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Original Research Article

Early Identification of the Factors Affecting the Academic Performance of Medical Undergraduate Students and Developing an Action Plan to Improve the Same Before Academic Failure

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ABSTRACT

Background: This study aims to identify factors influencing medical students' academic performance and develop a simplified action plan to prevent academic failure.

Materials and Methods: A prospective educational intervention utilized Ron Fry's Questionnaire to assess seven performance factors (concentration, comprehension, test anxiety, organizational skills, writing skills, computer skills, and system of taking notes in class) among medical students. Standard solutions with individualized action plans including intention statements, constant reminders, identifying reasons for test anxiety, and organizing oneself were offered based on these factors to create individualized action plans. Pre- and post-study test scores were compared using paired T-tests, and feedback was collected.

Results: A total of 117 students participated, showing significant improvement in post-study marks ($p = 0.00015$). 31.6% of students improved and avoided failure post-study. 99% of students believed such interventions could benefit future batches in early performance identification.

Conclusions: Utilizing Ron Fry's questionnaire to identify performance factors and offering support in the form of standard solutions, may collectively enhance academic performance and reduce academic failure.

Keywords: Action plan, Early performance identification, Medical students, Ron Fry's questionnaire

INTRODUCTION

Due to the extensive curriculum in the medical field, medical students risk academic failure. In the MBBS program, students are identified for support only after failing an exam rather than when they are at risk. Academic failure can negatively impact mental health, leading to low self-esteem, stigmatization, anxiety, depression, and suicidal thoughts.[1-3]

A qualitative study shows that medical students are often too embarrassed to seek help or unaware of their risk of failure. Therefore, the authors aimed to identify factors affecting low performance and develop a simple intervention/action plan to improve it.[3]

Research Question: Does early identification of factors contributing to academic performance in medical undergraduate students by Ron Fry's Questionnaire and offering simple interventions reduce academic failure in internal exams?

Aim of the study: To identify the factors affecting the academic performance of medical students early enough and develop a simple individualized intervention plan to support the students by offering them standard solutions before academic failure.

Primary Objective
To analyze the students' perception in identifying the factors contributing to their academic performance using the self-evaluation Ron Fry's Questionnaire.

Secondary Objectives

1. To evaluate the change/improvement in performance/marks of medical students after the factors affecting performance are identified by the students and a self-improvement action plan is designed by him with the simple standard interventions offered to them.
2. To compare the marks pre- and post-study after six weeks.
3. To elicit feedback on the study from the medical students.

MATERIALS AND METHODS

This prospective, questionnaire-based study was conducted in the Department of Pharmacology after ethical clearance from the Institutional Ethics Committee. We assessed 120 medical students based on their marks in the first and second terms and other class tests. A class was organized to explain the study's utility. The seven factors assessed using the Ron Fry's questionnaire were concentration, comprehension, test anxiety, organizational skills, writing skills, computer skills, and note-taking systems.

Inclusion Criteria: Phase-2 MBBS students willing to participate and complete Google forms.

Exclusion Criteria: Students unwilling to participate.

Study Duration: 6 weeks

Study Population: 120 second-year/phase-2 medical undergraduate students who have completed second terminal exams.

Study Design: Non-Randomized experimental study design

Data Collection and Analysis: Students completed a Google form to identify factors affecting their performance using Ron Fry's self-evaluation questionnaire. They then prepared a self-improvement action plan based on standard solutions provided in Google Form 1 (Table-1).

Google Form 2 helped students summarize and list factors and write a summary of the action plans during the 6-week study. Students scoring below the 50th percentile pre-study received reminders and could discuss their action plans with faculty. A post-test after 6 weeks evaluated performance improvement.

Students then filled out Google Form 3 for feedback and reflection. Responses from Google Forms 1, 2, and 3 were analyzed using Google Forms results. A paired 't' test compared pre- and post-study marks. Pearson's correlation coefficient assessed the relationship between pre-study percentile marks and Ron Fry scores. Qualitative feedback was collected using Rolfe's model from Google Form 3. Figure-1 explains the flowchart of the research plan of the study.

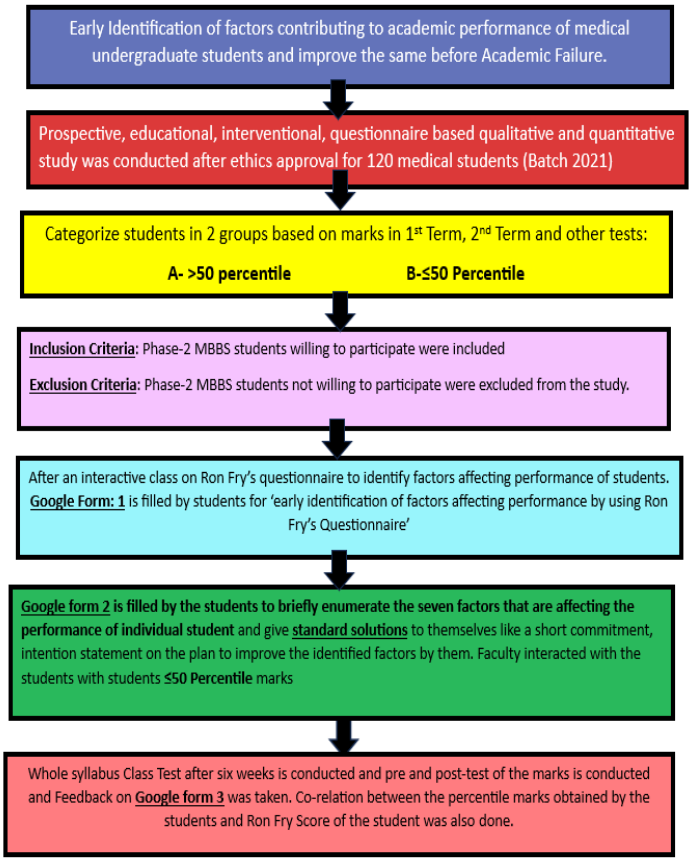


Figure-1: Flowchart of the Research Plan

Table-2 has been designed to explain the evaluation matrix plan of assessment of the impact of the study. Questions were designed to assess the impact on students' reactions, learning, application, and results through an evaluation matrix.

RESULTS

One hundred eighteen (118) students completed Google Forms 1 and 2 for self-evaluation of factors affecting their performance, and 103 students completed Google Form 3 for feedback and self-reflection.

Demographic Details: Of the 118 students, 72 were girls (61%) and 46 were boys (39%). (Total students in the batch: 72 girls and 48 boys).

Table-1: Simple standard solutions offered for the seven factors

7 factors affecting study skills	Simple standard solutions that were offered for improving these 7 factors[4-7]
Concentration	Please write down a short intention statement of what change are you planning to take regarding the same and re-evaluate yourself after one week for next six weeks. A conscious effort and constant reminders to oneself to not just sit with books thinking about something else but to clearly ensure that when you open your book it is of top priority to read and not do anything else like mobile chat/Instagram etc. Use Intention statements (An intention statement is essentially a written expression of your intention): 'Today I will make a conscious choice of studying'. 'Today I will be more present and focussed when I am studying'.
Comprehension skills	According to reading experts there are six fundamental purposes of reading: - To grasp a message - To find important details - To answer a specific question - To evaluate what you are reading - To apply what you are reading - To be entertained Write in short, what will drive and improve your reading and comprehension in future, and remember to remind yourself of the purpose before you start reading. Also, avoid pleasure reading, ensure that when you sit to read it should be critical reading (analysing a concept) or quick reference reading (focusing on seeking specific information). So, in short write a commitment to yourself of how will you improve your reading skills. Do you know what is prereading? Regarding pre-reading (skimming), acknowledge its importance in quickly gaining an overview of text. Aim to practice this method effectively to discern when detailed reading is necessary versus when skimming suffices. Improving in this area will help you manage study time more efficiently and enhance your overall comprehension skills. Write a short note and comment about the concept of prereading if you practice this or not, is there any need to improve in this area?
Way of study and test anxiety	In short identify what is causing this test anxiety and work on that? Hints for reasons of anxiety - Last moment preparation - Lack of preparing a time table and schedule of studies - Do you check last year's question papers and understand the pattern of questions being asked or do you do word by word pleasure reading of the whole text book casually? - Do you try to identify which topics are of more public health importance and therefore more important topics or continue reading what you like? - Do you read the competencies and prepare competency wise while preparing for your exams? - Do you think you need to adapt and work on your anxiety by doing some relaxation techniques like walking, meditation, playing, yoga or things you like to do. - Do you think you need to consult some psychiatrist and take antianxiety medicines as the anxiety is too much to hamper studying and nothing helps? - Any other reason that will help to reduce exam/test anxiety? - Kindly Comment would you like to discuss with your teacher about the same.

Organisational skills	Kindly comment briefly how will you organize your time? Kindly enlist and identify for yourself where does your major time go? - Meals/Sleeping/Entertainment/social media and Games/ Grooming/ Extra-curricular activities/ Hanging with friends etc. - You may identify any other area and enlist that too. - Give a commitment to yourself of how will you try to organize and manage your time.
Writing skills	If you are not getting good marks despite being a voracious reader you are not working properly on your writing skills for the answers. - Please write down the assignments allotted in class and seek guidance on how should one write good answers in theory medical exams.[8] - Please discuss with your teachers on what is expected to be written in various types of questions in the medical exam?[8] - Write down and commit to yourself on how do you plan to improve your writing skills in an answer?
Computer Skills	Kindly give a commitment/intention statement what will you plan to improve your computer skills?
System of taking notes in class and from text books	Write down few points on how are you planning to improve your system of taking notes in class.

Table-2: Evaluation matrix to assess the impact of the current study using specific evaluation questions and indicators

Levels	Evaluation Question	Indicators	Data Source	Data Collection Methods
Level-1 Reaction	To what extent do you like the way the present method of Ron Fry's self-evaluation Questionnaire of identifying early the factors affecting your performance is designed and conducted? (Content, presentation, preparation and facilities)	80% of the students should rate the program 3 or more than 3 on Likert Scale	Student Feedback	Feedback Questionnaire based on Likert Scale
Level-2 Learning	How much difference did it cause in the academic failure in internal exams before and after the early identification of factors affecting the low performance using Ron Fry's Questionnaire	50% improvement in academic failure should happen in internal exams before and after the study	Students marks before and after the study	Tabular representation of students marks and comparing before and after results
Level-3 Application	How well the students perform in the Pre-University Exam	80% of the students should score more than 50% marks in theory exam of Pharmacology	Students Marks	Tabular Representation of Students Marks and identifying students scoring more than 50%
Level-4 Results	How well did the medical undergraduate students performed in the Final Pharmacology University Exam across the state.	Comparison of academic failure in Pharmacology in various medical colleges across the state	Students Marks	% of students failed in Pharmacology at Pt JLNGMCH, Chamba in comparison to the rest of the other state Medical Colleges.

Percentage of students identifying factors affecting their performance: Table-3 shows the percentage of students who identified the need to improve in seven areas: concentration, comprehension, test anxiety, writing skills, organizational skills, computer skills, and note-taking. 82.1% of students (96/118) reported needing to work on concentration. Over 70% (82/118) identified the need to improve writing and organizational skills.

Table-3: Percentage/(number) of students who identified the need to work on the seven factors

S. No.	Seven Factors from Ron Fry's self-evaluation questionnaire	Percentage/(number) of the students who identified the need to work on the factors(n=118)
1	Concentration	82.1/ (96)
2	Comprehension	57.3/ (63)
3	Test Anxiety	55.8/ (79)
4	Writing Skills	71.8/ (79)
5	Organizational Skills	72.3/ (81)
6	Computer Skills	18.2/ (20)
7	System of taking notes in class	26.8/ (30)

Comparison of pre- and post-study marks

There was a significant improvement ($p < 0.00015$) in the post-study average marks (56.9±15) compared to the pre-study average marks (51.3±13.6). Before the study, 57 out of 120 students (47.5%) failed, while after the study, 39 out of 120 students (32.5%) failed, showing overall performance improvement. Additionally, 18 out of 57 students (31.6%) who initially failed passed the post-study exams. The two students who did not participate failed both pre- and post-study tests. Figure-2 shows a bar graph comparing the average pre- and post-study marks for the entire batch.

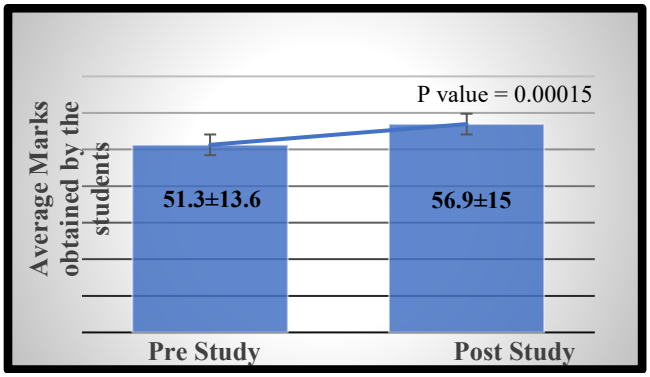


Figure-2: Bar graph for the comparison of pre- and post-study average marks obtained by whole batch

Correlation between Ron Fry's score and pre-study marks

The average Ron Fry's score for the batch was 12.33 out of 28, with a median of 12 and a range of 4-27. A higher score indicated more issues to be addressed. Pearson's correlation coefficient between the Ron Fry score and pre-study marks was -0.49 (confidence interval -0.6196 to -0.3442), indicating a weak negative correlation. This means that higher Ron Fry scores were associated with lower pre-study marks. The correlation was significant ($p < 0.05$). Figure-3 shows a linear regression curve illustrating the inverse relationship between Ron Fry scores and pre-study percentile marks.

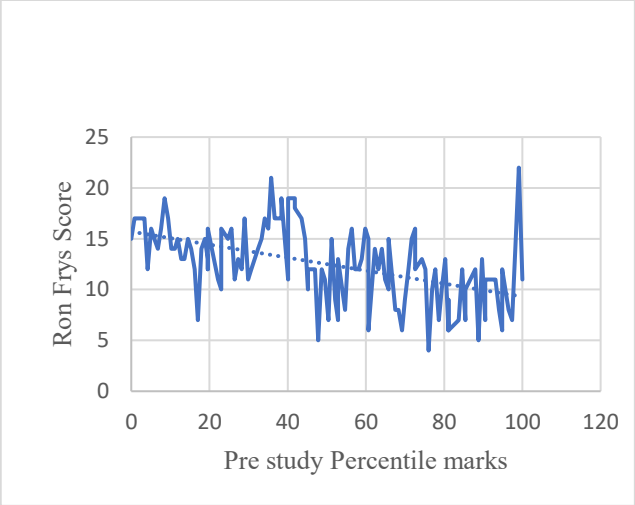


Figure-3: Pearson correlation between Ron fry score and pre-study percentile marks of the students

Reflection and Feedback from Students

Google Form 3, completed by 103 students, revealed insights into the effectiveness of the four exercises (Ron Fry's score, assignments, tests, and reminders). Using a four-point Likert scale (1: least difference, 2: mild difference, 3: moderate difference, 4: maximum difference), the bar graph showed that 72.8%, 85.4%, 84.4%, and 76.7% of students rated these exercises as making a moderate to maximum difference, respectively. Figure-4 illustrates the distribution of these ratings.

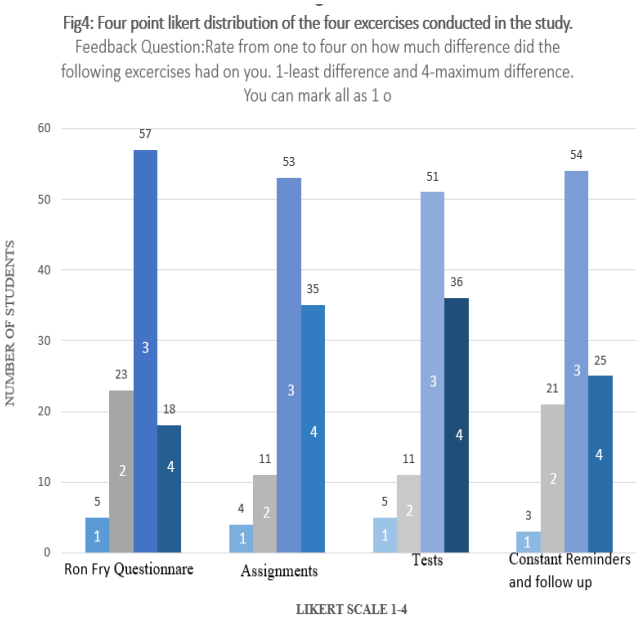
Additionally, 96.1% of students rated the self-evaluation questionnaire as well conducted/ very well conducted/ excellent (3 or higher on a 1-5 Likert scale).

Furthermore, 99% of students agreed that the facilitators were knowledgeable and responsive. 98.1% agreed that the 6-week exercise was a useful learning experience. All students felt they could identify their strengths and weaknesses due to the exercises. 99% would recommend this exercise to future batches and other medical colleges.

Table-4 presents common qualitative reflections from students, and Table-5 shows common intention statements related to the seven factors from Ron Fry's questionnaire.

Table 4: Two common quotes/qualitative responses of the students for the questions asked in the reflection using Rolfe's model

S. No.	Rolfe's Model of Reflective writing	Two common Quotes from the responses given by the students
Q1	Can you reflect on **what happened** in this 6-week exercise?	'This 6-week exercise helped me to focus on my weak points, like exam anxiety, lack of focus, and inability to recall. This helped me to improve all these points.' 'I feel highly motivated and exceptionally confident. I worked on my shortcomings and tried to be a sincere person, increased my productivity and marks'
Q2	**So what?** Does this exercise teach you something? Did you get any insight? Do you have some new understanding of the situation?	'Yes, I worked on my habit of procrastination. This was a major change which I noticed.' 'Yes, this exercise taught me that regular revision of topics or multiple time revision can help me to reduce test anxiety and also helps to recall things. 'Consistency is the key. If you are inconsistent an easy task can become difficult.
Q3	**What next?** How do you think it can improve things for you?	'It has provided me a system of self-assessment which will undoubtedly help me during exams and provide me the necessary insights on how I can further improve.' 'It improved many things. if I look back 6 weeks before and compare with today, I can see great changes. This exercise made me understand how to utilize time and focus on what is important or not.'



Results for Evaluation Matrix Indicators

Level-1: 96.1% of students rated the program 3 or higher on the Likert scale for the effectiveness of Ron Fry's self-evaluation questionnaire.

Level-2: There was a 31.6% improvement in academic failure rates before and after the study, which was 18.4% below the 50% improvement target.

Level-3: The goal was for 80% of students to score over 50% in the Pre-University Pharmacology exam, which was achieved with 93.3% scoring above 50%.

Level-4: In the University Pharmacology exams, out of 24 students across six state medical colleges who failed or were detained, eight (33%) were detained by our department due to poor attendance and internal assessments. All students who took the final exam passed.

DISCUSSION

Medical students are under significant pressure to learn the skills needed to become good healthcare professionals. Many feel lost and unsure of how to study effectively.[8] Factors affecting student performance include lack of concentration, interest, regularity, language problems, stress, depression, sleep disorders, parental and peer pressure, low socioeconomic status, career aims, gender, refractive errors, smartphone use, sleep habits, lifestyle, exam patterns, teacher-related issues, anxiety, large classrooms, dormitory crowding, and classroom facilities.[9-11]

Table-5: Two Quotes/qualitative responses from the common intention statements used by the students for the seven factors from the Ron Fry's questionnaire

S. No.	Ron Fry's Seven Factors	Two common Intention Statements
1.	Concentration	'I need to make a practically possible time table by including breaks after 1.30 hrs study span and keep a alarm so that I don't exceed the limit of break.' 'I will try not to use distractions such as my phone or tab while studying for at-least 2 hours.'
2.	Comprehension	'I'll try to understand things more rather than cramming the things leading to mix-up of all the topics I read.' 'I love reading but I devote more time in playing football and devote more time to friends. But from now onwards I'll devote more time in studying.'
3.	Test Anxiety	'My reason for not properly studying is last minute preparation, try to learn whole text, do not refer to previous year question and somewhere there is peer pressure also. I will make a proper time table and follow it daily. I'll also work on my anxiety which comes due to lack of revision.' 'I will study regularly; I will do meditation for anxiety.'
4.	Organizational Skills	'I spent most of time in watching movies, which I think I have to stop, and have to study.' 'Most of my time goes in mobile gaming sleeping and phone call from today I will channelize this time for studying.'
5.	Writing Skills	'I will work on my writing skills and will try to write in point and flow chart for better remembering them.' 'My handwriting is pretty bad which makes my work untidy. And I really struggle with spelling. It's just I am not able to memorize the spellings especially of drugs thus also not able to pronounce it. I will work on it.'
6.	Computer Skills	'I usually get distracted by the vast amount of information present on the internet and end up forgetting the real reason as to why I opened it. I'll keep that in check.' 'I have sufficient computer skills.'
7.	System of taking notes in class	'I will note every important point the teacher says and will make my system of taking notes better.' 'I make notes in class but don't study them. I prefer studying from book... But from today I will also look upon my notes.'

A systematic review reported that medical teachers often are unaware of the personal reasons behind students' academic failure, such as learning style, personality traits, motivation, self-efficacy, sleep, stress, physical activity, attendance, study strategies, and coping mechanisms.[12]

This study aimed to identify seven personal factors affecting students' performance using Ron Fry's self-evaluation questionnaire and provide simple action plans as interventions. There is limited evidence on solutions to address these factors, especially in resource-limited settings and low-middle-income countries (LMICs). The seven factors addressed were concentration, comprehension, test anxiety, organizational skills, writing skills, computer skills, and note-taking systems. Students identified their strengths and weaknesses via Google forms and received standard solutions as shown in Table-1 from which they derived their individual action plans.

Our study demographics show a trend of increasing female medical students, with 60% of participants being female which has been reported earlier too.[13-15] More than 80% of students identified the need to improve concentration, and over 70% needed to improve writing and organizational skills. Most students were satisfied with their note-taking and computer skills.

A study from East India using Ron Fry's questionnaire supports our findings, with many students needing to improve concentration, comprehension, test anxiety, organizational skills, and writing skills, while fewer needed to work on computer skills and note-taking. First-year students had more comprehension issues (98%) as

compared to second-year students in our study (57.3%) which could be because of their introductory exposure to the medical college in first year and by second year they get accustomed to the medical curriculum.[2]

Students identified their individualized action plans, wrote intention statements, and received reminders to work on themselves. Assignments and tests were conducted over six weeks. Faculty also counselled and reminded students, especially those with less than 50 percentile marks. While much work has identified factors affecting performance, little evidence exists from LMICs on effective interventions to improve academic performance among medical students which was designed in the current study.

Recent Study on Learning Strategies in Medical Education

A 2023 study introduced LASSI (Learning and Study Strategies Inventory) to assess student learning and study habits. The study proposes the 'Model of strategic learning,' emphasizing active learning processes to enhance confidence and academic performance. Workshops focused on information processing, test strategies, and time management were conducted with input from medical educators and psychologists.

In contrast, our study offers simplified individualised action plan/interventions including standard solutions, intention statements, reminders, assignments, and tests over six weeks. This approach is less resource-intensive compared to the 'Model of strategic learning,' making it viable for resource-limited settings in low- and middle-income countries (LMICs).[8]

Intention Statements

Intention statements are effective metacognitive strategies to improve prospective memory in adults by translating goals into actionable plans. Repeating these statements and constant reminders help execute planned actions.[16]

The use of intention statements, reminders, individualised action plan, assignments, and tests in our study proved beneficial, showing a 31.6% improvement in post-study exam failures. Despite a weak negative correlation between Ron Fry scores and pre-study marks, many high-performing students reported difficulties in Ron Fry's identified factors. This suggests a reason for a weak co-relation between Ron Fry scores and pre-study marks, it also indicates that numerous other factors influence academic performance/marks beyond those identified by Ron Fry.

The reflections and feedback provided by the students clarified that more than 70% of the students felt that the combination of using Ron Fry's questionnaire, assignments, tests, and constant reminders to work on oneself using intention statements was helpful and caused a moderate to maximum difference (3 and 4 scores) on the four-point Likert scale on their performance. All students felt the strategy helped identify strengths and weaknesses, and 99% recommended it for future batches and other medical colleges. This emphasizes the need for personalized action plans and learning interventions integrated into medical education curricula to support student success.

Evaluation of learning strategies and academic performance

The level-1 reaction from our evaluation matrix indicates that students found our simple strategic intervention plan favourable and acceptable.

At level 2, while we didn't achieve a 50% improvement in academic failure, we did observe a significant 31.6% reduction in post-test failures. This suggests that while improvement was notable, other factors affecting student performance were not fully addressed.

Level-3 application was successful, with 93.3% of students scoring above 50% in Pre-University Exams, underscoring the seriousness students attach to major exams and other factors influencing their academic performance.

However, at level-4, our target wasn't met as 33% of students were detained due to attendance and internal assessment issues by the Department, preventing them from taking the University final exam. Nonetheless, all students who did take the final exam passed, highlighting the multifaceted nature of final exam outcomes. Implementing personalized learning strategies and action plans is crucial to supporting students, though final exam results are influenced by various factors like attendance, health, motivation, and personal circumstances.

Study Limitations: Further studies with larger sample sizes across multiple batches could provide more robust evidence. The improvement seen in post-study marks might be influenced by internal evaluation biases. The influence of approaching pre-university exams on study habits could have led to improved performance in the Pre-University examinations.

CONCLUSIONS

Our study emphasizes the importance of designing individualised action plans/ tailored learning strategies to support students. Using Ron Fry’s questionnaire, standard solutions, intention statements, reminders, tests, and assignments proved beneficial, particularly in LMICs, with a significant 31.6% reduction in post-study exam failures. Student feedback highlighted the intervention’s effectiveness in identifying strengths and weaknesses, advocating for its continuity in future batches.

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