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Microlearning helps Alzheimer's Disease Patients

Jiayao Hu

School of Computer Science and Technology, Henan Polytechnic University, Jiaozuo, Henan 454000, PR China

Abstract

Alzheimer's disease is one of the most common diseases in older adults, and as the disease progresses, the need for daily care increases. Caregivers of Alzheimer's Disease patients face a variety of stresses and work pressures. Receiving professional and continuous training is one of the effective ways to improve their skills and competencies. A new approach to education is microlearning, where microeducational content is provided to learners. Microlearning as a pedagogical technique focuses on designing learning modules through micro-steps in a digital media environment. These activities can be integrated into learners' daily lives and tasks. Unlike "traditional" e-learning methods, microlearning often favours technology delivered through push media, thus reducing the cognitive load on the learner. Microlearning educational methods have been shown to be effective and efficient in educating and delivering materials to caregivers of older adults with Alzheimer's disease. This paper begins with a brief introduction to microlearning. And it details the key features and benefits of microlearning. Microlearning offers potential benefits to Alzheimer's Disease patients and their caregivers with its concise and focused approach. Secondly, machine learning enhances the design and delivery of microlearning, helping to provide a more personalised and effective learning experience. Machine learning plays a role in the design of microlearning. To conclude, microlearning offers a promising avenue of support and care for Alzheimer's Disease patients. Microlearning also provides a valuable resource for carers and healthcare professionals to gain the knowledge and skills needed to provide effective care.

Keywords: Microlearning, Alzheimer's Disease, Machine learning, Just-in-Time Learning, Learners, Bite-Sized Learning Units, Caregivers, Healthcare

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*Corresponding author. Email: hjy@home.hpu.edu.cn

1. Introduction of Microlearning

Microlearning is a pedagogical approach that involves delivering educational content in small, easily digestible units or modules, typically lasting just a few minutes [1]. This approach focuses on breaking down complex topics into bite-sized portions, making it easier for learners to absorb and retain information. Microlearning can take various forms, including short videos, interactive quizzes, infographics, podcasts, or text-based lessons [2]. Its primary goal is to provide learners with quick, targeted, and easily accessible knowledge and skills, often catering to their immediate needs and busy lifestyles [3]. Paper structure is shown in Figure 1.

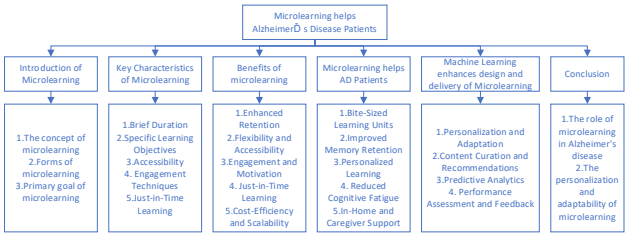

Figure 1. Paper Structure

2. Key Characteristics of Microlearning

Five key characteristics of microlearning are listed below, as shown in Figure 2.

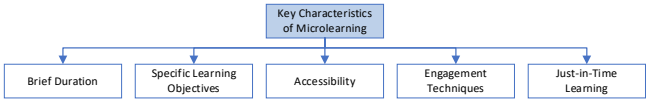

Figure 2. Key characteristics of microlearning

The key to microlearning is the fragmentation of content. One particularly clear point about microlearning is that if the learning content is not designed to be fragmented but is simply a way of using fragmented time to learn, such learning is inherently unproductive. Microlearning places more emphasis on fragmented, modular and tiny learning content. Its key characteristics are mainly manifested in the following aspects, as shown in Table 1:

Table 1. Specific descriptions of key characteristics of microlearning

Key Characteristic of Microlearning	Description of Characteristic
Brief Duration	Microlearning modules are intentionally short, typically lasting a few seconds to 15 minutes. The brevity of these modules is a central characteristic.
Specific Learning Objectives	Each microlearning unit is carefully crafted to address a specific learning objective or topic.
Accessibility	Microlearning content is designed to be easily accessible through various devices, such as smartphones, tablets, or computers. This accessibility enables learners to access the content wherever and whenever they prefer.
Engagement Techniques	Microlearning often incorporates a range of engagement techniques to make the learning experience more interactive and enjoyable.
Just-in-Time Learning	Microlearning excels at providing "just-in-time" learning. Learners can quickly access specific, relevant information when they need it most.

2.1. Brief Duration

Microlearning modules are intentionally short, typically lasting a few seconds to 15 minutes [4]. The brevity of these modules is a central characteristic [5]. Shorter content chunks align with the understanding that learners have limited attention spans, especially in today's fast-paced digital age [6]. The goal is to convey specific information or skills efficiently without overwhelming the learner with an information overload [7].

2.2. Specific Learning Objectives

Each microlearning unit is carefully crafted to address a specific learning objective or topic [8]. Unlike traditional courses that may cover a broader subject, microlearning hones in on a single, key concept or skill [9]. This specificity is a deliberate feature to ensure that the learning material is highly focused and directly relevant to the learner's immediate needs [10].

2.3. Accessibility

Microlearning content is designed to be easily accessible through various devices, such as smartphones, tablets, or computers [11]. This accessibility enables learners to access the content wherever and whenever they prefer. It caters to the modern learner's desire for on-the-go learning and the convenience of accessing educational content at their fingertips [12].

2.4. Engagement Techniques

Microlearning often incorporates a range of engagement techniques to make the learning experience more interactive and enjoyable [13]. These may include elements such as gamification, storytelling, multimedia components (e.g., videos, images), and interactive quizzes [14]. By making the learning experience more engaging, microlearning enhances information retention and motivation to complete the modules [15].

2.5. Just-in-Time Learning

Microlearning excels at providing "just-in-time" learning [16]. Learners can quickly access specific, relevant information when they need it most – whether it's for problem-solving at work, addressing an immediate knowledge gap, or gaining a new skill for an upcoming task [17]. This characteristic aligns with the practical and immediate nature of microlearning, making it a valuable resource for professionals and lifelong learners.

In summary, the key characteristics of microlearning underscore its effectiveness as a learning strategy [18]. Its brief duration, specific learning objectives, accessibility, engagement techniques, and focus on just-in-time learning create an efficient and engaging learning experience [19]. These features cater to the needs of modern learners who seek quick, relevant, and engaging educational content that fits seamlessly into their busy lives and on-the-spot learning requirements [20].

3. Benefits of microlearning

The benefits of microlearning are introduced below, as shown in Figure 3.

Figure 3. Benefits of microlearning

Microlearning refers to the process of breaking down large chunks of information into smaller chunks that are more conducive to the learner's digestion and assimilation. Although this concept has evolved with trends such as mobile internet and fragmented learning, in reality, the core process of learning is essentially microlearning. Listed below are a few of the benefits of microlearning, as shown in Table 2:

Table 2. Several Benefits of Microlearning

Benefit of microlearning	Detailed description
Enhanced Retention	Microlearning's concise and focused nature enhances information retention. By breaking down complex topics into bite-sized units, learners can absorb and remember key concepts more effectively.
Flexibility and Accessibility	Microlearning is highly flexible and accessible. Learners can access microlearning modules at their convenience, whether they're at work, at home, or on the go.
Engagement and Motivation	Microlearning modules are designed to be engaging and interactive. Elements like gamification, quizzes, and multimedia components capture learners' attention and maintain their motivation.
Just-in-Time Learning	Microlearning is well-suited for providing "just-in-time" learning, allowing learners to access specific, relevant information precisely when they need it.
Cost-Efficiency and Scalability	Creating microlearning content is often more cost-effective than developing traditional, lengthy courses. Furthermore, its scalability allows for the dissemination of consistent and standardized training materials across diverse groups.

3.1. Enhanced Retention

Microlearning's concise and focused nature enhances information retention. By breaking down complex topics into bite-sized units, learners can absorb and remember key concepts more effectively [21]. The short duration of microlearning modules prevents cognitive overload, allowing learners to concentrate on one specific idea or skill at a time [22]. This targeted learning approach improves memory recall, making it more likely that learners can apply what they've learned in practical situations [23].

3.2. Flexibility and Accessibility

Microlearning is highly flexible and accessible [24]. Learners can access microlearning modules at their convenience, whether they're at work, at home, or on the go [25]. This flexibility is particularly advantageous for busy professionals, as they can fit short learning sessions into their daily routines [26]. The content is often available on a variety of devices, including smartphones and tablets, further enhancing accessibility and convenience [27].

3.3. Engagement and Motivation

Microlearning modules are designed to be engaging and interactive. Elements like gamification, quizzes, and multimedia components capture learners' attention and maintain their motivation [28]. The brevity of microlearning content prevents boredom and disengagement that can occur during longer, monotonous training sessions [29]. Learners often find microlearning enjoyable and rewarding, leading to higher completion rates and increased enthusiasm for learning [30].

3.4. Just-in-Time Learning

Microlearning is well-suited for providing "just-in-time" learning, allowing learners to access specific, relevant information precisely when they need it [31]. This aspect is particularly beneficial in professional settings, as it facilitates problem-solving, quick knowledge acquisition, and the development of skills needed for immediate tasks [32]. It aligns with the practical, immediate, and on-demand nature of modern work environments [33].

3.5. Cost-Efficiency and Scalability

Creating microlearning content is often more cost-effective than developing traditional, lengthy courses [34]. Microlearning modules can be produced relatively quickly, and they can be easily updated or adapted as needed [35]. This cost-efficiency makes microlearning an attractive option for organizations and institutions looking

to deliver training and education to large audiences [36]. Furthermore, its scalability allows for the dissemination of consistent and standardized training materials across diverse groups [37].

In conclusion, microlearning's benefits, including enhanced retention, flexibility, engagement, just-in-time learning, and cost-efficiency, make it a valuable approach to education and training [38]. It addresses the evolving needs of learners in a fast-paced, technology-driven world, and it can significantly contribute to improving knowledge acquisition and skill development for individuals and organizations [39].

4. Microlearning helps AD Patients

Microlearning, with its concise and focused approach, offers several potential benefits for Alzheimer's Disease (AD) patients and their caregivers, as shown in Table 1:

Table 3. Microlearning helps AD Patients

Microlearning technology	Benefit of microlearning for AD
Microlearning allows information to be broken down into small, manageable units.	Enable AD patients to learn and retain basic information without the cognitive pressure associated with long-term learning.
Microlearning focuses on short, specific goals.	Enhance the memory of AD patients. Helping them remember basic tasks, names, or daily routines improves their quality of life and independence.
Microlearning can be tailored.	Meeting the individual needs and abilities of AD patients.
The simplicity of microlearning allows individuals to focus on short-term, achievable goals.	Alleviating the cognitive fatigue often experienced by AD patients. when faced with a wide range of cognitive tasks.
Microlearning is a valuable tool for healthcare professionals.	Caregivers can use microlearning to educate themselves on how to manage AD patients.

4.1. Bite-Sized Learning Units

AD patients often struggle with memory and cognitive impairments, making it challenging to engage in traditional, lengthy learning activities [40]. Microlearning breaks down information into small, manageable units, which can be less overwhelming for individuals with AD. These bite-sized modules allow patients to learn and retain essential information without the cognitive strain associated with longer sessions [41].

4.2. Improved Memory Retention

Microlearning's focus on brief, specific objectives can enhance memory retention for AD patients. Repetition and reinforcement of key concepts in short intervals can help reinforce learning and improve recall [42]. Caregivers can use microlearning techniques to help AD patients remember essential tasks, names, or daily routines, improving their quality of life and independence.

4.3. Personalized Learning

Microlearning can be tailored to meet the individual needs and capabilities of AD patients. Caregivers and family members can create customized microlearning modules that address specific challenges or areas of interest for the patient. This personalization ensures that the learning experience is highly relevant and engaging for the individual.

4.4. Reduced Cognitive Fatigue

AD patients often experience cognitive fatigue when faced with extensive cognitive tasks. Microlearning's brevity helps mitigate this fatigue by allowing individuals to focus on short, achievable goals. This can lead to increased motivation and participation in learning activities, promoting mental stimulation and preventing further cognitive decline.

4.5. In-Home and Caregiver Support

Microlearning can be a valuable tool for caregivers, family members, and healthcare professionals who work with AD patients. Caregivers can use microlearning to educate themselves on AD management, including effective communication, behavioral strategies, and safety measures. This can improve the quality of care provided and reduce caregiver stress.

5. Machine Learning enhances design and delivery of Microlearning

Machine learning [43] is essentially having a computer learn the patterns in the data itself and make predictions about future data based on the patterns obtained [44]. Machine learning has evolved over the decades and has spawned many classifications, which can be categorised as supervised learning [45], semi-supervised learning [46], unsupervised learning [47] and reinforcement

learning according to the mode of learning [48]. The classifications of machine learning are shown in Figure 4.

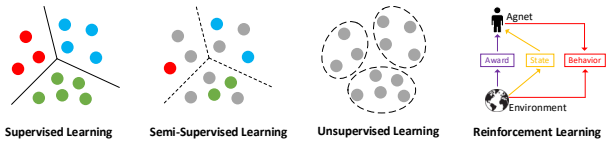

Figure 4. Classifications of Machine Learning

Machine learning (ML) [49] has the potential to significantly enhance the design and delivery of microlearning [50], contributing to more personalized and effective learning experiences [51]. Here's how machine learning can play a role in the design of microlearning, as shown in Table 2:

Table 4. The role machine learning plays in microlearning

The role of machine learning for microlearning	Specific performance
Personalization and Adaptation	Machine learning algorithms can analyze learner data, such as preferences, performance, and behavior, to personalize microlearning content.
Content Curation and Recommendations	Machine learning can automate the process of curating and recommending microlearning content.
Predictive Analytics	Machine learning can employ predictive analytics to forecast future learning needs.
Performance Assessment and Feedback	Machine learning can evaluate learner performance and provide real-time feedback within microlearning modules.

5.1. Personalization and Adaptation

Machine learning algorithms can analyze learner data, such as preferences, performance, and behavior, to personalize microlearning content [52]. By understanding individual learning styles and needs, ML can recommend [53] specific microlearning modules that are most relevant and engaging for each learner. This adaptability ensures that learners receive content that matches their proficiency and interests, optimizing the learning experience.

5.2 Content Curation and Recommendations

ML can automate the process of curating and recommending microlearning content [54]. It can analyze a vast amount of educational resources, identifying the most suitable modules for a particular learner or topic [55]. This capability is especially valuable for educators and organizations, as it streamlines the content creation process and ensures that learners have access to high-quality, up to date microlearning modules.

5.3. Predictive Analytics

Machine learning can employ predictive analytics to forecast future learning needs [56]. By analyzing past interactions and performance, ML [57, 58] can anticipate the skills or knowledge areas that learners may need to focus on next. This enables educators to proactively design and provide microlearning content to address upcoming requirements, ensuring that learners stay ahead of their learning goals [59].

5.4. Performance Assessment and Feedback

Machine learning [60, 61] can evaluate learner performance and provide real-time feedback within microlearning modules [62]. It can assess quizzes, simulations, or interactive exercises, offering learners instant insights into their strengths and areas that need improvement [63]. Adaptive feedback can guide learners toward revisiting specific modules or exploring related content to enhance their understanding.

In conclusion, machine learning plays a pivotal role in the design of microlearning by offering personalization, content curation, predictive analytics, and performance assessment. These capabilities improve the efficiency and effectiveness of microlearning, resulting in more engaging and tailored learning experiences for individuals. As machine learning technology continues to evolve, it is likely to further refine and optimize the microlearning process, making it a valuable tool in education and training.

6. Conclusion

Microlearning offers a promising avenue of support and care for individuals living with Alzheimer's disease. Its bite-sized, easily digestible approach to learning aligns well with the specific needs and challenges faced by AD patients. The concise nature of microlearning modules allows individuals to access and retain essential information [64] without the cognitive strain associated with traditional, lengthy learning sessions. This approach

can significantly enhance memory retention, reinforce cognitive functions, and promote a higher quality of life for AD patients.

The personalization and adaptability of microlearning are key strengths in tailoring content to the individual needs and capabilities of AD patients. Caregivers and family members can create customized modules that address specific challenges, making the learning experience highly relevant and engaging for the individual. By providing cognitive stimulation in a manageable format, microlearning can help reduce cognitive fatigue and increase motivation, ultimately leading to a more active and fulfilled life for AD patients.

In addition, microlearning serves as a valuable resource for caregivers and healthcare professionals, allowing them to acquire the knowledge and skills needed to provide effective care. By offering in-home and caregiver support, microlearning can lead to better quality care, improved communication, and a reduction in caregiver stress.

While microlearning cannot cure Alzheimer's disease, it can play a supportive role in managing the condition and enhancing the well-being of individuals with AD. As technology and understanding of AD continue to evolve, microlearning holds great promise in contributing to the overall care and support of those living with this challenging condition.

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Conflict of Interest
The author declares there is no conflict of interest regarding this paper.

Data Availability Statement
There is no data associated with this paper.

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