning is delivered through desktop computers, whereas m-learning is delivered through mobile devices [5,13].

2.2. Pros and Cons of M-Learning

The rapid development of Internet capabilities and the widespread ownership of personal mobile devices have fostered the extension of e-learning into m-learning. Many recent studies revealed that most students in higher education own smartphones or tablets, and they are highly self-motivated to adopt mobile technology in their current and future studies [3,5,8–12,14,15]. Recent research suggests that mobile online discussions can feel more equal, democratic, and engaging than classroom discussions, while also offering flexibility across time and location [16]. Encouraging a social environment, interaction with course content, interactions with teachers, and interactions among other learners are the crucial factors that influence students' behavior, perception, and satisfaction with online learning or m-learning [17]. Some educational researchers have provided evidence to support the advantages of m-learning and online interaction in knowledge sharing and access, learning engagement, online collaboration, and self-management of learning [18,19].

On the contrary, evidence on the academic impact of online interaction is mixed. Some studies suggest that online discussion activity does not strongly correlate with grades, and frequent participation in forums does not necessarily lead to better academic performance [17]. In other words, online interactions alone cannot improve the quality of learning; hence, it may not be a practical approach to learning. Furthermore, students participating in online learning without face-to-face communication with teachers may find it easier to become confused in courses with complex content or techniques [19].

2.3. Technical Issues and Trends

A key factor driving students' motivation for m-learning is that mobile technology allows students to access educational content and carry out learning activities anytime, anywhere [1–5,8]. Mobile devices are also widely used to access course materials and learning activities through learning management systems in online instruction [20]. However, technical barriers may reduce m-learning adoption, such as physical limitations of portable devices, low bandwidth, slow processor speed, and short battery life [1,3,8]. However, more recent studies revealed that such problems are gradually overcome by advancing technologies and lowered tariffs [2,4,5].

The content and system quality are closely related to the development of perceived usefulness and satisfaction in m-learning [5,6,21]. Additionally, the quality of online social information services is a significant determinant

of perceived usefulness, and platform and content developers should seek ways to enhance content quality [6,22]. More recently, generative AI tools such as ChatGPT have become part of students' learning environment, and research has examined students' acceptance and use of ChatGPT in higher education [23].

Prior research also shows that students use mobile apps for academic purposes in relatively consistent ways across different majors, mainly to interact with schoolmates, access reference materials, and share information. The most frequently used functions of apps include communication, collaborative work synchronization, and dictionaries [8]. Related work in library and information science has also developed and validated questionnaires to measure students' attitudes and perceptions toward mobile information literacy training [24,25]. However, the frequency of reading ebooks and academic journals from smartphones is significantly lower than that of leisure reading [3,11].

2.4. Research Gap in Students' Reference Needs

In this study, reference needs are defined as students' needs to access academic reference information and learning materials through smartphones for coursework and self-learning. This includes the types of academic materials accessed, the frequency of access, and the preferred access channels and applications. We distinguish these reference needs from other mobile learning activities such as communication with peers, participation in online discussions, or general course management, which are related but conceptually distinct.

Examining the research on this topic, the adoption of m-learning among university students is undergoing continuous transformation due to the emergence of revolutionary technological developments. Although many studies have explored students' behaviors, intentions, and advantages of using mobile apps for education, and some studies have measured attitudes toward mobile information literacy [24,25], students' reference needs in the context of accessing academic materials via smartphones have not received enough emphasis in prior research.

To bridge the gap between previous research and students' current perceptions of m-learning, this research explored the most up-to-date usage of m-learning and the reference needs of undergraduate students from three majors in the Social Sciences faculty of a major university. Moreover, we are interested in the factors affecting students' intention to adopt mobile technology for accessing academic reference information. Therefore, our research questions are as follows.

RQ1. *What is the current usage of mobile apps by social science students for accessing academic reference information?*

RQ2. *What are the social science students' reference needs for accessing academic materials from smartphones?*

RQ3. *What factors are associated with students' adoption of m-learning, measured as self-reported mobile learning time?*

To address RQ2 and RQ3, we apply the Technology Acceptance Model (TAM) proposed by Davis [26] to examine how perceived usefulness, perceived ease of use, attitude, and social influence relate to students' mobile reference access and their adoption of mobile learning.

3. Methodology and Data Collection

In this study, we employed a quantitative online survey to collect responses from undergraduates in three majors within the social sciences faculty at a major comprehensive university in Hong Kong, specifically Sociology, Journalism, and Politics and Public Administration (PPA). The survey comprised 23 questions measured on a five-point Likert scale, taking around 10 min to finish. The survey comprised six parts of different research interests: (1) demographic information such as gender, age, major, and education level, (2) reading habits for learning materials, (3) social influences on students' mobile learning adoption, (4) perceived usefulness of accessing learning materials on mobile apps, (5) perceived ease of use of accessing learning materials on mobile apps, and (6) attitude on accessing learning materials on mobile apps. The faculty-level ethics committee of the target university approved this research.

The questionnaire included items on mobile usage, reference materials and application categories, and TAM related constructs, including perceived usefulness, perceived ease of use, attitude, and social influence. We report internal consistency reliability (Cronbach's alpha) for the TAM construct scales and use a multivariate regression model to examine how these TAM constructs relate to students' self-reported mobile learning use time.

In this study, reference needs refer to students' needs to obtain academic reference information and course related learning resources using smartphones. We operationalize reference needs using three groups of survey items. The first group measures the frequency of accessing academic materials via smartphone. The second group measures the types of academic materials accessed, such as e-books, e-journals, lecture notes, and library

databases. The third group measures the channels and mobile applications used to access these materials, such as search engines, library platforms, and academic apps. General learning activities, for example peer communication or entertainment use, are analyzed separately and are not treated as reference needs in this study.

Six respondents were invited to a pilot test to verify the implementation of the questionnaire. The survey was distributed through Google Forms voluntarily with the help of the students' Social Sciences Society. One hundred responses were collected from undergraduates in three social sciences majors: 33 from Journalism, 33 from PPA, and 34 from Sociology.

Table 1 shows a summary of the demographic data of respondents. A Chi-Square test assessed the gender discrepancy and indicated no significant difference in gender distribution ($p > 0.05$) among the three majors. A Fisher's Exact Test was performed to examine the age discrepancy among the three groups. Although more than 90% of respondents are between 18 and 22 years old, the age difference among majors is insignificant ($p > 0.05$).

Table 1. Demographic data of respondents by major.

	Journalism (n = 33)	PPA (n = 33)	Sociology (n = 34)	Overall (n = 100)
Gender ($p > 0.05$)				
Female	20 (60.6%)	14 (42.4%)	23 (67.6%)	57 (57%)
Male	13 (39.4%)	19 (57.6%)	11 (32.4%)	43 (43%)
Age ($p > 0.05$)				
18–22	32 (97%)	32 (97%)	30 (88.2%)	94 (94%)
>23	1 (3%)	1 (3%)	4 (11.8%)	6 (6%)

In addition to descriptive statistics, we use nonparametric tests for group comparisons across the three majors because the key variables are measured on ordinal Likert scales. When overall Kruskal–Wallis tests are significant, we conduct post hoc comparisons and report effect sizes. To address RQ3, we estimate a multivariate regression model based on TAM to examine how perceived usefulness, perceived ease of use, social influence, and attitude relate to students' self-reported mobile learning time.

4. Data Analysis

4.1. Ownership of Mobile Devices

As shown in Table 2, all respondents owned smartphones, and 62% reported owning tablets. Electronic book readers were the least common device (15% ownership). Journalism students reported the highest ownership rates across the listed mobile devices, which may reflect the media-oriented nature of the major and the need for frequent access to news and digital content.

From the Fisher's Exact Test result, we observed a statistically significant difference ($p < 0.05$) in the number of mobile apps used for learning across the three majors. Nearly half of the Journalism students reported having 1–3 apps for academic purposes, about half of the PPA students reported having 4–6 apps, and 38% of Sociology students reported having 1–3 apps. Overall, these results suggest that our respondents were willing to adopt different mobile technologies for learning, but the level of adoption differs across majors.

Table 2. Overview of mobile device ownership.

	Journalism	PPA	Sociology	Overall
Mobile device ownership				
Smartphone	33 (100%)	33 (100%)	34 (100%)	100 (100%)
Tablet	25 (75.8%)	18 (54.5%)	19 (55.9%)	62 (62%)
Electronic book reader	6 (18.2%)	3 (9.1%)	6 (17.6%)	15 (15%)
Other devices	14 (42.4%)	13 (39.4%)	6 (17.6%)	33 (33%)
Number of apps for learning ($p < 0.05$)				
0	0	1 (3%)	1 (2.9%)	2 (2%)
1–3	16 (48.5%)	7 (21.2%)	13 (38.2%)	36 (36%)
4–6	6 (18.2%)	16 (48.5%)	8 (23.5%)	30 (30%)
7–9	8 (24.2%)	7 (21.2%)	4 (11.8%)	19 (19%)
More than 10	3 (9.1%)	2 (6.1%)	8 (23.5%)	13 (13%)

4.2. Time Spent on Accessing the Internet and Learning Activities on the Smartphone

Table 3 illustrates the daily time spent by respondents accessing the Internet and engaging in learning activities using mobile devices. There is no significant difference in respondents' time accessing the Internet ($p > 0.05$) among respondents from different majors. Most respondents spent between 3.5 and 5 h surfing the

internet from mobile devices daily, and nearly 80% of students spent more than 3 h per day accessing the Internet. There was no significant difference in the time they spent on learning activities from their mobile apps ($p > 0.05$) among the three majors. Most spent 1.5 to 3 h using mobile apps for learning.

These results can be summarized as the respondents are frequent Internet and smartphone users, as most of them browse the Internet daily for extended periods from their smartphones. Moreover, they are frequent mobile learners, as they integrate self-learning into their daily lives by going online.

Table 3. Duration of accessing the Internet and doing learning activities from mobile devices.

	Journalism	PPA	Sociology	Overall
Duration of daily Internet access from smartphones ($p > 0.05$)				
Never	0	0	0	0
Less than 30 min	1 (3.0%)	2 (6.1%)	0	3 (3%)
30 min–1 h	0	1 (3.0%)	1 (2.9%)	2 (2%)
1.5 h–3 h	5 (15.2%)	5 (15.2%)	6 (17.6%)	16 (16%)
3.5 h–5 h	19 (57.6%)	10 (30.3%)	14 (41.2%)	43 (43%)
More than 5.5 h	8 (24.2%)	15 (45.5%)	13 (38.2%)	36 (36%)
Duration of daily learning activities from smartphones ($p > 0.05$)				
Never	0	1 (3.0%)	0	1 (1%)
Less than 30 min	4 (12.1%)	1 (3.0%)	5 (14.7%)	10 (10%)
30 min–1 h	15 (45.5%)	9 (27.3%)	13 (38.2%)	37 (37%)
1.5 h–3 h	13 (39.4%)	21 (63.6%)	12 (35.3%)	46 (46%)
3.5 h–5 h	1 (3.0%)	0	2 (5.9%)	3 (3%)
More than 5.5 h	0	1 (3.0%)	2 (5.9%)	3 (3%)

4.3. Smartphone Usage for Learning Activities

Table 4 summarizes smartphone usage for learning activities across the three majors. Across the sample, the most frequent activities were searching for information, watching videos, and collaborative work. This pattern may reflect students' need to access information and engage with visual or audio materials when learning about current events and social issues in social science contexts.

We used Kruskal–Wallis tests to compare the frequency of smartphone-based learning activities across the three majors. As shown in Table 4 (mean ranks), there were no significant differences for searching information, accessing academic materials, watching videos, or collaborative work ($p > 0.05$).

Three activities showed significant overall differences across majors. Downloading learning materials differed by major ($H = 12.30$, $p = 0.002$, $\varepsilon^2 = 0.106$); post hoc comparisons (Holm-adjusted) indicate that PPA students reported higher frequency than Journalism and Sociology students. Online discussion also differed ($H = 8.09$, $p = 0.017$, $\varepsilon^2 = 0.063$), with Journalism higher than Sociology. Online coursework differed as well ($H = 7.47$, $p = 0.024$, $\varepsilon^2 = 0.056$); post hoc results indicate Journalism reported lower frequency than PPA.

Table 4. Smartphone usage for learning activities.

Activity	Journalism Mean Rank	PPA Mean Rank	Sociology Mean Rank	H (df), p	Post hoc (Holm adj p)	Effect Size (ε^2)
Search information	53.67	53.08	44.93	$H = 2.84$ (2), $p = 0.242$	N/A	0.009
Access academic materials	43.20	52.82	55.34	$H = 3.54$ (2), $p = 0.170$	N/A	0.016
Watch videos	58.15	49.08	44.46	$H = 4.46$ (2), $p = 0.108$	N/A	0.025
Download learning materials	45.97	64.09	41.71	$H = 12.30$ (2), $p = 0.002$	Journalism vs. PPA, $p = 0.010$; PPA vs. Sociology, $p = 0.005$	0.106
Online discussion	61.42	47.20	43.10	$H = 8.09$ (2), $p = 0.017$	Journalism vs. Sociology, $p = 0.022$	0.063
Collaborative work	51.36	56.20	44.13	$H = 3.41$ (2), $p = 0.182$	N/A	0.014
Online coursework	39.94	57.47	53.99	$H = 7.47$ (2), $p = 0.024$	Journalism vs. PPA, $p = 0.018$	0.056

Note: Scale: 1 = never, 5 = very often. Values are mean ranks. H and p are from Kruskal–Wallis tests; post hoc p values are Holm adjusted; ε^2 is the effect size.

4.4. Smartphone Usage for Respondents' Reference Needs

To address RQ2, Table 5 shows how frequently students accessed different types of reference materials on their smartphones. In this dataset, news reports, course learning materials, and documentaries were the most frequently accessed materials.

In contrast, magazines, e-books, academic journals, and theses were among the least frequently accessed materials. One possible explanation is that long-form academic texts may be less comfortable to read on small screens, which can discourage students from accessing these materials on smartphones.

Table 5. Smartphone usage for accessing different types of reference materials.

Material Type	Journalism Mean Rank	PPA Mean Rank	Sociology Mean Rank	H (df), <i>p</i>	Post hoc (Holm adj <i>p</i>)	Effect Size (ϵ^2)
Academic journals and thesis	41.15	44.24	65.65	H = 15.88 (2), <i>p</i> = 0.000	Journalism vs. Sociology, <i>p</i> = 0.001; PPA vs. Sociology, <i>p</i> = 0.003	0.143
Course learning materials	39.03	66.79	45.82	H = 18.17 (2), <i>p</i> = 0.000	Journalism vs. PPA, <i>p</i> = 0.000; PPA vs. Sociology, <i>p</i> = 0.004	0.167
News reports	56.68	49.95	45.03	H = 3.17 (2), <i>p</i> = 0.205	N/A	0.012
Documentaries	59.05	45.00	47.54	H = 4.76 (2), <i>p</i> = 0.092	N/A	0.028
Blog articles	62.82	41.27	47.50	H = 10.71 (2), <i>p</i> = 0.005	Journalism vs. PPA, <i>p</i> = 0.008; Journalism vs. Sociology, <i>p</i> = 0.034	0.090
Ebooks	53.58	42.50	55.28	H = 4.25 (2), <i>p</i> = 0.120	N/A	0.023
Magazines	44.36	44.82	61.97	H = 8.67 (2), <i>p</i> = 0.013	Journalism vs. Sociology, <i>p</i> = 0.023; PPA vs. Sociology, <i>p</i> = 0.034	0.069
Commentaries	57.36	46.48	47.74	H = 3.15 (2), <i>p</i> = 0.207	N/A	0.012
Institutional publications	54.44	46.85	50.22	H = 1.38 (2), <i>p</i> = 0.502	N/A	0.000

Note: Scale: 1 = never, 5 = very often.

Kruskal–Wallis tests (Table 5, mean ranks) show no significant differences across majors for accessing news reports, documentaries, e-books, commentaries, and institutional publications ($p > 0.05$). Four material types show significant overall differences. Sociology students accessed academic journals and theses more frequently than Journalism and PPA students ($H = 15.88$, $p < 0.001$). PPA students accessed course learning materials more frequently than Journalism and Sociology students ($H = 18.17$, $p < 0.001$). Journalism students accessed blog articles more frequently than PPA and Sociology students ($H = 10.71$, $p = 0.005$). Sociology students accessed magazines more frequently than the other two majors ($H = 8.67$, $p = 0.013$). These differences reflect how coursework demands and reading practices vary across majors.

4.5. Categories of Apps Used for Accessing Reference Materials

Table 6 shows the frequencies of different categories of apps respondents used to access learning materials. The top three usage categories are browsing, video, and mass media apps. These results could be linked to the learning activities and reference needs of social science students and explained as they searched for information using browser apps, watched videos and documentaries with video apps, and accessed news with mass media apps.

Kruskal–Wallis results for app categories are summarized in Table 6 (mean ranks). Browsers, mass media apps, and video apps show overall differences across majors ($p < 0.05$), but effect sizes are small to moderate ($\epsilon^2 \approx 0.04$ – 0.06). After Holm adjustment, the clearest pairwise difference is for video apps: Journalism students reported higher use than Sociology students. Use of physical library services also differs, with Sociology students reporting higher use than PPA students. For browsers and mass media apps, the overall tests are significant but adjusted pairwise comparisons are not, suggesting that differences are modest and distributed across groups rather than driven by one clearly separated pair.

Table 6. Categories of apps used for accessing reference materials.

App Category	Journalism Mean Rank	PPA Mean Rank	Sociology Mean Rank	H (df), p	Post hoc (Holm adj p)	Effect Size (ϵ^2)
Browsers	53.85	53.91	43.94	H = 6.49 (2), p = 0.039	N/A	0.046
Physical library	52.95	40.21	58.10	H = 7.27 (2), p = 0.026	PPA vs. Sociology, p = 0.043	0.054
Online academic databases	48.30	50.95	52.19	H = 0.34 (2), p = 0.842	N/A	0.000
Social media	51.50	49.64	50.37	H = 0.07 (2), p = 0.964	N/A	0.000
Mass media	54.26	55.74	41.76	H = 6.05 (2), p = 0.048	N/A	0.042
Video	57.94	52.38	41.46	H = 7.49 (2), p = 0.024	Journalism vs. Sociology, p = 0.029	0.057
Subscription content	50.00	57.80	43.90	H = 4.44 (2), p = 0.109	N/A	0.025
School apps	49.39	45.11	56.81	H = 4.09 (2), p = 0.129	N/A	0.022
Discussion forums	49.80	48.59	53.03	H = 0.45 (2), p = 0.797	N/A	0.000

Note: Scale: 1 = never, 5 = very often.

4.6. Factors Influencing Respondents' Adoption of Mobile Reference Access

Table 7 presents the factors influencing the respondents' adoption of accessing reference materials from their smartphones. All the positive aspects in Table 7 scored over 4, with 'accessing information anytime, anywhere' receiving the highest score, indicating respondents' preference for using smartphones to read reference materials for academic study due to their convenience and portability. They could learn and share academic information through their smartphones without space and time boundaries.

Table 7. Factors influencing respondents' adoption of mobile reference access.

Factor	Journalism Mean Rank	PPA Mean Rank	Sociology Mean Rank	H (df), p	Post hoc (Holm adj p)	Effect Size (ϵ^2)
Access information anytime, anywhere	52.45	53.97	45.24	H = 3.33 (2), p = 0.189	N/A	0.014
Easy to share information with others	62.82	43.71	45.13	H = 10.22 (2), p = 0.006	Journalism vs. PPA, p = 0.012; Journalism vs. Sociology, p = 0.012	0.085
Easy to discuss material content with others	63.30	49.89	38.66	H = 13.89 (2), p = 0.001	Journalism vs. Sociology, p = 0.001	0.123
User-friendly	55.23	51.70	44.75	H = 2.80 (2), p = 0.247	N/A	0.008
Facilitate multi-tasking	45.98	57.15	48.43	H = 3.12 (2), p = 0.210	N/A	0.012
Small screen size	55.14	54.80	41.82	H = 7.07 (2), p = 0.029	N/A	0.052
Slow response time	56.52	54.17	41.10	H = 7.53 (2), p = 0.023	N/A	0.057
Unstable network connection	49.77	50.76	50.96	H = 0.04 (2), p = 0.983	N/A	0.000
Text file formats are not supported	53.05	56.89	41.82	H = 6.86 (2), p = 0.032	PPA vs. Sociology, p = 0.046	0.050
Media formats are not supported	51.26	56.47	43.97	H = 4.63 (2), p = 0.099	N/A	0.027
Extra fee for accessing mobile content	40.67	52.30	58.29	H = 6.77 (2), p = 0.034	Journalism vs. Sociology, p = 0.045	0.049

Note: Scale: 1 = strongly disagree, 5 = strongly agree.

As shown in Table 7 (mean ranks), two positive factors differ across majors after Holm adjustment. Journalism students reported higher agreement than both PPA and Sociology students on 'easy to share information with others' (H = 10.22, p = 0.006). For 'easy to discuss the material content with others,' Journalism students reported higher agreement than Sociology students (H = 13.89, p = 0.001).

Across majors, respondents strongly agreed that technical constraints can reduce motivation to access reference materials via smartphones, especially small screen size, slow response time, and unsupported file formats (Table 7). For some constraints (small screen size and slow response time), the omnibus tests suggest overall differences ($p < 0.05$), but adjusted pairwise comparisons are not significant, indicating that group differences are modest. In practical terms, these findings highlight that support for common text and media formats and a smooth reading experience remain important for meeting students' mobile reference needs.

4.7. Perceived Benefits of Adopting Mobile Reference Access

Respondents expected several learning benefits from accessing reference materials on smartphones (Table 8). Across all three majors, students reported strong agreement for gaining in-depth knowledge of current and historical social issues, evaluating different arguments, and developing critical thinking. The item 'applying social science concepts to real-world issues' shows an overall difference across majors ($H = 6.19, p = 0.045, \epsilon^2 = 0.043$), but adjusted pairwise comparisons are not significant, suggesting the difference is modest.

Table 8. Perceived advantages and benefits of adopting mobile reference access.

Benefit Item	Journalism Mean Rank	PPA Mean Rank	Sociology Mean Rank	H (df), p	Post hoc (Holm adj p)	Effect Size (ϵ^2)
Get in-depth knowledge of concepts	41.77	52.67	56.87	$H = 5.23 (2), p = 0.073$	N/A	0.033
Get in-depth knowledge of current issues	54.98	48.58	48.01	$H = 1.60 (2), p = 0.449$	N/A	0.000
Get in-depth knowledge of historical issues	54.12	50.73	46.76	$H = 1.41 (2), p = 0.493$	N/A	0.000
Apply concepts to real issues	40.73	55.92	54.72	$H = 6.19 (2), p = 0.045$	N/A	0.043
Develop critical thinking	54.58	55.27	41.91	$H = 5.93 (2), p = 0.052$	N/A	0.040
Evaluate different arguments	55.14	51.86	44.68	$H = 3.31 (2), p = 0.191$	N/A	0.014
Discover new perspectives	56.00	51.36	44.32	$H = 3.64 (2), p = 0.162$	N/A	0.017

Note: Scale: 1 = strongly disagree, 5 = strongly agree.

4.8. Social Influence on the Adoption of Mobile Reference Access

Table 9 summarizes social influence on adopting mobile reference access. Kruskal–Wallis tests indicate no statistically significant differences across majors for interpersonal influence or perceived popularity of mobile apps ($p > 0.05$). Overall, respondents agreed more that app popularity matters than that interpersonal influence matters, suggesting that broader platform norms and network effects may shape adoption more than direct peer pressure.

The stronger effect of the popularity of mobile apps may be attributed to the network effect of App users. The network effect refers to the value of an app, which is positively related to the number of users. A large amount of information, discussions, and resources generated by the general public (e.g., YouTube) facilitates information search by using mobile apps and could better satisfy the reference needs of students.

Table 9. Social influence on adopting mobile reference access.

Item	Journalism Mean Rank	PPA Mean Rank	Sociology Mean Rank	H (df), p	Post hoc (Holm adj p)	Effect Size (ϵ^2)
Interpersonal influence	50.62	44.50	56.21	$H = 3.06 (2), p = 0.216$	N/A	0.011
Popularity of mobile apps	57.48	51.45	42.79	$H = 5.16 (2), p = 0.076$	N/A	0.033

Note: Scale: 1 = strongly disagree, 5 = strongly agree.

4.9. Perceived Usefulness and Perceived Ease of Use

Table 10 reports perceived usefulness and perceived ease of use of mobile reference access (mean ranks). Several perceived usefulness and ease-of-use items differ across majors, particularly those related to academic performance and the ease of searching for required materials ($p < 0.05$). Post hoc results suggest that the clearest differences involve Journalism versus Sociology, with Sociology reporting higher perceived academic-

performance benefits and Journalism reporting higher ease-of-search; effect sizes range from small to moderate ($\epsilon^2 \approx 0.05\text{--}0.09$). These results imply that students' perceptions of mobile reference access are shaped by disciplinary study practices and how they typically engage with course materials.

Table 10. Perceived usefulness and ease of use of adopting mobile reference access.

Item	Journalism Mean Rank	PPA Mean Rank	Sociology Mean Rank	H (df), <i>p</i>	Post hoc (Holm adj <i>p</i>)	Effect Size (ϵ^2)
Improve academic performance	39.88	50.11	61.19	H = 9.91 (2), <i>p</i> = 0.007	Journalism vs. Sociology, <i>p</i> = 0.008	0.082
Increase freedom of self-learning	55.91	55.14	40.75	H = 6.81 (2), <i>p</i> = 0.033	N/A	0.050
Efficient	57.61	53.88	40.32	H = 7.96 (2), <i>p</i> = 0.019	Journalism vs. Sociology, <i>p</i> = 0.020	0.061
Effective	59.53	50.42	41.81	H = 7.18 (2), <i>p</i> = 0.028	Journalism vs. Sociology, <i>p</i> = 0.029	0.053
Search for required materials	58.20	55.02	38.65	H = 10.84 (2), <i>p</i> = 0.004	Journalism vs. Sociology, <i>p</i> = 0.008; PPA vs. Sociology, <i>p</i> = 0.026	0.091
Use apps to access all types	45.12	56.33	50.06	H = 2.77 (2), <i>p</i> = 0.250	N/A	0.008

Note: Scale: 1 = strongly disagree, 5 = strongly agree.

5. Discussion

This study is based on undergraduate students from a comprehensive university in Hong Kong. While the institutional and cultural context shapes how students access mobile learning services, the core issues examined in this paper are widely relevant to higher education settings, including how curriculum demands shape mobile information practices and how perceived usefulness and ease of use influence adoption decisions. We clarify which findings may be transferable and which should be interpreted as context specific.

Since the rapid rise of generative AI tools, students can access AI based search and tutoring functions directly on smartphones. This development may change how students define useful reference materials and how they evaluate mobile learning systems. We also incorporate recent literature on AI in higher education and discuss how AI may reshape mobile reference needs, while noting that our data were collected prior to or during the early stage of this shift.

5.1. Current Usage of M-Learning for Education Purposes (RQ1)

This research used an online survey to collect data to explore the reference needs of undergraduate social science majors in the smartphone age. Our results show that all respondents have already owned mobile devices for mobile learning, and mobile computing has penetrated their lives, aligning with numerous related studies [1–4,8]. The younger generation generally holds more positive attitudes toward digital technologies, such as mobile devices, cloud computing, and social media [27–29].

Results revealed that respondents installed numerous mobile apps for learning and spent a considerable amount of time on learning activities daily, indicating the widespread adoption of mobile learning. This result aligns with recent findings in mobile learning research that students do not just use mobile devices for entertainment and casual Internet surfing but also for serious self-learning and general knowledge acquisition [3,5,8–12,14,15].

5.2. Reference Needs for Accessing Academic Materials (RQ2)

This research also explored the most frequent learning activities, reference materials, and mobile app usage among social sciences respondents. Results demonstrated that students from the three majors have similar preferences for the most popular learning activities and categories of apps. Respondents mostly used their smartphones to search for information and access learning materials. They generally had reference needs for news reports, course learning materials, and documentaries to understand social issues better [9]. As different majors have various academic assessment requirements, respondents may focus on reading particular course learning materials to fulfill their learning requirements. Therefore, there is a close relationship between students' reference needs and their majors' curricula, aligning with research results that compared different majors within the same faculty [2,5,8,12].

5.3. Factors Associated with Students' Adoption of m-Learning (RQ3)

Interestingly, respondents from the three majors were less concerned about extra fees for accessing mobile content. This finding differs from Wai et al.'s [8] study, which reported that Hong Kong students were reluctant to buy apps for educational purposes. Thus, students from different faculties had different concerns regarding adoption.

Journalism students considered slow response time the primary factor that decreased their adoption intention, while PPA and Sociology respondents expressed concerns about small screen sizes and media formats not being supported. These findings may be due to different curricular requirements. Learners' perception of the benefits of mobility may influence their tolerance of device limitations [3,8]. Unsurprisingly, the high preference for information searching on mobile devices (Table 4) revealed that accessing information without boundaries was the main reason students adopted m-learning. The opportunities to learn across time, space, contexts, and transportation have been widely supported by empirical evidence of the advantages of m-learning for students [1–5,8].

However, respondents did not strongly support the idea that mobile reference access significantly improved their academic performance. This finding contradicts the recent results of Dong et al. [16], Zhang et al. [5], and Yip et al. [4], likely due to differences in study level and discipline. Especially for undergraduate students, online learning activities and communications may not necessarily offer a better quality of learning than traditional face-to-face learning, and students may struggle to understand complex concepts without face-to-face contact with teachers [21]. Therefore, m-learning may better support classroom learning, but not replace it because face-to-face interactions among students and teachers are essential to the learning experience, and relying solely on m-learning is inadequate [19].

Although many respondents agreed that mobile learning could achieve various learning outcomes, such as gaining in-depth knowledge and evaluating alternative arguments on social issues, some learning outcomes, like learning theoretical concepts and applying these theories to practice, were not well received, again indicating that m-learning could not replace traditional classroom learning. Additionally, the content quality of reference materials has room for improvement, but this is a common issue with resources on the Internet and social media [30,31], as mobile technology and devices serve as a channel for transmitting training and educational content to learners. Therefore, the quality of learning materials has a decisive role in students' acceptance of m-learning, reflecting that respondents have high technology literacy, and mobile technology would not become a barrier to their information access. Instead, teachers, mentors, libraries, peers, and other educators should recommend appropriate and high-quality resources to learners, thereby forming a community of practice and learning [16].

We applied TAM to examine how perceived usefulness (PU), perceived ease of use (PEOU), attitude (A), and social influence (SI) relate to students' adoption of m-learning, measured as self-reported mobile learning time. The regression results (Table 11a) show that SI has a positive coefficient and is marginal (standardized $\beta = 0.217$, $p = 0.051$), while PU, PEOU, and attitude are not statistically significant predictors in this sample ($p > 0.05$). Overall, the model explains a modest amount of variance in mobile learning time ($R^2 = 0.045$). Reliability results (Table 11b) indicate acceptable internal consistency for attitude and moderate consistency for PEOU, while PU and SI show low alpha values. Given the low internal consistency of PU and SI in this dataset, the TAM results should be interpreted as exploratory and should not be used to draw strong conclusions about TAM pathways. Future studies should refine and expand these items and use validated multi-item measures before making confirmatory claims.

Table 11. (a) TAM regression results predicting self-reported mobile learning time. (b) Reliability of TAM constructs.

(a)						
Dependent Variable	Predictor	B	SE	β (Optional)	p Value	Notes
Mobile learning time (hours)	Perceived usefulness (PU)	−0.001	0.075	−0.001	0.990	
Mobile learning time (hours)	Perceived ease of use (PEOU)	0.008	0.101	0.010	0.939	
Mobile learning time (hours)	Attitude (A)	−0.053	0.089	−0.067	0.553	
Mobile learning time (hours)	Social influence (SI)	0.211	0.108	0.217	0.051	
Model summary	R ² , F-test	0.045	F(4,95) = 1.12		0.352	HC3 robust SE
(b)						
Construct	Number of Items	Cronbach's Alpha				
PU	3	0.297				
PEOU	2	0.653				
Attitude	2	0.763				
Social influence	2	0.266				
Intention	1	N/A (single-item use time)				

5.4. Practical Implications and Suggestions

As m-learning becomes a trend for self-study and informal learning, this study calls on education practitioners to consider students' reference needs when developing digital learning services [5]. To understand how recent undergraduates are applying learning apps, social science students, a group that relies heavily on online references to complete their academic assignments, were selected as respondents in this research. Results found that compared to PPA and Sociology students, Journalism students paid more attention to the interactive experience when using m-learning services. As they attended more online discussions than the other groups (Table 4), it is unsurprising that they had the highest requirements for smartphone-sharing functions (Table 7).

Results also showed that PPA students had the highest frequency of accessing coursework (Table 4) and course learning materials (Table 5) via smartphones. Because PPA study materials are primarily plain text, PPA students were most concerned with the hardware (e.g., screen size) and software quality (e.g., response time and supported file formats) of their smartphones when adopting mobile references (Table 7). Such concerns are typical for students in various disciplines [3,8].

The above findings suggested that students' reference needs generally comprised two categories: audio-visual and written learning materials. Moreover, even students in the same major may have different intentions and m-learning needs. Thus, app developers and academic professionals should always prioritize comprehensive development when building educational apps [8,10]. Prior work suggests three directions for improving library apps, focusing on service/functionality, usability/operation, and appearance/design [6] (Table 6).

Regarding "Service and Functions," library apps should ensure their services meet students' learning needs. One possible approach is to utilize cloud technologies in partnership with third-party educational apps to co-share resources. By providing a wide variety of learning materials, users can quickly access the content they want with minimal effort, thereby retaining user loyalty [32]. Regarding "Usage and Operation," in addition to providing compatible technical systems based on mobile device characteristics, library app developers can enable students to access educational materials even without a network connection [33]. Additionally, they should utilize the mobile device's features, such as enabling students' phone cameras to search for bibliographies of reference materials [34]. In terms of "Appearance and Design", building a game-based design library app can enhance users' engagement and retention rate. Students can earn points and badges by borrowing e-books and engaging in digital interactions on the library forums, social network pages, and virtual reference services [7,29,35]. Indeed, researchers have asserted that the components of the TAM model (e.g., perceived ease of use, perceived usefulness, and enjoyment) are gamification features that can significantly attract user attention to mobile activities [36].

It is difficult for an app to serve only a single group of students. Therefore, app developers should recognize and respond to the various reference needs of students to provide diverse learning services. Soon after, m-learning will no longer be just a supporting role, but will become an equally important learning mode, especially during the massive COVID-19 lockdown [6,37].

6. Conclusions

This study portrayed a more holistic picture of m-learning adoption by investigating the reference needs of social sciences students in a comprehensive university in Hong Kong. It focused on three majors in the social sciences, including sociology, PPA, and journalism, exploring students' use of mobile apps to access learning materials and the factors influencing their motivation to use mobile devices for reference materials. This study has enriched the literature and filled the research gap in adopting m-learning and the reference needs of undergraduate social science students. The findings provide insights for mobile app development professionals and educators to understand the primary factors that influence students' intention to use m-learning and propose suggestions for enhancing and attracting their use.

Time restrictions, sample size, and scale may have limited the width and depth of this study. To analyze students' experiences and perspectives in-depth, it would be beneficial to involve a larger sample size from various majors and different study levels, and conduct focused group interviews with students to gain a deeper understanding of the issues. Several interesting areas are proposed for future research. Students from other faculties should be researched, as their habits of using mobile devices and how m-learning benefits their study depend heavily on different curricula and learning needs. Furthermore, factors such as gender, age, experience, and voluntariness are also interesting to explore. As students also heavily use social media on mobile devices for learning, this is another major direction for research [7,15,21]. Furthermore, m-learning can help students attend classes remotely using mobile devices during the COVID-19 pandemic lockdowns [37], which is also worth investigating.

Author Contributions

S.Y.C.: writing—original draft preparation, conceptualization, methodology, software; W.Y.C.: writing—original draft preparation, data curation, visualization, software; H.Y.C.: writing—original draft preparation, visualization, investigation; E.W.S.K.: supervision, software, validation, writing—reviewing and editing. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of Faculty of Education, The University of Hong Kong (1 June 2025).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Data are available on reasonable request to the corresponding author.

Conflicts of Interest

The authors declare no conflict of interest.

Use of AI and AI-Assisted Technologies

During the preparation of this work, the authors used Grammarly to polish the language. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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