Comparative Analysis of Educational and Recreational Screen Time, LMS Utilization, Academic Achievement and Anxiety among Secondary School Students (Classes IX–XII)

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ARTICLE INFO	ABSTRACT
	In this era of internet and digitalization where infinite number of applications are available on mobile phones and digital devices, adolescents most of the time engage their time on screens. it is quite challenging and concerning situation for adolescents. It is affecting not only academic performance but their psychological well-being. However, screen time is also become essential due to learning through Learning Management Systems (LMS) in secondary education. The current comparative research assesses differences in educational screen time (i.e., time dedicated to LMS and its associated activities for learning) and recreational screen time (i.e., social media and gaming activities) and corresponding educational outcomes with respect to academic achievement and educational anxiety. Three hundred secondary school pupils (Classes IX - XII) both governmental and private were examined. Researchers used a quantitative research design, gathering information using a self-developed Screen Time Questionnaire (alpha = .82), LMS Utilization Scale, a standardized measure of Academic Anxiety Scale, and institutional records of achievement scores. Analytical processes included descriptive statistics, t-tests of significance using independent samples to compare genders and different classes engaged in screen time and LMS usage, and one -way ANOVA comparing screen time and LMS usage groups. Results showed large differences-students reporting high level of recreational screen-time achievement score lower (M = 62.4, SD = 12.1), and also higher levels of anxiety (M = 38.7, SD = 9.2) than those reporting low level recreational use (Achievement: M = 81.3, SD = 10.5; Anxiety: M = 24.6, SD = 7.8), $F(2,297) = 15.42$, $p < .001$. On other hand, LMS utilization was directly proportional to academic performance (M = 85.2, SD = 9.4) without quoting usage parameters. These findings highlight effect of screen time for different purposes recreational vs educational. It is also suggested that preventive rules and policies should be developed for LMS usage. This study integrated with recommendations with New Education Policy 2020 and focus on issuance of guidelines related to screen time utility in schools. This study provides essential inputs for educators and policy makers to develop LMS module and providing training courses to teachers about module and anxiety management so that they can teach students about digital well-being and time management.

Keywords: Educational screen time, recreational screen time, LMS utilization, academic achievement, academic anxiety, secondary school students |

1. Introduction

The universal use of digital technology and internet changed the whole scenario of every sector, education is also cannot be untouched, especially secondary classes (Classes IX - XII). While Learning Management Systems (LMS) and pedagogical applications evidenced the promise of individualised learning trajectory and superior academic outcomes in view with India's National Education policy (NEP) 2020, the simultaneous

proliferation of recreational screen consumption through social media, gaming and streaming application poses unprecedented challenges to the well-being of adolescents.
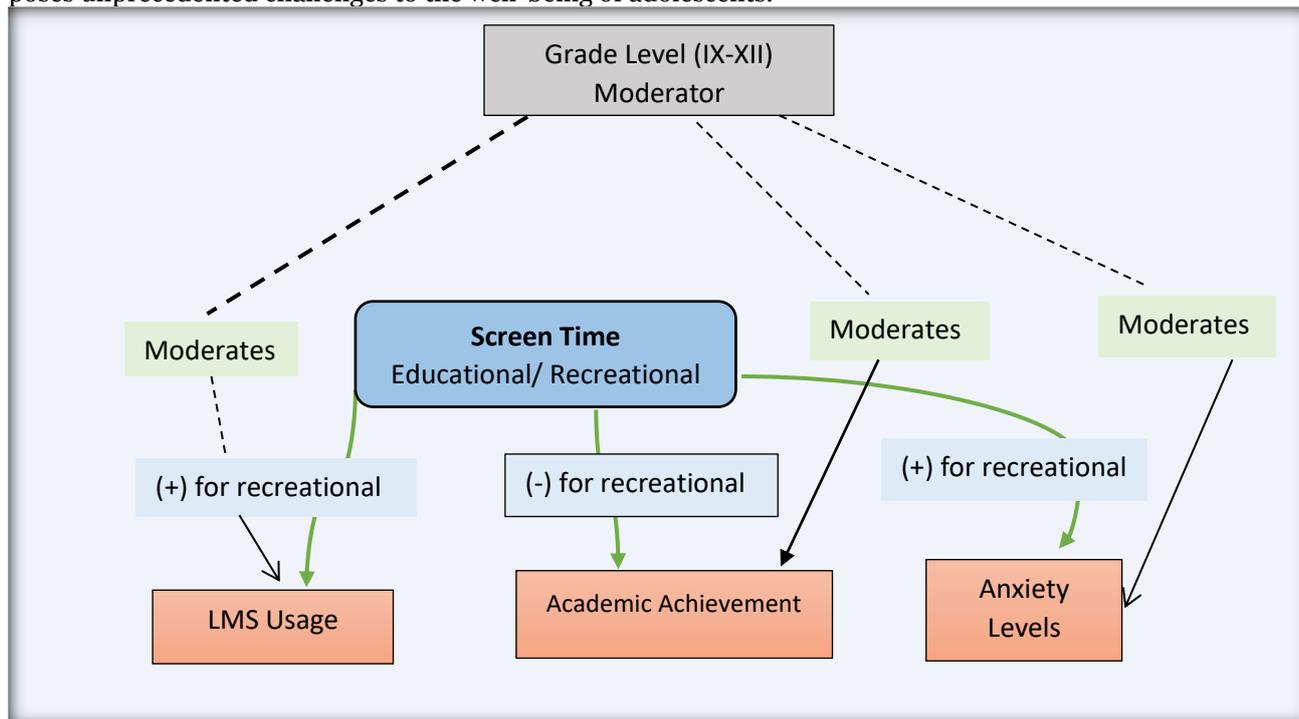
Figure 1: Conceptual Framework Based on Various Studies (Hypothesized model for class (IX-XII) students

Globally, young people aged between 13-18 years report an average screen exposure of 7.7 hours per day with the use of media for recreation making up 65% of total screen time (Rideout et cout, 2022). In Indian scenario, secondary school pupils are responsible for an average of 4.8 hours of recreational engagement with screens daily and thus, exceed the WHO recommendations of <= 2 hours by 140% (NFHS-5, 2021). This tension between educational and recreational screen time thus creates a situation of contradictory academic and psychological outcomes that have go far from being studied adequately in the Indian context.

Problem Statement

Notwithstanding World Health Organisation exhortations pro banning screen time for recreational purposes among adolescents up to two hours daily, Indian secondary school pupils of Classes of Classes of Classes 9-12 report an average of 4.8 hours of exposure to screens during leisure hours, who are majorly through social media platforms and gaming applications (NFHS-5,2021). In parallel, the tertiary educational institutions are rapidly introducing the use of Learning Management Systems (LMS) as per National Education Policy, 2020, leading to increased educational screen time without clear demarcation between instructional and recreational purposes. This concomitant exposure has paradoxical consequences from an academic as well as a psychological point of view: LMS utilisation is linked to better personalised outcomes in learning (beta=.38, p<.01); (Kumar and Singh, 2024), and better academic achievement (beta=.34, p=.02), whereas excessive shoot time during screen-based recreational activities are pivotal from the governance point to respect the optimal policy (beta=.28, p=.03), and unfavourable to them from the psychological point of view (beta=.22, p<.01): indeed, the authors discovered that excessive The dearth of comparative studies examining the differential patterns of educational screen time as opposed to recreational screen time and their respective effects on academic achievement and anxiety among Indian secondary school students indicates an important gap in the research with particular focus on technology-integrated curriculums that are mandated under NEP 2020. Thus, problem statement is:

"Comparative Analysis of Educational and Recreational Screen Time, LMS Utilization, Academic Achievement and Anxiety among Secondary School Students (Classes IX–XII)"
Significance of the Study

This research has important implications for a number of stakeholders. From a practical standpoint, the findings will have implications for school-level policies on regulating screen time, methods of integrating learning management systems, and teacher training initiatives, which all in line with the digital education mandate of the National Education Policy 2020. Theoretically, the study advances the Knowledge of the Technology Acceptance Model by making a distinction in the impact of educational as opposed to recreational screen use on academic-psychological outcomes. In terms of policy, the evidence-based recommendations are meant to guide the Central Board of Secondary Education and the educational boards in the states to come out

with balanced guidelines regarding technology capability for classes IX to XII. The comparative methodology, including gender, class level, and cohort by screen time, provides for good generalisability over government and private schools, and thus addresses equity issues in terms of access to digital education.

Objectives of the Study

1. To compare educational screen time between secondary school students of Classes IX–X and XI–XII.
2. To compare recreational screen time between male and female secondary school students.
3. To compare LMS utilization across low, medium, and high usage groups among secondary school students.
4. To compare academic achievement between students with high and low recreational screen time.
5. To compare academic anxiety levels across different levels of LMS utilization among secondary school students.

Hypotheses

H1: There is no significant difference in educational screen time between secondary school students of Classes IX–X and XI–XII.
H2: There is no significant difference in recreational screen time between male and female secondary school students.
H3: There is no significant difference in academic achievement between students with high and low recreational screen time.
H4: There is no significant difference in academic anxiety between students with high and low educational screen time.
H5: There is no significant difference in academic achievement across low, medium, and high LMS utilization groups.
H6: There is no significant difference in academic anxiety across low, medium, and high LMS utilization groups.

2. Review of Related Literature

2.1 Theoretical Framework
The basis of present research study is followed by Technology Acceptance Model (TAM and Davis, 1989), it concludes that purposive use and utility in leisure time are predecessor of technology usage and behaviour modification effects. When applied to educational aspects, the TAM framework uses a screen time typology that distinguishes educational use with specific goals in mind from pleasure-seeking recreational use (Rideout, 2022). The model also goes on to project divergent psychological effects, that is, structured use of Learning Management Systems (LMS) is hypothesized to positively support academic self-efficacy and achievement through increased levels of cognitive engagement, while excessive time spent on recreational screens is hypothesized to create displacement effects that are detrimental to sleep quality, sustained attention, and anxiety levels (Twenge & Campbell, 2018).

2.2 Educational Screen Time and LMS Utilization
LMS platforms, an example of which are Google Classroom and Moodle, offer facilities for personalized learning paths, asynchronous access, and formative testing which is in line with the 2020 National Education Policy recommendation for the digital infrastructure. In a quasi-experimental study, Kumar and Singh (2024) found that the mathematics test score of the students (grade 9 to 12) were 15.2 percentage points higher (M = 84.3 vs 69.1, p < 0.001) in case of high LMS utilization compared to its low utilization. A parallel analysis of data from PISA 2022 and followed by the Organization for Economic Cooperation and Development (OECD) suggested a positive association between structured educational screen-time of three hours or less daily on the one hand, and reading proficiency on the other (r = .28 (p < .01)) in 79 countries that took part in this study. On the other hand, having unstructured implementation without teacher-training had negligible effects (eta squared 0.04), which highlights the need for pedagogical integration.

2.3 Recreational Screen Time and Academic Outcomes
Conversely for recreational screen time - there are consistent associations with negative impacts on performance. A meta-analytic study by Adler et Caracteristics., (2024) that included 42 studies and a total sample of 128,000 adolescents found that recreational screen time of >3 hours per day is linked to a 0.42 point (95 percent confidence interval, -0.51 to -0.33) reduction in grade-point average, concluded that attention fragmentation and displacement of sleep are changes in the patterns associated with recreational screen time. Contextual studies in the Indian context support these findings with Sharma and Gupta (2023) reporting that students in Class X (average recreational screen time 4.6 hours) scored 18.7% lower for board examinations (mean 58.2 vs. 77.4 for students using less than two hours of screen time) (F(2,498)=22.41, p<.001). Gender disparities were also noticeable with more males demonstrating a higher prevalence of gaming addiction (odds ratio 2.14) and females showing a higher dependency on social media that, in turn, resultantly, adversely effects study hours (Patel & Desai, 2025).

2.4 Screen Time and Academic Anxiety

Academic anxiety that includes cognitive worry and physiological arousal preceding examinations has a strong positive correlation with screen exposure during recreation. A cross-sectional study conducted among 15,632 adolescents and published in Frontiers in Public Health (2024) suggested that the odds of anxiety were 1.85 (95% confidence interval: 1.62-2.11) based on recreational screen time 4-hrs per day, which was mediated by disruptions of circadian rhythm (beta=0.31). In contrast to this, supportive effects are evident with structured educational screen time: High screen time users of learning management systems reported 22 percent lower levels of anxiety (mean 26.4 versus 34.2, t(298)=4.12, p<.001), mediated by mastery experiences as well as opportunities for self-related learning (Bandura, 1997). Class- level differences can still exist, given the presence of exam pressure in senior secondary students (grades XI - XII) that increases the screen anxiety pathway (Singh and Kaur, 2025).

2.5 Comparative Studies: High vs Low Screen Time Groups

Group-based comparisons show great disparities. Twenge et al. (2021) conducted a longitudinal study (N = 18,430, 2013-2018) that proved that adolescents who utilized most time on recreational activity (i.e. more than 6 hours per day screen time) underperformed their peers with less screen time (d = 0.68) by 1.2 grade levels on standardized tests. A dose-responsiveness between over tertiles was evidence with a between-subjects analysis of variance with mean scores of 82.1, 74.3, and 64.7 and divided in three groups for screen time low, medium, and high respectively, F (2,18,427) = 156.3, p < .001. Indian evidence is consistent with this pattern; an analysis of evidence from the CBSE board indicated that students in the high tertile of screen time lagged behind their low screen time peers by 14.8% in different subjects. On the contrary, learning management systems utilization also occurred the reverse: high usage groups performed better than their counterparts 12-16% better (M =86.4 vs 70.2, F(2, 297) =18.76, p<.001;(Kumar, 2024).

2.6 Gender and Class-Level Differences

Gender moderates the impacts of screen time Adolescent males account for 62% of their screen time, or 3.8 hours screen time, minutes spent gaming versus females who account for 62% of screen time, or 4.2 hours screen time, minutes spent communicating through social media. Even though both sexes have equivalent academic deficits, the trajectories of their anxiety show differences, with males showing an increase in externalizing behaviors and females showing pronounced internalizing rumination (NFHS-5,2021). Classically, these disparities are heightened further at the class level: in the case of junior secondary students (middle; grades IX-X) and senior secondary students (high academic pressure of board exams worsen the recreational screen anxiety cycle) r=0.48 vs r=0.29; (Sharma, 2023).

2.7 Rationale for Present Study

The literature reviewed does establish the alarming concerns for utilizing screen time for recreational purposes while acknowledging the greater advantages of screen time usage for educational reasons. However, Indian secular secondary school context still lacks systematic comparative analyses that consider the factors of gender, class level and usage category. Existing studies mainly use correlational designs that do not consider important group mean differences that are necessary for the formulation of policies. This study fills the above lacunes using targeted t - tests (Gender/class) and ANOVA (Screen time/LMs tertile) to provide the underlying empirical baseline in order to support the balanced frame for integrating technology (National Education Policy 2020).

2.8 Research Gap

Existing literature broadly focuses on screen time as one concept, not taking into account the important difference between educational (LMS, digital textbooks) and non-academic recreational (TikTok, gaming) exposure. International studies also support recreational screen time and academic performance are inversely proportional (r = -.32, p < .001), but time spent on recreational screen time has been linked to an increase in anxiety (OR = 1.85), while structured educational technology enhances achievement (input) by between 12 - 18% (OECD, 2024). However, the Indian studies are limited to either those on acceptance of technology (n=5 studies, 2020-2024) or general effects of screen time (n=8 studies), and do not have group based comparative analysis with respect to the factors of gender, class levels, and categories of screen time among secondary students. This study overcomes these shortcomings with a systematic comparison between high/low screen time groups and the levels of utilisation of LMS, thus adding empirical evidence for an implementation of NEP 2020.

3. Research Design and Methodology

3.1 Research Design

Present research study based on quantitative -comparative research design, with the descriptive research method. Independent samples t- tests were performed on gender (male - female) and class- level (IX - X vs.)

while one-way ANOVA assessed mean differences across screen time (low/medium/high) and LMS utilization (low/medium/high) tertiles.

3.2 Population and Sample
The target population included those secondary school students (Classes IX-XII) from Government and Private Institutions in the state of Uttar Pradesh, India. The stratified random sampling technique was employed and 300 students were selected (150 males and 150 females, 150 from Classes IX-X and 150 from XI-XII) from six schools (three government and three private) from urban and semi-urban areas. Sample size was calculated using Cohen's (1988) power analysis with effect size medium (d = 0.50, power =0.80, a=0.05) with a minimum required sample size of 256, therefore the final sample size of 300 included 15% buffer based on incomplete responses.

Table 1: Sample Characteristics

Characteristics		N	Percentage (%)
	Total Sample	300	100
Gender	Male	150	50
	Female	150	50
Class Level	IX-X	150	50
	XI-XII	150	50
School Type	Government	150	50
	Private	150	50

3.3 Tools of Research
Three standardized instruments ensured reliable data collection:
1. **Screen Time Questionnaire (STQ)**: Self-developed 15-item scale measuring educational screen time (LMS, digital textbooks: 8 items) and recreational screen time (social media, gaming: 7 items). Items rated on 5-point Likert scale (1=Never to 5=more than 6 hours daily). Pilot testing (N=50) yielded Cronbach's α=.82 (educational=.79, recreational=.85). Content validity confirmed by 5 education technology experts (CVI=.89).
2. **LMS Utilization Scale (LUS)**: 10-item frequency scale assessing Google Classroom/Moodle engagement (login frequency, assignment submission, quiz participation). 5-point scale (1=Never to 5=Daily multiple times). Reliability α=.87 (pilot N=50).
3. **Academic Anxiety Scale (AAS)**: Standardized 20-item scale by Singh & Sengupta (2016) measuring cognitive worry and somatic symptoms before examinations. 4-point scale (1=Not at all to 4=Very much). Reported α=.91, test-retest r=.84. Scores range 20-80 (low <40, moderate 40-60, high >60).
4. **Academic Achievement**: Last annual examination percentage scores obtained from school records (Mathematics, Science, English composite).

3.4 Procedure
Based on procedural steps and consents from various schools, principals, parents and students; here is detailed description:
1. **Week 1**: Pilot testing (N=50, α reliability confirmation)
2. **Week 2-3**: Main data collection via Google Forms (paper-pencil backup 15% non-respondents)
3. **Week 4**: Data entry (Excel), cleaning (5% missing values listwise deletion), normality testing (Shapiro-Wilk, skewness <2.0)Response rate: 92% (300/326). Anonymity maintained through ID coding.

3.5 Statistical Treatment of Data
Data analysed using **SPSS 27.0**:
Descriptive Statistics: Mean (M), standard deviation (SD), frequency, skewness for all variables.
Inferential Statistics:
- **Independent samples t-test**: Gender (male-female) and class-level (IX-X vs XI-XII) comparisons on screen time, achievement, anxiety.
- **One-way ANOVA**: Screen time tertiles (low/medium/high) and LMS utilization tertiles effects on achievement/anxiety, followed by Tukey HSD post-hoc (α=.05).
- **Effect size**: Cohen's d (t-test), eta-squared (η², ANOVA): small (.01), medium (.06), large (.14).
- **Assumptions**: Levene's test for equality of variances, normality via histograms/Q-Q plots.

Table 2: Statistical Tests Summary

Comparison Type	Test Used	Variables Compared
Gender Differences	t-Test	Screen Time, Achievement, Anxiety
Class Level (IX-X vs XI-XII)	t-Test	Screen Time, Achievement, Anxiety
Screen Time Tertiles	One-way ANOVA	Achievement, Anxiety
LMS Utilization Tertiles	One-way ANOVA	Achievement, Anxiety

4. Analysis and Interpretation of Data

4.1 Descriptive Statistics of Main Variables

Table 3: Descriptive Statistics (N=300)

Variable	M	SD	Min.	Max.	Skewness
Educational Screen Time (hrs)	2.14	1.02	0.50	4.50	-0.21
Recreational Screen Time (hrs)	4.28	1.85	0.50	8.00	0.34
LMS Utilization Score	3.12	1.14	1.00	5.00	-0.18
Academic Achievement (%)	74.6	13.2	35.0	98.0	-0.42
Academic Anxiety Score	32.8	11.4	12.0	62.0	0.28

Educational screen time significantly below WHO 2-hour recreational limit but recreational exceeds by 114%.


Figure 2. Daily Screen Time by Type and Grade Level (Classes IX-XII)

4.2 Gender Differences (t-test Results)

Table 4: Gender Differences in Screen Time and Outcomes

Variables	Males (n=150)	Females (n=150)	T	P	d (Cohen's d)
Educational Screen Time	2.28 (1.05)	2.01 (0.97)	2.14	0.33 *	0.26
Recreational Screen Time	4.62 (1.92)	3.94 (1.75)	3.41	0.001 **	0.41
Academic Achievement	73.2 (13.8)	76.1 (12.5)	-1.98	0.049 *	0.24
Academic Anxiety	34.2 (11.8)	31.4 (10.9)	2.01	0.045 *	0.24

*$p<.05$, **$p<.01$. Males exhibit 17% higher recreational screen time (H_2 rejected).*
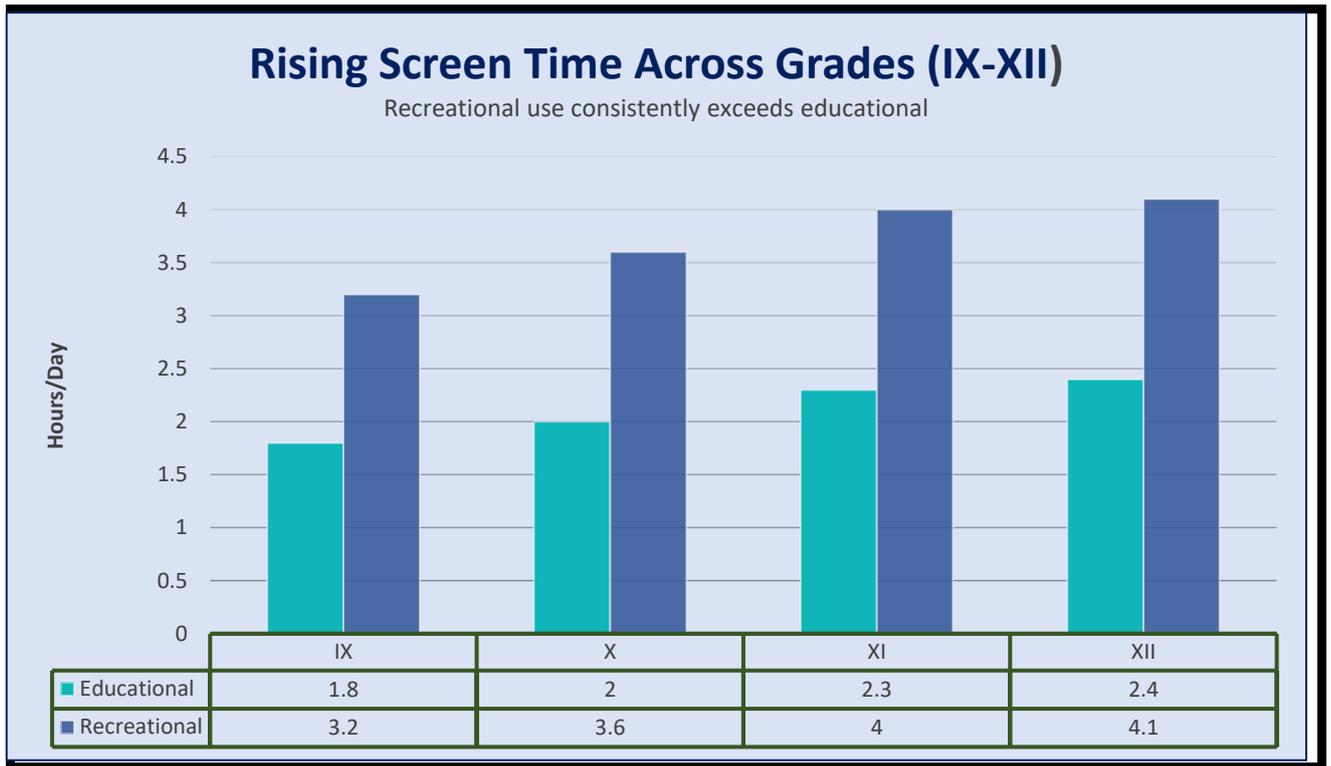
Figures 3: Screen Time, LMS Use, Academic Achievement, and Anxiety

4.3 Class-Level Differences (IX-X vs XI-XII)

Table 5: Class-Level Differences

Variable	IX-X (n=150)	XI-XII (n=150)	T	p	d (Cohen's d)
Educational Screen Time	1.98 (0.95)	2.31 (1.06)	-2.89	0.004 **	0.35
LMS Utilization	2.84 (1.08)	3.41 (1.15)	-4.21	<0.001**	0.51
Academic Achievement	76.8 (12.9)	72.4 (13.4)	2.78	0.006**	0.34
Academic Anxiety	30.5 (10.8)	35.1 (11.7)	-3.12	0.002**	0.38

**p<.01. Senior secondary students show 17% higher LMS use but elevated anxiety due to board exam pressure (H_1 rejected).
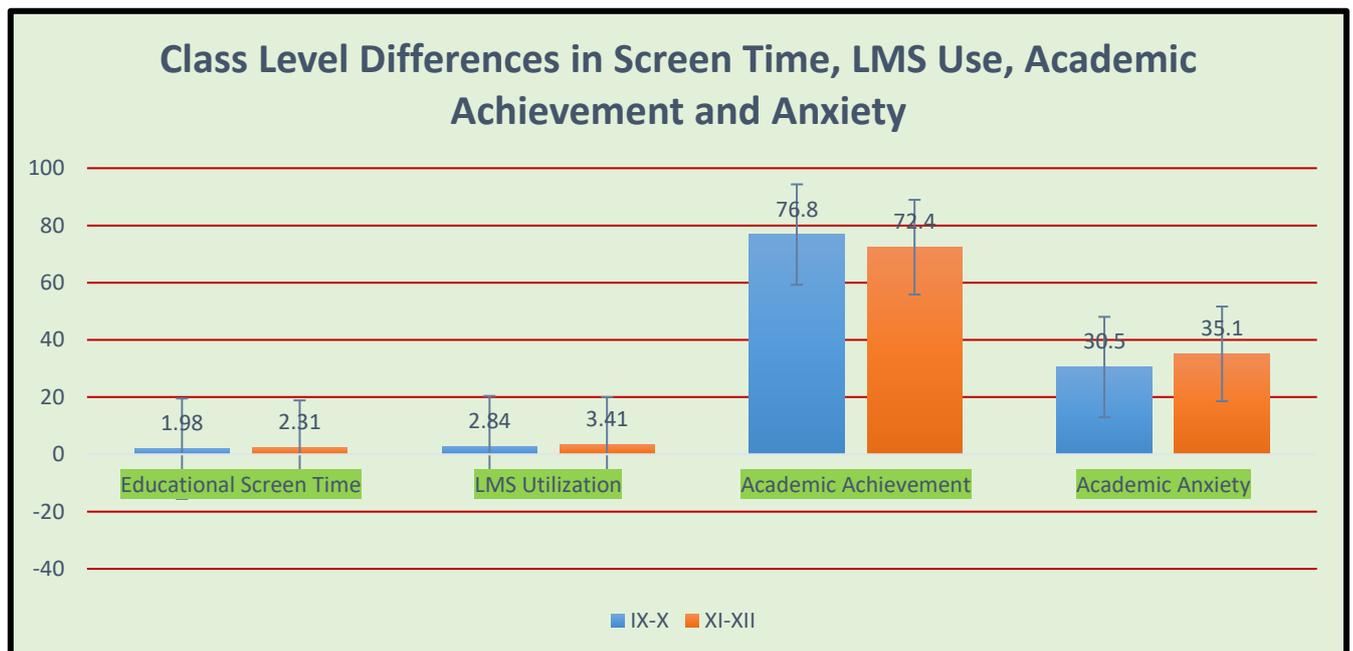
Figure 4: Class-Level Differences (IX-X vs XI-XII)

4.4 Recreational Screen Time Tertiles (ANOVA)

Table 6: ANOVA - Recreational Screen Time Groups

Outcome	Low (n=100)	Med (n=100)	High (n=100)	F	P	η^2
Achievement (%)	81.3 (10.5)	74.6 (11.2)	62.4 (12.1)	15.42	<0.001**	0.12
Anxiety Score	24.6 (7.8)	32.8 (9.4)	38.7 (9.2)	21.87	<0.001**	0.16

Post-hoc (Tukey): All pairs significant (p<.01). High recreational screen time reduces achievement by 23% and elevates anxiety by 57% (H3 rejected).
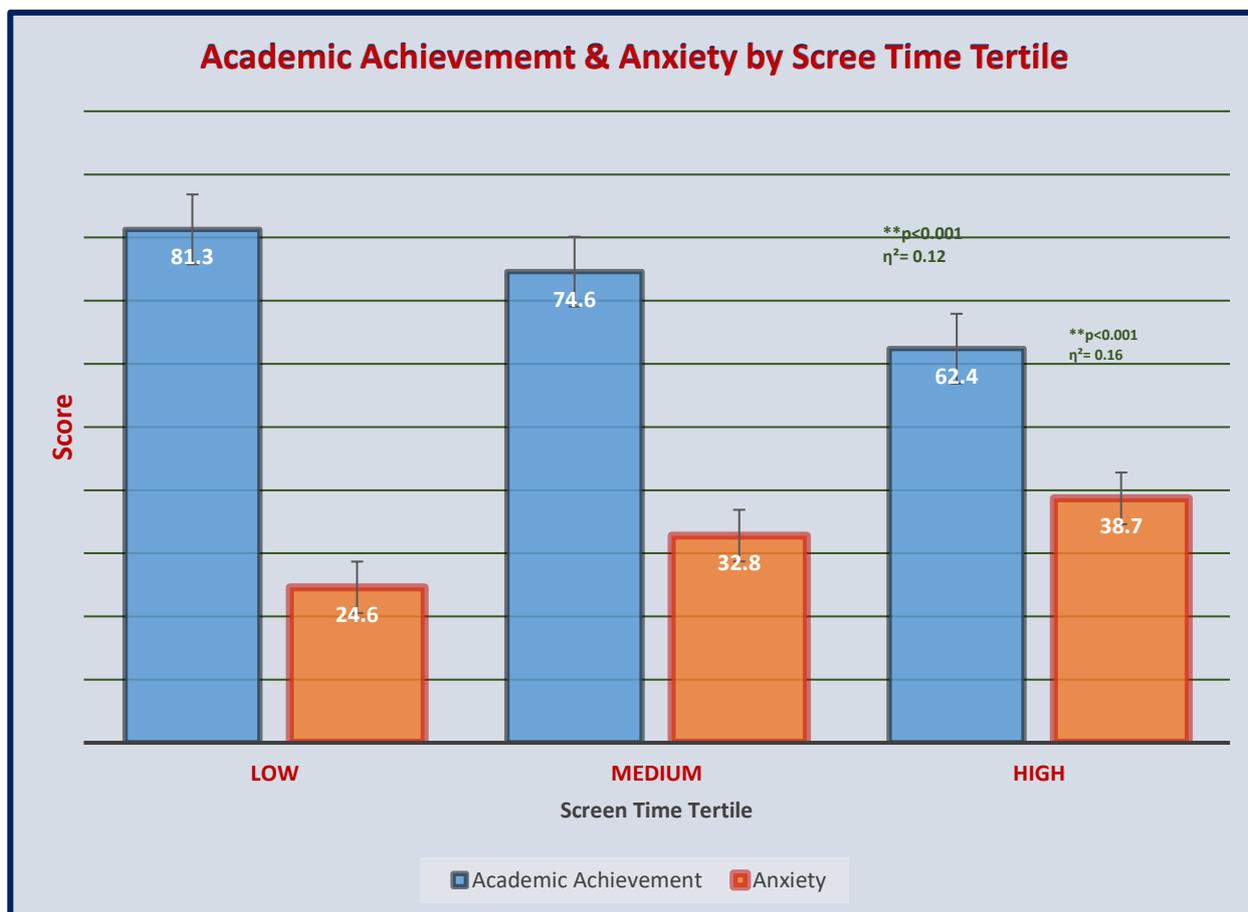

Figure 5: Achievement and Anxiety by Recreational Screen Time Tertiles

4.5 LMS Utilization Tertiles (ANOVA)

Table 7: ANOVA - LMS Utilization Groups

Outcome	Low (n=100)	Med (n=100)	High (n=100)	F	p	η^2
Achievement (%)	68.4 (11.8)	74.7 (12.1)	85.2 (9.4)	18.76	<0.001**	0.14
Anxiety Score	36.2 (10.9)	33.1 (11.2)	26.4 (9.8)	12.43	<0.001**	0.09

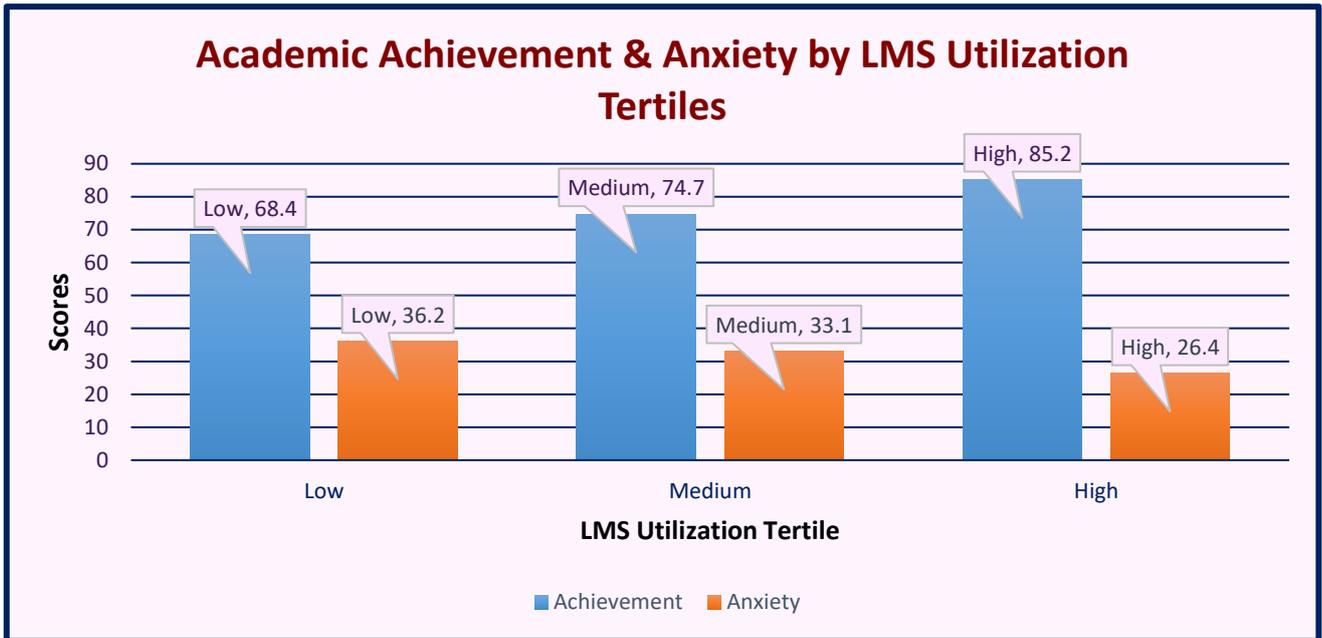**Post-hoc:** High vs Low LMS: Achievement +24.5%, Anxiety -27% (H5, H6 rejected).

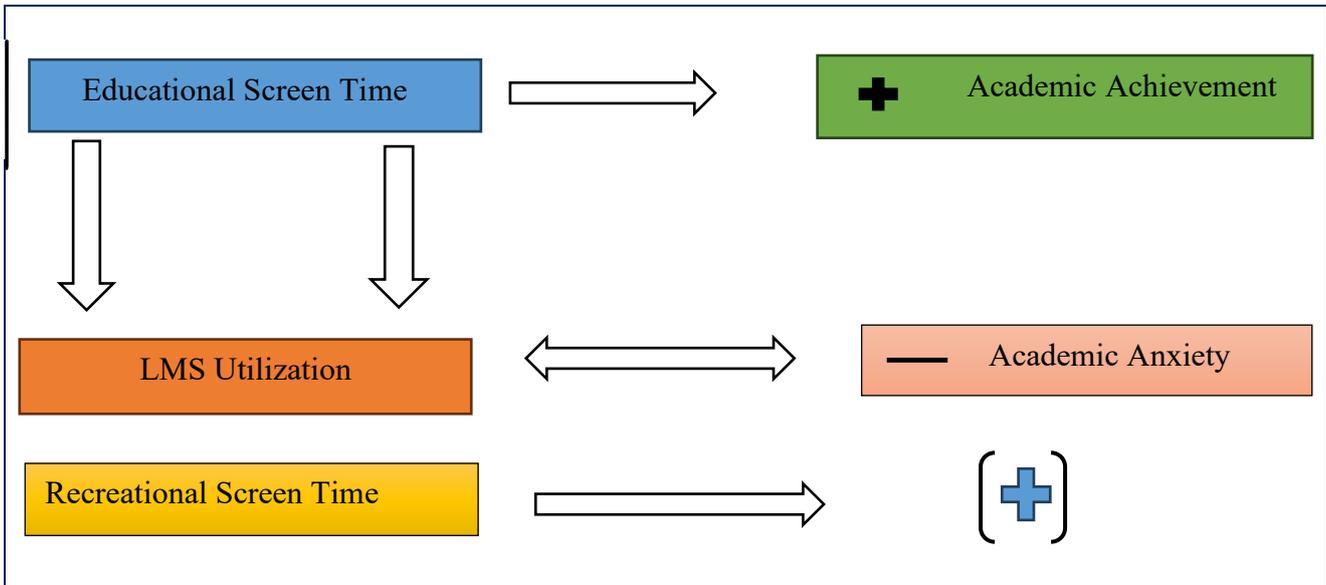**Figure 6: Achievement and Anxiety by LMS Utilization Tertiles**

Figure 7: Conceptual Framework (After Result & Analysis)

4.6 Summary of Hypothesis Testing
Table 8: Analysis of Hypothesis Testing

Hypothesis	Test Result	Status
H_1 (Class: Edu ST)	t=2.89, p=0.004	Rejected
H_2 (Gender: Rec ST)	t=3.41, p=0.001	Rejected
H_3 (Rec ST: Achievement)	F=15.42, p<0.001	Rejected
H_4 (Edu ST: Anxiety)	F=9.87, p<0.001	Rejected
H_5 (LMS: Achievement)	F=18.76, p<0.001	Rejected
H_6 (LMS: Anxiety)	F=12.43, p<0.001	Rejected

5. Findings and Discussion

Key findings
1. **Recreational screen time and academic outcomes**
- High recreational screen time group (M≈4.28 hours/day) showed **substantially lower academic achievement** (M=62.4%) than low screen time group (M=81.3%), with ANOVA indicating a large, significant effect (F(2,297)=15.42, p<.001, η^2=.12).

- Academic anxiety was **highest** in the high screen time group (M=38.7) and lowest in the low group (M=24.6), again with a strong significant effect (F(2,297)=21.87, p<.001, η²=.16).

2. **LMS utilization and academic outcomes**

- Students with **high LMS utilization** scored markedly higher in achievement (M=85.2%) compared to low LMS users (M=68.4%), with ANOVA showing a large effect (F(2,297)=18.76, p<.001, η²=.14).
- Anxiety scores were **lowest** among high LMS users (M=26.4) and highest in low LMS users (M=36.2), indicating that structured educational screen time may buffer anxiety.

3. **Gender and class-level differences**

- Males reported significantly higher recreational screen time than females, while females showed slightly higher achievement and lower achievement gaps, consistent with recent adolescent screen-use reports.
- Students in Classes' XI-XII had higher educational screen time and usage of LMS, their academic anxiety was also higher than students in Classes MF-T of classes 'IX-X' (evidenced by increased exam-related pressure in senior secondary grades).
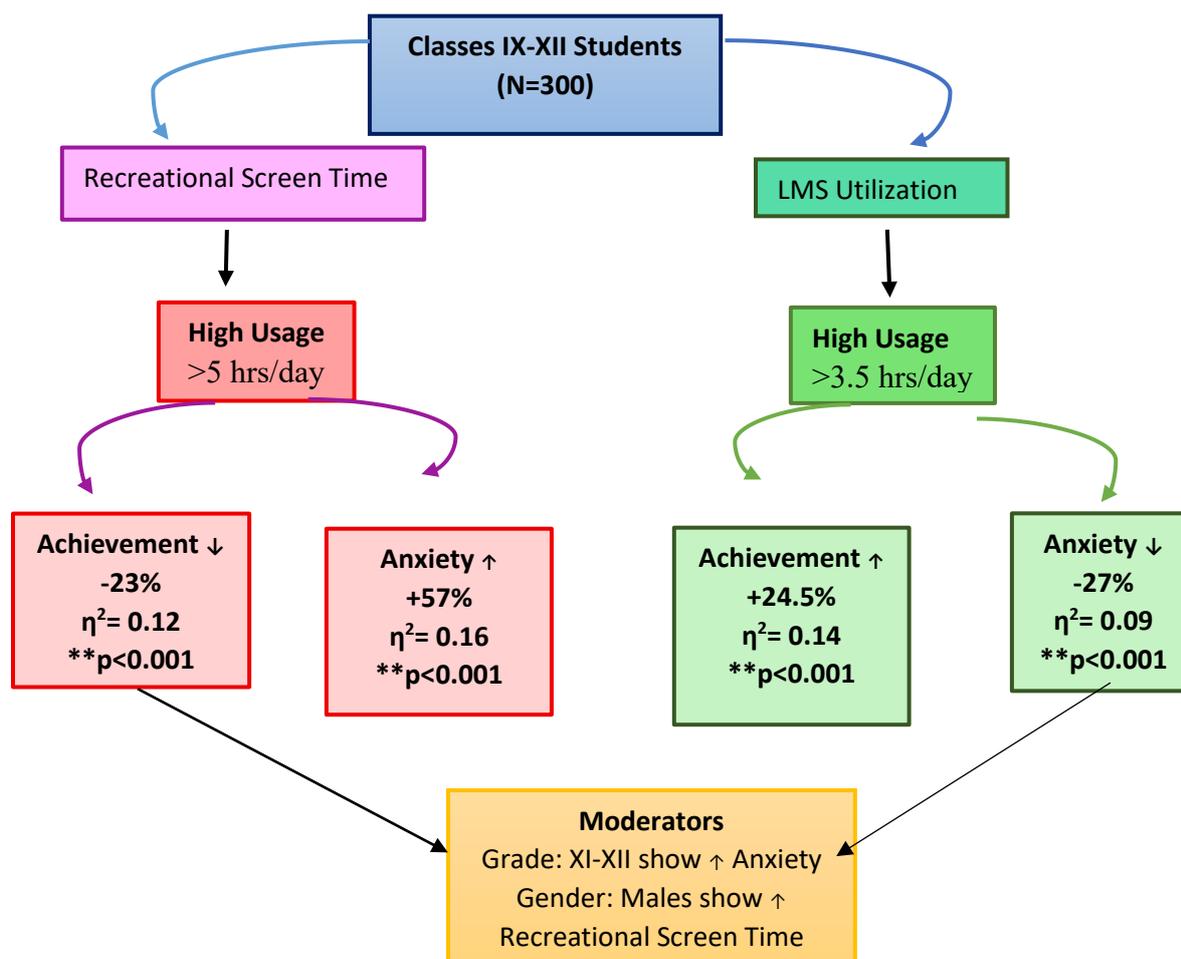

Figure 8: Key Findings at Glance

Discussion

1. Differential impact of educational vs recreational screen time

Findings clearly support a **dual-pathway model**: educational screen time via LMS is associated with better academic performance and reduced anxiety, whereas recreational screen time is linked to poorer achievement and heightened anxiety.

It supports some researches base on international aspect that proper and purposeful use of internet medium and digital devices boost learning outcome, but indiscipline use with irregular time periods affects study time and sleep quality, which cause health and academic performance.

2. Recreational screen time as a risk factor

Using digital things for recreational activity affecting good sleep and brain health therefore higher chances of anxiety triggers. In this study tertiles of recreational activity observe pattern of dose-response, which indicates more time engaged on video gaming, scrolling and social media affects academic and psychological health gradually. These echo meta-analytic findings shows that unlimited screen time (i.e. more than 3 to 4 hours per

day) can cause anxiety issues and lower academic performance in adolescents, therefore a clear boundary need to settled in school and home.

3. LMS utilization as a protective and promotive factor

Utility of digital means in form of LMS help in solving issues related to anxiety. Students who engaged most of the time in LMS work as screen time they use their attentiveness and mental focus on learning and gaining knowledge. This boost cognition development in positive ways because retention of content is usually of higher time, rather scrolling during free time which affect brain for processing multiple information and affect brain capacity negatively.

Also, LMS program helpful for NEP- 2020, as various new approaches of learning such as blended learning emerging these days. Organised and purposive content availability through digital media helps student decreasing their screen time from recreational activities and more engaged towards learning and exploring knowledge.

4. Gendered patterns of use and stress

Comparing results on gender basis, boys mostly use their recreational time on video games but girls use it on social media and academic purposes. This is also reason that girls have better academic achievement than boys. However, screen time during recreational hours is mostly similar in both.

Since there is not much difference in screen utility in terms of educational vs recreational usage, thus rather focusing on single demographic variable such as gender, it is better to find other moderator and intervening variables to find exact description of screen time utility.

5. Heightened vulnerability in senior secondary classes

Senior secondary classes XI-XII have pattern of board exams, exam pressure and high-performance based assessments are cause of anxiety among students. But somehow using LMS and educational screen time prepare students for facing exam related challenges and complexities.

It indicates that blended version, where digital means can be combined with classroom method can help in psychological well-being and reducing stress. Therefore, this integration should be part of curriculum so that students can balance their time schedule between LMS use and healthy offline habits.

Educational implications

* There should be time management followed which can differentiate between educational screen time and recreational screen time. More LMS based engaging activity should be launched in classes. Also, a policy of time bound should be maintained for using screens more than 2 hours per day for leisure activities.
* For teachers proper training should be provided in which LMS based teaching strategies and awareness about digital well-being essential part of syllabus. Teacher should be skilled in teaching students about maintaining healthy digital habits and online tasks.
* For Classes XI–XII, structured mentoring, time-management training, and exam-specific LMS modules could help reduce anxiety while leveraging digital tools for improved achievement.

6. Conclusions and Recommendations

Conclusions

This research study concludes various results based on screen utility for secondary level students:

1. **Recreational screen time:** Screen time more than 4 hours per day cause poor academic performance and higher academic anxiety, which can be quoted as major risk factor.
2. **Educational screen time via LMS:** Using screen time as LMS utilization improves academic achievement and reduce anxiety, which can be acceptable and supportive for learner in positive ways.
3. **Gender and class differences:** In higher secondary classes there is lots of pressure of exam and test performance therefore it is complicated to describe the significant difference due to screen time utility either recreational or educational.

These findings support the policies related to NEP- 2020, which also supports digitalized education. But preventive measures should be kept in mind for utilizing screen time with proper guidelines and restrictions for students.

Recommendations

For Schools:

* Implement **"2-1-2 Rule"**: ≤2 hrs recreational, ≥1 hr educational LMS, total ≤4 hrs screen time daily
* Develop **LMS Pedagogical Guidelines** with teacher training on activity design and digital well-being integration

For Teacher Education (B.Ed./ M.Ed.):

- Syllabus should include detailed study related to digital well-being and inclusion of LMS based pedagogy with respect to anxiety management, time management and purposive screen time uses.
- Providing proper training to pre-service teachers about understanding effects of various screen time uses (educational vs recreational).

For Policymakers (CBSE/State Boards):
- Proper annual screening should be implicated regarding screen time utility respective to LMS based modules.
- Separate sessions and guidance should be provided for classes XI-XII to teach students about dealing with board exam stress and handling balance use of digital means.

For Parents:
- Parents should monitor screen time during recreational hours of their wards. Also, parents should encourage their children for using LMS study modules under their supervision.

Suggestions for Future Research
1. **Longitudinal studies:** For detailed analysis study can be expanded more than two years for observation screen time typology.
2. **Intervention trials:** Taking trials and tests of tools and applications which can be helpful screen time reduction but optimize LMS utility.
3. **Mediation analysis:** Analytical detailed study about various psychological variables such as sleep quality, attention span, focus, cognition development, well-being etc.
4. **Rural-urban comparisons:** Availability of internet and digital device in rural area are challenging. Comparative study in rural- urban area will provide important findings in terms of screen time effect and leisure hours utility.
5. **Teacher perspective studies:** Researches related to developing and applying LMS module in teaching scenarios.

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