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**REVIEW ARTICLE**

# Short Bursts, Big Impact: Exploring Microlearning's Potential in Malaysian Higher Education

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## ABSTRACT

The rapid transformation of Malaysian higher education, prompted by technological advancements and evolving job market demands, highlights the critical need for institutions to adopt microlearning approaches. These microlearning approaches align with the country's Education Blueprint 2015-2025, emphasising lifelong learning and the acquisition of industry-relevant skills. Developing credentials that are outcome-based, personalised, on-demand, secure, and transparent is crucial for ensuring education remains relevant and responsive to both learner and employer needs. This study employed a systematic literature review, adhering to PRISMA guidelines, to identify best practices in developing and implementing microlearning strategies within Malaysian higher education institutions. The review revealed that effective microlearning strategies are characterised by their ability to break down complex subjects into manageable chunks, combat cognitive overload, and enhance knowledge retention. This paper concludes that for Malaysian higher education to remain competitive and adaptable, a strategic emphasis on microlearning is imperative. These strategies not only cater to the dynamic needs of the job market but also align with the lifelong learning objectives outlined in the national education blueprint, thereby preparing graduates for successful careers in the 21st century.

**Contribution/Originality:** This study contributes to the existing literature by addressing Malaysia's growing need for skilled workers through MCs as evidence of skills acquired. As HE in Malaysia embraces ML for credentialing, it ensures competitiveness and adaptability, aligning with lifelong learning objectives and preparing graduates for 21st century careers.

## 1. Introduction

The Malaysian higher education landscape is transforming, with a rising adoption of microlearning and micro-credentials aligning perfectly with the nation's Education

Blueprint 2015-2025, which prioritises lifelong learning and equipping graduates with industry-relevant skills (Ministry of Education Malaysia, 2013). The Malaysian Qualifications Agency (MQA) emphasises a learner-centric and outcome-focused approach in its "Guidelines to Good Practices: Micro-credentials" document. This underlines the importance of developing micro-credentials that are outcome-based, personalised, on-demand, secure, and transparent (MQA, 2020).

The push towards microlearning and micro-credentials is seen as essential for adapting to rapid economic and technological changes, with micro-credentials acting as digital badges for specific skills and competencies. This educational shift is crucial for ensuring a workforce that remains competitive and adaptable. Microlearning strategies are gaining momentum, reflecting a broader global trend towards flexible, personalised learning experiences that cater to the needs of a dynamic job market. Various literature identifies specific characteristics of microlearning that make it particularly suitable for today's educational needs. Schmidt (2007) and Coakley et al. (2017) highlight its conciseness and alignment with "anytime, anywhere" learning preferences, while Torgerson (2016; 2021) emphasises its efficiency and focus on impactful educational experiences. Microlearning supports personalised learning by breaking complex subjects into manageable chunks (Epp & Phirangee, 2019; Rusak 2017), making it effective for both e-learning and mobile learning environments (Koehler et al., 2021; Sankaranarayanan et al., 2023). Furthermore, the effectiveness of microlearning in combating cognitive overload and enhancing knowledge retention through techniques like spaced repetition and chunking is well-documented (Torgerson, 2021; Jahnke et al., 2020). Offering micro-credentials for these smaller learning units motivates learners and enables better tracking of achievements (Sirwan Mohammed et al., 2018; Shail, 2019).

### 1.1. Statement of Problem

While microlearning offers promising benefits, significant challenges exist in its implementation. Designing impactful and concise content requires considerable expertise to avoid oversimplification and ensure depth in complex topics (Uzun, 2012; Maytin et al., 2023; De Gagne et al., 2019). Assessing diverse microlearning pathways also presents unique difficulties (Choo & Rahim, 2021; Gabrielli et al., 2006). Furthermore, a lack of readily available content, coupled with the need for educator development in creating their own resources, can hinder adoption (Ghafar et al., 2023). Additionally, microlearning may not be suitable for all subjects, especially intricate ones, and learners may perceive it to be more time-consuming than traditional methods (Ghafar et al., 2023). Success hinges on educator preparedness for technology, student digital literacy, and reliable infrastructure (Bidarra et al., 2023; Khong & Kabilan 2022; Moraes et al., 2022; Vinayan & Harikirishanan, 2021; Hasnan & Mohin, 2021; Fraszczyk & Piip, 2020; Roddy et al., 2017; Alqurashi, 2017; Koehler & Mishra, 2009). Ineffective implementation by instructors can lead to learner confusion (Uzun, 2023). Maytin et al. (2013) further 2 mphasizes the need for research on adapting microlearning for online delivery, considering learner engagement, knowledge retention, and cost-efficiency.

To navigate these challenges, Malaysian higher education institutions must focus on developing specific, mobile-friendly, and engaging content that meets the needs of modern learners and employers. This involves investing in educator preparedness, enhancing digital literacy, and ensuring the reliability of technological infrastructure. By doing so, these institutions can leverage microlearning and micro-credentials to provide

relevant, flexible, and personalised education, preparing graduates for success in a rapidly changing world.

### 1.2. Research Objectives

This paper aims to identify best practices in developing and implementing microlearning strategies within higher education settings by examining the benefits and challenges associated with microlearning in enhancing academic performance, fostering skill development, and improving career readiness among learners. Through a comprehensive review of the literature, this study seeks to contribute to a better understanding of how microlearning can be effectively utilised in Malaysian higher education, ensuring that education remains relevant, flexible, and tailored to individual learning styles.

### 1.3. Research Question

To guide the strategic implementation of microlearning in Malaysian higher education, this study investigates the following key aspects:

i. What are the best practices in developing and implementing microlearning strategies within Malaysian higher education settings to enhance academic performance, foster skill development, and improve career readiness among learners?
ii. How does literature support effective use of microlearning in Malaysian higher education contexts to meet the diverse needs of learners?

## 2. Literature Review

As the Malaysian higher education landscape evolves rapidly, microlearning emerges as a powerful tool. It promises to revolutionise learning by aligning with how we acquire skills and retain knowledge. This review explores the theories behind effective microlearning strategies and how these theories translate into practical instructional design.

### 2.1. Fundamentals of Cognitive Load Theory (CLT)

As Malaysian higher education navigates a dynamic landscape, microlearning emerges as a powerful tool for delivering flexible, skill-oriented education catered to the demands of the 21st-century workforce. This approach aligns with the cognitive science of learning. The brain has two key memory systems: working memory, crucial for processing and temporarily storing information (Alloway, 2009; Anmarkrud et al., 2019), and long-term memory, which organises and retrieves information (comprehending, storing, and retrieving new knowledge), are pivotal in learning (Richey, Klein & Tracey, 2011; van Merrienboer & Sweller, 2005). Understanding the limitations of working memory becomes crucial here. Microlearning's focus on short, targeted content chunks aligns with this limitation, allowing learners to effectively process information and ultimately transfer it to their long-term memory for better retention and application. Building upon the limitations of working memory, Cognitive Load Theory (CLT) provides a framework for optimising learning by managing information processing. CLT emphasises aligning instruction with these limitations. Microlearning's chunked format directly addresses this by presenting information in manageable pieces, reducing cognitive overload and allowing learners to focus on essential concepts. CLT differentiates between long-term memory, where knowledge resides, and working memory, which handles temporary information and experiences cognitive load during learning (van Merrienboer & Sweller, 2005; Sweller, 2004). Cognitive Load Theory highlights several potential pitfalls in

instructional methods, particularly those that increase extraneous cognitive load. This can happen by overwhelming novices with complex tasks, providing unhelpful guidance, or offering redundant information. Effective instruction requires careful design to manage cognitive load, cater to learner experience, and foster positive learning experiences. Techniques like advanced organisers (introducing key ideas and relationships), chunking information into manageable pieces, and scaffolding (providing temporary support) help reduce extraneous load and enhance learning efficiency (Richey, Klein & Tracey, 2011).

### 2.2. Instructional Design and the Expertise Reversal Effect

The effectiveness of instructional techniques depends on the learner's expertise level. This highlights the Expertise Reversal Effect, which emphasizes that instructional methods beneficial for novices can become detrimental for experts (Artino, 2008). As learners develop schemas, their information processing changes, making initial guidance useful for novices but potentially hindering experts who benefit from less external support to avoid redundant processing. This effect emphasizes tailoring instruction to the learner's expertise level. Effective instruction for novices often involves more guidance and scaffolding, while for experts, reducing this support prevents cognitive overload and enhances learning efficiency.

Aligned with the Expertise Reversal Effect, the Zone of Proximal Development (ZPD) captures the relationship between a learner's independent abilities and the support provided by instructors, ultimately leading to learner autonomy (Danish et al., 2017). This dynamic zone is shaped by individual needs, prior knowledge, skill level, and the optimal challenge level that sustains motivation (Halpern et al., 2007). Within the ZPD, learners engage with "ideas beyond their reach" through scaffolded support, leading to cognitive growth and autonomy (Danish et al., 2017). Paas et al. (2003) propose two key approaches to scaffolding based on learner expertise; (1) learner control and scaffolding: Offering experienced learners more control while providing substantial scaffolding for novices, and (2) scaffolding based on learner expertise. Learner support should be tailored to their expertise level. What works for novices may hinder the progress of more experienced learners. This dynamic approach suggests gradually reducing instructional guidance as learners gain expertise, aligning with the expertise reversal effect.

### 2.3. Mayer's Cognitive Theory of Multimedia Learning (CTML)

Grounding online learning materials in Mayer's Cognitive Theory of Multimedia Learning (CTML), instructors can ensure their courses are designed to optimise learner engagement and knowledge retention (Mayer, 2002; Johnson et al., 2009; Mayer et al., 2001). This theory's practical implications are evident in the widely acknowledged "Mayer's Principles," which offer tangible instructional strategies derived from CTML concepts. However, it's crucial to recognize that the relationship between theory and practice should be reciprocal rather than one-sided. In an ideal scenario, there exists a dynamic interplay where practice informs theory, ensuring that instructional methods adapt to advancements in learning science (Kuba et al., 2021).

Conversely, theory should inform practice, evolving based on empirical observations of how learning unfolds in authentic contexts (Mayer & Fiorella, 2014). This reciprocal relationship aligns with the growing recognition of multimedia's value in learning materials, highlighting the significant impact of content presentation on learning outcomes. Mayer's (2002) theory, grounded in core assumptions regarding dual channels,

active processing, and limited capacity in working memory, aligns with established theories such as Paivio's (1991) and Baddeley's (1992) dual coding theory and Sweller's Cognitive Load Theory (Sweller, 1994). From these foundations, Mayer (2002) derives seven design principles, including the Multimedia Principle, Temporal Contiguity Principle, Spatial Contiguity Principle, Coherence Principle, Modality Principle, Redundancy Principle, and Individual Differences Principle, which collectively enhance the effectiveness of instructional materials, particularly for learners with varying levels of prior knowledge and spatial abilities.

Building on the idea of effective and sustainable L2 learning, Khong and Kabilan (2022) propose a theoretical model for microlearning in language instruction, which aims to cater to individual needs and contexts while merging cognitive and motivational theories into a structured approach. This blend of theories, including Cognitive Load Theory (CLT), Cognitive Theory of Multimedia Learning (CTML), and Self-Determination Theory (SDT), seeks to personalise learning experiences, accommodating individual needs and merging cognitive and motivational theories into a structured approach.

### 2.4. Engagement and Community in Online Learning

Ensuring microlearning effectiveness requires a strategic integration of distance learning theory and learner autonomy theory. Learner Autonomy Theory emphasises the importance of learners taking ownership of their learning journey, setting goals, and making decisions about their learning process (Liberati et al., 2009). This theory aligns well with the concept of cognitive engagement, particularly the emphasis on self-directed learning and critical thinking skills mentioned in Bowden et al.'s (2021) four pillars for understanding student engagement: behavioural, affective, social, and cognitive.

Behavioural engagement encompasses observable actions like positive conduct, attendance, participation, and dedication, fostering perseverance and resilience (Garrison, 1993; Moore, 1993; Holmberg, 1983). Affective engagement delves into emotions like happiness and pride, highlighting emotional investment in academic and social interactions. Heutagogy, a self-directed learning approach, thrives on social learning and student collaboration (Blaschke, 2012). Shared knowledge and reflective discussions fuel learning outcomes and cultivate essential skills like communication, teamwork, and empathy. Capable learners excel in such collaboration, efficiently working together towards common goals (Vinayan & Harikirishanan, 2021). Beyond individual impact, collaborative learning fosters broader communities. Bowden et al. (2021) and Roddy et al. (2017) advocate for social engagement and community building, emphasising the importance of belonging and inclusivity fostered through interaction and involvement. Handayani et al. (2021) further illustrate this through collaborative learning among participants in their studies, highlighting the enriching effect of shared practices within a community of practice. Finally, cognitive engagement emphasises self-directed learning (Verduin & Clark, 1991) and active mental states like planning, organisation, and understanding the value of academic work, encouraging critical thinking and effective learning strategies.

## 3. Research Methods

To explore the research questions, a systematic review of journal articles was performed, adhering to the PRISMA guidelines (Liberati et al., 2009) for transparent and trustworthy article selection (Moore & Miller, 2022; Page et al., 2021). This involved a comprehensive

search across major scientific databases like Springer and ScienceDirect, as well as the university's e-library and Google Scholar. Search terms included 'microlearning', 'micro learning', 'mobile microlearning', 'micro content', 'higher education', 'design elements', 'design and delivery', and 'microlearning development', to thoroughly cover the broad spectrum of microlearning topics within higher education.

Microlearning in higher education has gained momentum recently, particularly in the last five years, as evidenced by the increase in relevant research (Kadiev, 2021). This trend is attributed to several factors. Firstly, advancements in mobile technology have made microlearning more accessible via devices like laptops and smartphones, fitting well with learners' hectic lifestyles. Secondly, the rising demand for lifelong learning has fostered a need for flexible educational solutions, with microlearning offering incremental skill acquisition. Thirdly, higher education's growing emphasis on learner engagement and outcomes has spurred interest in microlearning, supported by research demonstrating its effectiveness in enhancing engagement and learning outcomes. Additionally, the expansion of learning management systems, online platforms, and various learning technologies has facilitated the creation and customization of microlearning content, thereby enhancing its educational impact.

The selection of literature for this study was guided by specific inclusion and exclusion criteria, as can be seen in Table 1.

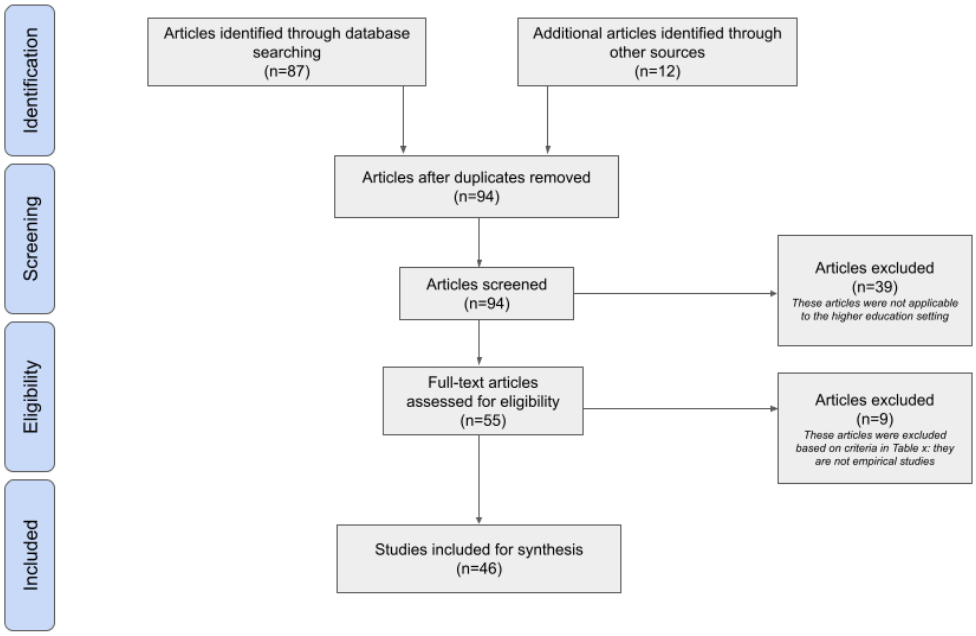
Table 1: Inclusion and exclusion criteria

| **Inclusion Criteria** | **Exclusion Criteria** |
|---|---|
| Utilises mobile devices like laptops or smartphones for microlearning.<br>Conducted in or relevant to higher education settings.<br>Based on practical or empirical methods.<br>Discusses microlearning design and delivery.<br>Covers microlearning implementation.<br>Explores methods to increase learner autonomy and engagement in microlearning. | Doesn't employ mobile devices for microlearning.<br>Outside the formal classroom environment.<br>Purely theoretical or conceptual in nature. |

To be considered, papers and articles had to fulfil the initial three inclusion criteria and at least one of the remaining criteria listed. Adherence to the exclusion criteria was also mandatory. A key inclusion criterion was the focus on practical or empirical studies, as these provide evidence-based insights crucial for developing a grounded framework. While theoretical and conceptual studies offer valuable perspectives on microlearning design elements and considerations, practical and empirical studies provide tangible evidence from real-world applications with actual learners.

For the initial phase of research, micro-credentials were excluded to concentrate on the fundamental aspects of microlearning in higher education, ensuring a focused approach. This decision aimed to establish a solid understanding of microlearning before delving into more complex topics like micro-credentialing. The PRISMA flow diagram, as illustrated in Figure 1, outlines the search and selection process.

Figure 1: Microlearning design and implementation in higher education literature search




## 4. Results

A systematic review of journal articles on microlearning yielded 94 articles, with 46 studies meeting the inclusion criteria. The studies per year were as follows: 3 in 2018, 6 each in 2019 and 2020, 8 in 2021, 11 in 2022, and 12 in 2023. The research spanned a global context, with studies conducted across various countries. Single studies emerged from nations including Brazil, Chile, Colombia, Italy, Malaysia, the Netherlands, Portugal, Russia, Serbia, Slovakia, Taiwan, Tanzania, Ukraine, and Australia & Malaysia. Meanwhile, multiple studies were documented in China (5), Czech Republic (5), Germany (2), Indonesia (4), Iran (3), Romania (2), Spain (3), UK (4), and the US (4), illustrating a worldwide interest and application in microlearning within higher education. The study participants span various fields within higher education. STEM fields were well represented, with participants in engineering (5), chemistry (1), computer science (1), mathematics (1), physics (1), and medical (7) disciplines. Humanities and social sciences were also represented, with participants in business (3), education (7), educational technology (1), journalism (1), and language acquisition (3) programs. Additionally, unique fields like the army (1) and marine (1) were also represented. Seven themes were identified, *Utilise ID Principles, Expert Collaboration, Focused and Relevant Micro Content, Varied Microlearning Formats, Engaging Interactive Elements, Choice of Modality and Platforms, Learner Empowerment* (as shown in Table 2). These themes are crucial for effective development and implementation of microlearning strategies in higher education institutions.

Table 2: Academic articles on the design and implementation of microlearning in higher education context

| | | Expert Collab. | Focused & Relevant Micro Content | | Varied Microlearning Formats | | | | | | | | Engaging Interactive Elements | | | Choice of Modality and Platforms | | Learner Empowerment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No | Author & Year | Collab. with Experts/ Prof. Bodies | Single LO | Relevant | Videos | Audio | Case Study | Software/ Apps | Info. | Anim. | Sim. | Discussion Forums | Interactive Elements (buttons, like, polls, etc) | Games/ Quiz | Interface Design | ML Mode: Online/ Offline/ Hybrid | Interop.: Mobile/ Desktop | Goal Orient | Additional / Supplementary/ Complementary materials/ Glossary |
| 1 | Lin et al. (2023) | | ✓ | | | | | | | | | | | | | | ✓ | ✓ | ✓ |
| 2 | Netzer and Mittelstädt (2021) | | ✓ | | ✓ | | | | ✓ | ✓ | | | | | | | ✓ | ✓ | ✓ |
| 3 | Lee et al. (2021) | ✓ | ✓ | ✓ | | | | | ✓ | | | | | ✓ | | | ✓ | ✓ | |
| 4 | Romanenko et al. (2023) | | ✓ | | ✓ | | ✓ | | ✓ | | | | | | | | ✓ | ✓ | |
| 5 | Kossen and Ooi (2021) | | | ✓ | ✓ | ✓ | | | | | | | | | | | ✓ | ✓ | |
| 6 | Zarshenas et al. (2022) | | | ✓ | ✓ | | | | | | | | | | | ✓ | ✓ | ✓ | |
| 7 | Susilana et al. (2022) | | ✓ | | ✓ | ✓ | | | ✓ | | | ✓ | | | | ✓ | ✓ | ✓ | |
| 8 | Mota et al. (2019) | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | | | | ✓ | | ✓ | | | ✓ |
| 9 | Román-Sánchez et al. (2023) | ✓ | | | ✓ | | | | | | | | | | | | ✓ | ✓ | |
| 10 | Buhu and Buhu (2019) | | | ✓ | ✓ | | | | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | | | |
| 11 | Javorcik et al. (2023) | | | | ✓ | | | | | | | | ✓ | | | | ✓ | | ✓ |
| 12 | Javorcik and Polasek (2019) | | | ✓ | | | | | ✓ | | | | ✓ | | | | ✓ | ✓ | |

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | Suhonjić (2019) | ✓ | | | | | | | | | | | | | | | ✓ | | | |
| 14 | de Vries et al. (2018) | ✓ | ✓ | ✓ | | | | | | | | | | | | ✓ | | ✓ | | |
| 15 | Fang (2018) | | | | | | | | | | | | | | | ✓ | | ✓ | | ✓ |
| 16 | Yin et al. (2021) | | ✓ | ✓ | ✓ | | | ✓ | | | | | ✓ | ✓ | | ✓ | ✓ | | | |
| 17 | Gill et al. (2020) | | | ✓ | ✓ | | ✓ | | | | ✓ | | ✓ | | | ✓ | ✓ | | | ✓ |
| 18 | Marinskaya and Marinskaya (2020) | | ✓ | ✓ | | | | | | | | | | | | ✓ | ✓ | | | |
| 19 | Zheng (2021) | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | | | ✓ | | ✓ | | ✓ |
| 20 | Conde-Caballero et al. (2023) | | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ | | ✓ |
| 21 | Javorcik, and Polasek (2018) | | | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ |
| 22 | Ekayana (2023) | ✓ | | ✓ | ✓ | | | | ✓ | | | | | | | ✓ | ✓ | | | |
| 23 | Rad (2023) | | ✓ | ✓ | ✓ | | | ✓ | | | | | ✓ | ✓ | | ✓ | | ✓ | | |
| 24 | Sedaghatkar et al. (2023) | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | | ✓ | ✓ | | | |
| 25 | Javorcik (2022) | | | ✓ | | ✓ | | | ✓ | | | | ✓ | | | ✓ | ✓ | ✓ | | |
| 26 | Ariani et al. (2022) | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | | | | ✓ | | | | |
| 27 | McKee and Ntokos (2022) | | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | | ✓ | | ✓ | ✓ | ✓ | | | |
| 28 | Isibika et al. (2022) | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | | | |
| 29 | McNeill and Fitch (2023) | | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | | | |
| 30 | Tabares et al. (2022) | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ | ✓ | | | ✓ | | | |
| 31 | Sung et al. (2023) | | | | ✓ | | ✓ | | | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | |
| 32 | Yusnidar and Syahri (2022) | ✓ | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | |
| 33 | Fedorova et al. (2022) | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 34 | Craig et al. (2023) | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| 35 | Olivier (2021) | | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | | | | | ✓ | ✓ | ✓ | | |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | Choo and Rahim (2021) | | ✓ | ✓ | ✓ | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ |
| 37 | Bannister et al. (2020) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| 38 | Wang et al. (2020) | | | | ✓ | | | | | | ✓ | | | ✓ | | ✓ | | | ✓ |
| 39 | Skalka and Drlik (2020) | | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ |
| 40 | Pascual et al. (2021) | | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ |
| 41 | Gherman et al. (2021) | | ✓ | ✓ | ✓ | | | | ✓ | | | ✓ | ✓ | | ✓ | | ✓ | | ✓ |
| 42 | Polasek and Javorcik (2019) | | | ✓ | ✓ | | | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| 43 | Romero-Rodríguez et al. (2022) | | ✓ | ✓ | | | | ✓ | | | ✓ | | | | | | | | |
| 44 | Sung et al. (2023) | | | | ✓ | | | | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | |
| 45 | Martinho et al. (2023) | | ✓ | | ✓ | | | | | | | ✓ | | | ✓ | | ✓ | | ✓ |
| 46 | Horst and Dörner (2019) | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | | ✓ | | | ✓ | ✓ | | | |

Collab. collaboration with Experts/ Professional Bodies, Info. – infographics/ Images/ Diagrams, Anim. – animations, Sim. - simulations

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This study investigates the effective implementation of microlearning in Malaysian higher education, aiming to ensure educational practices remain relevant, flexible, and cater to individual learning styles. A crucial aspect is expert collaboration, emphasised by MQA's guidelines for micro-credential development. Partnerships between academia, industry, and specialists enrich learning materials and ensure alignment with academic standards and market needs, ultimately enhancing practical application. Furthermore, exploring diverse formats like videos, simulations, podcasts, and digital cases showcases a shift towards personalised learning that accommodates diverse preferences and bridges the theory-practice gap. This adaptability positions microlearning as a dynamic methodological innovation that responds to the evolving needs of digital-age learners. Interactive elements and gamification further enhance engagement, participation, and motivation, fostering an active learning environment. The accessibility and effectiveness of microlearning are amplified by the use of various modalities and platforms, including Learning Management Systems (LMS) and mobile applications, which facilitate a blend of online and in-person learning to cater to diverse needs. Finally, learner empowerment is central, as microlearning's flexible content and supplementary materials enhance learner agency and ownership of the learning process, encouraging self-directed exploration and tailored educational experiences. Table 3 summarises the distribution of articles across various themes pertinent to microlearning in higher education.

Table 3: Summary of best practices as described by various academic literature reviews

| Themes | Articles |
|---|---|
| Expert Collaboration | |
| Includes collaboration with professionals, expert evaluations, and partnerships across industries for content development and validation | 14 |
| Focused and Relevant Micro Content | |
| Includes clearly defined learning objectives and outcomes, such as SMART objectives focused on achieving specific learning goals | 28 |
| Includes strategies for real-world relevance and learner engagement | 33 |
| Varied Microlearning Formats | |
| Videos (documentaries, TED talks, tutorials, etc) | 34 |
| Audio (podcast, voice-notes, etc) | 6 |
| Case Study | 6 |
| Software/ Apps | 19 |
| Infographics/ Images/ Diagrams | 20 |
| Animations | 9 |
| Simulation | 6 |
| Discussion Forums | 10 |
| Engaging Interactive Elements | |
| Games/ Quiz | 18 |
| Interactive Elements (buttons, like, quizzes, polls, etc) | 26 |

| | |
|---|---|
| Interface features that prioritise user-friendliness, and a cohesive look and consistent design template using familiar platform (Moodle, YouTube), standardise video formats for all resources | 5 |
| Choice of Modality and Platforms | |
| ML Mode: Online/ Offline/ Hybrid | 33 |
| Interoperability: Mobile/ Desktop | 35 |
| Learner Empowerment | |
| Additional / Supplementary/ Complementary materials/ Glossary | 16 |
| Goal Orientation and Self-Direction | 28 |

### 4.1. Experts Collaboration

MQA's guidelines (Ministry of Education Malaysia, 2013) emphasise expert collaboration for micro-credentials. This approach benefits learners (in-demand skills), employers (credential value), and overall quality. The process also involves collaboration with universities, industries, and various specialists (designers, librarians, etc.) to ensure a comprehensive approach (Ministry of Education Malaysia, 2013). Studies showcase the effectiveness of this approach. In Lee et al.'s (2021) study, journalist experts drafted micro lessons for journalism students, with researchers and external experts refining them for both academic accuracy and practical relevance. Similarly, Román-Sánchez et al. (2023) involved nurses in creating video content for mental health training, ensuring its effectiveness. Isibika et al. (2022) used collaboration to develop microlearning for librarians in Tanzania, demonstrating its cost-effectiveness. Craig et al. (2023) highlight collaboration's role in military education where instructional designers and instructors ensured PERLS met soldiers' specific needs. The recurring theme is clear: collaboration with experts across diverse fields is crucial for successful microlearning development. It ensures academic soundness, practical relevance, and ultimately, the success of microlearning initiatives.

### 4.2. Focused and Relevant Micro Content

Microlearning's strength lies in bridging theory and practice through focused, relevant content. Studies highlight this across various fields. Lee et al. (2021) emphasises sparking initial interest through "aha moments" and then sustaining engagement with practical applications. Similarly, Kossen and Ooi (201) and Zarshenas et al. (2022) used practical activities and scenarios to keep content engaging and impactful. This focus on relevance is crucial for building skills applicable to real-world situations (Mota et al., 2019, Buhu & Buhu, 2019; Javorcik & Polasek, 2019; de Vries et al., 2018). These studies showcase tailoring microlearning to specific needs, whether for student interests (Javorcik & Polasek, 2019) or workplace challenges (de Vries et al., 2018). The focus on practicality extends to the digital realm (Isibika et al., 2022; Yin et al., 2021; Gill et al., 2020; Marinskaya & Marinskaya, 2020), aligning content with digital preferences for a practical learning experience. This emphasis on real-world application is further solidified by diverse studies across various fields, from clinical settings (Sedaghatkar et al., 2023) to game design (McKee & Ntokos, 2022). By aligning content with specific needs and curriculum (Choo & Rahim, 2021; Craig et al., 2023; Tabares et al., 2022; Fedorova et al., 2022; Olivier, 2021; Bannister et al., 2020; Skalka & Drlik, 2020; Pascual et al., 2021), microlearning ensures learners are prepared for the challenges of the real world.

Furthermore, microlearning promotes active learning through practical application, especially activities that engage learners in creating instructional products that connect theoretical knowledge with practical skills (Javorcik et al., 2023). This approach is echoed in the studies by Kossen and Ooi (2021) and Zarshenas et al. (2022), which emphasise the effectiveness of micro-sized lectures and specialised content in fields like nursing, respectively, both of which increase learner engagement and professional competence. Moreover, microlearning's adaptability makes it particularly beneficial for learners with special educational needs, including those with dyslexia, ADHD, or hearing impairments, offering shorter, more manageable text units that cater to diverse learning preferences (Javorcik & Polasek, 2019). Isibika et al. (2022) further demonstrate microlearning's utility in professional development, enhancing the skills and efficiency of librarians through easily accessible educational modules, thereby confirming its effectiveness in various professional and academic settings.

### 4.3. Varied Microlearning Formats

Microlearning in higher education embraces varied formats to accommodate different learning styles and needs, effectively moving away from a one-size-fits-all approach. Various studies demonstrate the effectiveness of microlearning videos that range from 1-7 minutes (Kossen & Ooi, 2021; Zarshenas et al., 2022; Netzer & Mittelstädt, 2021; Romanenko et al., 2023), which are ideal for summarising key concepts, demonstrating procedures, or providing explainer content. The versatility of these formats is further shown through various applications across disciplines, such as Buhu and Buhu's (2019) practical, step-by-step textile technology and Román-Sánchez's et al., (2023) 'knowledge pill' videos in nursing education. Additionally, engagement is further enhanced through interactivity. Javorcik et al. (2023) use video tutorials with embedded tasks, while Yin et al. (2021) incorporate tasks within 10-minute videos. Conde-Caballero et al. (2023) demonstrated innovative platforms for delivering bite-sized information with 3-10 minute TikTok videos. Optimising video length is also crucial. McKee and Ntokos (2022) suggest a 5-8 minute "sweet spot" with adjustments for different audiences aligning with Dewanti and Sulistyaningrum (2023) and Rad (2023) who highlight the effectiveness of targeted durations. Sedaghatkar et al. (2023) further solidify this concept with skill-specific tutorials. Beyond short, informative videos, microlearning can be social (Bannister et al., 2020) and interactive (Olivier, 2021; Wang et al., 2020), fostering engagement and transforming passive learning into an active journey.

Beyond visual tools, microlearning also leverages audio formats to enrich the learning experience. Kossen and Ooi's (2021) audio-casts and Susilana's et al. (2022) podcasts offer succinct, easily accessible information perfect for on-the-go learning or auditory students. The integration of audio within video units or as standalone podcasts, as seen in studies by Javorcik (2022) and Ariani et al. (2022) highlights the adaptability of audio to meet diverse educational needs. Bannister et al. (2020) demonstrate audio's versatility through podcast adaptations, highlighting repurposing for diverse platforms and attention spans. These audio resources are designed not only to provide information but also to engage learners actively, making use of diverse formats and durations to suit different preferences and learning environments.

Case studies in microlearning serve as essential tools for linking theoretical knowledge with practical application as “real-world scenarios or problems,” encouraging critical thinking and problem-solving (Romanenko et al., 2023). This method aligns with Gill et al.'s (2020) technique of breaking down complex concepts into manageable steps within case studies, enhancing understanding and application. Furthermore, case studies can

stimulate lively discussions in online classrooms, fostering a collaborative learning environment where learners actively share insights and apply their knowledge (Fedorova et al., 2022). Bannister et al. (2020) extended this approach by adapting case studies for social media transforming them into short, engaging clips that facilitate active learning and peer interaction, thus enriching the educational experience by allowing learners to apply theoretical knowledge in practical, real-world contexts.

The adaptation of microlearning content into various software formats has greatly improved its accessibility, flexibility, and engagement. Mota et al. (2019) utilised a card format with integrated quizzes, while Yin et al. (2021) implemented a chatbot system for dynamic micro-lessons. The use of social platforms like TikTok and WhatsApp for delivering concise educational content, as seen in studies by Conde-Caballero et al. (2023) and Sedaghatkar et al., (2023) exemplifies the shift towards mobile-accessible learning. This is further supported by Ariani et al. (2022) who optimised content for YouTube to enhance accessibility and user engagement. Advanced tools such as QuickTime and Camtasia, utilised by Isibika et al. (2022) and Yusnidar and Syahri (2022) alongside Learning Management Systems like Moodle and PERLS (Fedorova et al., 2022; Craig et al., 2023), highlights the importance of structured, interactive content delivery. This caters to diverse preferences with options like Google Forms, YouTube, and podcasts (Choo & Rahim, 2021; Olivier, 2021; Bannister et al., 2020). Skalka and Drlik (2020); Pascual et al. (2021) used specific software for programming and publishing content. Polasek and Javorcik (2019) and Romero-Rodríguez et al. (2022) highlight student agency with interactive creation tools. This software transformation creates a diverse learning landscape, empowering educators to tailor experiences to individual needs.

Microlearning effectively utilises visual aids like infographics, diagrams, and images to simplify complex concepts into manageable, engaging snapshots that enhance comprehension and retention. Various studies illustrate how visuals cater to the human brain's pattern recognition capabilities (Lee et al., 2021; Fedorova et al., 2022; Netzer & Mittelstädt, 2021), making learning material not only easier to understand (Mota et al., 2019) but also more accessible. The integration of such visual elements into microlearning content ranges from static visuals like photographs and mind maps (Romanenko et al., 2023; Dewanti & Sulistyaningrum, 2023; Susilana et al., 2022; Gherman et al., 2021). Beyond static visuals, microlearning incorporates interactive elements for engagement. Buhu and Buhu (2019) recommend quick-reference infographics and checklists, while Javorcik and Polasek (2018; 2019) highlight the popularity of interactive infographics. Visuals can also support video content (Isibika et al., 2022; Javorcik, 2022; Ekayana, 2023) or be integrated into traditional formats like slideshow lectures (McKee & Ntokos, 2022). Infographics, diagrams, and images are not decoration; they are transformative learning tools (Mota et al., 2019).

Animations and simulations further extend microlearning's dynamic capabilities, offering immersive and interactive learning experiences that significantly boost learner engagement and understanding. Animations, from GIFs to full-motion videos, are highly effective in illustrating complex scientific and technical concepts (Netzer & Mittelstädt, 2021; McNeill & Fitch, 2023). Additionally, interactive animations and simulations are increasingly incorporated into Learning Management Systems for enhanced accessibility and personalised learning experiences (Fedorova et al., 2022; Yusnidar & Syahri, 2022). Practical applications of these technologies include simulations of textile processes (Buhu & Buhu, 2019) and augmented reality applications for equipment training (Gill et al., 2020), demonstrating how microlearning can adapt to various educational needs and environments, from professional training to higher education (Horst & Dörner, 2019).

These advancements highlight the significant role of digital innovation in transforming traditional educational paradigms into more engaging, efficient, and effective learning experiences.

Animations and simulations are highly effective in microlearning. Studies have shown that learners benefit from various animation formats in microlearning: engaging with TED-Ed videos (McNeill & Fitch, 2023), using GIFs to illustrate physics concepts (Netzer & Mittelstädt, 2021), and incorporating interactive animations for active learning (Buhu & Buhu, 2019; Olivier, 2021; Ariani et al., 2022). Additionally, some research advocates for integrating animations directly within Learning Management Systems (LMS) (Fedorova et al., 2022; Yusnidar & Syahri, 2022). Microlearning simulations offer a practical and engaging approach, employing diverse multimedia elements. Examples include videos and HTML5 embeds used for textile processes (Buhu & Buhu, 2019), an AR mobile app for equipment training with branching scenarios and flashcard guides delivered in a Just-In-Time format (Gill et al., 2020), simulations placing learners in realistic environments (Fedorova et al., 2022), and VR technology for simulated learning units (Horst & Dörner, 2019). These advancements highlight the significant role of digital innovation in transforming traditional educational paradigms into more engaging, efficient, and effective learning experiences.

Microlearning capitalises on active engagement through the use of discussion forums integrated with LMS platforms (Moodle, Google Classroom etc.) to create dynamic learning spaces equipped with quizzes, games, and interactive videos (Choo & Rahim, 2021; Fedorova et al., 2022; Skalka & Drlik, 2020; Susilana et al., 2022; Yusnidar & Syahri, 2022; Javorcik & Polasek, 2018). Discussion extends beyond LMS - Fedorova et al. (2022) highlight mobile and social media integration (Facebook, Twitter) for forum access and Zheng (2021) uses discussion features (brainstorming, Q&A) to personalise learning journeys based on student interactions. Similarly, Conde-Caballero et al. (2023) include interactive comments on TikTok to encourage discussion-like interactions. Collaboration tools like Padlet, Slack, WebEx, and Zoom (Choo & Rahim, 2021) further enhance engagement through collaborative activities. However, the effectiveness of discussion forums relies on proper integration and active participation, as ineffective usage can limit their potential benefits, emphasising the need for structured integration and active moderation to enhance engagement and foster a collaborative learning community (Javorcik & Polasek, 2018).

### 4.4. Engaging Interactive Elements

Games and interactive elements are powerful tools to keep learners motivated and actively participating in microlearning. Literature shows various effective strategies. Lee et al. (2021) use gamified quizzes like swipe-able true/false challenges, Mota et al. (2019) use reflective quizzes with real-life scenarios and feedback to deepen engagement and solidify understanding and various studies integrate diverse interactive experiences like drag-and-drop activities, brain games, and interactive diagrams within LMS (Buhu & Buhu, 2019; McKee & Ntokos, 2022; Rad, 2023; Yusnidar & Syahri, 2022). Javorcik et al. (2023) highlight H5P tools for interactive presentations, videos, and image hotspots, while Yin et al. (2021) showcase a chatbot for personalised micro-content delivery with activities and repeat options. These studies emphasise the effectiveness of tailored interactivity in maintaining learning performance and boosting intrinsic motivation.

Social media platforms offer another avenue for interactive microlearning. Various studies highlight the potential of platforms like TikTok, LinkedIn, Twitter, and Facebook

for incorporating interactive elements like quizzes, polls, and comments (Conde-Caballero et al., 2023; Fedorova et al., 2022; Bannister et al., 2020). These features foster engagement, positive experiences, and continuous learning through social interaction. Other studies further emphasise the importance of learner control and personalization. Learners seek interactive features like "Like," "Dislike," "Subscribe," and "Comment" to express reactions and manage their cognitive load (Sung et al., 2023; Clark & Mayer, 2016).

However, quizzes remain a popular choice (Choo & Rahim, 2021; Craig et al., 2023; Skalka & Drlik, 2020; Pascual et al., 2021; Gherman et al., 2021) for assessment, self-regulated learning, and personalised experiences. Polasek and Javorcik (2019) further demonstrate the effectiveness of mini-quizzes within microlearning units, providing immediate feedback and reinforcing correct information. These interactive strategies not only enhance the learning process but also empower learners to actively participate and control their educational journey, aligning with theories of learner autonomy and cognitive engagement in multimedia learning environments.

### 4.5. Choice of Modality and Platforms

Literature review revealed that various studies demonstrate the effectiveness of microlearning in various setting highlighting the pivotal role of Learning Management Systems (LMS) such as Moodle, Canvas, and Edmodo in catering to diverse learning styles through the delivery of short videos, quizzes, and interactive elements (Lee et al., 2021; Román-Sánchez et al., 2023; Isibika et al., 2022; Mota et al., 2019). The trend towards mobile accessibility is becoming increasingly important (Zheng, 2021; Conde-Caballero et al., 2023), which shows the growing preference for mobile-friendly learning environments, making microlearning more accessible and engaging for learners on-the-go (Javorcik & Polasek, 2019; Fang, 2018).

Hybrid learning models that integrate microlearning elements are becoming more prevalent, effectively blending online and face-to-face educational approaches. Fang (2018) and Sedaghatkar et al., (2023) exemplify this integration, utilising mobile technologies to provide flexible access to learning materials and merging online micro-videos with practical in-person applications in medical training. Such models not only enhance learner engagement and performance but also accommodate various learning needs and styles, which utilise platforms like Moodle and i-LMS UNJA (Fedorova et al., 2022; Yusnidar & Syahri, 2022). Moreover, Ekayana's (2023) approach of incorporating explainer videos into robotics courses illustrates the effectiveness of hybrid learning, which synergistically combines different teaching methodologies to maximise educational outcomes. This blending of learning modes is further supported by suitable platforms for both mobile and web interfaces (Craig et al., 2023), highlighting the adaptability and extensive reach of microlearning in modern education. Additionally, various studies have transformed e-learning courses into microlearning on Moodle, incorporating a flipped classroom model with online video lectures and interactive in-class activities (Gill et al., 2020; Rad, 2023; Wang et al., 2020; Javorcik & Polasek, 2018). This exemplifies the dynamic nature of hybrid learning. Regardless of delivery mode (online, hybrid, or traditional), microlearning content should be accessible across devices (Choo & Rahim, 2021; Isibika et al., 2022). Platforms like TikTok, WhatsApp, YouTube, Podcasts, and Google Forms offer interoperability, allowing learners to access and complete tasks on various devices (Choo & Rahim, 2021; Zarshenas et al., 2022; Sedaghatkar et al., 2023; Fedorova et al., 2022; Bannister et al., 2020; Skalka & Drlik, 2020; Romanenko et al., 2023; Conde-Caballero et al., 2023; Ariani et al., 2022). This cross-

platform adaptability of microlearning, across online platforms and hybrid models, caters to the evolving needs of modern learners in higher education.

### 4.6. Learner Empowerment

Another theme identified in the literature review is the variety of strategies that actively engage learners and nurture their sense of ownership over their learning process, illustrating the effectiveness of microlearning in enhancing learner agency within higher education. Its bite-sized nature allows for flexibility, while supplementary materials enhance understanding and prevent overload (Skalka & Drlik, 2020; Pascual et al., 2021; Netzer & Mittelstädt, 2021; Dewanti & Sulistyaningrum, 2023; Lin et al., 2023). These can include video lectures, infographics, or external links, allowing learners to delve deeper. Mobile accessibility is also crucial, with resources like Zheng's (2021) online sources or Fang's (2018) mobile English materials expanding learning beyond the units themselves. Supplementation can also be practical, like Gill et al.'s (2020) video library or Isibika et al.'s (2022) training resources, leading to better skill retention (Javorcik & Polasek, 2018), whereby learners then use supplementary materials to explore topics further and apply their knowledge through projects (Martinho et al., 2023). Ultimately, microlearning modules act as building blocks, with supplementary materials empowering self-directed learning (Conde-Caballero et al., 2023; Gherman et al., 2021).

The shift towards self-regulated learning reflects microlearning's ability to adapt to individual needs, enabling learners to manage their educational paths with great autonomy. Fang's (2018) study integrates microlearning throughout the learning experience, allowing learners to progress at their own pace and customise learning to their needs and preferences (Olivier, 2021; Susilana et al., 2022; Gherman et al., 2021; Sung et al., 2023; Martinho et al., 2023). Technology plays a key role: Zheng's (2021) platform uses algorithms for personalised learning paths, while Conde-Caballero et al. (2023) leverage TikTok for social engagement and learner control. Gill et al. (2020) use Just-in-Time learning and AR to provide instant access to content, while Tabares et al. (2022) proposes an adaptive feedback model using contextual data for a personalised learning experience. Additionally, learner empowerment is significantly enhanced by continuous assessment and feedback (Skalka & Drlik, 2020; Polasek & Javorcik, 2019). Interactive activities, automated assessments, and revisiting units with quizzes and revision tests all reinforce understanding and combat forgetting. This, along with diverse supplementary resources, fosters learner agency and transforms learning into an enriching experience.

The success of microlearning also centres on its goal-oriented and purposeful design, crucial for enhancing learner autonomy. Marinskaya and Marinskaya (2020) emphasise purposeful design where each unit contributes to the overall learning goals. Romero-Rodríguez et al. (2022) used a goal-oriented methodology within an international collaborative online learning framework to enhance creative competencies. Craig et al. (2023) with soldiers and Fedorova et al. (2022) with maritime learners further illustrate its role in promoting independent learning strategies through structured modules, personalised feedback, and social interaction.

## 5. Discussion

To address the research questions posed in this study, a multifaceted approach is necessary for developing and implementing microlearning strategies within Malaysian higher education. This discussion synthesises best practices that not only enhance

academic performance but also foster skill development and prepare learners for successful careers. Effective microlearning begins with a solid foundation in instructional design principles. Models like Gagne's or ADDIE can be leveraged to ensure structured and impactful learning experiences tailored to specific learner needs. Collaboration with subject matter experts and industry professionals further strengthens the content by ensuring its relevance, currency, and alignment with job market demands. This approach brings real-world application to the forefront, making learning more meaningful for learners. Microlearning content should be focused and targeted, addressing specific learning outcomes with clear objectives. It's crucial to ensure the content directly relates to learners' fields of study and future careers, integrating practical applications that demonstrate the value of theoretical knowledge. To cater to diverse learning styles and preferences, microlearning can incorporate a variety of engaging formats such as videos, podcasts, simulations, and interactive quizzes. Engagement can be further bolstered through interactive elements like quizzes, polls, and games. These elements provide immediate feedback and encourage active learning through practical application. Continuous assessment and feedback mechanisms also play a crucial role, allowing institutions to monitor progress, adapt content, and ultimately foster a responsive learning environment. Finally, recognizing the importance of accessibility, mobile-friendly design allows for on-the-go learning, catering to busy student schedules. This comprehensive approach will not only boost student academic performance and skill development but also equip graduates with the essential tools for career success.

Examining relevant literature reveals several key themes have emerged that demonstrated the effectiveness of microlearning strategies in addressing the diverse needs of learners. The importance of varied microlearning formats such as videos, audio, infographics, and interactive platforms is highlighted. This allows educators to tailor content to different learning styles and subject matter. Studies also indicate the effectiveness of short videos for summarising concepts and podcasts for auditory learners (Netzer & Mittelstädt, 2021; Romanenko et al., 2023). The value of incorporating engaging interactive elements like quizzes, games, and simulations is emphasised by the research. These elements boost engagement, provide immediate feedback (crucial for active learning and retention), and can be customised to challenge learners, leading to deeper understanding (Lee et al., 2021; Mota et al., 2019). The need for flexible delivery options through multiple platforms, including mobile compatibility, is also highlighted. This caters to diverse preferences and facilitates learning beyond the classroom, allowing for just-in-time learning integrated into daily life (Sedaghatkar et al., 2023; Fang, 2018). Finally, learner empowerment through self-directed learning is supported by the literature. Microlearning allows learners to control the pace, time, and scope of their learning, fostering autonomy and improving engagement and retention (Gherman et al., 2021; Zheng, 2021). By implementing these diverse formats, interactive elements, flexible modalities, and supporting learner autonomy, a more inclusive and engaging learning environment in Malaysian higher education can be promoted through microlearning. In essence, the versatility in microlearning formats, the integration of engaging interactive elements, the flexibility of delivery across multiple platforms, and the empowerment of learners through self-directed learning opportunities are all research-backed strategies. These approaches not only enhance the learning experience but also promote inclusivity and engagement, making microlearning a powerful tool in the repertoire of Malaysian higher education institutions.

## 6. Conclusion

The findings from the literature review illuminate the significant role that instructional design (ID) principles, expert collaboration, and focused, relevant micro content play in enhancing the effectiveness of microlearning for micro-credentialing in higher education. These components are critical for creating engaging, impactful, and personalised learning experiences that cater to the evolving needs of learners and the job market. For Malaysian higher education institutions, these insights are invaluable as they navigate the development and implementation of microlearning strategies to foster a skilled, adaptable workforce equipped with relevant micro-credentials. They offer a strategic roadmap for institutions to enhance their educational offerings, making learning more accessible, engaging, and aligned with industry needs.

For learners, the implications are profound. Engaging in microlearning designed around solid ID principles and expert insights means access to education that is both flexible and relevant, enhancing their employability and career progression. Instructional designers are tasked with a pivotal role, translating pedagogical theories into practical, engaging learning experiences. This requires a deep understanding of the learner's needs, the ability to incorporate feedback into the design process, and the creativity to leverage technology in facilitating learning.

For instructional designers, the implications of these findings are multifaceted and highlight the importance of their role in the successful implementation of microlearning and micro-credentialing initiatives within Malaysian higher education. They play a pivotal role in ensuring the success of microlearning and micro-credentialing initiatives. By focusing on collaboration, user-centred design, real-world relevance, technological innovation, flexibility, continuous improvement, and learner empowerment, instructional designers can create impactful learning experiences that prepare Malaysian higher education learners for success in the global job market.

Higher education institutions must embrace these strategies to stay competitive and relevant. This involves not only investing in technology and training for staff but also fostering a culture of collaboration with industry experts to ensure the relevance of their programs. Moreover, institutions need to focus on creating content that resonates with learners, incorporating real-world applications that enhance the learning experience and ensure the transferability of skills to the workplace.

In conclusion, the strategic incorporation of ID principles, expert collaboration, and relevant content into microlearning and micro-credentialing initiatives presents a transformative opportunity for Malaysian higher education. It promises to equip learners with the skills and knowledge needed for success in a rapidly evolving job market, while also enabling institutions to fulfil their role as catalysts for lifelong learning and professional development.

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