Developing a Design Features Taxonomy of Human-Computer Interaction in Social Media that Affect User Engagement and Addictive Behaviors

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Abstract. [Context and motivation] The rapid growth of social media has transformed how users, especially young people, engage with digital platforms and applications, raising concerns about their addictive potential. **[Question/problem]** However, there remains a limited understanding of what design features of Human-Computer Interaction in social media platforms most strongly encourage addictive behaviors and which user interface design elements are used to support engagement on these platforms. **[Principal ideas/results]** To close this gap, this study aims to develop a comprehensive design features taxonomy of Human-Computer Interaction within social media that influences addictive user behaviors and increases the time and frequency of usage. In developing our taxonomy, we drew from existing literature, incorporating insights from experienced Human-Computer Interaction, psychology, and software engineering practitioners to validate our taxonomy. By identifying specific design features that encourage prolonged engagement, this taxonomy provides a foundation for guiding design decisions that must be made to develop non-addictive social media. **[Contribution]** This taxonomy is a valuable tool for designing, regulating, and using social media more responsibly, balancing user engagement, user experience, and digital well-being while addressing the risks of compulsive behaviors and technology addiction.

Keywords: HCI Design Taxonomy, Social Media, Addictive User Behaviors

1 Introduction

In today's digital age, information and communication technologies (ICTs) have fundamentally changed how people interact, communicate, and participate in various activities. The prevalence of digital devices like smartphones and computers has led to increased use of digital platforms, resulting in significant changes in daily routines and social interactions [1]. This situation causes the issue of digital addiction, which is gaining more attention as studies show a considerable increase in the time people spend

on digital platforms, mainly social media1 [2]. Concerns have been raised about the potential for these technologies to encourage addictive behaviors, especially among young people who are the most frequent users of these digital platforms and applications.

The global issue of digital addiction, characterized by excessive use of digital applications such as social media, online games, and other internet-based platforms, poses a significant challenge to mental health and well-being [3]. Around 3.8 billion people worldwide use the internet, spending an average of 2.5 hours daily on social media [1]. Social media includes numerous applications and online channels such as Facebook, YouTube, Instagram, X, WhatsApp, TikTok, etc. These applications allow users to spend time interacting, creating, sharing, and consuming content [4].

To support responsible design through Requirements Engineering, it's essential to identify and integrate design features that promote healthy engagement while minimizing the risk of addictive behaviors [5]. Addressing a general research question (RQ0) like "How do HCI design features in social media platforms reinforce user retention mechanisms that drive engagement and addictive behaviors?" can guide the creation of social media prioritizing user well-being. From this general research question (RQ0), we defined two research questions that guided the study:

RQ1: Which user retention mechanisms in social media platforms have the strongest impact on engagement and addictive behaviors?

RQ2: What HCI design features reinforce and support these user retention mechanisms?

These questions directed the literature review and study selection criteria, shaping the taxonomy's focus on features influencing user engagement and potentially addictive behaviors.

The main objective of this study is to explore the design features of HCI within software designs that may contribute to developing addictive behaviors in users. Specifically, we focus on identifying and categorizing these design features into a comprehensive taxonomy. This taxonomy will provide a structured framework for analyzing the HCI features in software designs that may inadvertently lead to digital addiction. By highlighting these design features, the study aims to guide the development of non-addictive information systems (NAIS) [6] and contribute to ethical guidelines in software design, ensuring a balanced and healthy interaction with digital technologies.

The contribution of this paper is twofold: (i) to provide a design features taxonomy of HCI in social media that affect user engagement and addictive behaviors, and (ii) to what they are doing to empower users to take control over them and reduce compulsive interaction so that these apps are attractive but also respect the mental health and autonomy of users.

The paper is structured as follows: In Section 2, the background and related work are briefly described. In Section 3, the research methodology is described. In Section 4, the process to define the taxonomy is summarized. In Section 5, some

[1] In this work the terms "social media platform", and "social media" are considered similar.

recommendations for non-addictive social media are proposed. Finally, Section 6 summarizes our study's conclusions, limitations, and future work.

2 Background and Related Work

In this section, we will first briefly define and outline topics related to addictive software design.

2.1 Definitions

HCI is the academic topic within Computer Science under which addictive software design falls [7]. Interaction design involves organizing and utilizing available resources to define, shape, and determine all user-focused qualities—structural, functional, ethical, and aesthetic—of a digital artefact intended for one or more users [8]. Our proposal is focused on identifying the design features of HCI.

Research indicates that certain design features of HCI in software can encourage user engagement, sometimes leading to addictive behaviors. These design features include continuous notifications, infinite scrolling, and personalized recommendations, which aim to maximize user interaction but may also promote compulsive usage patterns [6]. Furthermore, the psychological mechanisms driving these behaviors, such as the need for social validation through "likes" and the desire for gaming achievements, add complexity to the issue [9].

The rise of digital addiction highlights the importance of user-centered design in software development. NAIS frameworks promote ethical design by encouraging balanced usage, transparency in usage patterns, and restrictions to prevent excessive use [10]. As researchers, software designers, policymakers, and individuals interested in digital addiction, our proposal in this process is vital.

2.2 Related Work

The second part of this section contains work related to studies reporting taxonomies proposed in games. Although our work is related to social media, these papers are closest to our research.

Flayelle et al. [11] propose a theory-driven general taxonomy of the design features of online applications that might promote uncontrolled and problematic online behaviors. The authors critically examine the available research on the relationships between technology design features and the loss of control and harms experienced by those who engage in online video gaming, online gambling, cyber sexual activities, online shopping, social networking, and on-demand TV streaming.

To enhance psychological understanding of problematic video gaming and to inform future research directions, King et al. [12] propose a new taxonomy of video game features, which includes (a) social features, (b) manipulation and control features, (c) narrative and identity features, (d) reward and punishment features, and (e) presentation features.

Windleharth and Ja Lee [13] present two taxonomies developed from studying 65 mobile games—a taxonomy of the types of transactions between game players and companies that transfer or create value for the gamer owner and a taxonomy of methods companies use to drive engagement and retention with mobile games. The paper also presents an example of applying these taxonomies to map the value transfer in the game.

These contributions highlight the critical relationship between design features in digital environments and user engagement, emphasizing the need for ongoing research in this area to understand better and mitigate problematic online behaviors.

To the best of the authors' knowledge, there is no detailed taxonomy of design features of HCI in social media that characterize user engagement and drive addictive behaviors.

3 Research Methodology

The present study aims to define a taxonomy of design features of HCI in social media using a three-phase approach. First, in the Data Collection Phase, we collected data from a literature review and explanatory expert interviews. Second, to address the RQs of this study adequately, we developed the taxonomy employing the methodology proposed by Nickerson [14] and Kundisch [15] called the “Extended Taxonomy Design Process” (ETDP), which adheres to the design science research paradigm and consists of six activities. Third, the taxonomy was evaluated by identifying the interaction design features of HCI on the most used social networks such as Facebook, Instagram, WhatsApp, Twitter-X, YouTube, and TikTok.

In this section, we describe each phase and the steps of this methodology applied to define our taxonomy.

3.1 Phase 1: Data collection

This phase consists of two steps: (i) identify relevant studies on HCI in addictive software design strategies and (ii) conduct a literature review on HCI + addictive design + social media. Therefore, we began by identifying relevant studies on HCI in the context of addictive software design strategies. This was followed by a focused literature review that examined HCI, addictive design, and social media.

To establish a research-based foundation, we considered prior studies on HCI and addictive behaviors [1] [16] [6], ensuring that taxonomy effectively addresses user engagement and the potential for addictive behaviors.

We did a comprehensive literature review to identify studies relevant to the research questions on social media addiction and HCI features influencing user engagement. To achieve this, we employed the following search query: ((addict* AND (feature* OR characteristic* OR factor* OR trait*)) AND ("social media" OR "social network*" OR "social platform*") AND (hci OR "Human-Computer Interaction" OR "user interface")). This search was designed to capture studies examining addiction-related features and user interaction patterns within social media environments. We searched databases such as Scopus, Taylor and Francis, and IEEE, identifying an initial pool of

314 studies. The studies followed a multi-stage filtering process. First, duplicated entries were removed, leaving 313 unique studies. Then, three reviewers screened titles and abstracts to assess their eligibility, which narrowed the selection to 97 studies.

Finally, a thorough full-text review led to the selection of 45 studies that closely aligned with the focus of the taxonomy on engagement and potential addictive behaviors. **Table 1** below summarizes each stage in the literature review and the study selection process.

Table 1. Summary of Literature Review Results Across Databases

Source	Potential Studies	Removing duplicates	Scanning title and abstract	Selected Studies
Scopus	25	25	14	9
Taylor and Francis	287	287	83	36
IEEE	2	1	1	0
Total	**314**	**313**	**97**	**45**

From the analysis of 45 selected studies, we identified key HCI features influencing user engagement and addictive behaviors on social media platforms.

3.2 Development of the taxonomy

To develop the taxonomy, five activities of the extended taxonomy design process (ETDP) provided by Kundisch et al. [15] were used, which enhances the taxonomy development method of Nickerson et al. [14]. The ETPD can be placed within the design science research paradigm, outlining relevant steps in this paradigm's six activities.

Activity 1: Identify the problem and motivate.

In this first activity, the problem identified is the lack of a taxonomy to define the design features of HCI in social media, reducing the effect of the addictive property that many social media platforms could include. So, the taxonomy stakeholders could include UX designers, software developers, policymakers, mental health professionals, researchers, and users.

The motivation for defining the taxonomy is related to balancing the addictive impact of social media platforms when the designers define the user interface elements to include in the social media platforms.

Activity 2: Define the objectives of a solution.

It was an iterative process along with the activity 3. Items identified in the literature were used to develop initial ideas of meta-characteristics and characteristics. Various grouping methods were explored to name items, characteristics, and meta-characteristics, leading to a three-iteration process.

The first iteration analyzed a list of item descriptions (e.g., recommendations, ads, reminders, labels) from the literature. Items were initially grouped based on graphical interface elements (e.g., links, buttons, scroll bars) and hardware devices (e.g., touchscreen, keyboard, mouse), with meta-characteristics classified as input or output elements. However, this approach was not orthogonal, so some elements appeared in multiple categories.

In the second iteration, items were classified based on their interaction elements (e.g., likes, comments) and their role, for example, in gratification, attention capture, and usability enhancement. Emotional and monetary gratification elements were grouped under the Gratification meta-characteristic, and new items were added or adjusted as needed. This allowed for better mapping of the different items found in the literature. Some meta-characteristics and characteristics resulted from the literature review (i.e., Reward from Reward and Punishment Features [12], Reinforcement and Reward [13]), Time from Temporarily Available Information [11], Attention Capture from Appeal Factors [13]) and the others were chosen by the authors as a result of several group sessions.

In the third iteration, the names of some meta-characteristics were adjusted; for example, Gratification came before Reward, and it was felt to represent better the descriptions of the elements identified in the literature that can be grouped under this meta-characteristic.

A similar process was performed for the rest of the meta-characteristics. The taxonomy development process is complete when all meta-characteristics and characteristics are unique, each characteristic is represented by at least one item, and no further changes are made during the final iteration. Non-exclusive characteristics across meta-characteristics are allowed to enhance flexibility. Additionally, taxonomy must meet subjective standards of being concise, robust, comprehensive, extendable, and explanatory [17].

Activity 3: Design and development.

Using the results from the literature review, a conceptual-to-empirical approach was employed, with iterative cycles refining the taxonomy until the predefined criteria were met. Each meta-characteristic (see **Table 2**) is a structured guideline to pinpoint essential characteristics and elements. For example, Notifications and Alerts fall under the Immediate Reward criterion, while Infinite Scrolling is categorized under User Engagement Design. These items are the design features of HCI in social media that most influence the promotion of addictive behaviors. They serve as a starting point for identifying features that encourage or discourage addictive behaviors from helping protect users from addictive behaviors and offer strategies for managing these effects.

This approach provides a detailed view of the various features within each criterion, enhancing our taxonomy's ability to reflect the diversity of HCI features across the studies. **Table 2** summarizes our initial taxonomy approach's meta-characteristics, characteristics, items, and examples. For a complete overview of the selected studies, refer to Appendices A and B, which list all studies from S001 to S045 alphabetically, along with the number of studies referencing each feature and their prevalence (N=45).

Activity 4: Demonstration.

This was applied to each social media platform considered in this research to ensure that the taxonomy's characteristics are mutually exclusive and collectively exhaustive. By using some iterations, the ending conditions were met.

Activity 5: Evaluation.

To evaluate the proposed taxonomy, we designed an expert-based evaluation. Eight experts from Computing, Design, Psychology, and Education participated voluntarily. This group included professor-researchers and professionals with experience in HCI, habit formation, interface design, and taxonomy development.

Firstly, we designed a demographic questionnaire using Google Forms and distributed it by e-mail. Each expert answered the questionnaire to provide his/her information regarding their experience in the area (details can be seen in Appendix E on file named "Expert_Evaluation_EN.pdf"). Then, a Likert scale survey was conducted to identify the most suitable experts regarding their experience in HCI, social networks, addiction, and taxonomies. Since the goal was to determine the relevance of the experts, a simple scale was sufficient. Secondly, we designed a questionnaire containing three sections on meta-characteristics, characteristics, and items, all included in the taxonomy (results can be seen in Appendix F on file named "validation of the taxonomy by experts.xlsx"). The expert validation was carried out through content validation [18], which consisted of an instrument that included the proposed taxonomy's meta-characteristics, characteristics, and items. For each item, the user was asked to select clarity, relevance, and coherence levels according to a table containing the meaning of each element of the proposed taxonomy. In addition, the sufficiency had to be evaluated at the item, characteristic, and meta-characteristic level to determine whether the items were sufficient to measure the group to which they belonged in the proposed taxonomy. The format employed was adapted from the model of the expert judgment template proposed by Escobar-Pérez and Cuervo-Martínez [19] (see Appendix D). In addition, the experts could add observations and suggest additional features for the taxonomy.

Expert feedback was used to refine the taxonomy through a dual approach, empirical-to-conceptual and conceptual-to-empirical, guided by the ETDP framework. Experts suggested improving some item descriptions (e.g., notifications and alerts), adjusting characteristic names (e.g., intuitive to attractive presentation), and meta-characteristics (e.g., Time for Time management). Also, items under the Persuasion and Manipulation characteristic, such as Hidden Charges, have been added to promote transparency, and under Permanent Connectivity, such as Cloud Sync, to support device interoperability.

Essential adjustments were made to enhance the taxonomy's practical application and align it with real-world user interaction patterns. Also, Quick Context Recovery was added to improve usability by allowing users to resume their activities smoothly after interruptions within the Usage Frequency characteristic. Items like Color Palette and Smooth Navigation were included in the Intuitive design characteristic to create a cohesive user experience (UX). After validation, some items added through expert input mentioned in this section were integrated into their respective characteristics and

aligned with relevant meta-characteristics. These additions, marked with an asterisk (*), can be seen in Table 2 and Appendix C as part of our final taxonomy. The authors reviewed the refinements until they reached a consensus, ensuring they met the study's objectives, were mutually exclusive and collectively exhaustive, and effectively captured social media applications' functional and ethical aspects.

Table 2. Summary Meta-characteristics (MC), Characteristics, Items, and Examples

RQ1		RQ2	
MC	**Characteristic**	**Item**	**Examples of user interface elements**
Reward	Immediate Reward	Notifications and alerts	Facebook: Notification of a new post from a friend and birthday reminders, messages, push alerts, and suggestions.
		Instant rewards	Reactions, likes.
		Auditory or visual responses	WhatsApp-red dot with a number to notify that there are new messages, sounds when reacting, and animations (GIFs).
	Variable Reward	Random or unpredictable reward systems	Likes (similar/surprise reactions), mentions and tags, viral content, and suggestions from friends or followers.
		Periodic reinforcements	Timing elements (e.g. hourglass, counter, etc.) Influencers, artists, and celebrities provide discount codes.
	Interactive Reward	Point and achievement systems	Streaks, offers. Facebook "Super Fan" badges, Twitter follower levels, Snapchat "streaks".
		Measurable progress	Progress bars or statistics that visualize progress toward a goal. Instagram: engagement stats (i.e. reach, impressions, interactions)
Time Management	Usage Frequency	**Quick context recovery ***	WhatsApp: featured messages, Instagram: save posts.
		Phase unlocks	Badge systems that users earn by accumulating time or certain actions (e.g. featured fan).
		Time spent metrics	Timer.
	Exclusivity and Lack of Time	Time-limited content	Messages, alerts, reminders, stories, or short statuses that disappear after 24 hours, seasonal offers.
		Exclusive access	Features are available only to premium users, and content viewing is restricted to certain users, such as Instagram best friends.
	Real-Time	Real-time updates	Instagram and TikTok: comments on live broadcasts.
		Live content	Video and live interactions.
Attention Capture	User Engagement Design	Infinite scrolling	Scroll and auto play videos.
		Fresh content cycles	Suggestion to refresh posts (e.g., pull to refresh).
		Recommendation navigation	Recommendations on streaming platforms or social media based on user preferences (e.g., Instagram shows suggestions for users)
		Sticky content	Reading recommendations: horoscopes, tests, interesting news, games, suggestive videos.

	Persuasion and Manipulation	Dark patterns	Locked or late access item, unlockable with points (e.g., money).
		Hidden charges or in-app purchases *	Timers, shopping cart, content unlock announcement.
		FOMO	Notifications, alarms (e.g., TikTok: “Everyone is watching”, WhatsApp: One-time viewing content)
	Customization	Content algorithms	Publications content according to the tastes and preferences of users (e.g., ”People you may know”, “For you” in WhatsApp)
		Customizable avatars/ profiles	Profile photos, avatar, appearance.
		privacy options *	Audience settings, online status control, video and comment restrictions.
Emotional Dependency	Social Interaction	Content reactions	Likes, dislikes, comments, and sharing posts.
		Social comparison	Leader boards, ranking lists, friends list, followers list;
		Real-time messaging	Real-time messaging and chat.
		Stalker	TikTok: profile views, X(Twitter): Publications, subscriptions, featured, multimedia, followers when viewing a profile.
	Emotional Engagement	Storytelling narratives	Control to publish chronological photos, location, etc., of the user (e.g., featured stories on Instagram).
		Self-presentation	Apps that constantly encourage users to share what they are doing, photos, or their location (e.g., Facebook: information on education, profession, work, marital status, messages like “What are you thinking?”)
Usability	Permanent Connectivity	Cross-platform access	Responsive graphical interface elements (display size, navigation size, textual content, visual content, brand identifiers, action buttons).
		Cloud sync *	Option to enable/disable synchronization.
	Intuitive	Consistency	Fixed key locations on buttons, menus, and layouts.
		Simplicity in design	There are fewer buttons, fewer popups, and simple icons.
		Color palette *	Buttons with familiar or striking colors.
		Clear language	Button labels, messages, descriptions (e.g., “Add to your story”, “Search” in Instagram).
		Smooth navigation *	Navigation bars, drop-down menus.

3.3 Phase 3: Evaluation

The proposed taxonomy was evaluated by applying it to social networks like Facebook, Instagram, WhatsApp, TikTok, YouTube, and Twitter-X. Systematically analyzing each platform made it possible to map their features to specific categories within the taxonomy. However, not all characteristics are equally applicable to every platform, as shown by the evaluation conducted (details can be seen in Appendix F on file named

"social_media_taxonomy_examples.xlsx"). Certain platforms lack some items from the taxonomy, or the importance of these items may differ significantly depending on the platform. Despite this, the taxonomy retains its utility, as most elements are consistently found across platforms. Although some characteristics are not included in each social media, moreover, since Meta Platforms, Inc. owns Facebook, Instagram, and WhatsApp, there is evidence of gradual feature integration among these platforms, such as adding message reactions and status updates to WhatsApp.

4 Taxonomy of Design Features of HCI in Social Media: Results and Discussion

This section provides detailed explanations of the proposed taxonomy of the design features of HCI in social media platforms. Additionally, it includes answers to each of the research questions proposed in Section 1.

4.1 Meta-characteristic 1: Reward

It is a positive reinforcement or outcome that follows a behavior, increasing the likelihood of that behavior being repeated.

Immediate rewards (e.g., notifications, likes) trigger curiosity and dopamine-driven motivation, encouraging repeated app use (S021, S045). Variable rewards (unpredictable reinforcement) create surprise, keeping users engaged through anticipation (S021). Periodic rewards (e.g., spaced notifications) sustain interaction via timed incentives (S014). Interactive rewards (gamified points, achievements, progress tracking) foster accomplishment through measurable metrics (e.g., follower counts, badges), enhancing motivation (S021).

Discussion: This meta-characteristic of social media platforms plays a significant role in fostering addictive behaviors among users. The platforms employ various reward mechanisms to boost user engagement and encourage addiction. Many platforms also integrate other types of reward points, achievements, and measurable progress metrics to cultivate a sense of accomplishment and encourage more frequent user interaction.

4.2 Meta-characteristic 2: Time Management

The temporal structuring of content is key in driving continuous engagement and reinforcing the platform's relevance in users' lives.

Temporal structuring drives engagement through content pacing and relevance. Usage frequency measures login/interaction rates, while quick context recovery helps users refocus post-distraction (e.g., minimizing notifications via Focus Assist). Scarcity leverages phase unlocks (e.g., time-limited bonuses) and time spend metrics to optimize retention (S023). Exclusivity fuels urgency via restricted access (e.g., VIP features) and short-form content (15–60-second videos) for rapid attention capture (S021, S016).

Real-time functionality (live updates, streaming) fosters immediacy, enhancing addictive appeal (S012, S025).

Discussion: The organization of time-related features is crucial for driving user engagement. Platforms monitor how frequently users log in and interact with content, optimizing their offerings based on this data to enhance engagement. This immediacy contributes to the addictive nature of social media by keeping users engaged with ongoing content.

4.3 Meta-characteristic 3: Attention capture

It refers to software features designed to draw or hold a user's focus, often automatically or without conscious effort.

User engagement design captures and maintains users' attention, encouraging them to interact meaningfully and repeatedly with a product or platform. Infinite scrolling (S030): Automatically loads fresh content without pagination, creating an "endless" stream to prolong the interaction. Fresh content cycles: Systematically introduce new material to sustain interest and encourage repeat visits. Recommendation algorithms (S016): Personalize content via behavioral data, fueling addiction by aligning with user preferences. Sticky content: Horoscopes, quizzes, or games build loyalty through low-effort, high-engagement interactions.

Persuasion and manipulation can have significant social and psychological effects on social media because of the platform's broad reach and the use of personal data to create highly targeted content. Dark patterns: Interfaces designed to trick users into unintended actions (e.g., trick questions, "roach motel" traps) that exploit cognitive biases and serve platform interests. Hidden charges: Financial transactions are obscured during app use, often via unclear prompts or default settings. FOMO: Anxiety about missing updates drives compulsive connectivity, fueling addiction by targeting emotional/social needs (S021).

Customization gives users greater control over their interactions and engagement, making their social media experience more relevant and enjoyable. Content algorithms (S021): Tailor feeds via user behavior/preferences, enhancing engagement and retention. Profile customization (S011): Avatars/updates boost self-esteem, potentially driving excessive use and dependency. Privacy options: Added by experts to balance personalization with data control.

Discussion: Features that capture and maintain user attention are essential in promoting addiction. Platforms systematically introduce new content to sustain user interest and prolong interaction time, which is vital for encouraging users to return. Additionally, algorithms that customize content based on user behavior provide an endless supply of engaging material, further fueling addiction.

4.4 Meta-characteristic 4: Emotional dependency

It refers to how certain design features are crafted to create a psychological reliance on the platform for emotional support, validation, or fulfilment. These features are often strategically designed to encourage frequent engagement by appealing to users' need for connection, recognition, and self-esteem.

Content reactions (likes, comments, shares): Users gauge social validation via others' responses (S011, S020, S024). Social comparison: Algorithms amplify life/achievement comparisons, driving engagement (S021). Real-time messaging: Typing indicators, reading receipts and status updates simulate face-to-face immediacy (S011, S030). Stalking: Monitoring others' activity (e.g., Facebook's second-most common use) fuels passive engagement (S011).

Emotional engagement occurs when users feel emotionally invested in their interactions on the platform, such as feeling happy, inspired, validated, or motivated by the content or people they follow. In cultures where video consumption dominates, creators prioritize engaging storytelling narratives and co-creation initiatives (S015). In a self-presentation, the users utilize videos to present themselves to the public while sharing content. This gratification activates the brain's reward system, reinforcing continued social media use and potentially leading to social media addiction (S027).

Discussion: Emotional dependency in social media addiction refers to users' psychological reliance on platforms for emotional support, validation, and fulfilment. Social media design features encourage constant engagement by appealing to users' connection, recognition, and self-esteem needs. A key factor is social comparison, driven by algorithms that promote content leading users to compare themselves to others, causing feelings of inadequacy or superiority. Additionally, real-time communication features enhance the sense of closeness and personal connection, deepening emotional dependency.

4.5 Meta-characteristic 5: Ease of Use/Usability

Design features that promote positive user experience encourage engagement and reduce frustration by making actions and information readily accessible.

Permanent connectivity refers to features that remain constantly connected to social media, enabling continuous access to information, social interactions, and online services. Cross-platform access: Seamless use across devices (e.g., mobile/desktop) via responsive design (S026, S028, S029). Cloud sync: Automatically updates data across devices, validated by experts for real-time access and management.

Attractive presentation characteristics ensure a smooth and enjoyable experience, encouraging more frequent use and deeper engagement by minimizing confusion or effort. Consistency: Fixed button/menu layouts reduce confusion (S018, S001). Simplicity: Minimal visual elements (e.g., fewer buttons, clear icons) minimize distractions (S012). Clarity: Concise language and labels ensure confident interaction (S018). Visual hierarchy: Expert-validated color palettes and smooth navigation guide attention and ease transitions.

Discussion: The discussed features enhance user engagement and reduce frustration. Permanent connectivity, cloud synchronization, and responsive design ensure seamless device use. An intuitive interface, appropriate color palette, and smooth navigation improve usability and encourage prolonged use. These usability features also support psychological mechanisms that contribute to addictive behaviors.

Final Discussion: It is important to recognize that almost any interaction feature in social media can be linked to addictive behaviors, depending on how it is designed and implemented. Items like notifications, infinite scrolling, variable rewards, and social validation mechanisms (e.g. likes, shares, comments) can enhance user experience and engagement and reinforce compulsive usage patterns.

This highlights the delicate balance between user experience, engagement, and addiction. While designers aim to create intuitive and engaging interfaces, excessive or manipulative use of these features can lead to problematic behaviors, digital overconsumption, and negative mental health outcomes.

Therefore, the proposed taxonomy will help developers and UX designers balance user interaction and well-being by identifying features that empower users to control themselves and reduce compulsive interaction so that these apps are attractive and respect users' mental health and autonomy.

5 Some recommendations for Non-Addictive Social Media

We apply two strategies to obtain recommendations for designing non-addictive social media: (i) A literature mapping to get recommendations from authors for the design of non-addictive user interfaces (e.g., [6]). (ii) Consult users and experts regarding which elements of the taxonomy should be avoided in the design of non-addictive interfaces.

The results obtained suggest that the recommendations for non-addictive social media can involve:

Prioritize Transparency. Providing users with information about addictive current risks and how to avoid them. This helps users understand the system (i.e. algorithms) and make informed decisions about their engagement.

Continuous Monitoring. Keep track of usage time (e.g., *time spend metrics*) and suppress some interaction features that trigger addictive behaviors. For example, timers or reminders can help users monitor their time on the platform.

Design for Well-Being. Introducing intentional interruptions to hinder flow is an important element in the development of addictive tendencies. For example, (i) encouraging scheduled breaks and offering options to limit daily usage can help create healthier habits, and (ii) a feature that gradually dims the screen or reduces color intensity after a set amount of time could subtly remind users to take a break.

Customization Options. Adjusting or adapting HCI features to avoid remaining constantly connected to social media. For example, (i) allowing users to customize their notification settings can help mitigate attention capture, and (ii) instead of constant alerts, platforms could offer digestible summaries at specific times, which promotes more intentional engagement with content rather than reactive browsing.

Some examples are included below (see **Table 3**) to evaluate whether these design recommendations have been integrated into the platforms used in the study.

6 Conclusions, Limitations, and Future Work

This paper gives a deeper understanding of the design features of HCI on social media that most effectively promote addictive behaviors and the user interface design elements used to drive engagement. To address this, we present a design features taxonomy of HCI in social media that influence user engagement and addictive tendencies.

Analyzing 45 research papers and conducting expert surveys, we identified five meta-characteristics—reward, time, attention capture, emotional dependency, and ease of use/usability—encompassing 13 features and 37 specific items. Key features identified, such as notifications, infinite scrolling, personalized algorithms, and real-time interactions, highlight specific design practices that increase user engagement but may also lead to compulsive usage.

Our study highlights the need for further research to analyses the interaction features of individual social media in greater detail. It underscores the importance of extending research to other categories of addictive applications, such as online video games, gambling, and other Internet-based services. Furthermore, our research establishes a foundation for comparing the characteristics of social media with other platforms, such as online games. Another contribution of this work is offering a basis for formulating design guidelines to develop social media that balances user engagement with ethical considerations like reducing addictive tendencies.

Despite its contributions, this study has certain limitations that point to areas for future research. The reviewed literature reflects our interpretation of the state of the art but represents only a portion of the rapidly evolving social media and HCI design landscape. Also, it does not differentiate between social media platforms; the platforms analyzed as examples of features promoting addiction were Facebook, X (formerly Twitter), Instagram, TikTok, YouTube, and WhatsApp, selected for their widespread use. However, due to this lack of specificity, not all characteristics may apply equally to every platform, as evidenced by the evaluation. Some platforms do not encompass all items in the taxonomy, or the relevance of these items may vary significantly depending on the platform. Nevertheless, the taxonomy remains valuable as most elements are present across platforms. We followed the methodology proposed by Kundisch D. et al. [21] for taxonomy development and validated its applicability through expert surveys, deeming it theoretically robust and relevant to current digital platforms.

Future research could enhance and expand the proposed taxonomy by utilizing qualitative and quantitative methods for more in-depth case analyses. Additionally, we plan to propose/extend a software quality model to evaluate addictiveness in social media platforms. Finally, this taxonomy and design criteria can be the basis for extending research to other categories of addictive applications, such as online video games, gambling, etc.

Table 3. Evaluation of design recommendations of social media platforms used in the study

Strategy	Facebook	Instagram	X	TikTok	WhatsApp	YouTube
Recommendation 2: Continuous Monitoring						
Set time limits	Users can set time to monitor and restrict usage	Users can set usage limits	It does not enforce time-based usage restrictions. It implements technical usage limits to ensure the stability of the platform.	Users can set usage limits	It does not enforce time-based usage restrictions. It implements technical usage limits to prevent spam and maintain service quality	It does not enforce native time limits or usage restrictions for users but offers voluntary tools to promote healthier viewing habits
Recommendation 3: Design for Well-Being						
Use restricted mode	It offers user-controlled privacy tools to limit content visibility	Reduce engagement pressure by disabling likes on posts	Hide likes and retweets to minimize compulsive interactions	Its algorithm and platform dynamics influence how engagement is measured and valued.	Reduce distractions by muting groups	Limits access filtering content (violence, mature, etc.)
Limit Engagement Metrics	Disable auto-play to reduce visual stimuli	Reduce engagement hidden likes and comments	Hide likes and retweets to minimize compulsive interactions	It does not impose direct limits on engagement metrics. It has restrictions to infinite scrolling.	Hide your online presence to avoid engagement pressure	Limit content exposure to avoid excessive engagement
Recommendation 4: Customization Options						
Manage notifications	Disable or limit push notifications	Temporarily disable notifications	Manage settings	Automatically limit notifications after 10 pm for younger users	Customize or disable notifications to prevent constant interruptions	It provides user-controlled notification management through customizable settings
Feed preferences	Prioritize or unfollow content to avoid compulsive scrolling	Adjust algorithmic content by muting certain keywords	Avoid algorithmic feeds by creating personalized lists of accounts	Users can adjust recommendations	It provides tools to customize conversations and groups. It does not support customizable preferences to help users.	It supports limited feed customization through user-driven preferences. In this case, native feed customization is reactive, not proactive (to help users limit usage)

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Appendices

They can be accessed at https://acortar.link/rwnBUs