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Leveraging Ecological Systems Theory to Identify the Factors Shaping the Learning Experiences of Engineering Students in Higher Education Institutions in Oman

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Abstract. The research thoroughly investigates the multifaceted factors influencing students' learning experiences at a prominent Higher Education Institution in Oman. To explore these factors in depth, the study involved a diverse group of 22 students from Levels 3 and 4 of Engineering courses. This exploratory, descriptive study employed focus group interviews structured around 18 carefully crafted questions grounded in Urie Bronfenbrenner's ecological systems theory. This theoretical framework provides a comprehensive lens to examine the intricate interactions between individuals and their various environments. Interview data was analyzed quantitatively and qualitatively by measuring and analyzing the frequency of opinions and information. The findings revealed that while students recognized the significance of written goal-setting record, family motivation, and the increasingly important role of artificial intelligence in education, they exhibited a concerningly low awareness of valuable resources such as online library services, massive open online courses, and potential job prospects in their field. This gap in awareness suggests a need for improved communication and outreach regarding available academic resources and career opportunities. Responses among participants varied regarding the effectiveness of peer tutoring, the value of group assignments, and participation in student clubs, indicating a spectrum of experiences that could benefit from targeted interventions. Notably, there was a positive attitude toward utilizing platforms like YouTube for study purposes, highlighting the potential of digital resources in enhancing learning.

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1. Introduction

In the aftermath of the COVID-19 pandemic, we have witnessed a significant transformation in how students interact with technology. As highlighted by Aboagye et al. (2021), students have become increasingly tech-savvy, with artificial intelligence (AI) tools like ChatGPT playing a pivotal role in this evolution (Gabrielli et al., 2020; Huang et al., 2022). The introduction of innovative teaching and learning tools has expanded the educational landscape, making it essential for educators to adapt to their students' rapidly changing expectations and behaviors (Ait Baha et al., 2024; Baha et al., 2022).

As digital natives, today's learners have different needs and priorities than previous generations. They are more comfortable with technology and expect a more interactive and personalized learning experience (Chang et al., 2022; Shah et al., 2024). This shift necessitates that tutors gain a deeper understanding of the psychological and behavioral changes accompanying this new learning age. Empowered and knowledgeable students are crucial to the socioeconomic development of any nation, as they contribute to a skilled workforce capable of driving innovation and progress.

To effectively meet the needs of these modern learners, educators must explore and implement diverse teaching pedagogies tailored to their unique learning styles and preferences (Rodés et al., 2021). While technology is a valuable asset in facilitating engagement and understanding, it is essential to establish boundaries, particularly regarding assessments, where reliance on technological aids is often restricted (Cotton et al., 2024).

Moreover, the rapid advancement of AI tools, such as ChatGPT, has made it imperative for tutors and academic leaders to remain attuned to their students' evolving learning styles(Karakose et al., 2022). This understanding is crucial for enhancing the educational experience and fostering an environment that nurtures creativity and critical thinking (Almulla& Ali, 2024; Chang et al., 2022).

Learning is a social phenomenon (Ngo, 2024), and researchers must adopt a holistic viewpoint to explore and analyze factors affecting learning choices, behavior, and the overall academic experience of technologically-savvy students (Guamanga et al., 2024; Le & Nguyen, 2024). Recently, various researchers have studied the impact of chatbots and mobile devices on teaching and learning (Ait Baha et al., 2024; Šimonová, 2015; Huang et al., 2022). However, a holistic assessment of the learning experience by considering complex environments and regional needs is unavailable.

Understanding and responding to the needs of new-age students is not merely an educational necessity but a strategic priority that will shape the future of learning and development in our society. The present study aims to identify various factors influencingstudents' learning behaviors and expectations at a Higher Education Institution (HEI) in Oman. Considering the emphasis on innovation and skill development in Oman's Vision 2040, this research is particularly relevant (Oman Vision 2040 Implementation Follow-up Unit, n.d.).

As anHEI in the region, the organization is committed to exploring and adapting to the changing educational landscape, ensuring that they equip the students with the skills and knowledge necessary to thrive in an increasingly complex world (AffiaThabassum et al., 2022). This includes inquiring, exploring and analyzing their motivation, awareness, library usage, online platforms, learning tools, social learning and job market awareness.

Research Objectives

This research aims to identify and quantify the critical factors that shape students' learning experience at the College of Education. Hence, research objectives are motivated and grounded in ecological systems theory (EST), developed by Urie Bronfenbrenner in 1977 (Bronfenbrenner, 1974, 1977, 1979).

1. To determine the motivations and drivers behind the academic success of Engineering students.
2. To assess the influence of the college environment onstudents' learning experiences.
3. To evaluate the impact of technology on students' learning experiences.

2. Theoretical Perspective

Considering the interplay of various environmental, contextual and temporal factors in deciding the learning experience of young students, the research team decided to ground this research in EST, developed by Urie Bronfenbrenner in 1977.

Bronfenbrenner (1977) studied how children develop and interact with their surroundings over time. His model highlights the importance of social and political factors that impact children, families and caregivers. Teachers and educators who base their practices on research aim to recognize the various influences on students' learning and growth, such as caregivers, family, friends, culture and historical context. (Bronfenbrenner, 1974, 1977)

The theory identifies several layers of environmental influences that impact development, often depicted as concentric circles:

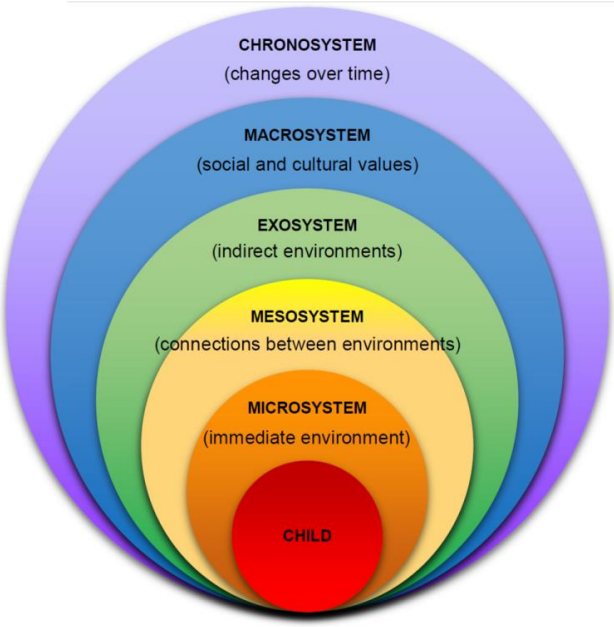

Figure 1: Environment in ecological systems theory (Bronfenbrenner, 1974)

The microsystem is the innermost layer, comprising immediate environments like family, school, peers andneighborhood, where direct interactions significantly impact an individual. The mesosystem represents the connections between different microsystems, such as the relationship between home and school, where positive interactions can enhance development while negative ones can hinder it. The exosystem includes broader social systems that indirectly affect growth, such as a parent's workplace influencing their availability for their child. The macrosystem encompasses the cultural, economic, and social contexts that shape all other systems, including societal values and customs. Finally, the chronosystem considers the time dimension, recognizing that all systems change over time due to life transitions, historical events and socio-economic shifts impacting individual development.

Ecological System Theory in Education

Lippard et al. (2018) studied Bronfenbrenner's theory by examining teacher-child relationships through surveys and observations. They found that these relationships significantly impact children's academic performance and classroom behavior, underscoring their role in development (Lippard et al., 2018). Wilson (2004) showed that a positive school environment that values diversity enhances student relationships, influencing the systems surrounding the child (Wilson, 2004). Langford et al. (2014) noted that a whole-school approach to health education improves academic achievement and student well-being, indicating that microsystems play a crucial role in student development (Langford et al., 2014). The rapid evolution of technology significantly impacts all aspects of life, particularly highlighted by events like the COVID-19 pandemic, which accelerated digital adoption and altered developmental experiences across age groups (Navarro &Tudge, 2023).

Contextualization and Adoption of Updated EST Theory

For the current research project, the team adopted an innovative framework. The team considered a mature update of the EST theory Process-Person-Context-Time (PPCT) model(Bronfenbrenner, 2004; Bronfenbrenner & Evans, 2000). This model emphasizes the interplay between four key elements:

Process: The core proximal processes driving development.

Person: Individual characteristics that influence these processes.

Context: The environmental systems (micro, meso, exo, and macro) where development occurs.

Time: The temporal aspect (Chrono level) of development, including individual life course and historical time.

In the current research, our team has merged the elements of the 'process' dimension with the person and context dimensions in the PPCT model. Finally, 18 interview questions were designed, considering this project's person, context and time dimensions, as given in Table 1.

Table 1: Mapping of Interview Questions with updated Person, Context, and Time (PCT) model and Research objectives

Levels	Interview Questions	Research Objectives (ROs)
Person	Do you have a written list of your academic goals?	RO 1
	Who motivates you to study better and fulfill your dreams: Teachers, Family and Peers?	RO 1
Micro-level	How many times do you visit the library in a week?	RO 2
	Purpose of going to the library.	RO 2
	Do you use Masader and ProQuest?	RO 2
	Do you know about Udemy, Coursera, eduX, etc.? Have you taken any courses or received certificates from them?	RO 2
Meso level	How is our campus internet? How does it help in your studies?	RO 2
	Do you learn more from a mobile iPad or laptop? Do you make notes on paper or iPad?	RO 3
	Which AI Chatbot do you use, and what is your purpose for using it?	RO 3
Exo-level	Do you have a study circle/group with friends? Do you do peer tutoring or learn from peer tutors?	RO 2
	Do you like group activities and assignments, and why?	RO 2
	What do you love more, lab or theory and why?	RO 2
	Are you part of any student club? Why?	RO 2
	Do you use YouTube for learning? Short or regular, which one is suitable for study, and for what purpose?	RO 2
Macro-level	Are you aware of the job market and its requirements in Oman, GCC and worldwide?	RO 1
	What is your family or University doing in this regard?	RO 1
Time	If you became a teacher or HOD, what three things	RO 1

Levels	Interview Questions	Research Objectives (ROs)
(Chrono level)	would you do to improve our students' learning experience?	
	How will AI and ML change learning in the next 5 years?	RO 3

3. Research Design

Research Method

The team adopted focus group interviews to collect insightful data for qualitative analysis. Focus groups are structured discussions with a small number of participants to gather qualitative insights on specific topics, products or ideas(Thelwall& Nevill, 2021). Participants are selected based on relevant criteria, and a facilitator guides the discussion with open-ended questions, encouraging interaction that reveals diverse perspectives. However, challenges such as the risk of groupthink, the complexity of analyzing qualitative data, and limited generalizability to larger populations can arise (Morgan, 1996).

Sample Size, Selection and Diversity

Twenty-two students from Level 3 and Level 4 were interviewed, representing a diverse mix of male and female participants from various courses. This diversity enhances the richness of the data collected and allows for a comprehensive understanding of different perspectives within the learning environment(Krueger & Casey, 2008). The decision to focus on Level 3 and Level 4 students is grounded in the belief that these individuals possess sufficient experience after spending two years in college to provide meaningful insights about their learning experiences.

Consent and Ethical Considerations

Before the interviews, the interviewer obtained informed consent from the participants. They were briefed about the purpose of the study and given a general introduction to the research project to understand the context of the questions. Participants who agreed to participate were allowed to proceed, ensuring voluntary involvement. This study obtained due permission from the Organizational Ethics and Biosafety Committee during the project proposal stage and just before the start of interviews. We ensured diverse participant composition and established clear guidelines to enhance ethical rigor in focus group interviews. Participants were assured of confidentiality, briefed beforehand and offered feedback opportunities post-session. Debriefing allowed for addressing concerns, and the study underwent an ethical review to align with established research standards, promoting trustworthiness.

Research Instrument

For the focus group interview, 25 questions were designed in the initial phase. However, after discussion with internal research methodology experts, peers, and a pilot study with four students, 18 structured questions were finally approved for the final research based on the updated PCT model of EST (Refer Table 1). This process was adopted to enhance the validity and reliability of interview questions and processes. A pilot study served as a preliminary test of the methodology, allowing the researchers to refine queries and procedures,

enhancing the main study's overall validity. Peer discussions provided critical feedback on the research design and analysis, helping to identify biases and improve result interpretation. Together, these approaches strengthened the rigor and credibility of the research, leading to more reliable and valid findings(Chioncel et al., 2003; Rauf et al., 2014).

Data Collection

In addition to the principal investigator, two other faculty members were identified as researchers and moderators. These three faculty members were familiar with the process of conducting focus groups. The interviews were conducted in September 2024 in a traditional classroom environment familiar to the participants in one attempt. After a 15-minute introduction and explanation of the study, participants were provided with hard copies of the interview questions. The interviews were conducted anonymously to foster a safe environment for participants to express their views. Only essential demographic information, such as gender, age and study level, was collected to provide context for the responses.

Data Analysis

Following the interviews, the responses were digitized using Google Sheets. The interview data wasanalyzed using a mixed-methods approach, incorporating both quantitative and qualitative techniques to assess the frequency of participant sentiments, opinions and information. A systematic coding framework was established to categorize opinionson each question allowing researchers to quantify the frequency of each opinion and information across the dataset. This quantitative assessment provided insights into the prevalence of responses. Subsequently, a thematic analysis was conducted to explore the qualitative aspects of the data. Researchers identified recurring themes from the coded opinions and information and the broader context of participant narratives, articulating these themes with supporting quotes from the transcripts. This analysis was contextualized within the existing literature, allowing a deeper understanding of how participant opinions aligned with or challenged previous findings. By integrating both quantitative and qualitative insights, the study offered a comprehensive understanding of participants' perspectives, enhancing the validity and richness of the findings.

4. Findings and Analysis

In this section, the findings of the interview data are presented with questions, responses and analyses to better understand the quantitative and qualitative data. This analysis is arranged in subsections aligned with three research objectives.

Research Objective 1: To determine the motivations and drivers behind students' academic success.

4.1 Do you have a written list of your academic goals?

Response: For this question, about two-thirds (64%) responded 'yes,' and 36% responded 'no.'

Analysis: Most respondents (about two-thirds) hadwritten goals, indicating a relatively high level of intentional goal-setting behavior among this group. This may reflect an awareness of the importance of planning and tracking academic objectives. Studies have shown that writing down goals improves accountability and increases the likelihood of achieving them (Ng, 2023).

However, over one-third (36%) of respondents didnot have written academic goals, which could imply a lack of awareness of the importance of goal-setting, difficulty in identifying or articulating academic goals, and a focus on informal or mental goal-setting rather than written documentation.

4.2: Who motivates you to study better and fulfill your dreams: Teachers, Family and Peers?

Responses: Interview responses to these questions are summarized in the following table.

Table 2: Source for Motivation

Source	Mentions
Family	14 mentions (64% of responses)
Myself (Self-motivation)	7 mentions (32% of responses)
Friends/Peers	5 mentions (23% of responses)
Teachers	2 mentions (9% of responses)
"All" (generalized)	2 mentions (9% of responses)

Analysis: Family wasthe most frequently mentioned source of motivation, appearing in 64% of responses. This suggests that many respondents felta strong sense of responsibility, encouragement or inspiration from their family members. Family wasoften paired with other motivators (e.g., "Myself and family,""Family and friends"), showing that family support wasfoundational (Moreira-Morales et al., 2024; Ryan, 2017).

Self-motivation was the second-most mentioned factor (32%). This indicates that many respondents weredriven by personal goals, ambitions or internal determination to succeed. (Kumar & Kapoor, 2024).

Friends/peers were mentioned in 23% of responses. For some, social connections, encouragement or peer competition may drive them to study harder and fulfill their dreams (Martin & Dowson, 2009).

Teachers were mentioned in only 9% of responses, which is surprisingly low, but it is confirmed by Liu and Chiang (2019). This implies that, while teachers can play a role (Karakose et al., 2023), their influence might not be as strong as that of family, self-motivation, or peers(Brophy, 2010; Wentzel, 2021).

4.3 Are you aware of the job market and its requirements in Oman, GCC and worldwide?

Response: The interviews revealed a substantial majority showing awareness, with 15 respondents (68.2%) agreeing, while 7 respondents (31.8%) expressed disagreement, indicating less awareness.

Analysis: A majority of students expressed awareness of the job market (Vicsek et al., 2022), particularly in Oman, indicating a growing recognition of

employment opportunities and requirements (Kopackova et al., 2024; Vicsek et al., 2022; Zainul &Maskur, 2024). A notable number of students lacked awareness of the job market, suggesting a need for increased information and resources. This situation is concerning. College management must proactively provide sufficient exposure to these students regarding local, regional and international job markets, as well as associated skills and requirements.

4.4 What are you, your family or the University doing in this regard?
Response and analysis: Several students mentioned efforts to improve their academic performance and skills through training and internships.

> *"improve my skills, do summer training, get experience by collaboration with engineers"*

While many students wereaware of the job market, the varying degrees of preparedness suggested that awareness didnot always translate into readiness. Some students weremore proactive than others in taking steps to secure employment.

> *"I am actively applying for the internship in the hope of securing a job in the future once I graduate, as well as improving my CV"*

Many students wereactively seeking internships and training to gain practical experience. This highlights the importance of a supportive ecosystem that encourages career development.

> *"trying to improve grades, family advice, University give special training"*

Many students actively engaged in activities that enhance their employability, such as internships, training and networking on LinkedIn.

> *"Created LinkedIn account"*

The number of students who wereunaware of the job market indicates a need for improved access to information regarding job opportunities, industry requirements, and career development resources (Kopackova et al., 2024; Overwien et al., 2024).

4.5 If you became a teacher or HOD, what three things would you do to improve our students' learning experience?
Response and Analysis: Students responded to these questions with valuable suggestions and insights. After careful analysis, the following themes emerged.

Curriculum Enhancement: Many students emphasized reviewing and updating the curriculum to make it more relevant and aligned with practical skills. Suggestions included reducing unnecessary content and enhancing hands-on learning opportunities. A strong desire for more lab work, practical classes and field visits was evident, as students believedthat practical experience enhances understanding and engagement. (Walker, 2020). Promoting collaboration through group work was frequently mentioned. This indicates a recognition of the value of teamwork in developing communication and interpersonal skills (Kuwabara et al., 2020).

Betterment of Learning Environment: Several responses highlighted the importance of integrating new technologies into teaching methods to make learning more engaging and effective (Patrick &Msekelwa, 2024). A notable

number of students expressed a wish to reduce the number of exams, assignments and coursework, suggesting they feltoverwhelmed and stressed by the current workload. Additionally many responses called for modernized infrastructure, such as new buildings and improved facilities, to create a conducive learning environment.

> *"curriculum development, enhanced support system, technology integration"*
>
> *"make theory hours less, and increase lab and practice work, help them go to summer internship training, involve more technology"*
>
> *"new learning techniques, less effect on students, modern, clean building suits to engineering students"*

Research Objective 2: To assess the influenceof the college environment on students' learning experiences.

4.6 How many times do you visit the library in a week?
Response: Interview responses to these questions are summarized in the following table.

Table 3: Frequency of Library Visits

Frequency	No of students	%
0	6	27
1	1	4.5
2-3	11	50
4	1	4.5
Daily	1	4.5
Occasionally	1	4.5
During exam	1	4.5

Analysis: Many students (6) didnot visit the library. Most of those who visitedwentinfrequently, with 11 students visiting 2-3 times a week or less. Only a few students (1 daily, 1 occasionally) visited frequently, indicating a potential lack of engagement with the library's resources. The low frequency of library visits suggests that many students may not see the library as a valuable resource for their studies or may prefer alternative study environments.

4.7 Purpose of Going to the Library
Responses: Exam preparation (repeated mentions), quiet place for discussion and study, help for assignments, extra reading.

Analysis: The primary purpose of visiting the library wasexam preparation, with many students emphasizing the need for a quiet environment for study and discussion. Help with assignments and extra reading werealso noted, indicating that students may utilize the library primarily when they have specific academic needs. The responses suggest that the library is viewed as a supportive resource primarily during high-pressure times (like exams) rather than a regular study

space. This could indicate a reactive rather than proactive approach to utilizing library resources (Beile et al., 2020; Khan et al., 2017).

4.8 Do you use Masader and ProQuest?

Response: Yes 12 (54.5%) and No 10 (45.5%)

Analysis: Approximately half of the students (54.5%) reported using Masader or ProQuest, indicating a significant level of engagement with these resources. These services are useful for academic success (Khan et al., 2017). However, nearly half (45.5%) didnot use these services, which raises questions about awareness, accessibility or perceived value. Students who didnot use these resources mightnot know how to navigate them or mightnot have been adequately informed about their benefits. Students who didnot engage with Masader or ProQuest might turn to less reliable sources, which could impact the quality of their academic work.

4.9 Do you know about Udemy, Coursera, edX, etc.? Have you done any courses/certificates from them?

Response: Interview responses to these questions are summarized in the following table.

Table 4: Awareness of MOOC platforms and courses

MOOC	**Responses**	
Awareness of MOOC platforms	Yes	No
	3 (13.6%)	19 (86.4%)
Engagement with MOOC courses	Completed	Not completed
	1 (AI course)	21 (95.5%)

Analysis: The overwhelming majority (86.4%) of students wereunaware of MOOC platforms like Udemy and Coursera. This lack of awareness suggests a significant gap in knowledge about available online learning opportunities (Alamri, 2022; Geryk, 2024). MOOCs provide engineering students with access to diverse, high-quality learning resources and expert instruction from around the world. They enhance skills and knowledge through flexible, self-paced courses, fostering a deeper understanding of complex subjects (Papadakis, 2023). Only a few students werefamiliar with these platforms, indicating that the college may not effectively promote these resources or integrate them into the academic experience. There may also be a lack of motivation to pursue additional learning outside the classroom. Students may feel overwhelmed by the prospect of self-directed learning through MOOCs without adequate support or encouragement from the college (Bingöl et al., 2020).

4.10 How is our campus internet? How does it help in your studies?

Response: Interview responses to these questions are summarized in the following table.

Table 5: Response against internet quality and usefulness

Campus Internet	Response
Quality of internet	Positive Responses (Good/Excellent): 6 (27.3%)
	Negative Responses (Bad/Kinda Bad): 12 (54.5%)
	Neutral Responses: 4 (18.2%)
Impact on studies	Positive Responses (Yes/Useful): 14 (63.6%)
	Negative Responses (No/Not Really): 3 (13.6%)
	Neutral Responses (Sometimes/Could be Better): 5 (22.7%)

Analysis: Most students described the internet quality as poor. A few students acknowledged good internet in certain buildings, indicating that while there wereareas of strength, overall satisfaction waslow. This could lead to a sense of helplessness or dissatisfaction with the learning environment, potentially impacting their overall academic experience. Most students recognized that the internet helped them with their studies, particularly for research, accessing learning materials and completing assignments. The positive responses indicated that students heavily relied on the internet for research and assignments (Abdulaziz A. Alfayez, 2024).

4.11 Do you have a study circle/group with friends? Do you do peer tutoring or learn from peer tutors?

Response: Interview responses to these questions are summarized in the following table.

Table 6: Response to Collaborative Learning Preference

Social Learning	Response Rate
Do you have a study circle/group with friends?	Yes Responses: 16 (72.7%) No Responses: 6 (27.3%)
Do you do peer tutoring or learn from peer tutors?	Yes Responses: 12 (54.5%) No Responses: 10 (45.5%)

Analysis: Most students (72.7%) reported having study circles or groups, indicating a robust inclination toward collaborative learning. The responses indicated that social dynamics significantly influenced students' learning preferences (Cupelli & Colalillo, 2024; Kuwabara et al., 2020). Those who participate in study groups may benefit from academic support and social interaction that reduces stress and fosters a sense of belonging within the academic community (Gast et al., 2017).

While just over half of the students (54.5%) engaged in peer tutoring or learning from peer tutors, a notable portion (45.5%) didnot collaborate. The engagement in peer tutoring reflected a recognition of the benefits of learning from peers. Students may feel more comfortable asking questions and seeking help from classmates, which can lead to a more supportive and less intimidating learning

environment (Rozenszayn&Assaraf, 2011; Slavin et al., 2003). The presence of students who didnot participate in study groups or peer tutoring suggests potential barriers, such as lack of time, differing academic schedules or personal preferences for independent study. Understanding these barriers is essential for improving peer learning opportunities (Alansari & Rubie-Davies, 2021; Page, 2017).

4.12 Do you like group activities and assignments, and why?

Response: Yes responses accounted for 12 (54.5%), while no responses totaled 8 (36.4%), and those who were not sure or responded sometimes made up 2 (9.1%).

Analysis: While a slight majority of students preferred group activities, a significant number remainedskeptical or negative about them, indicating mixed feelings toward collaborative work. Students who favored group activities appreciated the collaborative learning environment, highlighting benefits such as sharing ideas and distributing tasks. This suggests that they recognized the potential of group work to enhance learning outcomes through diverse perspectives (Alansari & Rubie-Davies, 2021; Baines et al., 2009).

"we can distribute the work between us and make it easier and faster"

"because it is easy and more ideas"

Students expressed frustration with peers who didnot contribute, indicating a desire for accountability and fairness in group work. This concern may discourage some from fully engaging in collaborative activities (Rozenszayn&Assaraf, 2011).

"distribute the work, but it difficult to trust their works"

"some students do not work, they get same marks as others"

4.13 What do you love more, lab or theory and why?

Response: 17 respondents (77.3%) expressed lab preferences, 3 (13.6%) indicated theory preferences, and 2 respondents (9.1%) remained neutral.

Analysis: The overwhelming preference for lab classes suggested that students foundpractical, hands-on experiences more engaging and effective for learning. This indicates a belief that practical application enhances understanding and retention of concepts (AffiaThabassum et al., 2022). Many students described lab work as fun and interesting, suggesting that enjoyment in learning activities couldlead to more positive educational experiences (Hernández-de-Menéndez et al., 2019; Walker, 2020).

" it is easy to understand; make the experiment memorizable"

"We interact and have a chance to practice what we learned"

"more fun, we do work, use our brain, so we love it"

Students may feel that theory alone does not provide sufficient understanding without the context of hands-on experiences.

"they help in combining practical and theoretical experience"

The limited enthusiasm for theory classes may reflect a perception that they lacked engagement or practical relevance.

4.14 Are you part of any student club? Why?

Response: Interview responses to these questions are summarized in the following table.

Table 7: Preference for student club and purpose

Question	Response
Are you part of any student club?	Yes Responses: 10 (45.5%)
	No Responses: 12 (54.5%)
Purposes	Entertainment & Networking: 9 mentions (40.9%)
	Skill Development: 7 mentions (31.8%)
	Showcasing Skills: 6 mentions (27.3%)

Analysis: While nearly half of the students wereinvolved in clubs, a significant portion werenot. This indicates a divide in student engagement with extracurricular activities. Students who participated cited reasons such as skill development, social interaction and enjoyment. Some mentioned the value of clubs for enhancing their resumes, gaining experience and social networking (Freeman, 2017; Funda UYSAL, 2023).

> *"Yes, Basma leader. I meet more people to help me to be punctual and brave and enjoy my time"*
>
> *"Yes, chess club, volunteer, building skills"*

The emphasis on networking and entertainment indicates that students value social connections and community as part of their university experience. Clubs provide a space for students to build friendships and engage with peers outside academic settings. Some students expressed disinterest in clubs, which may reflect a preference for focusing on academic responsibilities or a lack of awareness about available clubs. This suggests a need for better promotion of these opportunities.

> *"Yes, to spend my time and increase my skills"*
>
> *"Entertainment and networking help in learning new things"*

4.15 Do you use YouTube for learning? Short or regular, which one is good for study, and what is the purpose of using it?

Response: Interview responses to these questions are summarized in the following table.

Table 8: Response to YouTube Usage

Questions	Response
Do you use YouTube for learning?	Yes Responses: 20 (90.9%) No Responses: 2 (9.1%)
Shorts or regular videos – Which is suitable for study?	Regular Videos: 14 mentions (63.6%) Shorts: 6 mentions (27.3%) Both: 2 mentions (9.1%)
Purpose of using YouTube	Extra Knowledge on Topics: 16 mentions (72.7%)
	Learning New Topics/Ideas: 14 mentions (63.6%)
	Entertainment and Time Pass: 4 mentions (18.2%)

Analysis: Most students use YouTube as a learning resource, indicating its importance in their educational practices (Cetinavci et al., 2022; Jaffar, 2012). Most students preferred regular videos for study purposes, suggesting they valued the depth and detail of more extended content providers. Some students foundshort videos useful for quick information, indicating recognition of their role in providing concise content.

The primary purpose for using YouTube wasto gain extra knowledge on topics, particularly those taught in class. This reflects a proactive approach to their education, where they soughtadditional materials to reinforce their learning (Sadaf et al., 2024). While learning wasthe main focus, there wasalso an acknowledgment of YouTube's role in providing entertainment, reflecting its multifaceted nature in students' lives.

> *"Extra knowledge for topics taught by a tutor, learning new ideas, topics and entertainment"*

Research Objective 3: To evaluate the impact of technology on students' learning experiences.

4.16 Do you learn more from mobile, iPad or laptop? Do you make notes on paper or iPad?

Response: Interview responses to these questions are summarized in the following table.

Table 9: Preference for tools for learning

Tools	Response Frequency
Preference for learning tools	Laptop: 12 mentions (54.5%)
	Mobile: 6 mentions (27.3%)
	iPad: 7 mentions (31.8%)
Note-taking preference	Paper: 15 mentions (68.2%)
	iPad: 4 mentions (18.2%)
	Both: 6 mentions (27.3%)

Analysis: Most students preferred laptops due to their larger screens, ease of use and ability to run multiple applications, which supports various learning activities. Mobile devices werefavored for their portability (Thomas et al., 2013) and accessibility, indicating that students valued the ability to learn on the go (Krish et al., 2012; Mehdipour&Zerehkafi, 2013). iPads werementioned as beneficial for combining features of both mobile devices and laptops, highlighting their versatility (Bakic et al., 2024).

> *"laptop, iPad because i am able to search, easy on big screen"*
>
> *"mobile, because it is with me most of the time"*

A strong preference for paper over digital note-takingasevident, with many students citing benefits like clarity, ease of use and enhanced understanding through writing. Several students mentioned that writing by hand aided memory recall and concentration, indicating an awareness of the cognitive advantages of traditional note-taking methods (Flower & Hayes, 1981). Using paper and iPad for different purposes shows that students are adaptable and willing to utilize multiple tools based on context (Liu et al., 2024).

> *"paper, I feel like writing on paper helps me understand topics more*
>
> *"both, I use paper for rough work and math problems, and iPad for theory subjects"*

4.17 Which AI Chatbot do you use, and what purpose for using it?

Response: Interview responses to these questions are summarized in the following table.

Table 10: AI Chatbot and purpose of usage

Tool	Usage
Tool cost	Free Tools: 20 mentions (90.9%)
	Paid Tools: 2 mentions (9.1%)
Purpose of using Chatbot	Assignment Help: 15 mentions (68.2%)
	Learning new ideas, words, language: 14 mentions (63.6%)
	Building Skills: 7 mentions (31.8%)

Analysis: Most students utilized free AI tools, with ChatGPT being the most mentioned. This indicated a strong preference for no-cost options, possibly due to budget constraints or a belief that free tools sufficiently meet their needs. Many students used AI tools primarily for assignment help, indicating that they relied on these resources to assist with their academic workload (Barrot, 2023; Cotton et al., 2024). Many students also used these tools to learn new concepts, vocabulary and language skills, highlighting an eagerness to enhance their knowledge and capabilities. This reflected a proactive approach to learning, where students used technology to supplement their education (Barrot, 2023). While less emphasized, some responses indicated a desire to build skills, suggesting that students sawpotential in AI tools for personal and professional growth (Ait Baha et al., 2024; Barrot, 2023; Chang et al., 2022; Chen et al., 2020).

4.18 How AI and ML change learning in the next 5 years?

Response Analysis: In response to this question, students suggested innovative and informative scenarios. After careful analysis, the following themes were developed.

Many students believed AI and mobile learning (ML)wouldenable personalized learning experiences, adapting content to meet individual needs and preferences. This customization is seen as a way to enhance student engagement and effectiveness (Patrick &Msekelwa, 2024).

> *"intelligent tutoring will make learning more efficient and accessible"*

Students expressed that AI wouldmake learning more efficient and accessible, allowing for easier information retrieval and research. This suggested a desire for streamlined processes in their educational journeys (Liu et al., 2024).

The potential for intelligent tutoring systems to provide real-time feedback wasa recurring theme, indicating that students valued immediate support and guidance in their learning processes.

> *"helping in solving different problems of study"*

> *"it will take over the learning system; it will be easier to search and learn new skills"*

The mention of creating immersive virtual learning environments suggests that students wereexcited about the prospects of interactive and engaging educational experiences facilitated by AI (Ahmed & Hamdan, 2024).

> *"it will improve the learning system positively and make animmersive experience for students to learn whenever and wherever"*

Some responses indicated a worry that AI might take over traditional learning methods, suggesting a fear of losing the human element in education(Essel et al., 2022).

> *"make everything easy and become instead human"*

5. Conclusions

It is clear from the study that the majority of the students are motivated by written goal-setting record. They expressed low satisfaction with library visits and limited awareness of online resources like Masader and ProQuest.

Awareness of MOOCs such as Udemy and Coursera asalso low. Additionally, students reported inconsistent internet quality on campus and showed mixed preferences for learning devices, favoring paper for writing to enhance cognition. The majority of students confirmed the use of ChatGPT for assignment help and learning a new language. It is obvious, considering the ease and versatility of this tool.

Students hadmixed responses to study clubs and peer tutoring, generally recognizing the benefits of peer learning. While some appreciated collaborative group assignments, others expressed concerns about trust and workload fairness. Many students favored extracurricular activities for enhancing networking skills, showcasing talents and developing interpersonal skills. They showed a mature understanding of using YouTube for learning activities. They weresmart enough to comprehend the role of AI and ML in future education. Most of them recognized the benefits of these technologies in personalized learning, ease of education and immersive experience.

Students werepositively aware of job opportunities but feltunprepared, indicating a need for college management intervention. They demonstrated maturity in discussing their potential roles as HODs, emphasizing the need for curriculum redesign, technology integration, active learning and reduced academic and assessment loads.

In conclusion, this study successfully achieved the three research objectives. Our findings elucidated the factors that contribute to students' positive and negative experiences. This understanding is crucial for informing strategies to enhance student engagement and educational outcomes.

6. Recommendations

The following recommendations are made for the College:

- Promote written records of SMART goals through workshops to enhance student focus and motivation.
- Increase awareness of tools like Masader and ProQuest via workshops and curriculum integration, encouraging faculty to include these in assignments.
- Host educational events on MOOCs to showcase the benefits of online courses, guiding students throughenrollment and integration into their studies.
- Create platforms for students to share experiences with learning tools, fostering a community of best practices.
- Incorporate AI tools like ChatGPT into the curriculum to teach effective usage of technology for assignments.
- Investigate low participation in study groups through surveys and enhance accountability with structured group assignments and collaboration workshops.

7. Limitations

The team selected only Level 3 and 4 students for this research due to their enriched experience with the campus and its facilities. Only 22 students were selected for this study. Differences of opinion based on gender were notanalyzed in this work.

Contribution

Priy Brat Dwivedi: Conceptualization, design, data collection, analysis and writing.

Dr Santosh M Walke: Design and data analysis

Ms. Maryam Al Subhi: Data collection

Ms Nabila Al Balushi: Design and data analysis

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