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Attenuating the Effects of the Forgetting Curve Using Efficient Study Techniques: Analysis on the Implementation of a Personalized Learning Application, EduVerse

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ABSTRACT

Students tend to forget approximately 75% of what was learned after attending class or reading a chapter or article. Information that the brain stores can be lost over time when there is no attempt to retain it. Hence, some of those study at the last minute and not allow the brain to process the information for long terms therefore leading to a phenomenon known as the forgetting curve. The purpose of this study is to create a solution for the learning gap that numerous students have due to the inability to retain the information they study. The current study has been carried on offsetting or negating the forgetting curve helping students retain what they learn. The studying, teaching and note taking methods to maintain consistency in learning have been suggested to achieve a goal of retaining learning for longer periods. To solve this issue, an application has been designed to help all students with different learning styles study without gaps in learning, and they themselves can find out what style would fit them and find out how to execute them to attain the best results.

Keywords: Forgetting curve, Learning style, Memory, Retention of information

INTRODUCTION

The psychological processes of gathering, storing, grasping onto, and then recovering knowledge are collectively referred to as memory. We as humans tend to live our lives on the basis of memory, every sight, scent, taste, sound and feel is recognized by us through retaining memories from the past. Though memories are the building blocks of our lives, most of us do face difficulties in retrieving them, this costs us a lot as we depend on memory to live. Not only do exams and career depend on memory but also simple things like remembering a recipe or recalling someone's birthday depend on our capability to remember things. Memory is not solid, it can be tainted by emotion, it weakens with time and sometimes we store wrong information which is hard to change. When it comes to some of life's aspects which depend on memory and understanding like exams and career, we have to make sure that we are capable of maximizing our brain's cognitive ability. We all need to understand that the concept of memory is that of retrieving information from our brain whilst the concept of understanding is being able to explain or make connections to a certain memory, for example, our brain may remember the word mitochondria and that it is the powerhouse of the cell, but the question of understanding is whether I am able to connect and compare this cell organelle with other cell organelles, connect it to the bigger picture of the cell, then the tissue, the organ, the systems and finally a whole organism. The science of understanding comes with the ability to not lose the forest from the trees, as in when we focus too much on retaining the details, we end up forgetting the bigger picture.

The Forgetting Curve: An experiment was conducted by German Psychologist Hermann Ebbinghaus to learn why we forget things, his result is famously known as the "forgetting curve" (figure 1), it proved that in the first 24 hours after learning we forget 50% of the information and in the course of the next six days we lose almost all the information , but if we relearn the information after a period of time within the 6 days the memory can be reinforced and the process of forgetting slows down and when reviews of the information occur within extended periods of time the information will be retained by our brain for a longer amount of time. Though the research dates back to the 1880s, in 2015 a successful replication of Ebbinghaus' forgetting curve was presented [Murre and Dros, 2015] Understanding the process of memory will allow us to create a solution to combat the forgetting curve and implement it in our daily lives while reinforcing the true meaning of education through understanding and application.
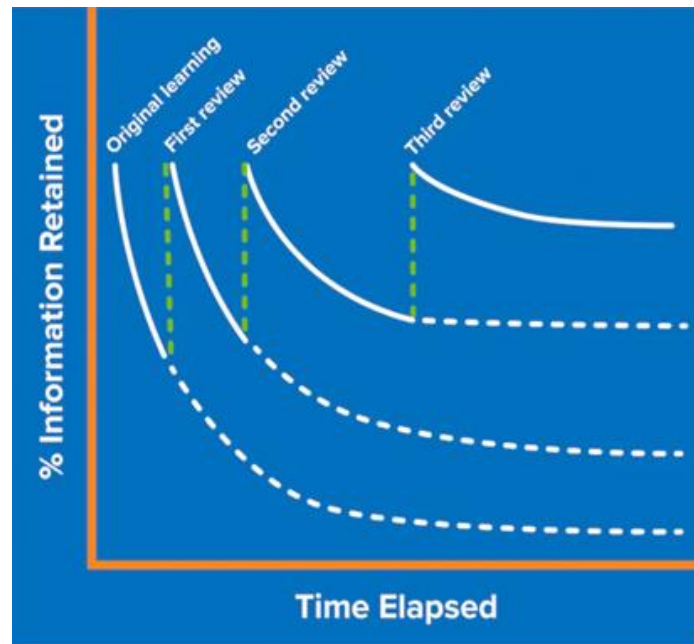
Figure 1: Ebbinghaus's Forgetting Curve

MATERIAL AND METHODOLOGY

Working of the application: EduVerse is a personalized learning app that aims to mitigate the effects of the forgetting curve by utilizing various study techniques personalized for each student, attempting to boost their memory in turn leading to enhanced academic performance [Dunlosky et al., 2013]. Its core features include a spaced repetition algorithm, personalized study plans using efficient study techniques and interactive study tools. By implementing these in a user-friendly interface, EduVerse aims to enhance memory retention, [Bulger, 2016] providing students with a revolutionary platform for effective and personalized learning.

Key features of the application:

1. Personalization: Students will take a comprehensive quiz in the beginning that will help to identify their learning style, preferences and strengths, furthermore this quiz narrows down 4-5 study techniques that suit the learner which the application will primarily focus on.

    - The shortlisted techniques from the quiz are implemented in study sessions/plans and users can provide feedback after each session to further refine the study techniques used by the students.

    - Study methods like Pomodoro, Retrospective revision, Active recall and Interleaving are fixed along with the methods shortlisted from the quiz, however students have the flexibility to choose other methods that they would like to try and incorporate into their study routine [Rezaeinejad et al., 2015].

2. Spaced repetition algorithm: This application utilizes a spaced repetition algorithm using the retrospective timetable concept which provides a flexible customizable schedule that enforces review and study sessions at optimal intervals to consolidate learning and maximize long term retention.

3. Subject-Specific Pathways: Each subject has a unique pathway based on the user's preferred study style and needs (this is customizable)

4. Assessment System: Short tests are held after every session to further reinforce learning, along with weekly and monthly assessments in order to track progress, modify and adapt the study pathway with the study techniques accordingly. A provided progress tracker will give students a visual representation of the overall progress along with achievements and achieved milestones [Jimaa, 2011].

5. Resource Hubs:

    - A centralized hub for accessing notes, flashcards and other study materials that will further boost learning.

    - A Module hub will allow learners to explore and try out different online courses related to their main topics of focus to enhance their understanding, create room for curiosity and make learning interesting rather than a tedious task.

    - Collaboration Platforms:

The application facilitates collaborative study sessions through virtual classrooms along with private one-on-one discussions with peers to further contribute to efficient learning. (ii)Community forums will enable students to share tips, discuss study strategies and seek help, groups for studying can also be made, this will foster a sense of connection and community for all the students.

6. Incentivization: A point system will enable students to earn points through regular study sessions, assessments and active participation, top performing students will be displayed on a weekly leaderboard to further provide an incentive for learning [Grove and Hadsell, 2012].

7. Gamification: Students will be able to earn badges for completing challenges or reaching study goals, the rewards will enhance motivation for learning [Khoshnoodi Far et al., 2023].

8. Feedback System: The feedback loops will allow each student to provide suggestions for modification and report issues, allowing modification to be made to the student's study pathways or the application itself for improvement.

- User-friendly Interface

- Ai powered chatbot and FAQ section for quick assistance.

- This app provides multi-language use for a diverse student base.

- Secure storage of students' data will be ensured by the application for safety and security.

RESULTS AND DISCUSSION

The data has been collected for responses through a survey from various students in a Dubai based school to see how relevant the proposed app is in the current market the results were the following: Most students tend to study around the range of 3-5 hours a week with 35.8% of students exceeding 5 hours of studying per week (figure 2). The graph given beside this information depicts the various note - taking methods and their usage levels. The commonly used techniques have been shown in figure 3. From the data, it has been seen that the blurting method (which is used as both a note taking and study method), sentence method and Cornell method used by 35% of the students who took this survey (figure 4).
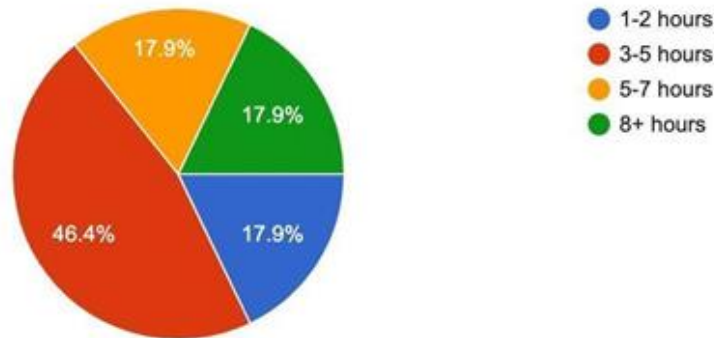

Figure 2: Number of hours the students study per week regularly
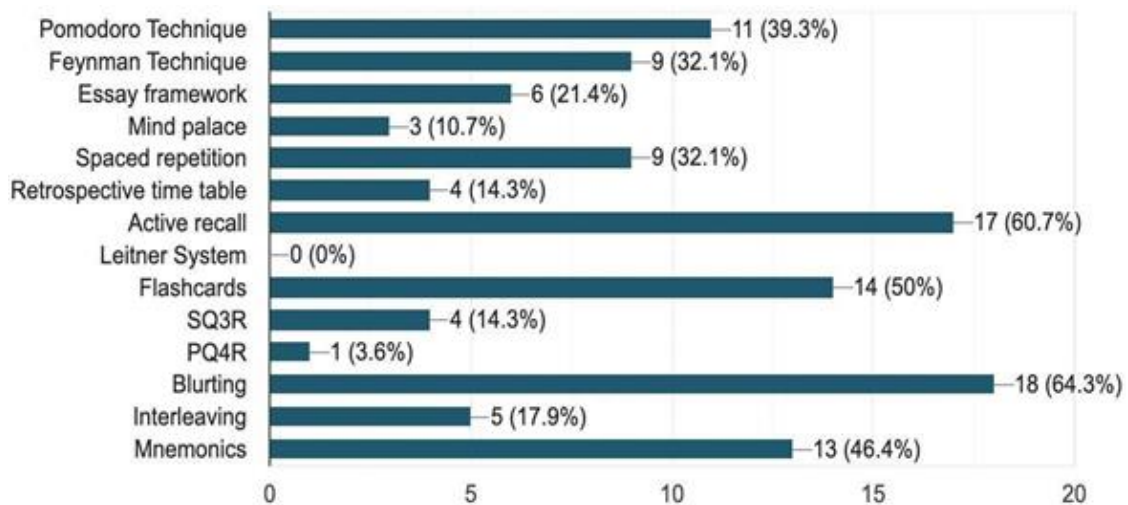

Figure 3: Commonly used techniques to retain information
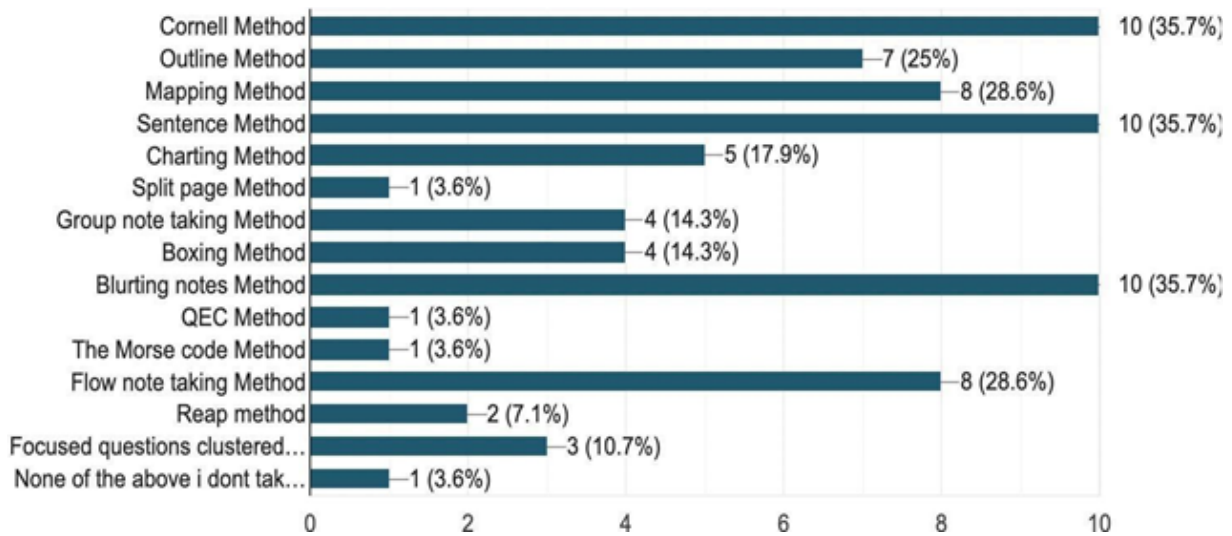
Figure 4: Strategies used for note taking

It has been seen that 82.2% of the students who took this survey have not found an efficient application which helps them to study, proving that our app, eduverse will be of great use to the students who will use it (figure 5). The question of whether this app has value in the current market is answered by 85.7% of responses saying a personalized study app would help in the improvement of academic performance (figure 6). Through research the authors have analyzed data collected by other researchers to convey the effectiveness this application holds in the current market. The intention is to move from narrower topics such as the effectiveness of each studying method to broader ideas including our worth in the current system of education.
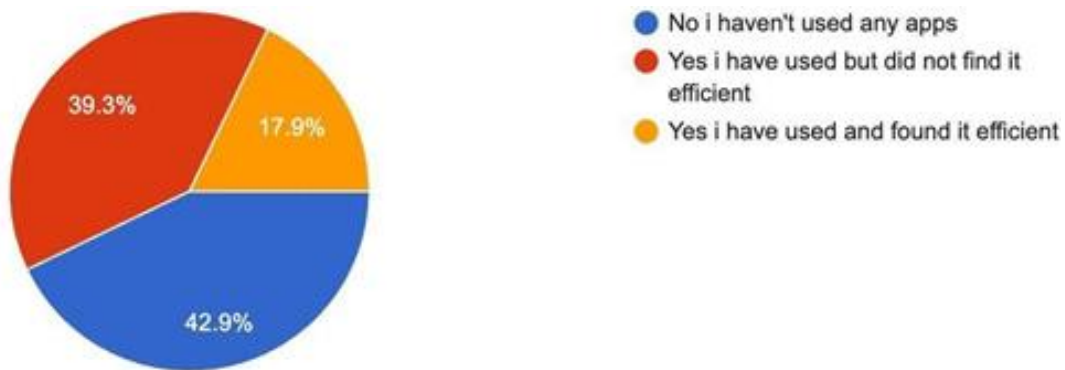

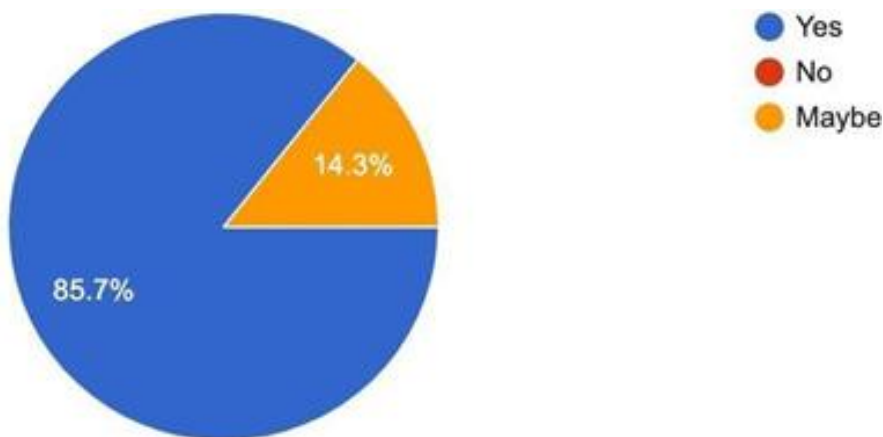Figure 5: Use of online tools to assist in studies

Figure 6: Is there any Impact of personalized study apps on improvement of academic performance?

Effectiveness of techniques:

Pomodoro: It is a technique which allows the user to work without feeling burnt out, through short breaks between each pomodoro. The brain does not need more than 5 mins to refresh after a concentrated work session therefore making this technique increases the user's efficiency by 25-50% if it adapts to their study style [Biwer et al., 2020, Donoghue et al., 2021]

Spaced Repetition: A study conducted by York university in Toronto concluded that students who used spaced repetition while studying had a higher mean score of 70% compared to the other students in the study.

Interleaving: When users learn and practice topics through interleaving, they are forced to identify and learn the unique features of each topic.

Feynman Technique: As in teaching the subject to learn it better, I think statistics aren't needed for this. We all know that the teachers who teach us each subject have way more in depth knowledge in it than us because they aren't teaching themselves rather they are teaching people who have no clue about it therefore when they explain something complex in simpler terms for a student they understand it better [Reyes et al ., 2021].

Why an application?

The whole world is moving forward in technology and through our recent pandemic even primary students are capable of efficiently navigating through mobile phones, tablets, laptops and other tech devices. Education app users skyrocketed from 185 million in 2019 to 270 million in 2020, marking a 46% increase. Since then, this upward trend has shown no signs of slowing down, with the user base expanding to 350 million in 2022.The numerous benefits of making our idea an application over an onsite process include:

- Cost efficiency

- Flexibility

- Working can be done at one's own pace

- Communication and collaboration happen digitally

- Travel time does not confine students [Kataria, 2022]

Memory is an essential part of the human developmental and cognitive processes as it helps the individuals to cope up with their surrounding environment, adapt to new information by the already integrated and processed information through past experiences. The current study aimed to develop a solution to help the students facing difficulties in learning and memorizing information in schools or other educational institutions thereby aiming to get a higher score in examinations and other tests or assignments. As the main focus of the current study was the emphasis on forgetting curve by Herman ebbinghaus and ways to develop main strategies to overcome forgetting of information learnt a while ago, this study presented the use of Eduverse to help students efficiently and effectively process information learnt to understand and memories for assessments or exams. As we all know consistency is the key, but that does not mean you tire yourself. There are times when us students study for multiple hours without break or maybe take too many breaks. There are times where despite studying so much you might not understand or remember the concept clearly. The mind learns best by linking concepts to others, we can use certain methods to help remember or understand concepts better. Despite so many apps that can help you learn they might not necessarily be effective as it might not help with your syllabus or not better explanation of concepts as we know 82.2 percent of people who took the survey have not found an efficient application which helps them to study even if found it's only to answer main questions not help you take up or catch up with the syllabus reminders can be given as well as methods to be used to catch up certain methods for certain subjects or you may choose whatever helps you best. So many techniques: pomodoro , spaced repetition , interleaving and so on each has a unique way of helping you understand a concept. Linking the key finding together, it can be stated that the Eduverse app can be an effective source of learning and improving memory in terms of memory test scores and memory. retention for age groups of (13-20) who use it on a weekly basis keeping a track of the amount of time spent on the app. The practical implications of the study include the usefulness of the app in necessary situations which can be learning for an assignment, memorizing key points for the exam or just general information. In addition to the point previously mentioned, the application and implication of the study further include in increasing memory retention for teens gamers and early adults for any learning materials they require to understand There are certain limitation to the current study which firstly includes, less sample size, due to a reduced and a less sample size the the study results can not be generalized to the whole population. Secondly, the current test was conducted specifically to the students in gems modern academy , the accuracy of the results might different when compared to other schools Thirdly, the questionnaire used in the survey is not evidence based and experimentally tested by previous authors and scholars, due to which the reliability and accuracy of the test scores is proven, hence the application and making of the questionnaire is for general understanding of the Eduverse app. Recommendations for future research involve firstly, that the current research study must be conducted on a larger sample size using an evidence based questionnaire for the subjects to test the effectiveness of the Eduverse app. Secondly, it is recommended that the method and materials of the study be conducted in other schools and then compare the results with the surrender study to see to what extent the results differ. With great dedication and consistency not only will we be able to promote our app but also help the user in better understanding. There are numerous benefits for the user, not only one but flexibility along with working at one's own pace can be an important factor in the learning journey.

CONCLUSION

How might we mitigate this rapid loss of information? The correct answer is through an amalgamation of tailored study techniques and space repetition. Hence, it has been concluded that the research to curb the effects of the forgetting curve has shown a need for personalized, efficient study techniques like spaced repetition and active recall. Based on current research, it's evident that the implementation of a centralized learning application, EduVerse, will prove to be a means to improve how we learn and retain information. Our App's potential to integrate personalized study techniques, spaced repetition algorithms, tactful study tools and more useful features will help students take a step towards long-term, efficient knowledge retention and enhanced academic performance. Furthermore, the use of gamification elements shows a potential to encourage motivation, helping change learning and studying from a tedious process to an interactive journey. To sum up this research paper, EduVerse will have the capacity to revolutionize learning by tailoring it

to each student's needs and fostering an engaging and efficient educational experience all leading to our goal of attenuating the effects of the forgetting curve and contributing to academic success. The ultimate goal is to create an engaging and dynamic platform that adapts to individual learning styles, encourages student collaboration, and provides a holistic learning experience for all students.

Acknowledgement

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