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Study Pal: An Automated Tool for Supporting Self-Regulated Learning Habits

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ABSTRACT

In an academic setting, the development of self-learning or self-study solutions is saddled with several challenges due to poor implementation of model-based self-regulated learning (SRL) strategies for the effective management of students' learning habits. With a case-based approach, the present study developed an SRL solution - Study Pal; a mobile application designed to regulate students' study habits by outlining various components of the Zimmerman cyclic model in the forethought, performance, and reflection stages. The study presented descriptions of each of the phases with respect to their evaluations via a semi-automated tool – TestRail. Results showed that the Study Pal solution is very effective at enhancing student study habits through SRL strategies; guiding students in planning, executing, and reflecting on their study activities to develop good academic performance and higher self-regulation with a success rate peaking at 92%. While the study contributes to existing knowledge by promoting the development of self-directed systems with strategies aligning to the phases of a standard SRL model, it was also evident that the reflective analytics suggest that reflective features of the Study Pal solution could benefit from additional features to improve the overall success rate.

Keywords: Educational anxiety; Self-regulated learning; Study habits; Academic performance; Self-study.

1. Introduction

In the literary study by Abadikhah et al. (2018), it was emphasized that a positive attitudinal change accompanied by confidence and competence building is an important factor in the development of self-learning skills that enhance academic performance. Taking this further, Melzner et al. (2020) argued that effective regulated strategies could foster a culture of regulation regarding self-learning, thus stressing the need for universities to promote self-directed or coordinated learning as an antidote for students battling educational anxiety. A significant percentage, 92% of the students in a tertiary institution have one or more smart devices; by this, research has proven students to be highly dependent on them for various reasons (Sari et al., 2020; Pratama et al., 2022; Pronenko et al., 2022). Insights from the literature showthat these dependencies purport the increase in distraction with unpredictable behavior toward self-organized or regulated learning for students; recognizing mobile (smart) phones as one of the major indicators of high irregularities in study habits (Abadikhah et al., 2018; Rezwan et al., 2021; Baars et al., 2022a; Faruq and Purwandari, 2022; Pratama et al., 2022).These irregularities are the consequences of educational anxieties attributed to students prior to the examination or assessment period (Pronenko et al., 2022; Salpocial et al., 2022; Emeka et al., 2023).

According to Zhu et al. (2020), substantiated by Baars et al. (2022b), controlled or regulated learning habits are surmised to be effective in promoting self-confidence in academic accomplishments. Clearly, such an ability to concentrate and learn at one's convenience rests with individual preferences (Kim et al., 2019; Baars et al., 2022b). Still, several challenges emerge in the development of effective learning habits or self-efficacy among students in academic settings due to a lack of time management or failure in setting priorities, self-organizational issues, and articulating the complexities linked with technological integration and overuse.

In recent efforts, the employment of modern technologies in regulating learners' attitudes towards self-guided study, especially by means of controlling their studying behaviors in relation to planned preferences through technology-based platforms on mobile devices has been highlighted in literature with resulting conclusions on students' learning habits, motivations and time management (Oliha, 2014; Kim et al., 2019; Baars et al., 2022a; Khiat and Vogel, 2022; Bembenutty, 2023). Some sources highlighted the significance of mobile applications as an intervention tool for successful SRL processes which could be regarded as a significant factor associated with reduced educational anxiety levels within one's learning ability (Khiat and Vogel, 2022; Salakay and Shrivastava, 2024). Others exposed that most self-study applications or systems available in the likes of Study Pro (Lobos et al., 2021), Todoist (Coscos et al., 2022), Notion (Breitwieser et al., 2023), and Trello (Salakay and Shrivastava, 2024) are more task management-oriented and thus, inadequate with core SRL strategies as proposed by Zimmerman cyclic model (Zimmerman, 2008).

Zimmerman's SRL model divides learning habits into three steps, namely forethought, performance, and reflection. Each of these phases has an integral role for students in terms of how they control and improve their learning experiences (Baars et al., 2022a; Oliha, 2022a).

- In the first phase of forethought, every preparatory step before students undertakes a studying task is outlined such that, they analyze their task of interest and set achievable goals for themselves. This phase encompasses cognitive tasks which transit to the next phase of performance.

- In the performance phase, students are actively involved in the process of learning with adopted strategies like focusing attention on specific details, imagery, and other techniques in controlling and monitoring their study habits. The performance phase is highly dependent on the forethought phase because it involves continuous monitoring and regulation of the cognitive activities during the study periods or sessions (Oliha, 2022b; Abenoja and Edig, 2023). It facilitates metacognitive operations that help adjust strategies for study habits to a particular task aimed at enhancing their overall productivity or effectiveness in self-regulated learning.
- The final phase is the reflection stage, where students review their performance and think about the study process of learning. In this phase, they look at their satisfaction with the results and evaluate how well they acted on it. This will aid them in recognizing strengths and areas for improvement and hence promoting a cycle of ongoing fine-tuning of study habits. The cognitive evaluation of the processes as well as outcomes is included in this phase alongside metacognitive reflections.

According to Pratama et al. (2022), metacognitive processes are associated with higher-order thinking skills that facilitate students' planning, monitoring, and controlling strategies while studying (Jin et al., 2023). This encapsulates the whole cyclic nature of the model such that, in the forethought phase, some examples include setting goals; monitoring learning progress goes in line with the performance phase while reflecting upon the learning experience constitutes part of the reflection phase. The importance of the SRL models is basically to improve learning outcomes with a self-paced efficacy (Khiat and Vogel, 2022).

1.1 Purpose and Significance of the study

The basis for understanding the domain of interest with an attempt to proffer valuable solutions to identified challenges associated with effective study habits and technological approaches is based on insights from background studies. Insights exposed a gap between SRL strategies implementation in actual self-regulated applications in the likes of Study Pro, Todoist, Notion, and Trello; it revealed that they are more task-oriented and thus, inadequate with core SRL strategies (Abenoja and Edig, 2023; Salakay and Shrivastava, 2024). Also, students have been proven with unpredictable habits towards self-organized or regulated learning due to some technological distractions, poor time management, and undisciplined priorities with their learning habits (Faruq and Purwandari, 2022; Pratama et al., 2022). In response to these, the present study modelled a self-regulatory application codenamed “Study Pal” adopting the Zimmerman SRL cyclic model. It further evaluated the proposed Study Pal for SRL effectiveness in accordance with the forethought, performance, and reflection phases of the model.

In significance, the present study attempts to offer a remedy for improved academic performance via the self-regulatory application which aids in managing students' study habits effectively. Notably, the outcomes of the study play a significant role in emphasizing the implementation of SRL strategies in self-study applications or systems to regulate students' attitudes or habits toward learning. The study contributes to the educational research domain by promoting the development of self-directed systems with strategies aligning to the phases of the SRL model to attain a better learning outcome.

The rest of the paper is organized as follows:Section 2 describes the methodology and the development of the Study Pal phases. Section3presents the evaluation and reports for self-regulatory services while Section 4discusses the results and Section 5 concludes the paper.

2. Materials and Methods

A case-based methodology was adopted for the study and the steps required for the realization of the Study Pal solution aredepicted in the conceptual framework of Figure 1. The case-based approach is suitable for research interests where the study is modelled around a selected case study (Halida and Oktava, 2022; Oliha and Usiobaifo, 2024). Thus, students ofthe University of Benin as a case under study, wererandomly selected as participants for the study.

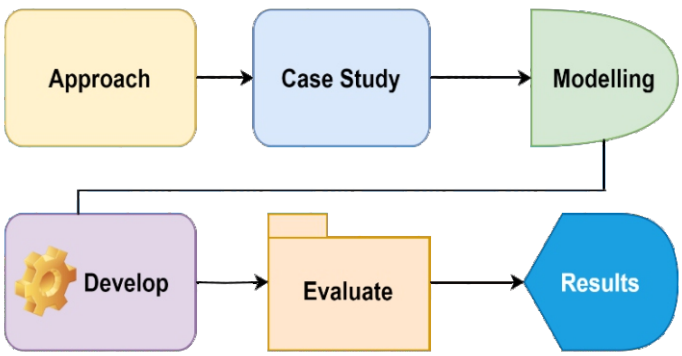

Figure 1: Conceptual Framework

The framework consists of several components that support the complete implementation and evaluation of the Study Pal application. Considering the approach and the case study, the Study Pal solution is a mobile application modeled and developed after the phases of the Zimmerman SRL cyclic model; it is then evaluated for performability with reported analysis as noted in related literature (Oliha, 2022b). Complementing the Zimmerman SRL model with the framework fosters students' creative personalities and thinking abilities, providing a basis for effective management of time, learning strategies and evaluation. Hence, the description of the Study Pal SRL mobile application according to the phases of the Zimmerman model is presented in subsequent sections.

2.1 Description of the Proposed Study Pal Features

In this paper, the Study Pal SRL mobile app was developed to accommodate the model's adaptable features suitable to the scope and philosophy of the present study. In the Zimmerman SRL cyclic model, the whole study process is divided into a trio of forethought, performance, and reflection.

2.1.1 Forethought Stage

The forethought phase provides clarity in terms of purpose and strategies for meeting a study plan, making this first phase effective for self-directed learning. It encompasses cognitive activities such as task analysis, goal setting, and strategic planning. To emulate these constructs, Figure 2 depicts four screens: A, B, C, & D; A is the onboarding phase of Study Pal, a roadmap to exploring the sophisticated features of the application. In screen B, task creation and goal setting are established with the understanding of the requirements and expectations of the learning task. Screen C and screen D allow the students to prioritize their goals towards a targeted time frame.

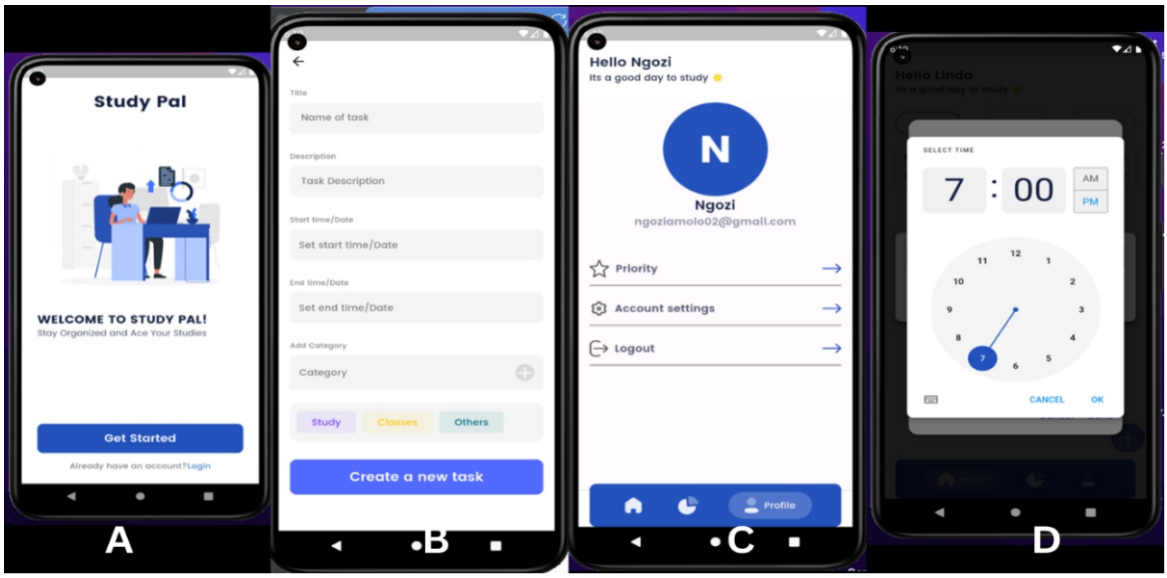

Figure 2: The Forethought Stage of Goal Setting and Study Plan.

Indications from these activities (task analysis, monitoring, goal setting) highlight the metacognitive and motivational processes of engaging in a self-regulated learning habit and predetermined outcomes for students; thus confirming the claim by Salakay and Shrivastava (2024).

2.1.2 Performance Stage

Once students have devised their study plans during the forethought phase, they proceed to the performance phase to commence their study sessions. Illustrated in Figure 3,Screen E and Screen F depict various monitoring tactics engaged by students while executing study tasks. Screen E shows the details of the study task and the targeted time plan, the progress of what has been covered – notifying the percentage of what is left, while screen F is the report generated by the Study Pal on the progress sheet of several tasks in terms of completion and ongoing.Significantly, the timer functionality of the Study Pal SRL mobile application solely aids in planning, monitoring, and controlling of their learning behaviour. Indications from this stage reveal that there is minimal interaction with the application itself, as the focus is to ensure that students refrain from using their phones. Consequently, the only action available to students during the performance phase, aside from reviewing their study tasks, is to refer to their study plan, which includes details about the selected study strategy as shown in Figure 3.

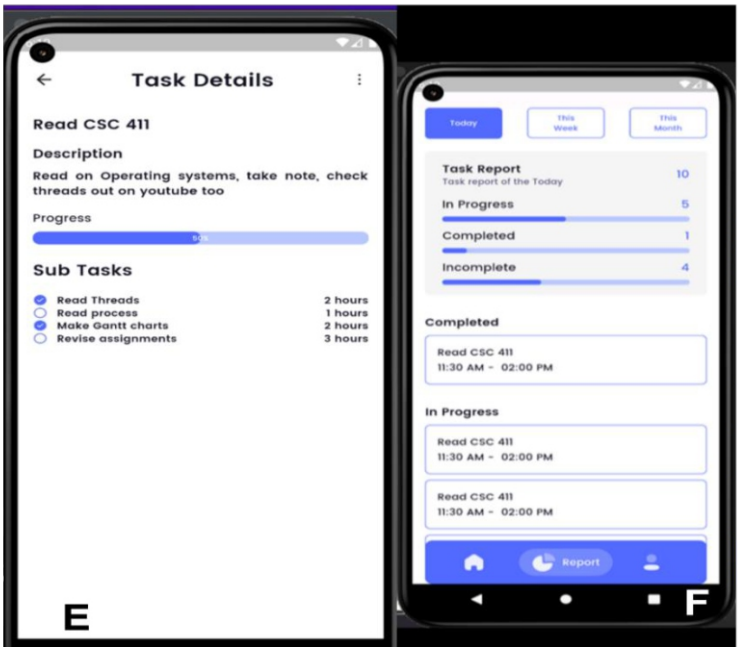

Figure 3: Performance Monitoring Stage

2.1.3Reflection Phase

Reflection aids in recognizing strengths and areas for improvement and hence promoting a cycle of ongoing fine-tuning of learning activities. Figure4. illustrates the review of students' performance while reflecting on their studying habits. They look at their satisfaction with the results and evaluate how well they acted on it as depicted on screen G and screen H. Implications from this phase highlight that Study Pal encourages students to be motivated to maintain a consistent habit with their study session by some means of gamification and interactions for example, “Let's finish your task today” as shown in Screen H for the user named Ngozi.

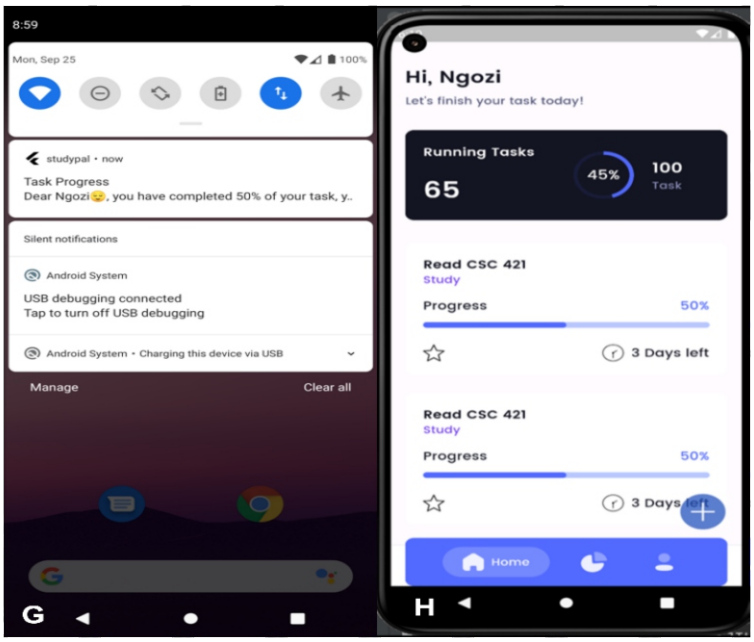

Figure 4: The Reflection Stage.

3. Evaluation and Results Analysis

The study employed a semi-automated quality assurance tool – TestRail to evaluate the Study Pal solution for performability according to the phases of the Zimmerman SRL model. The TestRail evaluation tool is deemed suitable for the assessment due to its capability to efficiently manage test cases, allowing for the manual configuration of test cases according to plan and test runs (Oliha and Usiobaifo, 2024).The evaluation comprised 8 students at the University of Benin, who were participants in the exercise. According to research, a minimum of 3 and a maximum of 15 is adequate for system evaluation and this justifies the number of evaluators for the study (Macfield, 2009; Oliha, 2021a; Oliha and Iyoha, 2023). The test plan orchestrated 27 scenarios with 113 test cases designed across three phases.

Figure 5 visualizes the outcome for the forethought phase of the SRL model examined via TestRail using the implemented application – Study Pal.

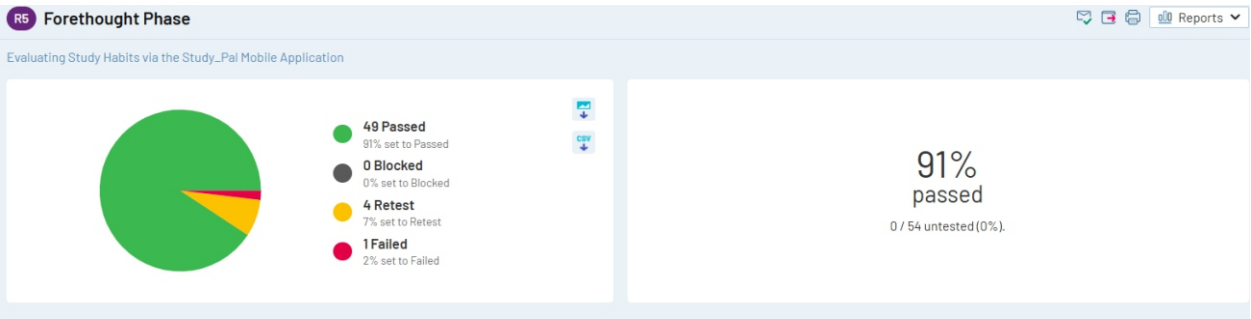

Figure 5: Evaluation Outcome for the Forethought Activities.

The activities of the forethought phase are crucial for effective self-regulated studying habits and hence, a 91% success rate indicates that most students have been able to set their goals well and plan their study sessions accordingly via the Study Pal. The evaluation results showed that total cases of 49 out of 54 passed, 4 retest cases, and 1 failed case with 0 cases untested and blocked. The performance phase is depicted in Figure 6.

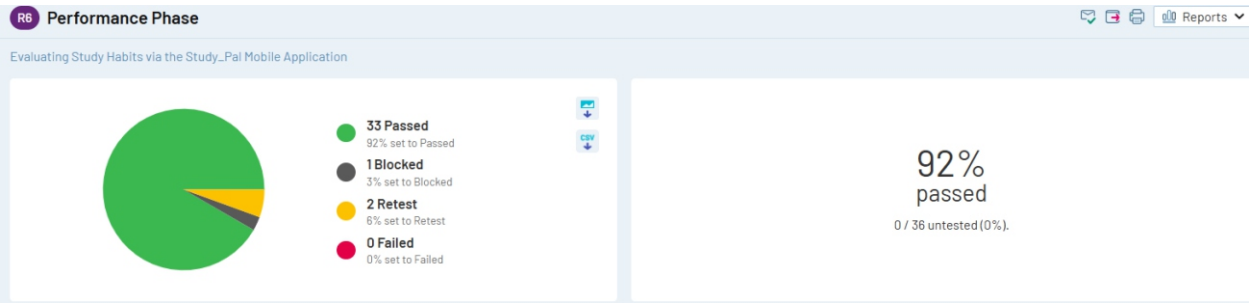

Figure 6: Evaluation Outcome for the Performance Phase

A total of 36 test cases were configured for the monitoring stage as shown in Figure 6. A total of 3(8%) test cases did not satisfy the evaluators but 33 of the totals passed the assessment monitoring. With a 92% pass rate, it is evident that students can effectively engage in their study activities while utilizing the Study Pal app to observe and monitor their progress. The last stage, as depicted in Figure 7 pictures the analysis of their reflection.

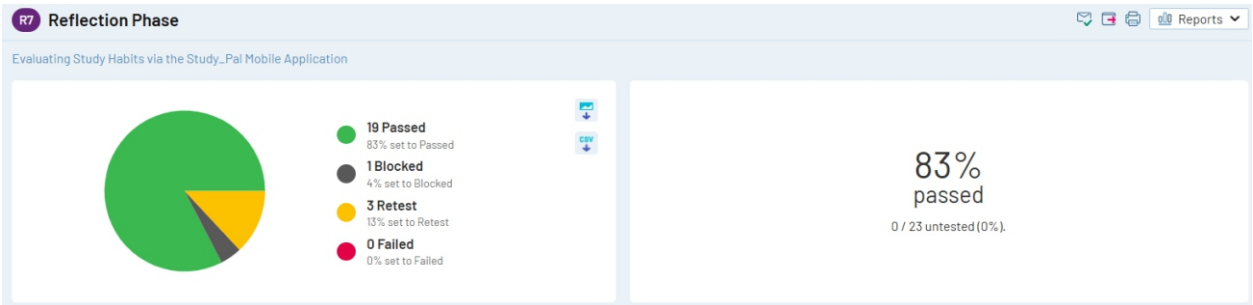

Figure 7: Evaluation Outcome for the Reflective Phase.

In Figure 7, the overall pass rate of 83% shows the ability of the students to assess their performance based on the goals they configured for themselves and reflect on their study behaviours and experiences. However, this outcome is below the excellent rate for an SRL application (Hayat et al., 2019; Oliha, 2021b).

4. Discussion

To comprehensively understand self-study applications, the SRL model was examined via document analysis and the phases were deemed important to the development of an SRL application – Study Pal, to help assist and determine its impact on self-regulated study habits among university students. To this effect, a framework was conceived to realize and implement the solution. A semi-automated cloud-based evaluation tool was employed to check how well the Study Pal mobile application assists students in managing their study habits toward better academic achievements. Thus, the evaluation yielded outcomes worthy of significance to students' academic performance.

First, participants who were students at the University of Benin were meant to assess the Study Pal application and after some time, they were granted access to the evaluation dashboard to manually automate their experiences based on the automated test plan and test runs. The forethought phase of the Study Pal solution was meant to aid students in goal setting, planning, and other metacognitive activities crucial for effective self-regulated studying habits. Results, as depicted in Figure 2,indicated with a success rate of 91%, that the Study Pal mobile application is effective as most students were able to set their goals well and plan their study sessions accordingly. This finding is in consonance with the outcome of Baars et al., (2022a), highlighting that goal setting is vital towards achieving the desired learning outcomes via an SRL system.

Understanding how the implemented solution helps examine the progress of their study sessions based on the targets and goal plans, the result insights in Figure 3. showed a success rate of about 92%, indicating that students can effectively engage in their study activities and monitor their progress via the SRL solution. Salakay and Shrivastava (2024) on monitoring study sessions, emphasized that self-study applications should be highly interactive with gamification and reminders as features that are engaging to maintain an effective study period. The outcome aligns with the works of Salakay and Shrivastava (2024) in terms of effective monitoring of study session progress with a success rate of 85% or more. Thus, it is worth noting that the observed progress (92%), maintaining adherence to the timeline, and test runs were all very important toward the attainment of desired outcomes, ensuring completeness and thorough evaluation as reported in related studies (Baars et al., 2020b; Abenoja and Edig, 2023).

The overall pass rate for the reflective phase was 83%. This indicates that the reflective analysis component of the application did not meet the required 85% benchmark for the effectiveness of an SRL system as opined by Salakay and Shrivastava (2024). Althoughthe results show that the Study Pal application is effective in helping students to go through all the phases of SRL, the ability of the students to assess their performance based on the goals they configured for themselves and reflect on their study behaviours and experiences shows that the Study Pal features and capabilities developed with the SRL strategies are particularly more effective in the performance phase, where it peaked at 92%.

Significantly, the findings contribute to the assertion by Baars et al. (2022b) on the proposition that SRL apps are designed to enhance and assess student study habits through the implementation of SRL strategies. However, the notable study's limitation is that the result is confined to the case study and further work is recommended to extend the functionalities beyond the scope. Also, the reflection phase can be further enhanced by the inclusion of more features that can aid effective study habits in a way that helps support academic achievements and therefore reduce educational anxiety among learners.

5. Conclusion

The deployed Study Pal application is an intervention for enhancing students' study habits using SRL strategies outlined in the Zimmerman cyclic model. The phases were described in relation to how they can help students attain a high success rate, peaking at 92% effectiveness in enhancing student study habits through SRL strategies. In significance to the actual stakeholders, it helps students to develop good academic performance and higher self-regulation in their study session qualifying them to ace their studies. The findings and significance ascertain the technological involvement of mobile applications in SRL development toward enhancing and assessing student study habits through the implementation of SRL strategies.

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