A STUDENT-CENTERED APPROACH FOR FOCUS ENHANCING BY SUPPORTING SELF-REGULATED LEARNING THROUGH A MOBILE APPLICATION

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Abstract

The need for effective, accessible, and student-centered support has become increasingly evident in the context of inclusive education and the growing recognition of neurodiversity in academic environments. Traditional institutional approaches such as curriculum restructuring, flexible deadlines with reminders, lecture redesign with brief summaries, controlled exam environments, and the use of assistive tools (e.g., headphones or fidget devices) play an important role, however, these approaches are often constrained by structural and administrative barriers, making them slow to adapt, not consistently available across institutions, and limited in personalization and real-time responsiveness. As a result, there is a growing interest in utilizing digital technologies, particularly mobile applications, as complementary tools for supporting students in managing their learning processes and cognitive states more effectively.

The main contribution of this paper is a mobile application designed for neurodivergent learners that integrates six core features aligned with self-regulated learning processes, including attention regulation, emotional self-regulation, peer support, and academic scaffolding within a unified platform. In addition, the application provides customizable functionality and interface options, enabling users to adapt the learning environment to their individual needs and preferences. In doing so, this work contributes to the broader development of inclusive, technology-enhanced learning environments that support and complement existing institutional accommodations.

Keywords: Self-regulated learning, neurodiversity, attention management, mobile application, student engagement, inclusive education.

1 INTRODUCTION

During higher education, many students face challenges related to attention, motivation, and cognitive load. These are particularly pronounced among neurodivergent students, who may face additional barriers due to differences in cognitive and sensory processing. Such challenges include sustaining attention, regulating concentration, coping with low intrinsic motivation, and resisting distraction from both internal stimuli (e.g., intrusive thoughts, anxiety) and external environmental factors (e.g., noise, digital interruptions). In addition, the increasing demands of higher education, characterized by intensive coursework, continuous assessment, and high expectations for independent learning, often contribute to elevated stress levels and mental fatigue in all students. Collectively, these factors can significantly impact productivity, academic progression, learning outcomes, and overall well-being.

To better understand these challenges, it is important to consider the concept of neurodivergence. The term refers to individuals whose patterns of thinking differ from what is considered neurotypical. It is an umbrella term that encompasses autism spectrum, ADHD, learning differences (dyslexia, dyscalculia, dysgraphia, dyspraxia), conditions such as OCD, and Bipolar Disorder [1].

Contemporary perspectives increasingly view neurodivergence as a natural variation in neurological functioning rather than a deficit, recognizing that these differences may also be associated with strengths such as creativity, innovative thinking, and alternative problem-solving approaches [2], [3].

Despite this shift in perspective, higher education systems remain largely structured around neurotypical learning models, and many institutions have yet to implement accommodations for neurodivergent students. In this context, digital technologies, particularly mobile applications, offer a promising approach for supporting students in managing their cognitive and emotional states. Mobile platforms enable continuous, personalized support that adapts to individual learning needs. However, existing digital solutions, ranging from focus tools (e.g., Forest) to mental wellness apps (e.g., Headspace) and ADHD-specific platforms (e.g., Inflow), often focus on isolated aspects of support for neurodivergent individuals

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rather than providing an integrated solution specifically tailored to the academic and self-regulated learning needs of neurodivergent students.

2 METHODOLOGY

The proposed mobile application is grounded in the framework of Self-Regulated Learning (SRL), which describes the processes by which learners actively monitor, regulate, and control their cognition, motivation, behavior, and environment in pursuit of learning goals [4]. SRL is typically described across three cyclical phases: forethought, performance, and self-reflection, each involving strategies such as goal setting, attention control, emotional regulation, help-seeking, and self-evaluation [5]. For neurodivergent students, sustaining these self-regulatory processes can be particularly demanding, increasing the importance of external support. At the same time, the academic experience of neurodivergent students is shaped by factors that extend beyond self-regulation, including increased stress, feelings of social isolation and sensory sensitivities.

To address both dimensions, the application integrates six core features into a cohesive, multi-dimensional support system. The feature Focus Alerts supports attention regulation, while Study Buddy supports planning, task initiation, and help-seeking. Grounding Activities supports emotional and physiological self-regulation, while Reading & Resources promotes better self-awareness through psychoeducation. Ambient Noise addresses sensory regulation through controlled auditory stimulation, and Support Forum addresses social and emotional needs by fostering peer connection.

In the following subsections, these features are described in detail.

2.1 Onboarding

The onboarding process as shown in Fig. 1 is designed to reduce decision fatigue through an adaptive and personalized approach. Upon initial use, users complete an assessment to identify their primary challenges encouraging self-reflection and awareness. Based on the results, the system generates a personalized set of three recommended features, presented as a “Starter pack”.

Additional features can be enabled at any time via the “Unlock all features” button. This follows the principles of adaptive and recommender systems, where user input is used to personalize the experience [6], while also applying progressive disclosure to reduce cognitive load [7].

As part of the onboarding flow, users may create a profile or continue anonymously. Profile creation requires only a username and password, without collecting personal information (e.g., email or phone number), thereby minimizing identity-related pressure and supporting privacy-by-design principles [8].

Finally, the home interface supports user-driven customization, enabling users to rearrange the core features through drag-and-drop interactions. This enables adaptation of the interface to individual preferences and usage patterns.

Figure 1. Onboarding Flow: register, assessment, home screen (starter pack), home screen (regular).

2.2 Grounding Activities

The Grounding Activities module as shown in Fig. 2 is designed to provide users with techniques aimed at emotional and physiological self-regulation. The module currently includes four core activities:

Breathing Bubbles – a guided breathing exercise that supports controlled respiration patterns. Such techniques are associated with activation of the parasympathetic nervous system, leading to reduced physiological arousal and lower stress levels [9].

Name Three Things (also known as 5–4–3–2–1 technique) – a grounding exercise based on sensory awareness. It guides users to identify stimuli they can see, hear, touch, or smell, thereby redirecting attention to the present moment. By shifting focus away from intrusive thoughts toward immediate sensory input, this technique helps reduce cognitive overload and enhance feelings of control and situational awareness.

Progressive Muscle Relaxation (PMR) – a structured technique that guides users through successive muscle groups, alternating between states of tension and relaxation. This approach has been shown to reduce physical tension, alleviate stress and anxiety, and improve sleep quality [10].

Brain Dump – a free-writing activity that allows users to express thoughts without concern for structure or correctness. The input is automatically deleted after a short period of inactivity, encouraging spontaneous expression without pressure. By externalizing internal thoughts, this activity reduces cognitive load and helps alleviate mental clutter, supporting emotional regulation.

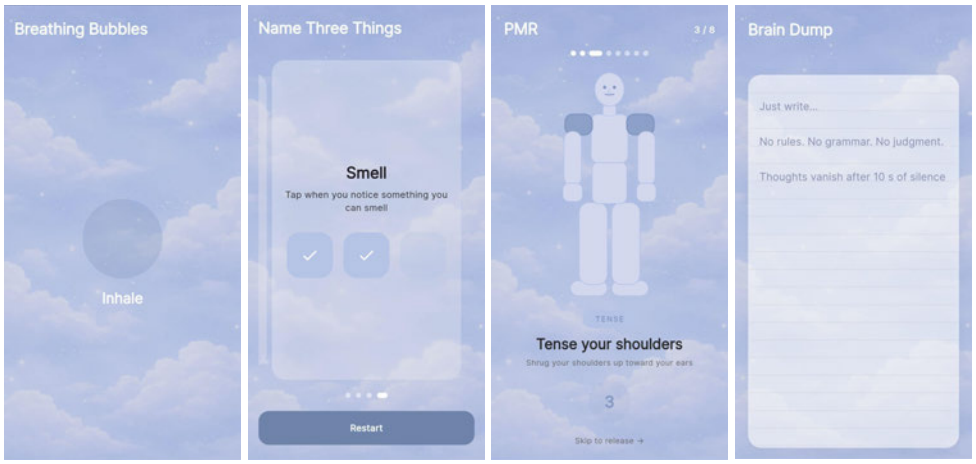

Figure 2. Grounding activities: Breathing Bubbles, Name Three Things, PMR, Brain Dump.

2.3 Reading & Resources

The Reading & Resources module as shown in Fig. 3 serves as an educational module aimed at improving users' psychological literacy (psychoeducation), helping them better understand their cognitive and emotional processes, develop coping strategies, and reduce mental health–related symptoms [11]. The module combines expert knowledge with community-contributed resources, offering a balanced approach between theory and experience. It is organized into two main segments:

Curated Articles – A collection of verified resources covering topics such as attention and focus, anxiety and stress, and learning strategies. It aims to provide accessible and informative content that supports users in developing a deeper understanding of their own experiences.

Community Suggested Links – A participatory section that enables users to recommend resources they have found useful. All submissions are subject to moderation to ensure appropriateness, with content approved prior to publication and removed if reported as harmful. This feature enables users to support one another, fostering a sense of community and shared learning.

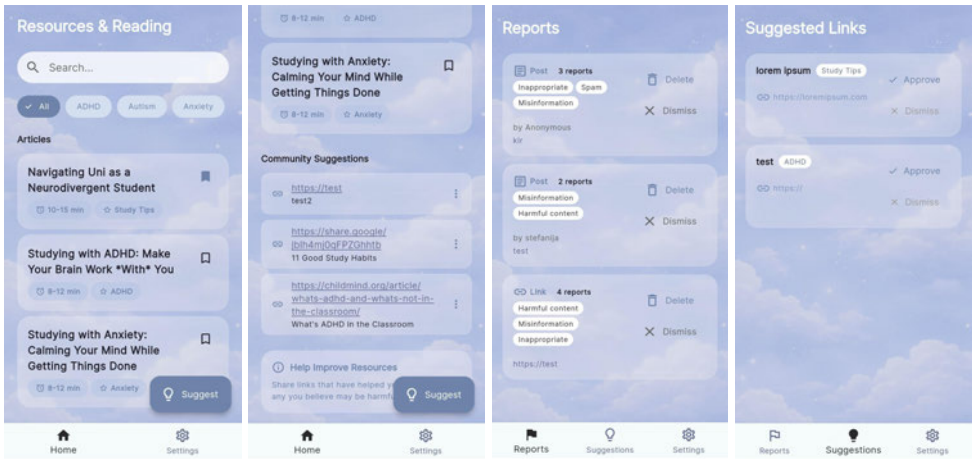

Figure 3. Articles, community suggested links, admin screens - reports and suggestions.

2.4 Support Forum

The Support Forum module as shown in Fig. 4 is designed to offer a safe and supportive environment. Neurodivergent students often experience feelings of isolation and lack of understanding, which can increase stress and negatively impact both academic performance and emotional well-being. Online communities have been shown to provide emotional, informational, and social support, particularly for individuals experiencing isolation [12].

The forum enables users to express themselves, exchange perspectives, and develop a sense of belonging. To encourage openness and reduce fear of judgment, users are given the option to post anonymously. Additionally, content reporting and moderation are implemented to ensure the removal of inappropriate material and maintaining a safe environment.

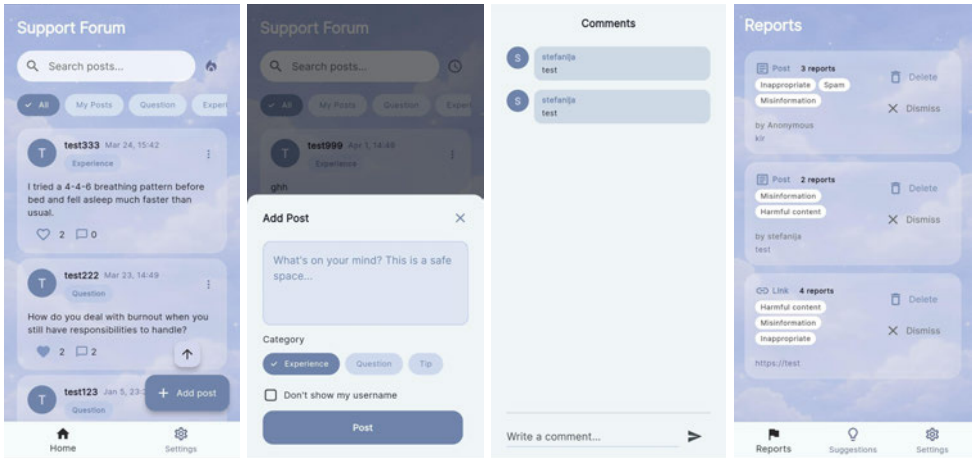

Figure 4. Forum posts, add post, comments, admin screen - reports.

2.5 Focus Alerts

The Focus Alerts module as shown in Fig. 5 is designed to support users who experience mind wandering, loss of focus, and reduced time awareness, particularly individuals with attention-related difficulties such as ADHD, which can negatively affect learning and lecture engagement. The module employs external attentional cues, such as vibration, sound, flash, or notifications, delivered at predefined intervals over a specified duration (e.g., every 10 minutes for 60 minutes) to facilitate refocusing.

This approach aligns with the concept of attention regulation through cueing – by which external stimuli act as a mechanism for reorienting cognitive focus. Such cues have been shown to help redirect attention and reduce mind wandering, particularly in individuals with attention-related challenges [13].

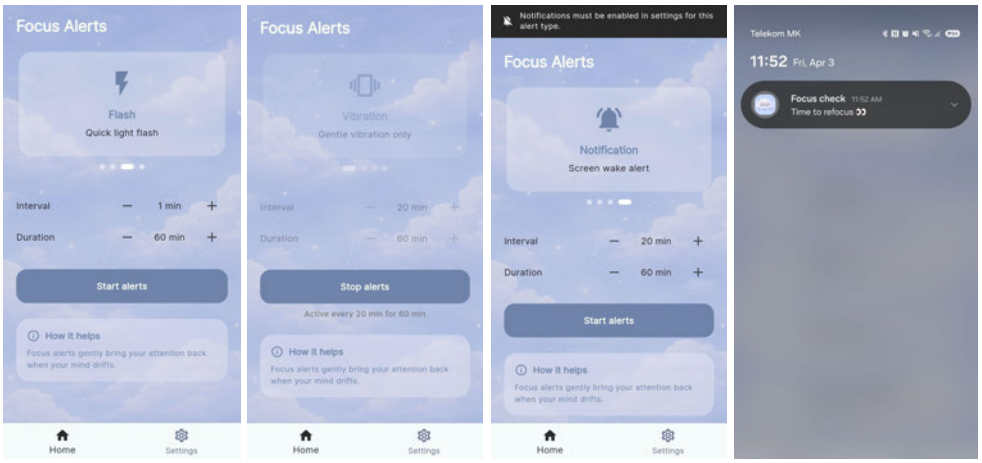

Figure 5. Focus alerts screen, active alert, notification disabled indicator, focus alert notification.

2.6 Ambient Noise

The Ambient Noise module as shown in Fig. 6 is designed to support the regulation of sensory overload through controlled auditory stimulation. Neurodivergent individuals often exhibit heightened sensitivity to sound, which may lead to increased cognitive and emotional strain. In this context, controlled audio can help mitigate sensory overload and enhance focus by masking distracting environmental sounds and supporting sustained attention. The module provides three main categories of auditory stimuli:

Colored noise (e.g., brown, white, pink, blue) – continuous sound patterns that mask unpredictable external noise, thereby reducing the impact of sudden auditory distractions.

Binaural beats (e.g., alpha, beta, delta, theta) – slightly different frequencies presented to each ear, producing a perceived third frequency that may support states of relaxation, focus, and sleep.

Nature sounds (e.g., rain, ocean, thunder, fireplace) – predictable and natural auditory patterns that contribute to a calming and stable sensory environment.

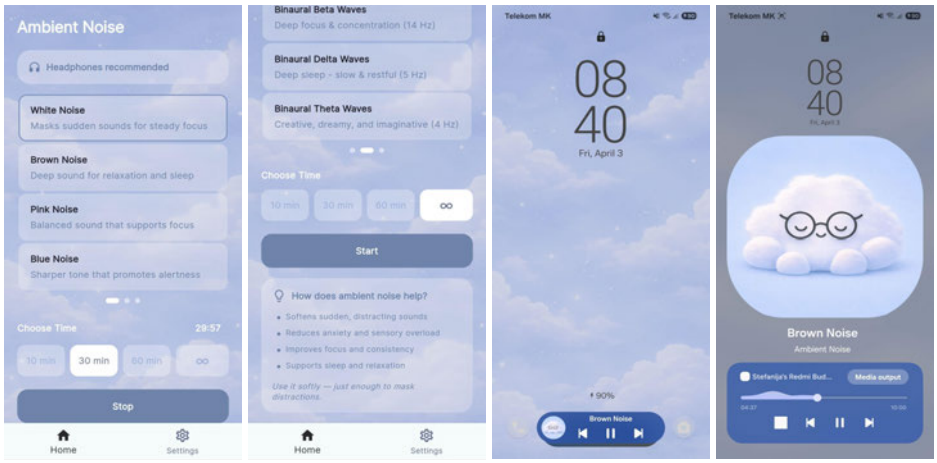

Figure 6. Ambient noise screens, ambient noise playing in background.

2.7 Study Buddy

The Study Buddy module as shown in Fig. 7 is designed to support the learning process by providing structured and adaptive assistance. It offers four types of support:

Quick Task – Generates a small, specific, and time-limited task related to the lecture, aimed at reducing task initiation barriers. This approach draws on principles such as the 5-minute rule and behavioral activation, where initiating a simple action provides a clear entry point, builds momentum, and supports continued engagement.

Ask the Tutor – Provides access to a virtual tutor within a safe and anonymous environment, supporting users who may be hesitant to seek help in traditional settings. This reduces barriers to asking questions, enabling users to clarify misunderstandings and receive immediate, personalized support.

Lecture Breakdown – Structures the material into smaller, logically connected segments, addressing challenges related to executive functions such as planning, organization, and working memory. By breaking down complex content, it reduces cognitive load and improves comprehension.

I Zoned Out – Supports recovery from lapses in attention during lectures by generating a concise summary of previously covered material based on a brief user-provided input. This allows users to quickly regain context and continue following the lecture without feeling lost or disengaged.

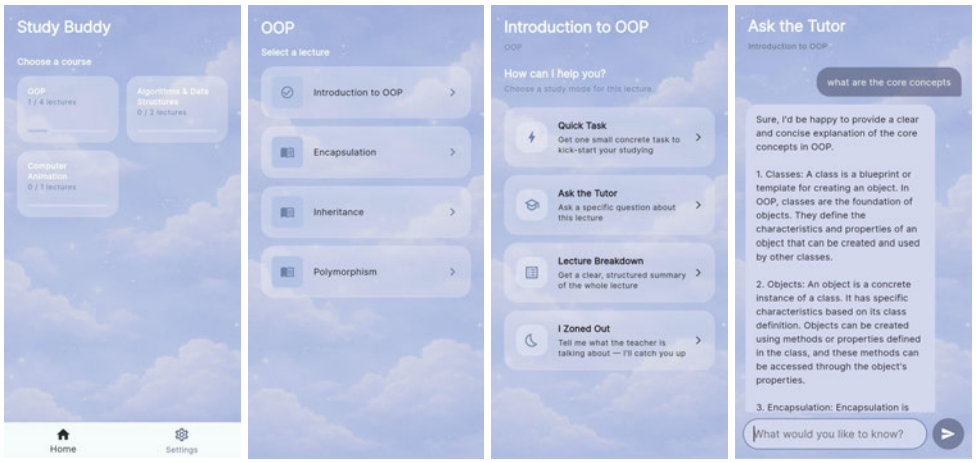

Figure 7. Courses screen, lectures screen, study buddy mode screen, chat screen.

2.8 Settings

The Settings module as shown in Fig. 8 serves as a centralized interface for customizing the user experience according to individual needs. It enables interface adjustments such as dark mode, reduced motion (limiting animations), and configurable text size, supporting accessibility and inclusive design principles [14]. The user interface and experience are designed with a focus on neurodivergent users, using a simple, consistent, and calming design to reduce sensory overload and cognitive load.

Additionally, a feedback mechanism is integrated, aimed at facilitating the collection of user input, supporting iterative refinement and continuous improvement of the application. Feedback is sent anonymously, ensuring that submissions are not linked to individual users.

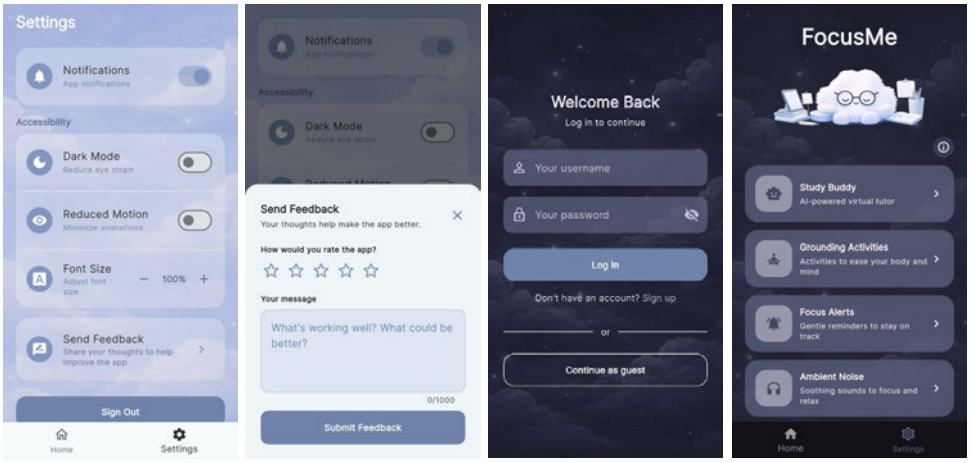

Figure 8. Settings screen, add feedback, dark mode screens: login and home.

3 RESULTS

To evaluate the effectiveness and usability of the mobile application, a preliminary user study was conducted with 10 participants following one week of use. The sample included participants who self-identify as neurodivergent or experience lack of focus. Data were collected through a questionnaire consisting of Likert-scale and open-ended questions. All participants took part voluntarily, and their responses were collected anonymously.

The results indicate that the most frequently used features were Study Buddy, Focus Alerts, and Ambient Noise. Study Buddy was used consistently by 90% of participants (9/10), while Focus Alerts and Ambient Noise were each used by 60% (6/10). Most participants reported that these features were particularly beneficial during lectures and study sessions. They indicated improved focus, enhanced task initiation, reduced distractions and mind wandering, and higher productivity.

The study was conducted during a regular academic period rather than an examination period. As such, usage patterns may differ under exam conditions, where features related to stress regulation (e.g., Grounding Activities) and peer support (e.g., Support Forum) may be used more frequently.

In terms of usability, the application received an average score of 4.3 out of 5, with users particularly highlighting customization options, ease of navigation, and the onboarding process.

Qualitative feedback further revealed several areas for improvement. Participants suggested the introduction of automated focus alerts aligned with academic schedules (e.g., through calendar integration), as well as the incorporation of lecture materials aligned with users' specific university courses, enabling access to institution-specific content (i.e., materials from their own university). Additional recommendations included reminder systems for academic deadlines based on institutional calendars, the inclusion of a chat feature, and the addition of different color themes and a high-contrast mode.

Participants reported a generally positive experience using the application throughout the one-week period, suggesting an overall improvement in study routines. However, these findings are subject to limitations, including the small sample size, short usage period, and reliance on self-reported data.

4 CONCLUSIONS

This paper addressed the challenges faced by neurodivergent students in higher education, including attention regulation, motivation, and cognitive load, which can significantly impact academic performance and overall well-being. These challenges highlight the need for accessible, student-centered support that complements existing institutional accommodations.

In response, this work presented a multi-feature mobile application grounded in the framework of Self-Regulated Learning. The application integrates six features, covering attention regulation, emotional self-regulation, sensory regulation, peer interaction, and academic assistance within a unified and personalized platform. By providing external support for the processes that neurodivergent students often find most demanding to sustain, the application moves beyond single-purpose tools and offers an integrated approach to supporting diverse learning needs.

The contribution of this work lies in demonstrating how mobile applications can be designed to support not only the cognitive aspects of learning but also the emotional and behavioural dimensions, aligned with the principles of inclusive and technology-enhanced education.

Future work will involve more extensive evaluation with larger and more diverse user groups over longer periods, as well as further refinement of the features based on user feedback.

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