Designing for Doctors in Training: User-Centered Design for Digital Continuing Medical Education

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Abstract
Continuing education for professionals is becoming increasingly important, especially in complex socio-technical settings like healthcare, to ensure up-to-date clinical competence. Digital learning platforms offer flexibility and accessibility, but often fail to align with the realities of clinical work. This qualitative study explores how User-Centered Design (UCD) principles can improve the design and effectiveness of digital continuing medical education (CME). The research setting is in Swedish healthcare, and focuses on a digital learning platform used by resident doctors as part of their specialist training. Guided by UCD and adult learning theories, the study draws on semi-structured interviews to examine user experiences, challenges, and preferences. Thematic analysis identified key areas affecting platform use, including content relevance, usability challenges, unclear communication, learning formats, workload constraints, and specific suggestions for improvement, such as personalization and flexible design. The findings highlight socio-technical issues where system design affects user behavior and organizational outcomes, and contribute practical recommendations for platform development, emphasizing the importance of involving end-users in the design and evaluation of digital CME tools to enhance engagement, usability, and learning outcomes. Theoretically, this study illustrates how digital learning is embedded in the social context of clinical work, extending discussions on user-centered digital learning in healthcare settings.

Keywords
Continuing Medical Education, Healthcare, Learning platforms, Socio-technical perspective, UserCentered Design

1. Introduction

The digitalization of society has rapidly transformed the way we work, live, and learn. In many professions, including healthcare, professionals must continually update their knowledge and skills to remain relevant in their professional roles and practices throughout their careers [1]. The need for ongoing education is particularly critical for doctors who must keep up with emerging diseases, new treatments, and advances in medical technology to maintain clinical competence and ensure patient safety [2, 3]. The complexity of healthcare systems is increasing, with greater emphasis on interdisciplinary collaboration, patient-centered care, and evidence-based practice [4]. Ethical challenges, data privacy issues, and evolving regulatory requirements add further layers of responsibility. As a result, the ability to engage in continuous learning and apply new knowledge in real-time clinical decision-making has become a critical competency [5]. Continuing medical education (CME) is considered a fundamental and integrated part of healthcare work, defined as any activity intended to maintain, develop, or increase the knowledge, skills, and professional performance that doctors use in patient care [6].

In the context of CME, digital tools can play an important role in ensuring that doctors continuously develop and refine their skills, opening new possibilities for learning by offering flexibility, accessibility, and self-paced education [7, 8]. These tools include e-learning platforms, mobile apps, virtual simulations, and interactive modules, all of which can support professional skill development. However, as highlighted in previous research, designing, using, and managing healthcare information systems involves complex, dynamic, and socio-technical challenges [9, 10]. For digital learning platforms to be effective and truly support learning, they must be designed with the user in mind, understanding not just what doctors need to learn but also how, when, and why they are likely to engage with digital education. Previous studies have reported recurring challenges in digital CME, including limited interactivity, a lack of clinical relevance, poor alignment with work routines, and platform navigation issues that hinder learner engagement [7, 11, 12]. For resident doctors, who are still undergoing specialization while managing clinical duties, CME is both a necessity and a challenge. These doctors need educational opportunities that are flexible, focused, and manageable within tight schedules [13]. As the demands on healthcare workers increase, the delivery format of CME becomes just as important as the content. Poorly designed learning experiences can add to the burden rather than support professional growth [14].

In this paper, we argue that a stronger focus on user feedback and real-world practice conditions is necessary when designing learning platforms that consider the dependency between the context and the system to better assist doctors in maintaining and developing their skills. User-centered design (UCD) offers a practical and evidence-based approach to addressing the mentioned challenges, as it emphasizes designing systems that are grounded in a deep understanding of users' behaviors, needs, and work environments [15]. Rather than relying on assumptions, this approach involves users throughout all stages of development, from identifying problems to prototyping and testing, ensuring that the final product is both usable and meaningful in real-world contexts [16]. While digital education has been widely studied in higher education and formal academic settings, there is comparatively less research examining how digital platforms support informal, self-directed learning for healthcare professionals within clinical environments. This qualitative study addresses that gap by exploring the lived experiences of resident doctors using a digital CME platform within a Swedish hospital setting. Resident doctors are a particularly relevant user group because their learning is embedded in time-pressured, unpredictable work settings that demand both flexibility and relevance. The aim of the study is to identify and analyze how current platform design supports or hinders learning within the context of clinical work, and to develop recommendations grounded in user experience and educational theory. By focusing on the specific user group of resident doctors in specialist training, this research contributes both theoretical insights into the applicability of UCD in medical education and practical guidance for improving digital learning environments in healthcare. We pose the following research question: *How could digital learning platforms be designed to support the continuing medical education of resident doctors?*

The remaining part of the paper is structured as follows: Section 2 presents related research on digital learning in medical settings, followed by a presentation of theories on adult learning and user-centered design that have guided the paper. Section 3 outlines the methodology used for data collection and analysis. The empirical findings from interviews with resident doctors are presented in Section 4 and further discussed in Section 5. Finally, Section 6 presents our conclusion, highlighting the study's contributions, implications for practice, limitations, and suggestions for future research.

2. Related research

Among the medical workforce, resident doctors face unique challenges in engaging with continuing medical education (CME). These doctors are still in training while working full-time in hospitals, often under high pressure. Traditionally, CME was delivered through face-to-face workshops, conferences, and seminars, allowing doctors to meet experts, attend lectures, and sometimes participate in hands-on training [17]. While these formats are useful, they often require

doctors to take time off from work, travel to other cities, and adjust their schedules. Many find it challenging to balance ongoing learning with the demands of daily practice. Therefore, if CME is not flexible, targeted, and efficiently delivered, it risks being sidelined or seen as a burden. [8]. Digital learning platforms are often suggested as alternative learning formats that align with residents' limited time and support their learning goals in a more convenient and realistic way. However, while digital platforms offer convenience and flexibility, they often fail to deliver effective or engaging learning experiences. Resident doctors report frustration with systems that are poorly designed, difficult to navigate, and filled with content that is either too basic, outdated, or disconnected from their daily clinical practice [12]. In addition, some platforms are text-heavy, overly lengthy, or lack interactive features that support active learning, which can reduce user motivation and limit the practical benefits of the training. One contributing factor to these challenges is that the design and development of many learning platforms often proceed without involving the intended users [16].

Understanding how doctors prefer to learn is therefore essential for designing effective digital platforms. Doctors juggling clinical responsibilities tend to favor platforms that allow them to set their own pace while also offering chances for collaboration and community. Although flexibility is appreciated, there is still a strong need for personal feedback, social interaction, locally relevant content, and active dialogue, rather than passive modules [11, 18, 19]. Previous studies have highlighted the importance of balancing these dual demands for self-paced learning, which supports individual autonomy, with collaborative features that foster community and engagement in digital learning [20, 21]. The importance of contextual relevance is another key aspect. Self-directed learning is not just about individual motivation. It is shaped by whether learners can realistically integrate digital content into their daily workflows [7, 17, 22]. Several studies suggest that digital learning environments can strengthen applied knowledge and decision-making skills, particularly when they are integrated into broader learning processes and mirror real clinical environments [23]. Digital clinical reasoning tests, for example, can encourage deeper reflection and self-study, especially when combined with clear performance feedback [24]. Simulation-based tools can provide a safe space for learners to engage with complex scenarios, allowing them to practice without fear of real-world consequences and develop clinical reasoning under pressure [12].

While previous research offers valuable insights into the potential and challenges of digital CME platforms, studies often emphasize user satisfaction and access to resources while overlooking context-specific design strategies or implementation barriers [12]. Flexibility and self-paced learning are widely appreciated, but interaction and feedback are also essential features, highlighting the importance of connecting with peers, receiving personalized feedback, and engaging in reflective practice as integral parts of all learning. Highly tailored content suited to specific roles [19] and modular, self-paced digital learning have been shown to work well in healthcare settings because they fit the work routines of healthcare professionals, aligning with their schedules and feedback [25]. Beyond high-quality content, digital learning needs to reflect the real working lives and learning preferences, including, for example, virtual case discussions or team-based learning, to sustain engagement over time [7, 12, 21, 25].

Taken together, findings from the literature show that when digital learning platforms are thoughtfully designed, they offer important benefits such as flexibility, improved access to learning, and professional growth. However, aligning with the socio-technical approach, their effectiveness is shaped not just by technology, but by how well they are adapted to the needs, work routines, and learning cultures of medical professionals. The importance of designing learning technologies around the real needs and daily routines of users has long been emphasized in participatory approaches to design and development, where users are not passive recipients but active co-creators of the system [26, 27]. Socio-technical co-design can be applied to collaboratively design digital technology, educational content, and social situations within the same process [30]. As studies in healthcare demonstrate, it can also involve doctors in co-designing the content of a learning platform and utilizing it for collaboration and knowledge sharing [28]. A growing body of

research indicates that user experience (UX) and design quality have a significant impact on the effectiveness of digital learning platforms. This reflects a broader trend towards UCD, which calls for involving end users in all phases of development, from identifying problems to evaluating prototypes. As shown in [16], co-design with residents in virtual care settings led to tools that were more aligned with clinical workflows. Similarly, engaging students with emotionally and cognitively challenging content through an interactive "digital escape room" increased both user satisfaction and knowledge retention [12]. Prior studies focusing on resident doctors [7] identified three key design factors that influence platform usability: socio-technical (ease of integration with clinical systems), educational (alignment with learning goals), and administrative (clarity of structure and support).

In summary, there is an increasing interest in understanding how digital learning platforms can be co-designed, not only for convenience and static content delivery, but with a strong emphasis on usability, pedagogical quality, and clinical relevance to support meaningful learning outcomes [7, 8, 25]. This paper builds on and contributes to the literature on digital learning in the context of continuing medical education. In the following section, we outline the theoretical framework of the study, focusing on user-centered design and adult learning theory, which provide a foundation for understanding the design and evaluation of digital learning platforms for resident doctors.

3. Theoretical framework

The theoretical framework that underpins this study is based on user-centered design (UCD) and adult learning theory to help explain how digital learning environments can be structured to support continuing medical education in clinical settings.

UCD theory is both a philosophical framework and a practical approach that focuses on actively involving users throughout the design and development process to ensure that their needs, behaviors, and experiences are at the center of the design process [32, 33]. Rather than assuming what users need, UCD emphasizes direct consultation with users, observation of their behavior, and incorporation of their feedback during requirements gathering, prototyping, and usability testing [29]. UCD can vary in intensity, from minimal user consultation to deep partnerships where users co-create products with designers. Key practices include needs analysis, iterative testing, and involving stakeholders such as primary, secondary, and tertiary users [29]. The ultimate goal is to produce systems that are easy to learn, efficient to use, and aligned with users' real-world workflows and mental models. The principles of UCD are not new; they build upon decades of work in the Scandinavian socio-technical tradition of participatory design, which has since the 1970s advocated for democratic and collaborative approaches to system development. This tradition holds that users, particularly those affected by workplace technologies, should be actively involved in shaping the tools they use [26, 27, 30]. These inherently socio-technical values remain as relevant and continue to influence the contemporary design and development of information systems. It emphasizes a critical and reflective approach that reinforces the idea that system effectiveness depends not only on technical performance but also on how well it aligns with users' social, professional, and organizational contexts [10, 31].

Since its early formulation, UCD theory has continued to evolve, incorporating new methods and responding to emerging challenges in technology development. Usability testing became a core component, emphasizing the importance of observing users performing real tasks to identify issues and improve designs [29]. However, UCD's growth also introduced challenges, such as the need for resources and longer development timelines, as involving users throughout all stages of the design and evaluation process through interviews, prototyping, and testing requires time, funding, and interdisciplinary coordination [32]. Still, UCD remains a leading approach for ensuring that technology is human-centered, adaptable, and effective in a wide variety of application areas.

Adult learning theory emphasizes the distinct ways adults approach learning and argues that adult learners possess unique characteristics, such as a preference for autonomy, practical application, and using past experiences as a foundation for learning [33]. These studies recognize

that adults bring prior knowledge, experiences, and specific learning needs into educational settings, requiring approaches different from traditional childhood education [33, 34]. Over time, adult learning theory has become foundational for professional development, workplace learning, and continuing education initiatives. It emphasizes several key principles that distinguish adult learners from younger students, such as that that they are self-directed, internally motivated, and focused on learning that addresses real world problems [33] In medical context, Taylor and Hamdy [34] further argue that learning in medical education must integrate multiple adult learning approaches such as experiential learning, reflective practice, and problem-based learning to accommodate doctors' need for contextualized, practice-oriented education. Adults value learning experiences that build on their prior knowledge, are relevant to their current professional roles, and offer opportunities for immediate application. Learning environments should therefore be collaborative, respect learners' autonomy, and encourage active participation and reflection [28]. Designing educational initiatives around these principles increases engagement, enhances knowledge retention, and supports the development of meaningful skills for adult learners in various contexts, recognizing that adult learners benefit from opportunities to collaborate, reflect, and apply knowledge in authentic contexts [33]. Rather than viewing adults as passive recipients of information, adult learning theory positions them as active participants in their own development. Adult learners are motivated by internal factors, value relevance, and seek learning opportunities that are problem-centered and applicable to their professional lives [33], and medical professionals in particular, require flexible, clinically relevant learning embedded in their practice context [34]

Together, UCD and Adult Learning Theory provide a foundation for examining digital learning platforms in the context of medical education. UCD focuses on the development of digital learning platforms based on the needs, behaviors, and real-life contexts of users. Adult Learning Theory explains how adult learners, such as resident doctors, engage most effectively with learning that is relevant, problem-oriented, and self-directed.

4. Methodology

The research approach is qualitative, aiming at understanding how digital learning platforms can be designed to support continuing medical education for resident doctors. The study setting is in Swedish public healthcare, at one of the larger non-university hospital groups that serve as training sites for approximately 250 resident doctors undergoing specialist training. The digital learning platform (hereinafter referred to as 'the learning platform') currently includes six courses designed to support their ongoing medical training, combining both online and offline learning elements. The digital components consist of recorded lectures, reading materials, quizzes, and interactive activities, while the offline parts may involve practical exercises or group-based discussions. The goal of the learning platform is to offer flexible access for resident doctors to complete training despite busy clinical schedules. However, concerns have been raised about whether the platform's structure, interface, and content truly meet the needs of resident doctors. Some feedback suggests that the system may not be fully aligned with the pace and demands of their working environment. This study aims to explore these concerns in more detail, focusing specifically on the experiences and perspectives of resident doctors.

Empirical data were collected through a total of seven interviews, conducted with resident doctors working at the selected hospital at the time. Respondents were selected through purposive sampling [35] based on their direct involvement in specialist training and regular use of the hospital's digital learning environment. Semi-structured interviews were chosen to allow for a balance between consistency and flexibility, ensuring that key themes were explored while giving respondents space to elaborate on their individual experiences. An interview guide was developed, and a pilot interview was conducted prior to the main data collection. The pilot interview was not included or analysed as part of the empirical data but helped assess whether the questions were understandable, relevant, and appropriately sequenced. Minor adjustments were made based on feedback from the pilot interview, improving the flow and clarity of the final interview protocol.

Interviews were conducted via secure video conferencing, depending on the respondent's availability and preference. Each interview lasted approximately 30 to 45 minutes. All sessions were audio recorded with informed consent and transcribed verbatim. Ethical principles were observed throughout the entire process, in accordance with good research practice as outlined by the Swedish Research Council [36].

Table 1
Presentation of data collection

Source of Data	Type of Data	Use in the Analysis
Semi-structured interviews with resident doctors (R1-R7)	Audio recordings and verbatim transcripts	Used for thematic analysis to explore patterns in user experience and platform interaction
Participant descriptions of learning experiences with the learning portal	Direct quotes and narratives	Informed theme development related to usability, relevance, engagement, and barriers
Observations on resident doctors' reflections and responses	Interviewer notes	Provided additional context for thematic coding and ensured accuracy in interpretation

The transcribed interviews were analyzed through thematic analysis, following Braun and Clarke's [37] six-phase approach, to explore how resident doctors experience the digital learning platform. The purpose of this method was to identify recurring patterns across the interview data and provide a rich, grounded understanding of participants' perspectives. Themes were then refined, clearly defined, and checked for coherence and distinctiveness. Special care was taken to maintain the context of participants' narratives, avoiding over-fragmentation during the coding process. This helped preserve the richness and meaning of their responses while highlighting common patterns. In total, seven interviews were conducted and included in the final analysis. In the analysis, the final interview did not introduce any additional themes, but it confirmed and strengthened the patterns identified in the previous interviews. Since no new concepts were identified in the last interview, the research group determined that the main patterns and findings had been thoroughly captured. Respondent validation, also known as member checking, allowed participants to reflect on the interpretations of their input, helping to ensure that findings genuinely represent their experiences. These practices enhance both credibility and confirmability, key markers of quality in qualitative research [35].

5. Findings

The findings are presented below based on six interrelated themes derived from the analysis, which illustrate how resident doctors interact with, make sense of, and sometimes resist the learning platform within the context of their specialist training. Table 2 presents a summary of the key themes, along with example codes, participant quotes, and short interpretive notes to explain their relevance.

Table 2.
Representation of codes and themes

Codes	Themes	Description	Example transcript

Not specialty-specific Used for registration Info comes via email Not used in practice Too general	Relevance of platform content to clinical practice.	Platform content feels too general and is not useful for residents' specific specialties or daily practice.	*"Like for my daily work as a doctor, it doesn't really help me that much."*
Login issues Poor search results Confusing navigation Inconsistent layout Not intuitive Hard to find content	Navigation and usability challenges as a barrier to learning	The platform is difficult to navigate, with login issues, poor search functionality, and inconsistent layouts causing frustration.	*"[...] I tried to find a course, I cannot find what I'm looking for, or I find too much... Yeah, the navigation part, mostly."*
Unclear requirements Email dependent Missing timeline Inconsistent info Not sure what's relevant	Communication, expectations and passive engagement	It's unclear what residents need to do and when. They often rely on emails instead of the platform for guidance.	*"I've only done the ones I got an email about, that you have to do this, then I've done them."*
Prefers in-person Likes mix format Likes videos Likes interactive	Learning format preferences	Residents prefer a mix of formats to suit different learning needs.	*"[...] So, for me, it would be better to use an interactive learning base."*
No time at work Studies at home Admin eats study time Too busy for platform Only if required Workload delay	Workload impact and structural invisibility	Heavy workloads limit time to use the platform. Most engage with it outside of work hours.	*"Usually outside of the work. Late at night before the course starts, if there is an assignment I need to take in or usually before the deadline."*
Simplify login Better navigation Make user-friendly Add useful content More specialty content	User-driven suggestions for personalization and flexible design	Residents want simpler login, clearer structure, better navigation, and more relevant, specialty-based content	*"[...] I'd like to see different sections like video courses, required courses, etc. so, I can easily find what I need without guessing or searching too much."*

5.1.   Relevance of platform content to clinical practice

A recurring concern across interviews was that the content offered often lacks specificity and direct relevance to the residents' clinical practice. Notably, respondents working in specialized fields such as psychiatry and internal medicine found the content too broad or generic to meet their practical and educational needs: *"Not very much, especially because it's not really tailored to psychiatry. The content is more general, not focused on my specialty."* (R6). Similarly, respondents highlighted the disconnect between the platform's course offerings and the day-to-day realities of their work: *"They are not specific for internal medicine. They are more broad courses that are required*

for every kind of residency [...]” (R4), and emphasized that the learning platform was not their preferred platform for actual learning: *“I have never used the learning platform for the purpose of it's like if I want to learn something I don't go to the learning platform. 90% of the time is because I have to”* (R5). These perspectives suggest a common frustration among respondents, in that they perceive the platform as fulfilling administrative requirements while failing to support deeper, specialty-specific learning.

However, respondents also shared more nuanced and positive views, as reflected in the following quote, acknowledging that while not all courses were completed, those that were felt appropriate and useful: *“I think it's the material is really good the courses. I've taken are really good, so. I think it's fine.”* (R1). Likewise, although the limited medical value for daily work was acknowledged, the platform's role in providing access to required formal education was still recognized: *“For my daily work as a doctor, it doesn't really help me that much but for the A and B targeted courses, I think the the learning platform is quite good because you can find all these courses here”*.

5.2.   Navigation and usability challenges as a barrier to learning

Many respondents experienced problems with navigation in the learning platform, partly related to the broad scope and lack of targeting, designed for the entire region: *“for both nurses and doctors and other specialties. So, it's very diffuse and hard to navigate.* (R3). Several participants described difficulties locating specific courses or understanding how to navigate the platform. One respondent described their repeated confusion when using the system: *“I feel like I'm a bit confused always when I'm in the learning platform, like I'm clicking around and I don't really understand what will happen[...]”* (R1). This sense of disorientation was echoed also by other resident doctors, who found the layout inconsistent and unhelpful across courses: *“Each course has its own style. So, it's not the same for each course within the learning platform. So, I don't like that as well because it doesn't give an easy-to-use structure”* (R3).

The platform's lack of filters or sorting mechanisms was another source of frustration, as one respondent pointed out, referring to initial confusion during login and overwhelming search results, particularly when trying to find relevant material: *“The login in the learning platform was a little bit strange. When I just search, I see what comes up. You go through so much stuff* (...) *Alphabetic relevance is not really relevant, it could be based on, like, required regional courses or subject.”* (R5). The platform's lack of intuitiveness and the amount of time spent searching were often emphasized: *“Yes, it's hard to find what I need. The layout isn't user-friendly. I spend too much time searching.”* (R7), along with a critique of the lack of instructions: *“[...] I often have to search a lot to find what I'm looking for.”* (R6). In contrast, however, one respondent had a notably different experience, describing the platform as straightforward and showing little frustration: *“Pretty straightforward, I suppose. No complications, really.”* (R4). Another respondent also provided a more ambivalent view, acknowledging that it was "cluttered" but manageable for their purposes: *“I think like as I mentioned I think it's a bit cluttered and it's hard to really understand what I have to do or even why”* (R2).

5.3.   Communication, expectations and passive engagement

Across the interviews, respondents expressed that the learning platform often lacks clarity, in terms of clear communication of expectations, such as what courses to take, what assignments are required, and when tasks must be completed: *“I think, I know there are obligatory things you have to do. But I saw it now, I haven't done all of them. I've only done the ones I got an email about [...]”* (R1). The respondents shared these feelings of uncertainty about what was expected of them when using the platform, sometimes resulting in missed obligations: *“Honestly, I don't really go to the learning platform that often. So, it's very easy to miss something that you actually have to do.” (R2).* Interestingly, most respondents reported that they rely heavily on email communication outside of the platform itself to receive instructions: *“We don't actively use the platform for planning. We*

receive instructions via email, then go to the platform to register or report." (R6), and direct access to the relevant content: *"Most often we get like an email from the hospital that this course has to be done, click here, and then it's easier to find that way."*(R3).

However, clarity may vary depending on the individual course: *"[…]Partly depending on the course, they have given you information on what to do and so on, yeah."* (R3). Some respondents expressed more positive experiences regarding communication, describing the course information as sufficient: *"I think it has all the courses that we need to apply to. So, I would say it does the job well." (R4),* highlighting that course requirements and preparation instructions were typically provided: *"They usually explain the assignments and then we can also easily access it in the learning platform the requirements for attending the course are enlisted there in the first page."* (R5). Despite this relative clarity, respondents mentioned that they had not used the platform frequently in recent months, suggesting that their memory of these processes might be limited or outdated. While some respondents found the platform sufficient in providing course-related information, the learning platform was generally experienced as something to be "checked off" when required.

5.4.   Learning format preferences

The interviews revealed diverse preferences when it comes to learning formats, but it was evident that respondents generally emphasized a preference for interactive and practical learning experiences, beyond passive digital content. As one respondent noted: *"I prefer videos and documents. I don't use interactive modules much. In general, I learn better from books or from in-person teaching with a supervisor."* (R6) In-person learning was also favored because screen-based sessions were perceived as tiring and less engaging: *"I personally prefer in person, it's much more tiring to be focused on a screen, especially when three people are holding a lecture."* (R5).

Videos were perceived as helpful when they're relevant and not too long, but respondents also appreciated the flexibility of reading: *"Visual content is nice, but sometimes it's nice to just like read a document because you can do it whenever you want"* (R2). Respondents expressed appreciating variety in learning channels, suggesting that seeing, hearing, and reading the same material through different formats helped with memory and comprehension: *"I like when you're learning something that you kind of it's a way to learn something so you actually know it you read it in a book and then you see it online in a video […]"* (R1). Even when digital formats are used, respondents generally emphasized that engagement and structure matter more than the medium itself and there was a shared view that content should be aligned with the topic and learning goal. As one respondent explained: *"It all depends on the type of course that you take I don't think the learning platform has been a platform useful for digital content." (R5).* The importance of combining theory with real-world practice was highlighted: *"Probably a mix of both, because you learn all the practical things, but you're also required to read up on the theoretical matters."* (R6). Generally, the participating resident doctors preferred short, visual, and interactive content, particularly videos, a preference reflecting their need to learn in short bursts during unpredictable and high-pressure clinical schedules.

5.5.   Workload impact and structural invisibility

The influence of clinical workload and time constraints on the resident doctors' ability to engage with the learning portal was a prominent theme across the interviews. Some respondents found time during work hours to engage with the platform, but most described difficulties in prioritizing it due to busy schedules, often pushing platform-related tasks to evenings or moments of minimal demand. The following quote illustrates how workload affects engagement, noting that learning activities on the platform are frequently completed outside regular hours: "*Usually outside of the work. Late at night before the course starts, if there is an assignment I need to take in before the deadline."… "Even if you get study time, then you need to use the study time to catch up with the administrative load"* (R5). A similar approach was described to fit platform tasks into short breaks during the workday, suggesting limited dedicated time for structured learning: *"I usually try to do*

that during working hours when I have a spare half hour or something." (R2) or, as another respondent admitted, to skip non-mandatory tasks on busy clinical days: *"During my clinical days, there is a lot of things to do so, I don't think I go if I don't have to on those days." (R1).*

Most platform usage happens outside work hours, as the clinical setting is often too demanding for focused online learning: *"I mostly use it outside of work!"* (R3). Interestingly, however, not everyone experienced workload as a barrier. Respondents also took a more neutral position, suggesting that their clinical schedule allowed for sufficient flexibility to engage with the platform during working hours: *"I usually do it I think during working hour and there's enough time to do, yeah!" (R4)* The issue of prioritization also arose indirectly: *"We don't actively use the platform for planning. We receive instructions via email, then go to the platform to register or report." (R6).* While they didn't explicitly cite time pressure, respondents noted a general underuse of the platform, possibly related to limited time or perceived value

5.6. User-driven suggestions for personalization and flexible design

All respondents offered specific, often overlapping suggestions on how the learning platform could be improved, centered around platform structure, enhancing relevance, and making the system more user-friendly and engaging. A common theme was the need for better filtering and personalization. Several residents suggested that the platform should be tailored more specifically to their medical specialty or residency year: *"Make it more fitting more to a specific category that is not so broad, that it's a little bit narrower, but more relevant."…"It seems to be a platform for everybody, which makes the platform too busy without really any purpose."(R5).* The lack of intuitive design and logical categorization was also a concern that could be addressed by a personalized interface based on the user's role: *"Maybe it should be more personalized for who are logged in. Now you get everything, and you have to find what is relevant for me.".* (R3).

A practical suggestion related to performance tracking and planning was likewise suggested: *"It would be helpful to have like my own page okay for you this year is important... you have to do these courses within this time frame"* (R2). Respondents emphasized the need for reminders or a more proactive system to keep users informed of relevant courses: *"If the platform was more attractive to use like there will be courses about this and that in the the learning platform this week, if there is anything that is important or interesting for you I think it would be good."* (R7) Overall, respondents called for a clearer, better-structured layout that allows for easier navigation: *"I would make it clearer and better structured. For example, when I log in, I'd like to see different sections like video courses, required courses, etc." (R6).* Socially oriented improvement ideas were also proposed, such as incorporating opportunities for peer interaction: *"If there would be some way to have like some sort of a social interaction with other residents and maybe somehow share our different sources of information."* (R4). While not everyone had concrete suggestions, there was broad agreement that the platform in its current form could benefit from being redesigned with the resident experience in mind. As one of the resident doctors concluded: *"We really need a more user-friendly system. That would help us use it more effectively during our residency."* (R6)

Overall, the feedback suggests a need for more targeted, intuitive, and interactive design to create a flexible and adaptive learning environment that supports the development throughout all stages of training. Despite frustrations, residents offered concrete, forward-looking suggestions for improving the platform, including specialty filters, progress dashboards, and learning recommendations. Their feedback reflects a readiness to participate in the platform's future development.

6. Discussion

In this paper, we have explored how resident doctors experience and engage with the digital learning platform as part of their continuing medical education during residency. By integrating resident doctors' lived experiences with theoretical frameworks of user-centered design (UCD), adult learning theory, and prior research on digital CME, the following discussion section outlines

the structural shortcomings and potential opportunities for enhancing the platform as a meaningful learning tool within the residency context. The discussion addresses i) how the design and usability of the learning platform align with or diverge from the practical needs of resident doctors; ii) how the platform supports learning in practice, focusing on content relevance, motivation, and learning formats; and iii) the user-driven solutions that emerged from participants' suggestions for improvement.

First, our findings point to a misalignment between the structure of the learning platform and the working realities of resident doctors. Respondents found much of the platform's content to be too generic and insufficiently connected to their clinical specialty or stage of training, which reduced the perceived value of the platform and discouraged voluntary engagement. From a UCD perspective [38], this suggests that the learning portal, in its current form, lacks the adaptive structures necessary to support specialized roles effectively, which is essential in complex fields such as internal medicine or psychiatry. Designed as a regional platform for a broad user group, including nurses, administrative staff, and physicians from various specialties, the platform does not account for the highly contextualized learning needs of doctors in specialist training. Aligning with the socio-technical approach, our findings, in this regard, confirm the importance of contextual relevance in the design and development of information systems [10, 31], as well as the need for digital learning systems to align with the learner's context and responsibilities to be perceived as relevant, highlighted in prior studies [16, 25]. From an adult learning theory standpoint, this lack of relevance hinders the learner's ability to self-direct their educational experience, as relevance and task alignment are critical for sustaining motivation in digital learning environments, particularly in healthcare [8, 34].

Findings from this study further suggest that the platform's design does not adhere to basic usability principles from user-centered theory, which emphasize the importance of clarity, consistency, and predictability in system interfaces [38]. While some resident doctors were able to navigate the platform without issues, many found the navigation and interface confusing and unintuitive, particularly in relation to login procedures, inconsistent course structure, the lack of filtering options, and a general need for user guidance. The lack of structure not only undermines user autonomy, as emphasized in adult learning theory [39], but also leads to underuse or passive compliance rather than active learning engagement. Furthermore, the analysis revealed that the lack of structured guidance or learning pathways led resident doctors to rely on external communication (such as emails or supervisors) instead of engaging with the platform. This signals a breakdown in the platform's role as a self-contained system for managing and organizing learning. In contrast, effective learning platforms are expected to integrate communication, scheduling, and progress tracking in a seamless way [12, 19].

Secondly, according to the study findings, whether online, in-person, or blended, the underlying desire among resident doctors is for relevant, accessible, and well-designed learning experiences. However, although the learning platform is intended to support resident doctors' continuing medical education, the lack of relevance to their actual clinical practice reveals a weakness in the platform's educational value, in terms of reflecting the needs of adult learners, who are most motivated when learning is immediately applicable to their real-life roles. When content lacks specificity, users perceive it as an administrative obligation rather than an educational resource, a finding supported by prior studies on digital education in medical settings [7, 24]. The preference for more engaging and blended learning formats, as revealed in interviews, emphasizes the value of combining self-paced digital learning with in-person repetition, and the corresponding need to balance, sometimes conflicting, needs for self-paced learning and the social, collaborative, and interactive elements of digital learning [7, 22]. According to the experiences of resident doctors in this study, the digital-only nature of the learning platform made it difficult to stay focused, especially when courses were passive, text-heavy, or lacked interactive components, as also expressed through calls for more practical, application-focused resources. This aligns with adult learning theories, which emphasize active participation and contextual experience as essential for developing practical knowledge [33, 34]. It also supports previous research suggesting that a

multimodal approach, combining asynchronous digital modules with face-to-face sessions, improves knowledge and learner satisfaction [12].

Another challenge raised by residents relates to their motivation to use the platform, as usage was driven by external requirements rather than intrinsic interest, often prompted by email reminders used out of obligation rather than personal initiative. This reflects a problem often seen in systems designed without sufficient user autonomy or control, where learners feel more like passive consumers than active participants, or when the content lacks clinical relevance or interactive features [8, 20, 21]. In the case of the learning platform, the lack of personalization, unclear relevance, and technical barriers all contribute to a platform experience that is seen more as a chore than a support for learning. Without internal mechanisms for course alerts, deadline tracking, or personalized recommendations, the learning platform functions as a static catalog rather than a dynamic learning companion, thus failing to meet both practical and pedagogical expectations [19, 39]. A final key factor affecting learning was the gap between the clinical workload and the time available to engage with the platform [13] meaningfully. This finding highlights the real-world pressure on residents and reveals a disconnect between the platform's structure and the rhythms of clinical life [22, 25], further distancing it from being a practical or sustainable learning solution. As prior research has shown, for digital learning tools to be effective in healthcare, they must be designed with workflow integration in mind [17].

Thirdly, we identified specific user-driven solutions based on the respondents' suggestions for improvement. Their recommendations revealed a shared vision for what an improved platform could look like, one that better reflects their real-world needs and supports their CME development. The aforementioned concerns relevant to clinical practice indicate a need for the platform to adopt a more segmented content structure, where learning materials are filtered based on the user's specialty and stage of training. Such segmentation not only improves relevance but also enhances motivation by providing learners with a sense of ownership over their educational journey, in line with adult learning theory [34, 39] and supported by empirical findings [e.g., 16]. The user-driven ideas proposed by resident doctors, such as personalized checklists or structured dashboards that display courses relevant to their specialty and training level, suggest basic yet powerful interface enhancements that could significantly enhance usability and reduce the time spent navigating the system. From a UCD perspective, integrating such features would reflect a shift toward designing with, rather than just for, the user —an approach that has long been advocated in the socio-technical tradition of participatory design [10, 26, 27] and emphasized in recent healthcare education research [12]. As reflected in our findings, the reliance on parallel systems to compensate for the platform's lack of guidance causes confusion and undermines the platform's role as a centralized learning hub. Embedding smart reminders, a personal dashboard, and overview calendars could increase learners' sense of control and help prevent missed assignments practices that align with best-practice recommendations in digital learning system design [24]. Finally, the user-driven solutions proposed by the participants show that the resident doctors are not resistant to digital learning per se, but to the way it is currently implemented. When considered through the lens of adult learning theory, the envisioned more adaptive platform that offers access, support, clarity, and meaningful guidance throughout their learning, reinforces the importance of enabling learners to shape their own pathways, engage actively, and connect educational material with lived clinical experiences [33, 34].

Based on the findings of this study and guided by the theoretical frameworks of user-centered design and adult learning theory, this paper concludes with the following proposed design principles to inform the development of digital platforms for continuing medical education (CME), particularly within clinical training environments.

- *Ensure clinical relevance of content:* Learning materials should reflect the clinical practice areas and specializations of resident doctors. When content is general or lacks relevance to real-world tasks, learner engagement and motivation decline [7, 34].
- *Prioritize usability through simple and consistent design:* Digital platforms should adopt a clear, predictable, and consistent interface to reduce cognitive load and support efficient

navigation. Intuitive design enables learners to focus on content rather than interface challenges [15, 40].

- *Embed clear guidance and learning expectations:* Instructions, course structures, deadlines, and progress indicators should be fully integrated into the platform environment. Learners should be able to understand their requirements and track their progress without needing to rely on external communication [12, 16].
- *Support microlearning and time-conscious design:* Content should be presented in short, manageable modules that fit into the demanding and fragmented schedules. Features such as bookmarking, time estimates, and resume functionality can further support flexible learning [22, 25].
- *Enable personalisation and adaptive learning pathways:* Platforms should provide personalized learning suggestions based on specialties, progress, and preferences. Such features enhance relevance, autonomy, and learner motivation [19, 39].
- *Facilitate social interaction and constructive feedback:* Peer interaction, reflective practice, and opportunities for tutor feedback should be integrated to foster engagement and deeper learning. Social features also contribute to professional identity formation and knowledge sharing [8, 20]
- *Engage users throughout the design process:* Consistent with UCD principles, resident doctors should be involved throughout the design, testing, and evaluation phases of platform development. This ensures the platform is aligned with users' goals, contexts, and challenges [26, 29].

Together, these principles provide a strategic foundation for improving the usability, relevance, and educational effectiveness of digital CME platforms in clinical environments. It supports the idea that platforms developed without end-user involvement often miss the mark, appearing functional but failing to meet learners' needs. Designing with users, not just for them, leads to digital tools that are more engaging, easier to navigate, and more likely to be integrated into clinical practice. This participatory approach is especially relevant when designing platforms for resident doctors, who balance intense clinical demands with ongoing educational requirements.

7. Conclusion

Using a qualitative approach grounded in user-centered design and adult learning theory, this study has examined the experiences of resident doctors in using a digital learning platform as part of their continuing medical education (CME). The findings indicate that, although the learning platform is accessible and widely available, barriers arise from a disconnect between the platform design and the lived realities of healthcare professionals. Identified challenges include content relevance, usability challenges, unclear communication, learning formats, workload constraints, and specific suggestions for improvement, such as personalization and flexible design. While the study was limited by its small sample size and single-site scope, it provides a foundation for further research that could include multiple institutions, comparative studies, or quantitative evaluation of redesigned features. Future work may also investigate how different user groups, such as supervisors or nurses, interact with similar platforms, thereby extending the scope of UCD in clinical education.

In sum, this study contributes to a growing body of socio-technical research advocating for more user-informed development of educational technologies in healthcare. It also addresses gaps in the literature by demonstrating how UCD can be applied in a hospital setting, transitioning from a content-driven to a needs-driven approach, and developing systems that are not only functionally sound but also educationally meaningful and contextually relevant. Based on our findings, this paper argues that effective digital CME tools cannot be designed in isolation from their users. The main contribution is a set of design considerations that others can use to ensure that digital learning technologies not only meet technical standards but also respond meaningfully to the

needs of those they are intended to serve. In doing so, they can become more than information delivery systems they can become trusted, integrated tools for lifelong professional development in healthcare.

Declaration on Generative AI

During the preparation of this work, the authors used GPT-4 and Grammarly in order to: Grammar and spelling check. After using these tool(s)/service(s), the authors reviewed and edited the content as needed and take full responsibility for the publication's content.

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