HUMAN-CENTERED INNOVATIONS

INTERDISCIPLINARY APPROACHES TO DESIGN, EDUCATION AND SUSTAINABLE LIVING

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Pranjali Nirantar
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Dr. Peeyush Gupta

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CHAPTER 1

EXPLORING THE ETHNOGRAPHIC STUDY OF AUTISTIC CHILDREN'S AND SOCIAL DEVELOPMENT IN PRIMARY SCHOOLS

Ishita Panda[1], Pranjali Nirantar[2], Zoya Warsi[3], Dr. Peeyush Gupta[4]
[1,2,3]Student, [4]Faculty
ATLAS ISDI- School of Design & Innovation,
[1,2,3,4]Atlas Skilltech University, Mumbai
Email: ishita.panda.bdes2026@atlasskilltech.university.edu.in[1],
pranjali.nirantar.bdes2026@atlasskilltech.university.edu.in[2],
zoya.warsi.bdes2026@atlasskilltech.university.edu.in[3], peeyush.gupta@atlasuniversity.edu.in[4]

ABSTRACT:

Autistic children in primary school, particularly those aged 6 to 13, commonly experience significant challenges in social development, including difficulties in forming friendships and engaging in peer interactions. Barriers such as time constraints, high costs of specialized therapies, and limited access to resources further restrict their social growth, often leaving families to seek support outside regular schools. While interventions like behavioral therapy, parental education, and sensory-based therapies have demonstrated benefits, their integration into mainstream education remains limited, creating gaps in support. An ethnographic study at Little Hearts Learning Centre in Mumbai highlighted the effectiveness of tailored teaching methods, such as flashcards and sensory activities, in promoting social skills, but also revealed persistent obstacles, including unconventional program structures and funding shortages. Despite these challenges, active parental involvement emerged as a vital factor in bridging the gap between therapeutic and educational interventions, even when resources are scarce. Financial struggles and time demand for personalized learning surfaced as major concerns, with long-term therapies like Applied Behavior Analysis (ABA) often unaffordable for many families. These findings underscore the importance of inclusive, accessible, and affordable support systems within mainstream education to foster social development and well-being for autistic children.

KEYWORDS:

Autism, Parental Involvement, Primary School, Sensory Activities, Social Development.

1. INTRODUCTION

Social development is very important for primary school children because it helps them make friends, learn how to work with others, and build emotional strength. These skills are necessary for children to grow well and succeed in life. For autistic children, this stage of social development can be especially hard [1]. Many autistic children have trouble with speaking, understanding social signals, and interacting with their classmates. If these difficulties are not addressed early, autistic children may feel left out and lonely, which can hurt their emotional health [2]. That is why it is very important to focus on helping autistic children develop social skills during their early school years. Doing so can help them form meaningful friendships, communicate better with others, and feel more confident in social situations.

The social development of autistic children aged six to thirteen in primary school is not well understood, which causes concern for teachers, parents, and policymakers. Although more autistic children are now attending regular schools, there is still little clear information about how they learn social skills compared to children without autism. Autism Spectrum Disorder (ASD) affects many children worldwide, and many of these children are enrolled in primary schools. Without a clear understanding of their social development, schools and families may not provide the right support [3]. This lack of support can make it harder for autistic children to connect with peers, participate in class, and learn important life skills. Early help is very important because it improves autistic children's social skills, making it easier for them to handle social situations and improving their quality of life. Therefore, there is an urgent need for detailed research to better understand these challenges and to develop teaching methods that meet the unique needs of autistic children.

Autistic children often want to interact with others but do not have the skills to do so, or may feel overwhelmed by social situations. Some children may avoid social contact even though they want friends, while others might act out to get attention until they learn better ways to communicate [4]. Social skills include many parts, such as knowing when to speak, paying attention, understanding body language, and communicating clearly. These skills can be taught step by step through practice and support. For example, teachers and caregivers can use praise to encourage good social behavior, model how to take turns in conversations, and teach children how to notice what others around them are doing [5]. Using pictures, stories, and role-playing can help autistic children understand social rules and safely practice them.

In school, autistic children may not easily join in with other children's play or group activities. They might prefer to play alone or with adults rather than peers. They may also have difficulty understanding personal space, taking turns in conversations, or knowing how to start and end interactions. These challenges can make it hard for autistic children to form friendships and feel included. However, with support and practice, many autistic children can improve their social skills and enjoy positive interactions with classmates. Creating small groups or structured activities focused on social learning can help them practice these skills in a comfortable setting.

Family and culture also influence how autistic children develop social skills. Many autistic children rely on their family for advice about social situations. While family support is helpful, it sometimes limits the child's chance to make independent social choices. Encouraging open conversations about social behavior within families can help autistic children learn how to manage social situations on their own and build confidence [6]. There are many strategies to help autistic children develop social skills. These include joining playgroups designed for children with autism, using visual aids like picture cards to explain social rules, role-playing common social situations, and providing positive feedback when children practice good social behavior. Social skills groups, where children can practice talking, sharing feelings, and playing with others in a supportive environment, are also very helpful [7]. Teaching empathy, or understanding how others feel, is another important part of social development that can be taught through stories and guided conversations.

Overall, social development is a complex but essential part of growing up, especially for autistic children who face extra challenges. Early and ongoing support from teachers, parents, and peers can help autistic children build the skills they need to connect with others, succeed

in school, and feel good about themselves [8]. More research is needed to understand exactly how autistic children develop social skills and to create teaching methods that meet their unique needs. By focusing on social development in primary school, we can help autistic children have happier, more connected lives and prepare them for success in the future.

2. LITERATURE REVIEW

Bella *et al*. [9] studied the use of theatrical play as a teaching method is a fairly new idea in schools. This approach aims to help students, especially those with autism, to interact with others in a fun and supportive way. To understand what teachers, think about this method, twelve teachers from general primary schools in Northern Greece, who work with autistic students, took part in interviews. These teachers, who are around 40 years old on average, answered questions during 45-minute interviews. The interviews included both open and closed questions, and their answers were recorded for careful study. After analyzing the teachers' responses deeply, it was found that they believe theatrical play can be very helpful for autistic students. They feel that when theatrical play is included in the school curriculum in the right way, it offers valuable opportunities for these students to improve their social skills and enjoy learning in a supportive environment.

McLeod *et al.* [10] explored the higher levels of these autistic traits were linked to more academic problems, such as failing courses and having trouble with schoolwork, regardless of whether students had an official autism diagnosis. In particular, mentalizing difficulties were connected to lower grade point averages. Socially, students with more autistic traits were less likely to have someone they could trust, reported lower quality friendships, and faced more social exclusion. Interestingly, these negative social effects were stronger for students who had autistic traits but no formal diagnosis, and the effects were more noticeable in women than in men. This suggests that autistic traits can impact college students' success both academically and socially, even if they have not been diagnosed with autism. The findings highlight the importance of creating support programs that help all students with autistic traits, not just those with a diagnosis, to improve their academic performance and social well-being.

Hotez *et al.* [11] studied that autistic students face big challenges when moving from high school to college, and often do not get enough help to manage this change. To support them better, a group of researchers worked closely with autistic college students to create and test two week-long summer programs designed to ease this transition. First, they developed a program curriculum based on advice from autistic students already involved in a mentorship program. Then, they tested this initial program to see how well it worked. After gathering feedback from participants, they improved the curriculum and created a detailed manual to guide future programs. These summer programs focus on teaching important skills like self-advocacy, understanding autism, building confidence, and preparing for college life both socially and academically. The involvement of autistic students in designing and leading the programs helped make sure the support matched their real needs.

Locke *et al*. [12] discussed that autistic young adults are going to college now than before, but they often face special challenges that make their college experience harder and can lead to dropping out. To help with this, the MOSSAIC program was created as a peer-mentoring support system that focuses on improving executive functioning, social skills, and self-advocacy for autistic students. A study involving thirteen autistic students who received mentoring and twelve non-autistic mentors looked at their experiences in the program. Through

interviews, participants shared mostly positive feedback, saying the program helped them improve in areas like socializing, managing tasks, doing better academically, and preparing for future careers. However, some mentees found it difficult to relate to mentors who were not autistic and felt they had to explain a lot about autism to their mentors. Because of this, many suggested including autistic peer mentors in the program to better match mentees' needs.

3. METHODOLOGY

3.1.Design:

The social development of autistic children aged 6 to 13 is observed because it allows researchers to observe how these children interact naturally in places like playgrounds and classrooms. By spending time with them in their everyday environments, researchers can notice small details and patterns that might be missed through surveys or interviews alone. This method helps to understand how peer interactions, teaching styles, and the overall school culture affect autistic children's social skills, as shown in Figure 1. Unlike just asking children or adults about their experiences, ethnography provides real-life, personalized observations that show both the challenges autistic children face and their progress in social development.

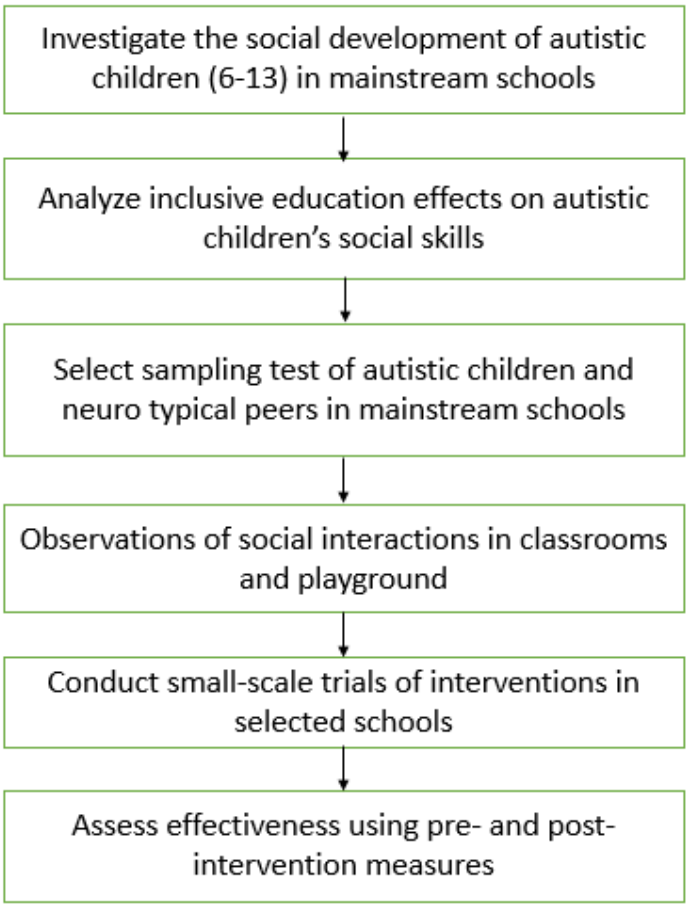

Figure 1: Illustrates the systematic framework for autistics study.

It also encourages the involvement of everyone around the child-teachers, parents, and peers-making the research more inclusive and meaningful. Because autism varies widely from child to child, this detailed approach helps create tailored support strategies that fit each child's

unique needs. Ultimately, ethnographic research offers valuable insights that can lead to better ways to help autistic children build strong friendships and improve their social abilities, enhancing their overall growth and happiness in school.

3.2.Sample:

A variety of sampling methods are used to study and improve social skills interventions, ensuring that each child's unique needs are addressed. The center employs purposive sampling, selecting children aged 6 to 13 who are enrolled in their programs, to ensure the interventions are relevant to the target group. Social skills training (SST) at Little Hearts begins with individualized assessments to identify each child's strengths, challenges, and social goals. Based on these assessments, tailored intervention plans are developed that may include structured playgroups, visual supports like social stories and cue cards, and peer modeling, where children learn by observing and interacting with peers who demonstrate positive social behaviors [13]. The sampling process also involves gathering input from teachers, therapists, and families to ensure a comprehensive understanding of each child's learning context. Interventions are then implemented and monitored, with regular feedback collected to refine strategies and ensure they are effective for each participant. This approach allows Little Hearts to adapt evidence-based methods, such as role-playing, video modeling, and positive reinforcement, to the individual learning styles and developmental levels of their students [14]. By using purposive sampling and ongoing evaluation, the center ensures that social skills programs are both inclusive and responsive, maximizing the potential for meaningful social growth in every child.

3.3.Data Collected:

Teaching methods for children with autism often use a mix of strategies, such as flashcards and storytelling, to make learning more engaging and effective. Flashcards, especially those with clear pictures and simple words, help children recognize and remember new words, while storytelling and video-based lessons make it easier for them to understand concepts and stay interested. Other creative methods, like using music and dance, can also help improve children's motor skills and make learning fun. Table 1 shows the Observation shows the network relationship at different theme categories.

Table 1: Observation shows the network relationship at different theme categories.

Theme	Cluster	Network Relationships
Teaching Methods	Eclectic Method	Combining strategies like flashcards and storytelling.
Child Development	Child Improvement	Improvements in behavior, speech, and academic performance.
Parental Involvement	Therapy Observation	Parents observing therapy sessions.
Therapy	ABA (Applied Behavior Analysis)	Customized techniques to meet specific developmental requirements.

These different teaching approaches are important because they can be tailored to fit each child's unique learning needs, helping them learn better and faster. Child development is the

main goal, with a focus on improving behavior, speech, and academic skills. Reaching these goals often requires teamwork between teachers and families. Parental involvement is very important; when parents watch therapy sessions and practice lessons at home, children tend to make more progress [15]. This teamwork bridges the gap between what children learn at school and what they practice at home, making learning more consistent. However, some challenges remain, such as children feeling anxious or overwhelmed, and families not always having enough resources for therapy or education. Addressing these challenges with the right teaching methods and strong family support can greatly improve learning and development for children with autism.

3.4.Data Analysis:

The social and developmental growth of autistic children is shaped by a network of interconnected factors. Therapy and teaching strategies, such as the eclectic method, work hand in hand to create a supportive environment where both therapeutic and educational interventions can help children make steady progress. However, this positive collaboration is often challenged by financial constraints. Limited access to resources and the high cost of therapies can significantly reduce parental involvement, which is crucial for a child's success [16]. Financial difficulties not only restrict the availability of intervention and educational resources but also increase parental stress, making it harder for families to reinforce learning and development at home. The findings align with well-known theories and existing research, which highlight the importance of using structured and multi-faceted approaches for autistic children. For example, Ayres' theory of Sensory Integration suggests that behavior and learning are influenced by how children process sensory information. Activities like dancing, occupational therapy, and sensory therapy provide controlled sensory input, helping children focus and regulate their emotions and actions.

4. RESULT AND DISCUSSION

Many different factors work together to shape how autistic children grow and develop, especially when it comes to their social and emotional skills. Therapy and teaching methods are most effective when they are used together in a coordinated way, as shown in Figure 2. For example, using a mix of different approaches-like speech therapy, occupational therapy, and creative activities such as music, dance, or art-can help children make steady progress. This is called the eclectic method, and it allows teachers and therapists to choose the best parts of different strategies to fit each child's needs [17]. However, even when the right methods are used, there are still challenges that can get in the way. One of the biggest problems is money. Many families struggle to afford all the therapies and resources their child needs. When money is tight, it's harder for parents to get the right help for their child, and this can slow down the child's progress. Financial stress also makes it harder for parents to be as involved and supportive as they want to be, which is very important for the child's learning.

The findings from this research match what experts have said for years: children with autism benefit most from structured, multi-layered support. Theories like Ayres' Sensory Integration explain how children process sights, sounds, and other sensations can affect how they behave and learn. Activities like dance, occupational therapy, and sensory play are helpful because they give children the right kind of sensory experiences. These activities help children focus, calm down, and interact better with others [18]. Another helpful theory, Dunn's Sensory Processing Framework, points out that autistic children may react to sensory input in different

ways. Some children might seek out new sensations, while others avoid them. By understanding these patterns, teachers and therapists can choose activities that help each child feel comfortable and ready to learn.

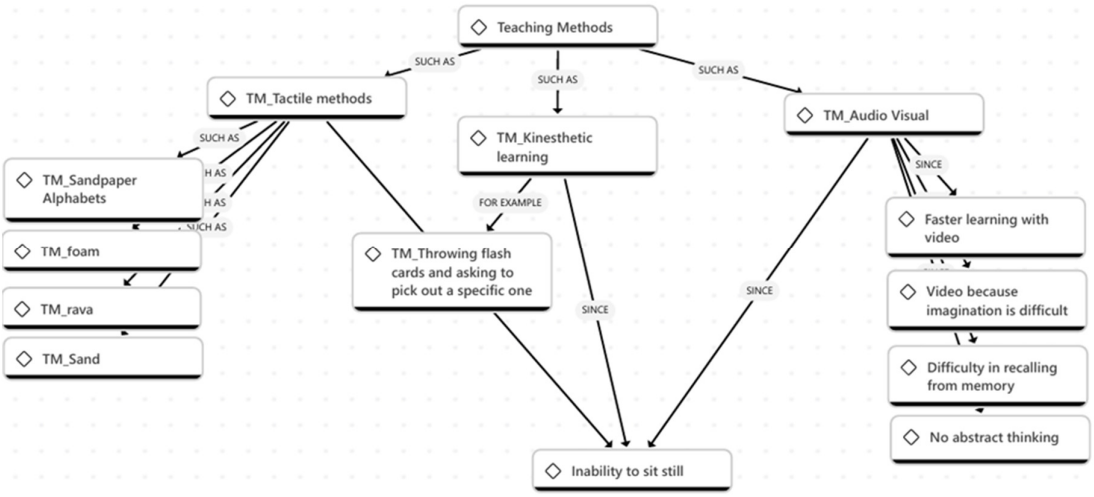

Figure 2: Illustrates the teaching network at different parameters.

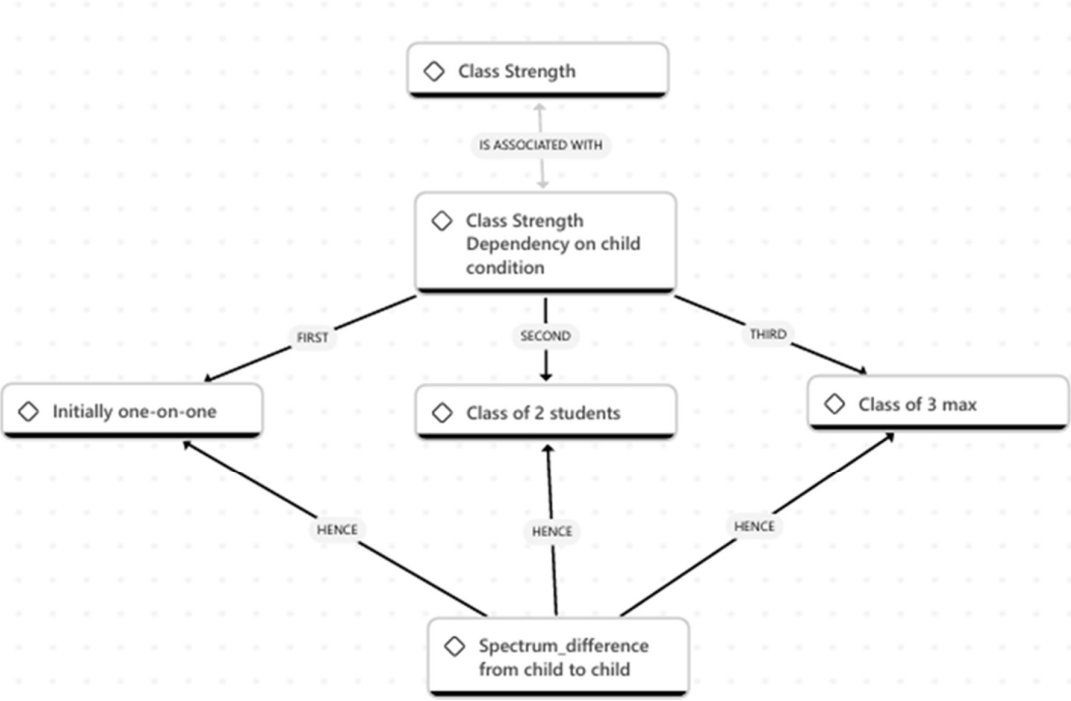

Figure 3: Illustrates the correlation of the different classes method.

Social learning theories, such as Bandura's Social Learning Theory, also support the idea that children learn a lot by watching and copying others. This is why activities that involve imitation, like dance or group games, are so valuable [19]. When children see their peers or adults model certain behaviors, they are more likely to try those behaviors themselves, as shown in Figure 3. This not only helps with learning social skills but also improves motor skills

and thinking abilities. Occupational therapy and dance therapy also fit into bigger ideas like the developmental-individual-difference-relationship-based (DIR) model, which says that every child is different and needs activities that are both engaging and personalized to help them reach important milestones. Parental involvement is another key factor.

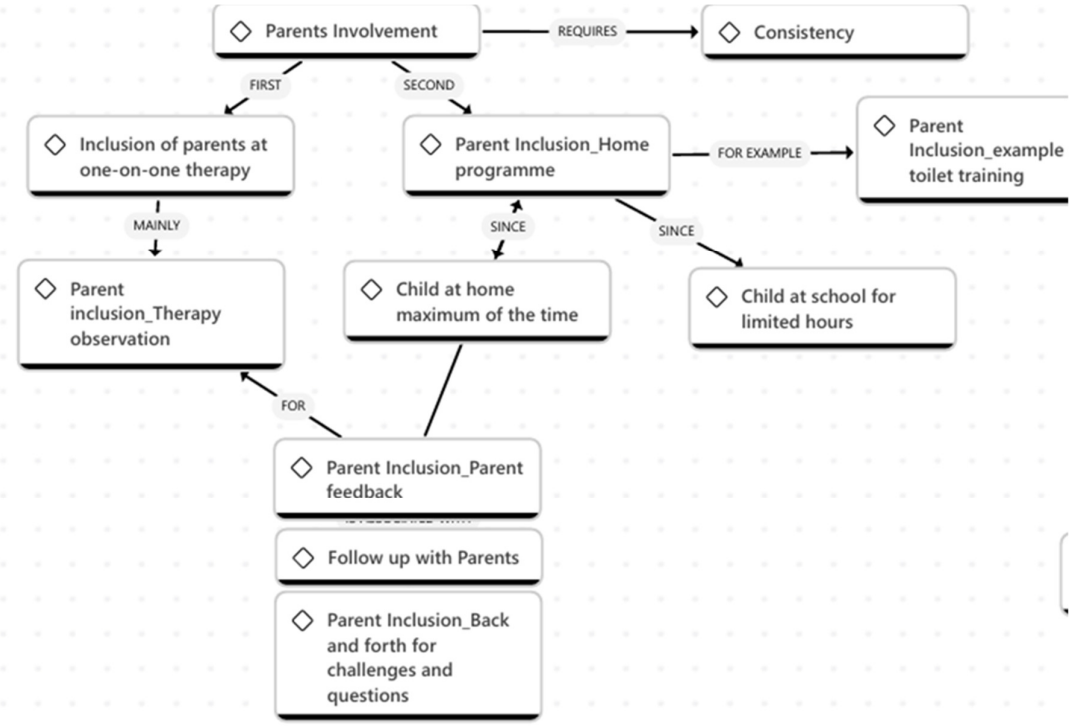

Figure 4: Illustrates the network of parenting the child.

When parents are part of their child's learning and therapy, and when they keep routines and practice skills at home, children are more likely to remember what they have learned and manage their emotions better. This is similar to family-centered therapy approaches, which encourage parents to be active partners in their child's growth, as shown in Figure 4. Research shows that children make more progress when their parents are involved and when learning is reinforced at home. Overall, the best results for autistic children come from a combination of well-coordinated therapies, creative teaching methods, and strong family involvement [20]. Financial barriers can make it harder to access these supports, but when families, teachers, and therapists work together and tailor their approaches to each child's needs, children are more likely to develop social skills, emotional control, and independence. This growing body of evidence highlights how important it is to provide personalized, flexible, and family-centered support for the overall development and happiness of autistic children.

5. CONCLUSION

The academic and social development of autistic children is shaped by a complex web of instructional methods, family participation, therapy, and persistent challenges. The use of varied audio-visual teaching strategies, such as flashcards, video-based lessons, and visual supports, has been shown to significantly improve learning efficiency and comprehension for autistic students. These methods, especially when combined with structured routines and individualized instruction, help reduce anxiety and support the acquisition of academic and

social skills. Parental involvement emerges as a cornerstone of success, bridging the gap between home and school environments. When parents actively observe therapy sessions and reinforce learning at home, children experience greater skill retention, improved emotional regulation, and better social relationships. However, challenges such as anxiety, overstimulation, and especially financial barriers can limit access to essential therapies like ABA, restrict parental engagement, and increase stress within families. These obstacles often undermine the consistency and quality of interventions, impacting the child's overall growth and well-being. Personalized learning opportunities and small class sizes offer promising avenues for meeting each child's unique needs, ensuring that every child receives the attention and support necessary for meaningful progress. Nevertheless, financial hardship and resource scarcity remain significant hurdles, highlighting the urgent need for institutional changes and increased funding. Addressing these interconnected factors through comprehensive, evidence-based strategies is essential for fostering the academic success and holistic development of autistic children.

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CHAPTER 2

EXPLORING PATHWAYS TO GUIDE YOUNG ADULTS AND FINANCIAL ILLITERACY

Devika Kole[1], Miti Sheth[2], Nidhi Dooa[3]. Dr. Jyoti Saini[4]
[1,2,3]Student, [4]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3,4]Atlas Skilltech University, Mumbai
Email: devika.kole.bdes2026@atlasskilltech.university.edu.in[1],
miti.sheth.bdes2026@atlasskilltech.university.edu.in[2], nidhi.dooa.bdes2026@atlasskilltech.university.edu.in[3],
jyoti.saini@atlasuniversity.edu.in[4]

ABSTRACT:

Financial literacy is a crucial life skill that directly impacts an individual's economic stability and overall well-being, yet remains a significant challenge for young adults globally, including those in India. Defined as the combination of knowledge, skills, and attitudes required to make informed financial decisions, financial literacy encompasses budgeting, saving, investing, and responsible money management. Despite its importance, many young adults in India struggle with poor financial habits, limited formal education on financial matters, and strong cultural influences that often prioritize spending over saving. This research paper employs a mixed-methods approach, integrating both qualitative interviews and quantitative surveys, to identify the root causes of financial illiteracy among Indian youth and to examine the consequences of inadequate financial knowledge. Findings reveal that the absence of structured financial education, coupled with reliance on informal sources such as family and social media, leads to impulsive spending behaviors and insufficient savings. Early exposure to financial education, whether through formal training or practical experience with managing pocket money, is shown to foster disciplined financial behavior and informed investment decisions. The study underscores the urgent need to incorporate comprehensive financial education into school curricula and to promote open discussions about money within families and communities. Such interventions are essential for empowering young adults to develop strong financial habits, make sound decisions, and achieve long-term economic security.

KEYWORDS:

Financial Literacy, Financial Education, Impulsive Spending, Savings, Young Adults.

1. INTRODUCTION

In today's rapidly evolving digital landscape, financial literacy has become an indispensable life skill, especially for young adults navigating a world of complex financial products, instant digital transactions, and aggressive consumer marketing. As India continues its trajectory as one of the world's fastest-growing economies, the urgency to equip its youth-particularly those aged 21 to 25-with robust financial knowledge and skills has never been greater. Yet, the reality on the ground is sobering: only about 27% of India's population is considered financially literate, and among students, the figure drops to an alarming 16.7%. This stark deficit is not merely a statistical concern; it has profound implications for individual well-being, economic stability, and the nation's future prosperity [1].

The financial landscape facing young Indians is dramatically different from that of previous generations. Digital payment systems, online investment platforms, and a proliferation of

fintech solutions have transformed the way money is managed, earned, and spent. While these technological advancements offer unprecedented convenience and access, they also demand a higher level of financial acumen to avoid pitfalls such as overspending, debt accumulation, and susceptibility to fraud. Unfortunately, many young adults in India enter adulthood without the foundational knowledge required to navigate these challenges [2]. The consequences are far-reaching: poor financial decisions can lead to chronic debt, low creditworthiness, and even bankruptcy, while also exacerbating broader social issues such as wealth inequality, economic instability, and mental health struggles related to financial stress.

One of the most pressing issues is the cultural and social environment that surrounds young Indians. Prevailing norms often encourage impulsive spending and discourage open conversations about money management. The ease of digital payments, combined with relentless marketing, has fostered a culture where over 60% of young adults allocate a significant portion of their earnings to discretionary spending, rather than saving or investing for the future (National Institute of Consumer Affairs, 2023). This trend is especially concerning given the lack of structured financial education in schools and universities. Without early exposure to concepts such as budgeting, saving, investing, and risk management, young people are ill-equipped to make informed choices in a complex financial world [3].

The absence of financial literacy is not just a personal disadvantage; it perpetuates systemic inequalities. Research shows that income disparities, uneven access to quality education, and regional differences in economic development all contribute to significant gaps in financial knowledge and capability across India [4].

Adolescents from low-income backgrounds, in particular, face additional barriers, as their families may lack both the resources and the knowledge to provide effective financial guidance. Gender disparities further compound the problem, with girls in low-income households often receiving less financial education and support than their male counterparts. These inequities not only limit individual opportunities but also hinder broader efforts to promote inclusive economic growth and financial stability.

Against this backdrop, the importance of early financial literacy education cannot be overstated. Introducing financial principles at a young age has been shown to significantly improve financial behaviors later in life, fostering habits of saving, prudent spending, and informed investing. Experts argue that integrating financial literacy into school curricula is one of the most effective ways to address the knowledge gap and empower the next generation to make sound financial decisions [5].

Such education should go beyond rote learning, incorporating practical exercises, real-life scenarios, and culturally relevant examples to ensure that students can apply what they learn in their daily lives. Culturally responsive approaches are particularly important in India, where taboos and misconceptions about money can inhibit open discussion and learning.

The benefits of early financial literacy extend beyond individual empowerment. A financially literate population is better equipped to participate in the formal economy, access credit responsibly, and contribute to national economic growth. Financially savvy citizens are less likely to fall victim to scams, predatory lending, or unsustainable debt, and more likely to invest in their own education, health, and entrepreneurial ventures [6]. Moreover, widespread financial literacy can help bridge the gap between rich and poor, promoting greater economic

equality and social mobility. For policymakers, educators, and community leaders, the imperative is clear: to build a resilient, prosperous society, financial literacy must be prioritized as a core competency for all, starting from the earliest stages of education.

Efforts to improve financial literacy in India are underway, with initiatives from government agencies, financial institutions, and non-profit organizations aiming to reach diverse segments of the population. The National Centre for Financial Education (NCFE), for example, has launched campaigns and educational programs targeting students, teachers, and parents, while the Reserve Bank of India (RBI) has advocated for the integration of financial education into the national curriculum [7]. Despite these efforts, challenges remain, including disparities in access, varying quality of instruction, and the need to adapt content for different linguistic, cultural, and socioeconomic contexts. Technology offers new avenues for engagement, with digital tools and platforms enabling interactive, personalized learning experiences that can reach even remote and underserved communities.

India's youth face an increasingly complex financial environment, and the need for comprehensive, culturally relevant financial literacy education has never been more urgent. Empowering young adults with the knowledge and skills to manage their finances is not only essential for their success but also for the nation's economic resilience and social cohesion [8]. By investing in early financial education, fostering open dialogue, and leveraging technology, India can build a generation that is not only financially capable but also confident and prepared to navigate the challenges and opportunities of the digital age.

2. LITERATURE REVIEW

Amari *et al*. [9] studied that financial literacy is very important because it helps people make good money decisions and improves their overall well-being. However, many young adults around the world, including university students in Tunisia, do not know enough about managing money, especially when it comes to personal investments. This study looked at how much university students in Tunisia understand about finances and found that most of them lack basic financial knowledge. The problem of not knowing enough about money is common, and even though this study focused on Tunisia, the way they measured financial knowledge can be used to check financial literacy among young adults in other countries, too.

Kadir *et al.* [10] examined poor financial decisions can lead to serious problems for young people, such as falling into debt, facing bankruptcy, or becoming victims of financial scams. To help young adults avoid these costly mistakes, it is important to check how much they know about managing money and to teach them more about finances. This study aims to find out what factors affect the financial knowledge of university students and to see how well they understand personal finance. The results show that most university students do not know enough about managing their money, so they need to improve their financial skills to keep themselves financially safe in the future.

Xu *et al*. [11] studied that health system that is supposed to provide full coverage for people suspected of having enteric fever, but many still face barriers in getting the best diagnostic test, which is a blood culture (haemoculture). This test is important because it can confirm if someone has enteric fever, helping doctors give the right treatment. However, a study done in six counties of Yunnan province found that only 57% of suspected patients could afford this test, even though it is recommended by doctors. Most of the people in the study were young

adults and farmers from low-income families, and the cost of the test (about $11) was a big reason why many could not get it. Health insurance was found to help some people access the test, but not everyone had enough coverage. This means that, despite having a system meant to help, many people still miss out on proper diagnosis because of money problems. Without the right test, patients might not get the right treatment, which can lead to serious health issues and even spread the disease to others.

Dombrovska *et al*. [12] studied that it is very important for people in Ukraine, especially young people and university students, to learn about financial literacy. Young people who are studying now will not only use this knowledge for themselves but will also teach it to others in the future. The study looks at what financial literacy means, why it matters, and what main skills and traits a financially literate person should have. It also reviews statistics from the Organization for Economic Cooperation and Development (OECD) to show how well people in Ukraine understand and manage their finances, highlighting areas where improvement is needed.

3. METHODOLOGY

3.1.Design:

Financial illiteracy among young adults in India is caused by several key factors, including gaps in education, cultural influences, and behavioral tendencies, as shown in Figure 1. Many schools do not include financial education in their curriculum, leaving students without basic knowledge about managing money, saving, or investing. Cultural attitudes also play a role; in many families, money is a taboo topic, so young people do not learn about finances at home. Additionally, behaviors like impulsive spending and a lack of saving habits contribute to financial instability.

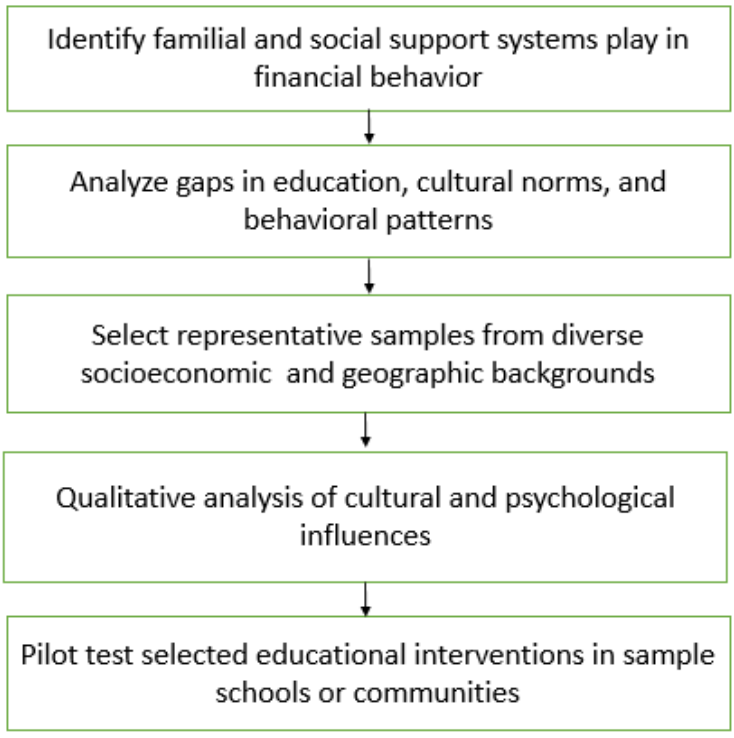

Figure 1: Illustrates the schematic approach for testing the financial behavior.

To understand these issues better, researchers use a mixed approach that includes surveys and interviews with young adults from different backgrounds. They study how education, culture, and family support affect financial knowledge and decision-making. The research also looks at successful financial education models, including the use of digital tools and gamification, to find ways to make learning about money more engaging. The goal is to develop practical strategies to integrate financial literacy early into school curricula, either as standalone courses or by including it in subjects like math and social studies. Policymakers and educators are involved to ensure these strategies are effective and accessible, especially in rural and disadvantaged areas. By improving financial education and support systems, young adults can become better prepared to make smart financial decisions and achieve greater financial stability.

3.2.Sample:

A stratified random sampling method was employed to ensure the sample accurately represented the diverse population of young adults targeted for analysis. The population was first divided into relevant strata based on key demographic variables such as age, gender, and educational background, as these factors were anticipated to influence financial behaviors and literacy levels [13].

Within each stratum, participants were randomly selected, allowing for proportional representation of each subgroup in the final sample. This approach was chosen because stratified sampling enhances the representativeness of the sample, reduces sampling bias, and increases the reliability of findings, especially in heterogeneous populations where subgroups may exhibit distinct financial practices and challenges.

The sampling frame consisted of a comprehensive list of young adults from various academic institutions and community groups, from which the sample size was determined based on statistical guidelines to ensure adequate power for analysis. By using stratified sampling, the study was able to capture variations in financial literacy and practices across different demographic segments, providing a nuanced understanding of the issues at hand.

3.3.Data Collection:

Many participants shared that they had received some kind of formal financial education, either at school or college. However, most young adults still depend on informal sources like social media, advice from family members, and online videos to learn about money matters. This shows that the current education system is not doing enough to teach young people the basic financial skills they need for real life [14]. Those who studied subjects like commerce or finance seemed to have a better understanding of financial topics and were more confident in managing their money. For example, working students with a background in finance or commerce were more likely to plan their finances carefully, regularly saving and investing a good portion of their earnings. Table 1 shows the behavior of youth in different categories.

Table 1: Observation shows the behavior of youth in different categories.

Category	Subgroup/Detail	Percentage (%)	Notes/Description

Formal Financial Education	Received (Academic/College)	37	Participants with formal financial education
Formal Financial Education	Relied on informal sources	63	Social media, family mentoring, and online videos
Advanced Knowledge	Commerce/Finance background	-	More advanced financial knowledge
Working Students (Finance/Comm)	Managed income appropriately	60	Set aside 30-50% for saving/investment
Working Group	Saved/Invested part of earnings	70	Portion of earnings into savings/investments
Working Group (Savers)	Saved >25% of monthly income	40	Of those who save/invest
Working Group	Average allocation to investments	35	Of earnings
Students (Non-working)	Saved a fraction of pocket money/stipend	15	Only a small portion was saved from pocket money
Students (Non-working)	Spent most of my pocket money	85	The majority spend rather than save
Students (Non-working)	Spent >50% of pocket money on leisure	60	Leisure, amusement, social events, dining

They tended to follow a routine, setting aside money for future needs and making thoughtful decisions about spending and investing. On the other hand, most students who were not working did not save much from their pocket money or stipend. Instead, they spent most of what they received on daily needs, entertainment, and social activities. This highlights the need for better financial education to help all young adults develop good money habits and make wise financial choices.

3.4.Data Analysis:

There is a clear link between what people learn about money as children and how they handle their finances as adults. Participants who were given the chance to manage their own spending money when they were young often said that these early experiences had a positive impact on their financial habits later in life. Those who learned to save and budget as children were more likely to become organized and careful with their money as adults [15]. They developed good habits like setting aside money for savings and making thoughtful spending decisions. On the other hand, people who did not have the opportunity to manage their own money as children, or who only had very limited funds, often found it harder to stick to a budget and control their spending impulses as adults [16]. This suggests that learning about money management early in life, whether through school lessons, help from family, or simply by practicing with their own money, can make a big difference in how well people handle their finances when they grow up. Another important finding is that most young adults today rely on informal sources for financial advice. They often turn to YouTube, social media, or family members rather than formal education or professional advisors for guidance on managing their money.

4. RESULT AND DISCUSSION

The analysis of young adults' financial behaviors and attitudes uncovers notable shortcomings in both formal financial education and the real-world management of money, while also highlighting the different ways demographic groups approach income, savings, and investment, as shown in Figure 2. Across the board, there is a clear lack of structured financial education for young adults. Most have not received formal instruction in financial matters, and even those who have often find the content insufficient for the demands of adulthood.

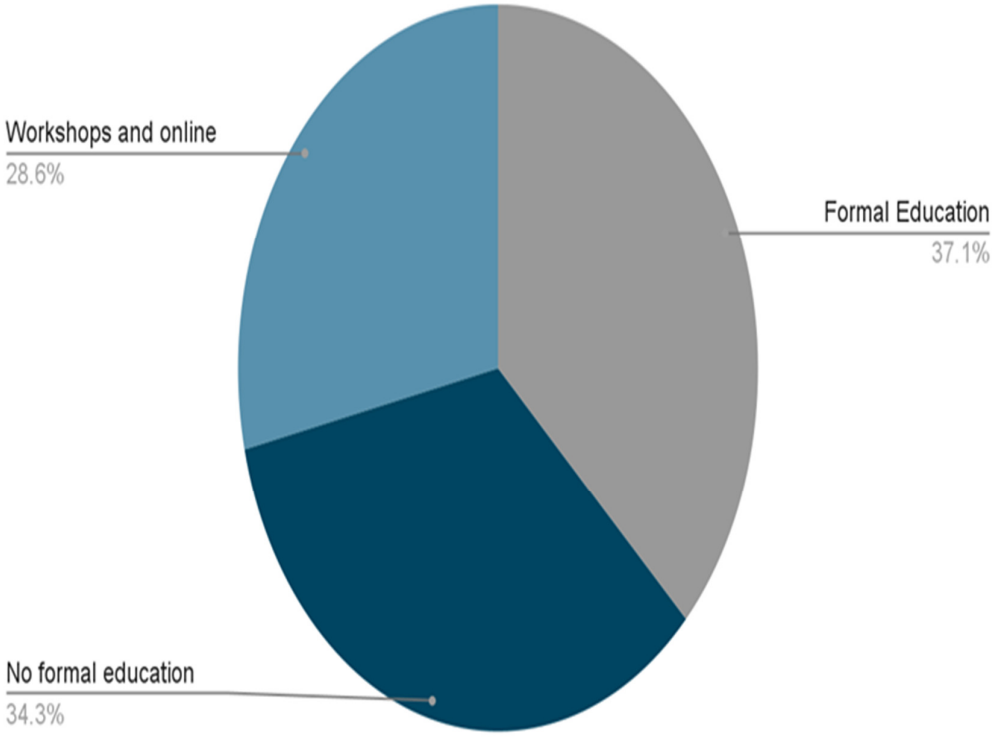

Figure 2: Illustrates the formal financial literacy among the youth.

Instead, the majority turn to informal sources-such as social media, family advice, or online videos-for guidance. This reliance on unstructured learning leaves many young people without the foundational knowledge needed to make sound financial decisions, especially as they encounter increasingly complex financial products and responsibilities.

The consequences of this educational gap are evident in everyday financial practices. Many students report difficulty controlling impulsive spending, with a significant portion of their money going toward entertainment, food, and other non-essential expenses [17]. This pattern suggests a lack of budgeting skills and an absence of long-term financial planning. In contrast, employed young adults generally display more cautious and controlled financial behaviors, likely influenced by higher or more stable incomes and a greater need to plan for recurring expenses, as shown in Figure 3. However, even among those with regular earnings, lapses in discipline are common during festive seasons, when spending habits shift and budgets are more likely to be broken. This seasonal fluctuation underscores how cultural and social factors can override otherwise prudent financial habits.

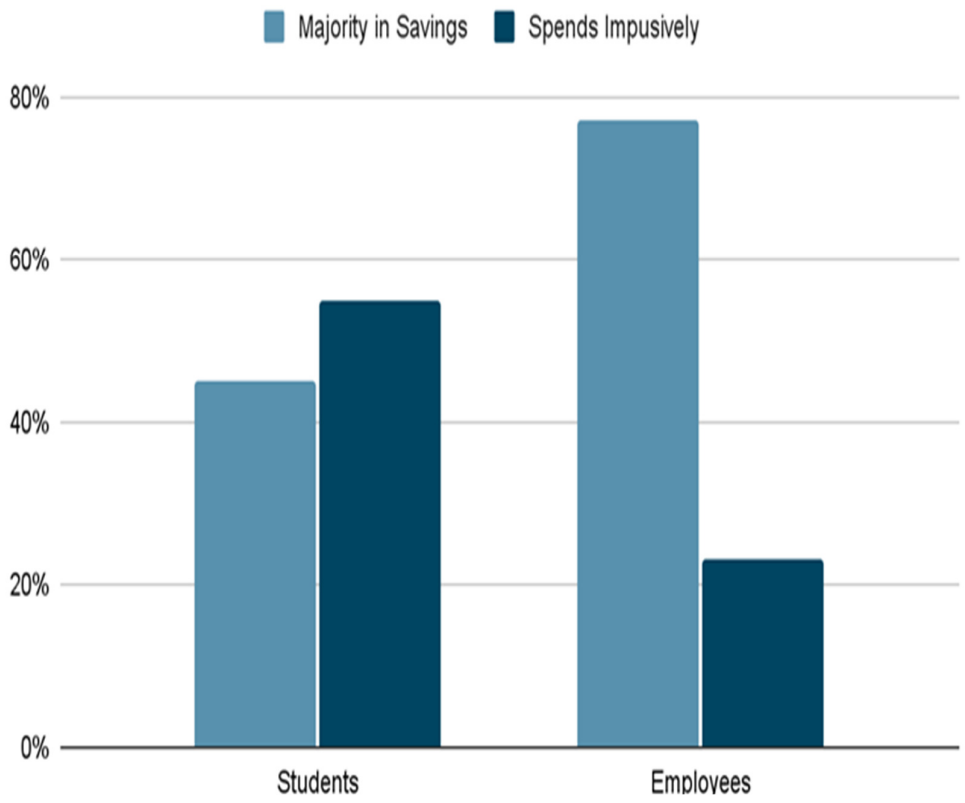

Figure 3: Illustrates the financial behaviors of participants.

Cultural and familial influences play a particularly significant role in shaping young adults' financial behaviors. Many students, especially women, tend to consult family members before making major purchases, reflecting a tradition of seeking guidance from elders and valuing collective decision-making, as shown in Figure 4. This dynamic can be both a source of support and a barrier to independence, depending on the financial literacy of the family itself. For some, family advice offers valuable lessons in saving and investing, while for others, it may reinforce outdated or ineffective financial habits [18]. Employees, on the other hand, are more likely to make independent financial decisions, suggesting that financial autonomy increases with age, experience, and income level. Still, the influence of upbringing and early exposure to money management remains strong, shaping attitudes and behaviors well into adulthood.

The lack of formal financial education is not simply an individual issue but a systemic one. Educational institutions have only recently begun to recognize the importance of financial literacy, and even now, many programs are limited in scope or optional rather than integrated into core curricula. Where financial education is offered, it tends to focus on theoretical concepts rather than practical skills, leaving students unprepared for real-life challenges such as budgeting, managing debt, or planning for retirement [19]. Research shows that young adults with access to comprehensive financial education are more likely to develop good habits, such as saving regularly, avoiding unnecessary debt, and making informed investment choices. These habits contribute not only to personal well-being but also to broader economic stability, as financially literate individuals are less likely to experience crises that can ripple through families and communities.

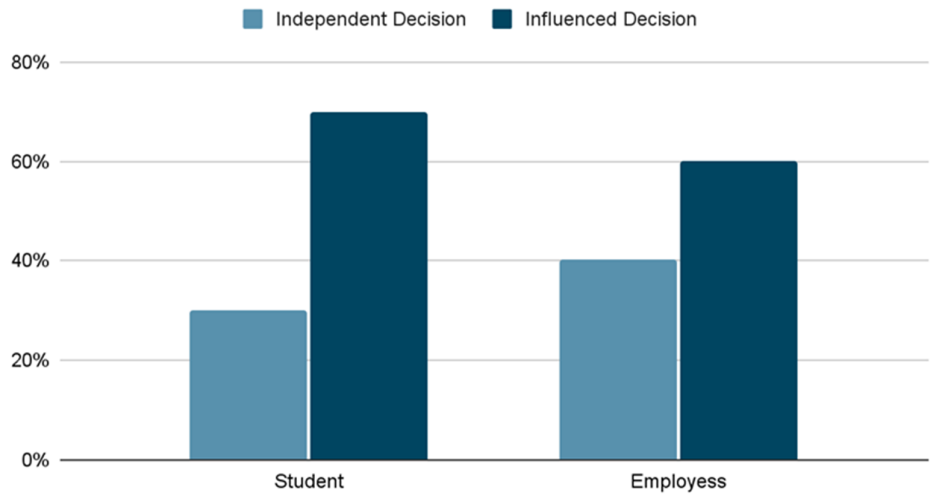

Figure 4: Illustrates the cultural and family influence among the youth.

In the absence of robust formal education, online resources and peer networks have stepped in to fill the gap. Platforms offering self-paced courses, interactive budgeting tools, and practical advice are increasingly popular among young adults seeking to improve their financial literacy. While these resources can be valuable, they also vary widely in quality and reliability, making it difficult for users to distinguish between sound advice and misinformation. This variability highlights the need for standardized, accessible, and evidence-based financial education that can reach all young people, regardless of background or income. Ultimately, the data reveal that financial education and behaviors among young adults are shaped by a complex interplay of personal experience, cultural norms, and systemic factors [20]. Addressing the inadequacies in financial education requires coordinated efforts from schools, families, and policymakers to ensure that all young people have the knowledge and skills needed to navigate an increasingly complex financial world. By investing in comprehensive, practical financial education and fostering environments that encourage responsible financial behaviors, society can empower the next generation to achieve greater financial security and independence.

5. CONCLUSION

The valuable insights into the financial literacy challenges faced by young adults, particularly those in the early stages of adulthood. While some individuals have developed effective money management skills, a significant number continue to struggle with budgeting, saving, and investing due to a lack of formal financial education and heavy reliance on informal sources like family, social media, and online content. The absence of practical financial guidance, coupled with cultural influences and societal norms, further complicates their ability to make sound financial decisions. One of the key findings is the importance of early financial education. Young adults who were exposed to managing pocket money or received formal training in financial matters were more likely to demonstrate disciplined behaviors such as regular saving and informed investing. This highlights the urgent need to incorporate financial education into school curricula, ensuring that young people are equipped with essential knowledge and skills from an early age. The study also reveals a tendency towards impulsive spending, especially among students and those with limited disposable income, which hampers their ability to save for future needs. To address these issues, there must be a focus on practical,

hands-on financial education, culturally sensitive counseling, and open discussions within families and communities. By adopting a comprehensive approach, society can empower young adults to navigate the complexities of personal finance with confidence and responsibility.

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CHAPTER 3

INVESTIGATION ON COMMUNICATION DESIGN RESEARCH

Ayush Batra[1], Kartikeya Singh[2], Yuvraj Dabral[3], Malvika Mahidar[4]
[1,2,3]Student, [4]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3,4]Atlas Skilltech University, Mumbai
Email: ayush.batra.bdes2027@atlasskilltech.university.edu.in[1],
kartikeya.singh.bdes2027@atlasskilltech.university.edu.in[2],
yuvraj.dabral.bdes2027@atlasskilltech.university.edu.in[3], malvika.mahidhar@atlasuniversity.edu.in[4]

ABSTRACT:

Communication Design Research explores the strategic use of visual, verbal, and experiential elements to convey messages effectively across various media and cultural contexts. This interdisciplinary field blends design thinking, semiotics, media studies, and user-centered methodologies to investigate how communication tools can shape perception, behavior, and interaction. By employing both qualitative and quantitative approaches, such as ethnography, usability testing, prototyping, and data visualization, researchers gain insights into the effectiveness of design in real-world applications. This paper reviews key methodologies, trends, and challenges in Communication Design Research and highlights its role in creating impactful, inclusive, and sustainable communication systems.

KEYWORDS:

Communication Theory, Data Visualization, Design Ethics, Human-Centred Design, Information Architecture.

1. INTRODUCTION

Communication Design Research is a multidisciplinary and evolving field that merges elements of design, communication theory, media studies, psychology, semiotics, sociology, technology, and cultural studies to investigate how visual, verbal, and experiential messages are conceptualized, transmitted, received, and interpreted [1]. As a discipline, it examines the practices, processes, and impacts of designing messages for diverse platforms, including print, digital, environmental, and interactive media. In the early 2000s, the rise of digital communication technologies prompted a shift in how design research approached communication. Designers were no longer merely concerned with aesthetic outcomes or static visual outputs; instead, their focus expanded to include user experience, interface usability, interactivity, multimodality, and engagement.

Research in this area began to explore not just how to make things look appealing but how communication functions within complex systems involving users, technologies, and socio-cultural contexts. As communication design grew in complexity and scope, the need for more rigorous, theory-driven, and evidence-based methodologies became increasingly apparent. This led to the emergence of new research paradigms that emphasized reflexivity, iteration, and co-creation [2]. The field thus matured beyond its traditional focus on craftsmanship and intuition into one that embraces critical inquiry, experimentation, and a synthesis of qualitative and quantitative research approaches. Today, communication design research is concerned with understanding the dynamics between message creation and audience interpretation, including how context, culture, and technology mediate meaning.

Researchers in this domain often draw on interpretivist methodologies such as ethnography, phenomenology, and grounded theory to explore how individuals and communities interact with designed messages. Simultaneously, quantitative methods like eye-tracking, A/B testing, and data analytics are employed to evaluate the effectiveness of design interventions. This dual methodological approach reflects the hybrid nature of communication design as both an art and a science [3]. The origins of Communication Design Research can be traced to the evolution of graphic design, visual communication, and information design, disciplines historically focused on the effective arrangement of visual elements to convey messages. However, with the advent of digital media and the proliferation of information platforms, designers were required to think more systematically about the role of design in facilitating understanding, shaping behavior, and influencing public discourse.

The increasing convergence of media technologies such as augmented reality, artificial intelligence, virtual reality, and the Internet of Things has expanded the scope of communication design research into new domains like speculative design, interaction design, and experience design. These emerging areas encourage researchers to imagine possible futures, critique current systems, and propose alternative modes of engagement [4]. For instance, speculative design research might explore how future communication systems could be more democratic or decentralized, while interaction design research might investigate how touch, voice, and gesture impact user engagement and comprehension. Such research is inherently experimental and iterative, often involving prototypes, simulations, and scenario-based testing.

The methodologies here are often practice-led, where designing is both the method and the subject of inquiry. Design studios and labs have thus become vital sites of research, where designers test ideas, gather feedback, and refine solutions in real-world or simulated environments. These spaces also foster interdisciplinary collaboration among designers, computer scientists, anthropologists, marketers, and educators, each contributing their expertise to enrich the research process.

At the heart of communication design research is a commitment to improving communication effectiveness, enhancing user experiences, and generating new knowledge about how design operates within social systems. This includes examining visual rhetoric, the persuasive power of images and symbols, and understanding how visual hierarchies, spatial relationships, and narrative structures shape cognition and emotion. It also involves exploring the semiotic dimensions of design, such as how signs and symbols are encoded and decoded across different cultures and contexts. With globalization and the increasing diversity of audiences, cross-cultural communication has become a central concern, requiring research that is sensitive to linguistic, cultural, and socio-political differences. This is particularly relevant in areas like international branding, public health campaigns, or global user interfaces, where miscommunication can have serious implications. Researchers must therefore engage in continuous testing, user feedback, and iterative refinement to ensure their designs are both effective and ethically sound.

2. LITERATURE REVIEW

M. Chan *et al.* [5] discussed that within the last 20 years, the number of research studies using mediation analysis has skyrocketed. In this study, 387 publications published between 1996 and 2017 in the Journal of Communication, as well as the Journal of Communication Research, Communication Research, Journalism and Mass Communications Quarterly, and Media Psychology are examined with an emphasis on research design. The majority of research finds significant indirect effects, but the results are insufficient to conclude causality. While alternate

theories and mediators were rarely recognized, authors frequently imply that they have discovered the "true" mediator or mediators. Future studies ought to focus more on the function of the methodology and how it affects the ability to conclude causality.

A. Smith *et al.* [6] analyzed that there is no precise definition of feminist methodology for the group's constituency or how it may be used across its fields, although feminist research methodology has been employed as a framework in several ACM-SIGDOC studies. By asking TPC and communications design scholars four questions about how they define these kinds of research structures and whether they use them in their scholarship, they were able to create an initial grasp of the field's comprehension of feminist research methodologies. They provide the survey's findings and utilize the answers from participants as well as previously written research in the area to develop a classification of feminist methodological ideals that might direct TPC and communication layout studies.

A. Nixon *et al.* [7] examined how ethnography was created by anthropologists to investigate other civilizations. It entails conducting interviews with the research population and observing circumstances. Ethnography has two fundamental features: first, it involves observation in a natural environment; second, it requires researchers to comprehend how members of a community perceive and interpret an event. Accordingly, ethnography is a qualitative research tool that is used to examine individuals and cultures to gain a thorough understanding of the socio-technological reality of routine software development practices. In terms of user interface design and human-computer interaction, ethnography may assist in revealing not just what practitioners do but also why they do it.

S. Ji *et al.* [8] investigated the majority of research on environmentally friendly design from the standpoint of emotional durability concentrates on product design, specifically examining how the product's features influence consumers' emotional states after use, but it ignores the substantial influence that consumers' visual perceptions of the product have on their assessment. To advise extending the useful life of products and lowering waste and resource consumption, this article seeks to determine how to sustain an emotionally enduring connection between people and products through visual communication design. This work initially used the case study approach to assess over 85 high-quality design instances and propose initial design methods, drawing on literature studies on sustainable design, visual design, and psychologically durable design.

A. Venter *et al.* [9] proposed that a strong, commonplace, and daily activity, communication, affects most, if not all, facets of our life. However, communication's significance and complexity are still frequently disregarded. At Company-GIS (CGIS), a medium-sized business, poor communication throughout software development projects led to job delays, which hurt quality, on-time delivery, or budgetary delivery. According to this study, a cooperative approach was necessary to guarantee a proper diagnosis of the issue, producing several artifacts to solve the communication issues. They contend that a practice-inspired challenge is better suited for a more modern research approach known as action design research (ADR).

The above-mentioned studies do not explain that communication design became inherently strategic about solving problems, aligning with user needs, and engaging in societal and ethical considerations. As a result, research began to include not only formal design elements like typography, color theory, and composition but also user-centered design, participatory design, inclusive design, and design for social innovation. The field now regularly interrogates issues of accessibility, equity, power dynamics, representation, and sustainability. For example, researchers explore how visual communication can either reinforce or disrupt cultural

stereotypes, how interface design can either include or exclude certain populations, or how narrative strategies in branding can affect trust and credibility. These lines of inquiry require communication designers to develop sophisticated analytical skills and ethical awareness, positioning them not just as makers but as critical thinkers and cultural mediators.

3. METHODOLOGY

3.1 Design:

This research deals with the exploration of the link between urban stress and the practice of yoga and pranayama, to examine the objections or barriers to its implementation and offer possible recommendations for wider integration. A mixed-methods approach was used that included qualitative research and quantitative approaches, as summarized in the following methodology using culture probe kits, video interviews, focus group discussions, and feedback from participants. Figure 1 illustrates the flowchart of the research framework.

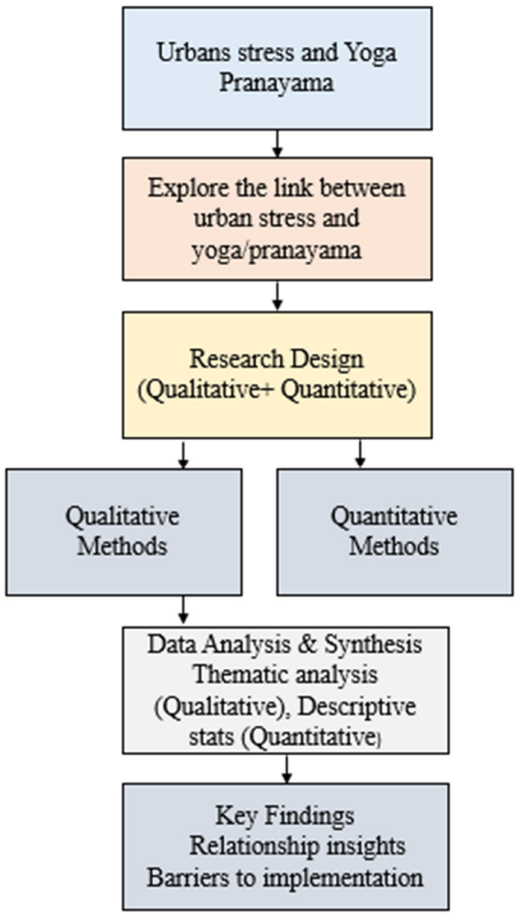

Figure 1: Illustrates the flowchart of the research framework.

3.2 Sample/Instruments used:

To investigate the subject, the study included participants at various stages of data collection. Culture probe kits were given to 14 participants; 3 participants were interviewed. Individually, a focus group discussion was also conducted with a group of yoga practitioners. In this regard, age groups, different types of occupations, and varying familiarity with practices had participants representing a varied and comprehensive range of viewpoints. This diverse pool

helped to capture variations in the experiences related to stress management and space perception in urban settings. Table 1 illustrates the sample used in this research framework.

Table 1: Illustrates the sample used in this research framework.

Demographic factor	Who	Why
Age	Young adults (25-35) middle aged (36-55) and elderly (55+)	Age influences physical ability and psychological disposition towards adopting wellness practices
Gender	Gender neutral	Gender impacts perceptions about wellness practices with women being more involved in yoga traditionally
Occupation	Medical professionals, para medical people, people involved in high stress related occupations, employees and students	Impacts daily routine, time and stress levels
Education level	Basic to higher level of education (high school, to degree)	Affects awareness and understanding of the practices and benefits of yoga
Health status	Chronic conditions or mental health issues	Motivation and availability of adopting stress related practices for well-being
Location	Urban areas	Standardises the area of focus and identifies high stress related demographic
Family structure	Alone, partners, children, extended family	Influences the time available for self care practices and responsibilities of each,

3.3 Data Collection:

Culture probe kits were developed to acquire qualitative information about the participants' daily life routines, their level of stress, and their perceptions of physical and emotional spaces. Several artefacts were included in the kit, such as stress rating cards for the month, mood maps, personal journals, and creative exercises like space illustrations and photo activity. Participants documented their experiences over two weeks by providing information about their emotional states, the stresses they faced, and their coping mechanisms, hoping to learn pranayama. Three participants were interviewed using a semi-structured interview format, allowing for the flexibility to explore key themes while encouraging open-ended responses. These interviews sought to understand the participant's personal stress management strategies, their relationship with physical space, and what motivated them or barred them from practices like yoga and pranayama. A focus group for yoga students was held to identify common experiences, cultural perceptions, and practical challenges regarding yoga adoption. It offered a collective insight garnered both for the benefits of yoga, the cultural significance of the practice, and ways of overcoming barriers in an urban environment. Feedback forms were distributed at the end of the data collection process for gathering participants' reflections on using the culture probe kit and overall engagement with the study. The research process remained participant-centered through this step and also revealed those aspects not consulted during the study.

3.4 Data Analysis:

The quantitative data obtained from the rating of stress cards and scales for space perception were thereafter analyzed using Microsoft Excel. Various statistical measures like mean, median, mode, and correlation coefficient (Pearson) were computed to show the summary of central tendency and correlation between the factors in responses. Pearson correlation coefficient was computed to generate insight into the relationship between perceived space and the level of stress, hence throwing light on how the physical environment may impact city

stress. The qualitative data will be based on journals, mood maps, interviews, and focus group discussions, and each of these will be analysed thematically based on common themes identified after conducting affinity mapping. On MiroBoard, affinity mapping of relevant ideas was to identify emerging patterns and themes by clustering related ideas together and mentioning the important keywords in the answers. Stickers in the journal helped to visualise connections between the participant's experiences, barriers to practice, and emotional wellness, as it was used to check and verify whether the response was correct or was subjectively changed during the practice.

4. RESULTS AND DISCUSSION

Communication Design Research also plays a critical role in education and pedagogy. In design schools and universities, it informs curriculum development, teaching strategies, and assessment practices. Research helps educators understand how students learn visual languages, how they develop critical thinking and problem-solving skills, and how design can be taught in ways that are inclusive and empowering. Pedagogical research in communication design often explores studio-based learning, peer critique, reflective practice, and interdisciplinary collaboration [10].

Moreover, as the job market increasingly demands designers who are not only skilled in tools but also adept in systems thinking and storytelling, research supports the development of new teaching models that integrate theory with practice. This has led to a growing emphasis on design literacy not just for designers but for all citizens, recognizing that in a media-saturated world, the ability to interpret and critique visual messages is a vital skill.

Another important strand of Communication Design Research is its impact on public policy, social innovation, and civic engagement. Governments, NGOs, and community organizations increasingly turn to communication designers to help address complex societal challenges from climate change to health literacy, from digital inclusion to misinformation.

Research in these contexts often involves participatory methods that engage stakeholders in the design process, ensuring that solutions are contextually relevant and socially responsive [11].

For example, a research project might involve co-designing educational materials with marginalized communities to improve health outcomes or developing visual tools to help voters understand electoral processes. This orientation toward social impact underscores the ethical dimension of communication design, emphasizing the responsibility of designers to contribute to the public good. It also highlights the importance of empathy, listening, and collaboration in the research process.

As the field continues to evolve, Communication Design Research increasingly incorporates insights from emerging disciplines like data visualization, behavioral economics, cognitive psychology, and digital humanities. These intersections offer new ways to understand how design influences decision-making, memory, attention, and behavior. For instance, researchers study how the framing of information in infographics can shape public perceptions of risk or how dashboard design can influence business decisions. Such research often involves mixed methods, combining interviews, surveys, usability tests, and statistical analyses to gain a holistic view of the design problem [12]. Moreover, the proliferation of big data and analytics has opened up new opportunities for evidence-based design, where decisions are guided by real-time user behavior and feedback. However, this also raises ethical questions about

surveillance, data privacy, and algorithmic bias issues that communication design researchers are increasingly called upon to address. Figure 1 illustrates the relation between space and relaxation.

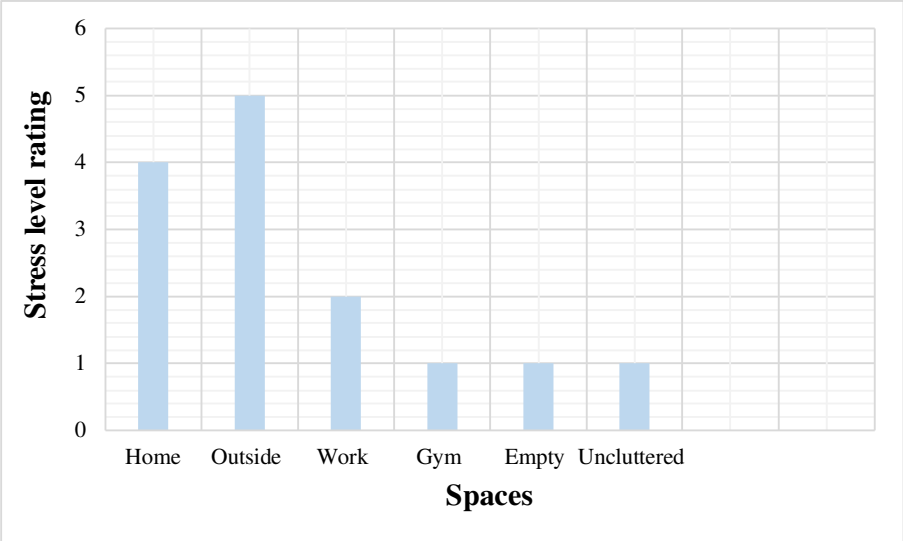

Figure 1: Illustrates the relation between space and relaxation.

Communication Design Research represents a critical and evolving dialogue within the broader discipline of design studies, reflecting both the complexity of communication processes in contemporary society and the transformative potential of design practice. As the world becomes increasingly mediated through visual and interactive technologies, the importance of systematically understanding how messages are constructed, transmitted, and interpreted has never been more vital. Communication Design Research explores these dimensions through both theoretical inquiry and empirical investigation, drawing from a wide range of disciplines including semiotics, media studies, cognitive psychology, anthropology, digital humanities, and cultural theory. At the core of this research lies an inquiry into meaning-making: how people make sense of visual and textual content, how context influences understanding, and how design choices affect interpretation and behavior.

The discussion around this field increasingly revolves around its methodological hybridity, where traditional design studio practices intersect with research-based models such as ethnography, action research, usability testing, and content analysis. This intersectionality not only enriches the design process but also legitimizes it within academic and scientific frameworks, enabling designers to contribute to knowledge creation while simultaneously solving real-world problems. Furthermore, Communication Design Research interrogates the power dynamics embedded within visual messaging and media systems, raising questions about authorship, representation, inclusivity, and bias. In doing so, it challenges the designer's role as a neutral creator and instead positions the designer as a cultural agent who has a responsibility toward ethical communication and social justice.

One of the central themes in the current discourse on Communication Design Research is the shift from object-centered approaches to process-oriented and systems-based thinking. Historically, the focus in design was often on the final product—a poster, a logo, an advertisement—but contemporary research emphasizes the entire communication ecosystem,

including the goals, actors, feedback loops, channels, and contexts that shape and reshape the message. This systems approach encourages researchers and practitioners to think critically about how messages circulate, how they are affected by technological platforms, and how they are reinterpreted by different audiences. Figure 2 illustrates the relationship between space and stress.

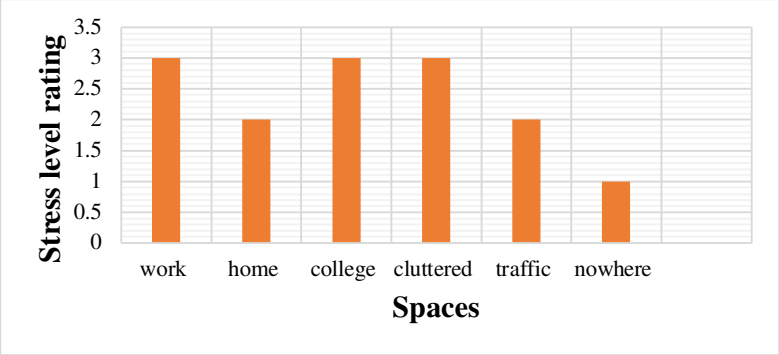

Figure 2: Illustrates the relationship between space and stress.

Communication design is thus not a linear transmission of information from sender to receiver, but a dynamic, recursive process influenced by culture, power, technology, and identity. The discussion also highlights the critical role of audience research in understanding communication effectiveness. By engaging users early and throughout the design process through interviews, participatory workshops, usability testing, or journey mapping, researchers gain deeper insight into how people interact with and respond to design. This user-centered methodology enables more inclusive and empathetic solutions that better reflect the diverse needs and preferences of end-users. Moreover, it raises important epistemological questions about whose knowledge is valued in the design process and how co-creation can democratize knowledge production. Communication Design Research thus serves not just the creation of effective messages but the building of relationships and trust between communicators and communities.

In today's city life, people suffer from stress issues that have direct implications on the mental and physical well-being of people. Fast work and hectic city life expose individuals to more stress and anxiety issues that lead to mood disorders. This leads to the rising demand for practical, easily reachable, and holistic ways to deal with stress and well-being. Out of the many available options, pranayama, a part of yoga, is one of the tried and tested practices with benefits. Pranayama1 means controlled breathing techniques that bring relaxation, concentration, and overall health. Unlike other wellness practices that require specific equipment, space, or financial investment, pranayama is accessible to almost anyone as it can be done anywhere.

This is especially appealing in an urban context where time and space are limited. Scientific research supports the profound, nervous system, otherwise known as the "rest and digest" system, thus diminishing the levels of the stress hormone, cortisol. This regulation of the body's stress response brings emotional stability, improves mood, and mental clarity. Looking into how urban populations might use pranayama to manage stress, improve their mood, and overall well-being, we apply a participatory research method using a culture probes kit. This method was used to provide participants with a set of tools and artefacts to document their pranayama

practice over 2 weeks. Insights drawn from these artefacts offer rich qualitative understanding of how pranayama affects their everyday lives and adds to the discourse on stress management in an urban context. Table 2 illustrates the correlation coefficient for the relationship between space and stress.

Table 2: Illustrates the correlation coefficient for the relationship between space and stress.

SPACE	SPACE ID	NUMBER OF PEOPLE (x)	STRESS SCORE (y)	x	y	x * x	y * y	x*y
work	1	3	2.91	3	2.91	9	8.46	8.73
home	2	2	4.21	5	7.11	4	17.72	8.42
college	3	3	2.56	8	9.67	9	6.55	7.68
cluttered	4	3	2.23	11	11.9	9	4.97	6.69
traffic	5	2	1.95	13	13.85	4	3.8	3.9
nowhere	6	1	2.3	114	16.15	1	5.29	2.3

Another important aspect of the discourse centers on the ethical and political implications of communication design. With the proliferation of fake news, propaganda, and algorithm-driven content curation, researchers are increasingly called upon to address how design contributes to or combats misinformation, manipulation, and surveillance. This has led to a deeper examination of the responsibilities of communication designers in shaping public discourse and fostering democratic engagement. Researchers are exploring how design can make information more transparent, how visual storytelling can humanize marginalized narratives, and how interface design can be leveraged for civic education. In these cases, communication design becomes a form of activism, where research supports the development of campaigns, tools, and platforms that empower users, advocate for social justice, and facilitate participatory governance.

Table 3: Illustrates the guide for checking the score.

Pearson correlation coefficient (*r*)	**Correlation type**	**Interpretation**
Between 0 and 1	Positive correlation	When one variable changes, the other variable changes in the **same direction**.
0	No correlation	There is **no relationship** between the variables.
Between 0 and –1	Negative correlation	When one variable changes, the other variable changes in the **opposite direction**.

Additionally, communication design is discussed as a mediator in sustainability discourses, helping to visualize environmental data, communicate climate risks, and engage communities in sustainable practices. This illustrates how the field extends beyond conventional media into domains like public policy, education, and healthcare spaces where the clarity and accessibility of communication can have tangible impacts on behavior and well-being. Table 3 illustrates the guide for checking the score.

The role of technology in shaping Communication Design Research is another widely debated topic. The digitization of media and the emergence of new communication paradigms have expanded the scope of research to include digital interfaces, virtual environments, augmented and mixed realities, social media platforms, and AI-driven systems. Each of these media comes with unique affordances and constraints, requiring new forms of literacy, experimentation, and evaluation.

For instance, interface design research may explore how users navigate digital products and how information architecture influences cognition and behavior. Meanwhile, motion design and interactive storytelling are studied for their potential to enhance engagement, comprehension, and emotional resonance.

$$\bar{x} = \frac{\sum x}{n}$$

- $\bar{x}$ = sample mean
- $\sum x$ = sum of each value in the sample
- n = number of values in the population

$$\mu_{\bar{x}} = \frac{\bar{x}_1 + \bar{x}_2 + \bar{x}_3 \ldots + \bar{x}_n}{n}$$

Formula 1: Illustrates the formula for calculating the mean (left) and means of mean (right).

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Formula 2: Illustrates the formula for calculating the 'r' coefficient of correlation.

Researchers are also examining how algorithmic systems personalize and mediate content, potentially reinforcing filter bubbles and biases. The challenge here lies in understanding not just how technologies change the medium of communication but how they reshape the social and cognitive processes underlying communication itself. This requires an ongoing redefinition of design research tools and methods such as eye-tracking, heat maps, sentiment analysis, A/B testing, and digital ethnography that can capture the complexity of user experiences in real time. The discourse also recognizes the limitations of technological determinism and emphasizes the need for critical perspectives that question whose interests are served by emerging technologies and how equitable access to communication tools can be ensured.

The discussion on Communication Design Research also brings attention to the epistemological foundations of the field, particularly the tension between practice-based knowledge and academic rigor. Unlike traditional scientific disciplines that rely heavily on replicability and quantifiable evidence, communication design often thrives on tacit knowledge, intuition, iteration, and aesthetic judgment. This has led to ongoing debates about what constitutes valid research in design and how practice-led inquiry can be systematically documented, evaluated, and disseminated. One response has been the development of research-

through-design, a methodology that recognizes the act of designing as a form of inquiry in itself. Here, prototypes, mock-ups, and iterative refinements are not just deliverables but evidence of a thinking process that can generate new insights.

Visual documentation, design journals, and reflective writing are used to capture the evolution of ideas and the rationale behind design choices. While some critics argue that such methods lack generalizability, proponents assert that they offer a depth of understanding that is grounded in real-world complexities and contextual realities. The challenge for researchers is to strike a balance between creative freedom and methodological rigor, ensuring that the knowledge generated is both credible and applicable. The academic institutionalization of Communication Design Research has also sparked discussion about curriculum, pedagogy, and research culture. As design schools increasingly integrate research components into undergraduate and postgraduate programs, questions arise about how to teach research methods in a way that is accessible, meaningful, and relevant to design students.

Traditional research training often emphasizes linear processes and abstract theorization, which may not resonate with students accustomed to visual thinking and iterative making. Consequently, educators are exploring alternative pedagogies that incorporate studio-based learning, problem-based research, critical reflection, and collaborative projects. These pedagogical models aim to cultivate design researchers who are not only skilled in technical execution but also reflective, analytical, and ethically aware. There is also a growing emphasis on developing visual research methods such as mapping, diagramming, and visual storytelling that align more closely with the cognitive styles of designers and the nature of design inquiry. At the same time, academic institutions face pressures to produce measurable research outputs, secure funding, and align with global research agendas, which may sometimes conflict with the exploratory and experimental ethos of design research. Navigating these tensions requires strong leadership, interdisciplinary collaboration, and institutional support for practice-based inquiry.

Communication Design Research is increasingly seen as a global conversation that must account for cultural specificity, linguistic diversity, and geopolitical context. Much of the foundational literature in design research originates from Western, industrialized nations, but scholars and practitioners are working to decolonize the field by incorporating indigenous knowledge systems, non-Western design traditions, and multilingual perspectives. This effort involves challenging dominant paradigms, broadening the canon of design scholarship, and creating platforms for underrepresented voices in the field. Research that explores vernacular design practices, community-based communication, and non-linear narrative forms contributes to a more inclusive understanding of how communication design operates across different settings. It also raises methodological questions about translation, cultural appropriation, and the ethics of representation. For Communication Design Research to be truly global and equitable, it must embrace pluralism and remain open to diverse epistemologies, aesthetics, and modes of inquiry.

Finally, the impact of Communication Design Research is a central theme in current discourse. As a field that bridges academia, industry, and civil society, its success is measured not only by scholarly publications but also by real-world outcomes how it improves communication effectiveness, fosters critical awareness, enhances user experiences, and addresses pressing societal issues. This impact orientation has led to the development of applied research projects,

living labs, and design consultancies within universities and research institutions. These initiatives often work with external partners' businesses, governments, NGOs, and communities to co-create solutions and generate context-specific knowledge. This applied dimension reinforces the value of communication design as a problem-solving discipline that engages with complexity and change. However, it also calls for robust mechanisms to evaluate impact, including longitudinal studies, stakeholder feedback, and policy influence.

The ability of communication design research to effect changes rests on its capacity to articulate its value, adapt to evolving contexts, and remain grounded in ethical, user-centered, and culturally aware practices.

5. CONCLUSION

Communication Design Research plays a vital role in shaping how information is structured, delivered, and perceived in an increasingly complex media environment. Through a blend of creative practice and empirical inquiry, the discipline provides tools to understand and improve communication efficacy across sectors such as education, healthcare, marketing, and social innovation. As digital technologies and cultural shifts continue to transform communication landscapes, the need for adaptive, user-centered, and ethically responsible design research becomes even more critical. Future research must embrace cross-disciplinary collaboration and emerging technologies to create communication strategies that are not only functional but also meaningful and socially responsive.

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CHAPTER 4

REDESIGNING SHOPPING MALLS FOR SENIOR CITIZENS' NEEDS

Lavanya Jaiswal[1], Khush Lodha[2], Divvyam Jaain[3], Prasad Anaokar[4]
[1,2,3]Student, [4]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3,4]Atlas Skilltech University, Mumbai
Email: lavanya.jaiswal.bdes2026@atlasuniversity.edu.in[1], khush.lodha.bdes2026@atlasuniversity.edu.in[2], divyam.jain.bdes2026@atlasuniversity.edu.in[3], prasad.anaokar@atlasuniversity.edu.in[4]

ABSTRACT:

This study explores the development of inclusive shopping mall environments tailored to the diverse and evolving needs of senior citizens. Recognizing the growing aging population and their increasing engagement with public spaces, a multidisciplinary team of design students conducted an in-depth investigation using a user-centered approach. Through a combination of observational studies, structured surveys, and participatory design sessions, the research identified key barriers and preferences that influence the shopping mall experience for elderly visitors. Central challenges included inadequate seating, disoriented navigation, limited visibility of accessibility features, and insufficient resting spots, particularly in high-traffic areas like food courts. In response, the team employed the User-Centered Design Ideation Framework to brainstorm and refine targeted solutions. Focus areas included (i) the integration of modular seating at regular intervals to promote physical comfort, (ii) intuitive and visually enhanced wayfinding systems for better orientation, (iii) improved signage and placement of ramps and wheelchairs, and (iv) designated seating options in food courts. Prototypes were developed to reflect these priorities and tested for feasibility and adaptability. The study underscores the vital role of inclusive design in enhancing the public experience for senior citizens. By embedding empathy into the design process, this work advocates for public spaces that are not only accessible but also dignified and enjoyable for aging populations.

KEYWORDS:

Comfort, Inclusive Design, Senior Citizens, Shopping Malls, User-Friendly Amenities.

1. INTRODUCTION

Shopping malls have evolved into pivotal components of contemporary urban life, serving far more than their original purpose of providing retail access. Today, these commercial hubs are multifunctional spaces offering opportunities for leisure, dining, community engagement, and even routine social interactions. With their climate-controlled environments, range of services, and cultural programming, malls have transformed into semi-public spaces that attract diverse demographics across age groups [1], [2]. Among these, senior citizens have emerged as a notable segment of mall-goers, not only engaging in consumer activities but also utilizing these environments as sites of recreation, routine exercise, and social connectivity. Yet, despite the evident presence of elderly individuals in these environments, most shopping malls remain poorly equipped to accommodate their specific needs. The architectural and operational design of most malls heavily prioritizes visual aesthetics, commercial branding, and consumer throughput. The spatial layout often assumes high mobility and rapid visual processing, qualities that may be compromised with age. Senior citizens frequently encounter physical and cognitive barriers that hinder their ability to navigate, rest, or interact meaningfully within such

environments [3], [4]. Issues like insufficient and sporadically placed seating, dim or overly glossy lighting, abrupt changes in floor levels, lack of ramps, hard-to-spot wheelchair stations, and complex mall layouts significantly impair their user experience. These challenges are not trivial; they intersect with age-related physiological realities such as limited mobility, impaired vision, reduced endurance, and sensory sensitivity, compounding the level of discomfort and frustration experienced by elderly users. Figure 1 shows the symbols assisting the people in the mall.

Figure 1: Represents the symbols that help people in the mall.

Goldsmith's (1997) concept of "architectural disability" provides a compelling lens through which to understand the exclusion of senior citizens from such public environments. According to this framework, disability is not solely a result of physical impairments but is often created by environments that fail to accommodate human diversity. Design becomes a barrier rather than an enabler when it disregards the spectrum of capabilities that exist among its users [5], [6]. In this context, shopping malls despite being theoretically public and inclusive, can become zones of implicit exclusion when they fail to incorporate essential supportive features such as handrails, accessible restrooms, tactile navigation cues, and socially inclusive seating arrangements. Figure 2 provides the symbols representing signage in the mall.

The consequences of such exclusion are multi-dimensional. On a physical level, poorly designed spaces can increase the risk of accidents and fatigue. Psychologically, they can lead to a diminished sense of independence, reduced self-esteem, and social isolation. On a broader scale, the neglect of senior-friendly infrastructure reflects a systemic oversight in urban planning and commercial architecture, one that fails to recognize the growing demographic shift toward aging populations [7]. As longevity increases and the proportion of older adults continues to expand globally, the urgency of addressing their needs in public infrastructure becomes both a moral and practical imperative. While the discourse around inclusive design has gained traction in architectural and policy circles, there remains a conspicuous gap between

theory and practice, particularly in commercial environments such as shopping malls [8], [9]. Much of the existing research and implementation efforts have focused on accessibility in government buildings, healthcare facilities, and transportation hubs, with limited attention paid to retail and recreational centers. This oversight is problematic, given that malls serve as critical nodes of urban interaction, where the lack of accessible infrastructure may inadvertently marginalize elderly individuals and restrict their participation in everyday civic life.

Figure 2: Displays the signage in the mall.

To address this oversight, the present study adopts a user-centered design approach to systematically identify and analyze the challenges faced by senior citizens in shopping malls. Rather than assuming the needs of this demographic, the research is grounded in primary data collected through observational studies, user surveys, and participatory design methods. This methodological framework allows for the co-creation of solutions with senior citizens, ensuring that their lived experiences and preferences directly inform the design process. Insights gathered through these activities are then synthesized into design ideations and prototypes, guided by the principles of functionality, accessibility, and psychological comfort.

A key component of this approach is the integration of the User-Centered Design Ideation Framework, which facilitates the translation of user insights into tangible, implementable solutions [10]. The focus is placed on four primary domains of intervention: (i) strategically placed modular seating arrangements to combat fatigue and encourage social interaction; (ii) enhanced wayfinding systems with intuitive signage and tactile guides to support navigation; (iii) better visibility and physical access to wheelchairs, ramps, and elevators; and (iv) increased availability of designated seating areas in high-demand zones such as food courts. These interventions aim not only to improve physical access but also to foster a sense of dignity and independence among elderly mall users. By documenting the process from problem identification through ideation and prototyping, this research provides both a conceptual

framework and a practical blueprint for transforming commercial environments into inclusive public spaces. The outcomes of this study are expected to serve as actionable guidelines for architects, mall developers, urban planners, and policymakers. It repositions inclusivity not as a niche concern or regulatory compliance issue, but as a fundamental principle of good design, one that enhances usability for all while affirming the social value of our aging citizens. In sum, this research seeks to catalyze a paradigm shift in how shopping malls are conceptualized and developed, urging stakeholders to move beyond superficial inclusivity and engage with the deeper systemic and experiential needs of senior citizens. By integrating empathy-driven design with practical execution, the study aims to contribute to the development of malls that are not only commercially successful but also socially responsive, fostering urban environments where every individual, regardless of age, can participate fully, safely, and with dignity.

2. LITERATURE REVIEW

Aboutalebi [11] emphasized that as urban populations expanded, the number of senior citizens also grew. In response, the World Health Organization identified accessibility, proximity, safety, affordability, and inclusiveness as core features of age-friendly cities. The study focused on shopping malls as significant social venues for older adults, considering them "third places" beyond home and work. The Place Versailles mall was observed using mapping, tracing, and tracking techniques to assess senior usage patterns. Findings showed that older adults spent considerable time in malls, valuing them as key social hubs. Crowded areas were most favored, enabling both passive and active socialization. The study underlined the dual commercial and communal role malls played for seniors.

R. Day [12] highlighted a critical gap in environmental justice discourse, noting that age had been significantly underexplored compared to factors like race and class. Drawing on empirical data from older adults in three Scottish neighborhoods, the study employed a framework rooted in environmental and social justice theory. It revealed that older people were frequently excluded from urban spaces through issues of inequitable resource distribution, lack of procedural inclusion, and inadequate social recognition. These exclusions affected their mobility, accessibility, and sense of belonging. The findings emphasized that incorporating age into environmental justice not only enriched the theoretical landscape but also demonstrated the necessity of aligning it more closely with broader social justice principles.

Degen et al. [13] contended that the experience of built environments was not solely a result of design features, challenging dominant assumptions in academic and policy contexts. Based on empirical data from two UK towns using surveys, ethnographic walk-alongs, and photo-elicitation interviews, the study found that sensory encounters with urban spaces were mediated by two key factors. First, bodily mobility, particularly walking practices, shaped how individuals perceived space. Second, perceptual memories influenced present experiences by layering, interpreting, or dulling sensory input. The study concluded that sensory engagement with urban environments was complex and dynamic, shaped as much by individual histories and movements as by the physical features of the environment.

Yuan et al. [14] aimed to identify architectural design elements that shaped consumer experiences in shopping malls. A systematic literature review first revealed 13 design elements, which were validated through interviews with 30 professional designers. These elements were transformed into a questionnaire and distributed to 1,016 diverse consumers across China. Data

analysis, conducted through cluster analysis, principal component analysis, and difference analysis, demonstrated that consumer experience was influenced by four core dimensions: visual atmosphere, physical comfort, space structure, and business planning. Among these, space structure and business planning had the most significant impact. Perception of design elements varied notably across individual consumer groups, emphasizing the need for inclusive, differentiated architectural strategies.

Salim [15] aimed to raise awareness about the influence of contemporary food court design on ambiance and its connection to attractiveness in shopping malls. The study analyzed interior design elements such as flooring, walls, and ceilings at Senayan City, comparing the original Food Studio layout with the renovated Delicaè design. The documentation emphasized the importance of cohesive decorative features tied to scale, color, and style. Findings showed that modern, visually appealing renovations significantly impacted shopper satisfaction. The research highlighted that mall attractiveness was closely linked to design updates. It concluded that staying current with design trends was essential for shopping centres to remain competitive and appealing to today's open-minded consumers.

3. METHODOLOGY

3.1.Design:

This study adopted a qualitative, user-centered design research methodology to investigate the challenges faced by senior citizens while navigating shopping malls. A three-member student team from the field of Design was constituted, each assigned specific roles aligned with their strengths: Divvyam Jain as the interviewer, Lavanya Jaiswal as the audio/video documentarian, and Khush Lodha as the primary writer and analyst. The age group targeted ranged from 60 to 80 years to ensure inclusion of diverse physical, cognitive, and emotional challenges. The research focused on malls with a notable footfall of elderly visitors to yield contextually rich data. Initial groundwork included the development of an interview script designed to establish rapport and facilitate open, empathetic communication with senior participants. Field research began with direct engagement in shopping malls, where the team approached elderly individuals after a careful introduction and explanation of research objectives. Figure 3 provides the architecture for the Upper Ground Floor of Phoenix Marketcity, Kurla, Mumbai.

Foundational interviews were conducted to understand lived experiences, barriers, and motivations associated with mall visits. A visual provocation exercise using cue cards, each depicting specific mall features, was administered to gauge participant preferences. Respondents categorized these cards into 'likes' and 'dislikes', providing justifications that enriched understanding of their comfort and discomfort zones. While some participants initially faced difficulty interpreting the task, guidance was provided to facilitate participation.

A follow-up visit aimed to conduct participant walkthroughs within the mall for real-time observational insights. Though consent for walkthroughs was limited, interviews were successfully carried out, capturing detailed narratives about personal challenges and expectations. Observational studies complemented interviews, focusing on infrastructure such as mall maps, escalator signage, wheelchair placement, and staff support. Noteworthy features like Phoenix Mall's TUCKIT luggage storage unit were recorded for their potential senior-centric utility. Collected data and photographs served as critical design inputs for ideation and prototyping of inclusive interventions.

Figure 3: Presents the Upper Ground Floor of Phoenix Market city, Kurla, Mumbai.

3.2.Sample:

Inadequate seating limits their ability to rest, leading to fatigue during long walks. Poor accessibility due to missing ramps or lifts restricts mobility. Small-font signage and unclear layouts make navigation difficult. Slippery or uneven floors increase fall risks, while poorly located or inaccessible toilets deter prolonged visits. Overcrowding and high noise levels cause distress, compounded by dim lighting that reduces visibility. Staff often lack training or sensitivity to seniors' needs, while emergency systems are scarce or poorly marked. Lastly, limited public transport options hinder easy access to retail spaces, amplifying isolation risks. The table outlines critical barriers older individuals face in shopping centres, reflecting physical, sensory, and emotional challenges. Table 1 shows the Key issues for older people in shopping centres.

Table 1: Represents the Key issues for older people in shopping centres.

Key Issue	**Description**
Inadequate Seating	Lack of frequent, ergonomically designed resting areas causes fatigue.
Poor Accessibility	Insufficient ramps, handrails, and elevators impede smooth mobility.
Unclear Signage	Small fonts and confusing layouts challenge wayfinding and navigation.
Slippery or Uneven Flooring	Increased risk of falls due to poorly maintained walking surfaces.
Inaccessible Toilets	Toilets often lack grab bars, space, or are located far from common areas.

Overcrowding and Noise	High noise levels and crowd density contribute to anxiety and disorientation.
Inadequate Lighting	Poorly lit zones cause discomfort and reduce visibility, especially in corners.
Staff Indifference or Lack of Training	Minimal assistance or empathy is shown by retail staff towards the elderly.
Limited Emergency Support	Lack of visible emergency systems or support personnel for immediate help.
Poor Transport Connectivity	Difficulty accessing malls due to inadequate public or paratransit options.

3.3.Instruments:

The primary source of information for this research consisted of in-depth interviews and focus group discussions with older adults frequenting various urban shopping centres. Supplementary data were gathered through non-participant observations conducted at selected retail complexes, capturing behavioral patterns, environmental conditions, and accessibility barriers.

The research employed qualitative tools including semi-structured interview guides, thematic coding frameworks, and observational checklists. Audio recordings and field notes were systematically analyzed to extract recurring themes and user experiences. Digital tools such as NVivo were used for qualitative data analysis to ensure consistency and depth. The methodological approach enabled a comprehensive understanding of older people's interactions with shopping centre environments.

3.4.Data Collection:

A dismissive management approach, ignoring complaints, enforcing seat vacating, or failing to address noise, undermines trust and comfort. Long checkout lines and loud music heighten fatigue and stress. Poorly maintained floors with cracks or clutter elevate fall risk. Inadequate seating, lacking ergonomic features, or public tables limit rest, mobility, and social interaction. Broken escalators without alternatives and poorly placed lifts obstruct movement across levels. Confusing signage with small fonts impedes wayfinding. Addressing these issues through thoughtful design and inclusive policies significantly enhances the shopping experience for older individuals, promoting safety, dignity, and independence. Table 2 categorizes challenges older people face in shopping centres, highlighting the significance of responsive design and management.

Table 2: Shows the Importance of the type of management and signage.

Category	Key Issues Identified	Importance for Older People

Management Approach	Lack of responsiveness to complaints and mobility needs; dismissive behavior by staff.	Empathetic, age-sensitive management ensures inclusive customer service and trust in the space.
Enforcement of 'move-on' policies; forced seat vacating.	Creates emotional discomfort and exclusion; supportive policies are essential.	
Long supermarket queues due to insufficient checkouts.	Reduces physical strain and fatigue when properly managed.	
Loud music and noise pollution.	Lower volumes improve auditory comfort and prevent sensory overload.	
Floor Maintenance	Slippery, hard, or cracked flooring; cluttered walkways.	Ensures safety from falls, joint stress, and allows clear, hazard-free navigation.
Seating Provisions	Inadequate seating quantity and ergonomic design, lack of padded seats and armrests.	Crucial for physical support, rest, social engagement, and inclusive use across mobility levels.
Absence of public tables; inaccessible supermarket seating.	Enhances prolonged stay, social interactions, and shopping comfort.	
Escalator/Lift Use	Malfunctioning escalators with no alternatives, and poor lift placement.	Essential for vertical mobility and accessibility, especially for those with impairments.
Signage System	Small fonts, confusing maps, and non-perpendicular placement of signs.	Large, legible signage and intuitive maps foster independent navigation and orientation.

3.5.Data Analysis:

The analysis of senior citizens' experiences in mall environments reveals critical gaps in inclusivity, accessibility, assistance, comfort, and safety. Structural and navigational barriers such as poorly placed elevators, scarce ramps, limited visibility of mobility aids, and inaccessible restrooms significantly hinder senior mobility. Dispersed seating and distant restrooms exacerbate physical strain, while inadequate signage and digital navigation tools impair wayfinding. The visitor experience is further compromised by crowding, noise, long waiting times, and insufficient prioritization from staff. Safety concerns arise from hidden emergency exits and safety equipment, which remain difficult for seniors to locate. These

findings underscore the urgent need for user-centered design interventions that prioritize visibility, accessibility, and on-ground support. Figure 4 shows the first floor of Phoenix Marketcity, Kurla, Mumbai.

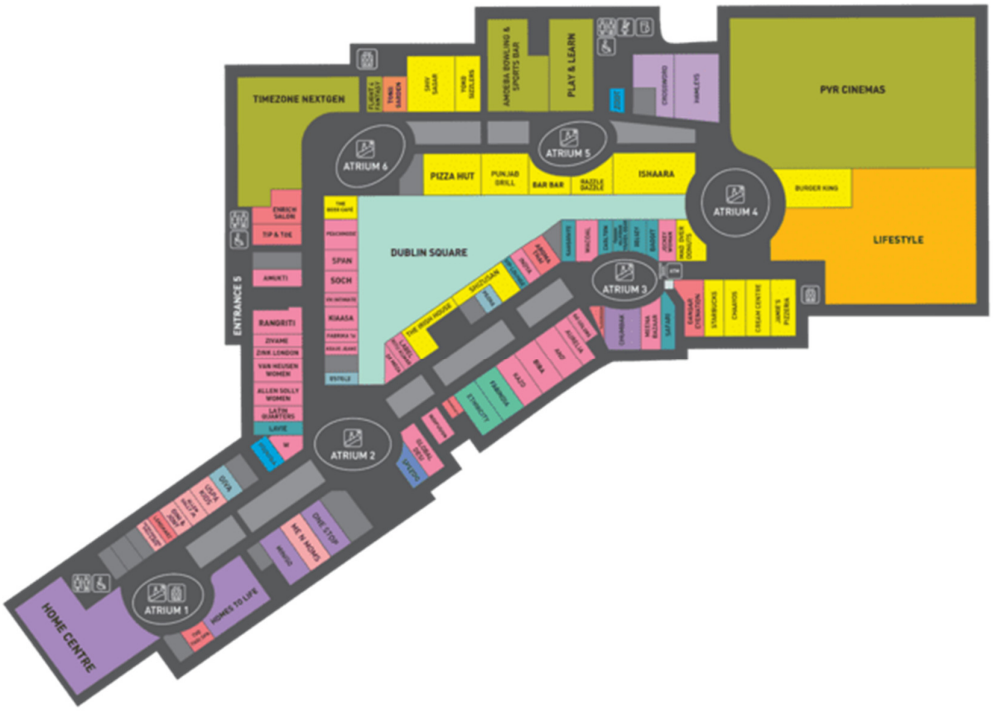

Figure 4: Displays the first floor of the Phoenix Marketcity, Kurla, Mumbai.

Proposed solutions include centralized mobility aids, senior-dedicated seating, clearer signage, digital and audio-assisted navigation, roaming assistance personnel, and enhanced emergency route visibility. Additionally, addressing social priorities such as designated seating and quiet zones fosters a more welcoming and respectful environment for seniors. Ultimately, these insights emphasize that a holistic, multi-faceted approach integrating infrastructure redesign, technology, and human support is essential to elevate senior citizens' mall experience. Future research should validate these interventions with direct senior input to ensure practical efficacy, fostering truly inclusive public spaces that accommodate the diverse needs and purposes of elderly visitors.

4. RESULT AND DISCUSSION

The data collected through primary observations, in-depth interviews, and secondary research converge on a set of core structural and service-based inadequacies that diminish the mall-going experience for senior citizens. By systematically codifying these experiences into key challenge areas ramps and wheelchairs, seating, navigation, and food court seating, the research successfully identifies gaps in physical infrastructure, service provision, and environmental design that collectively hinder accessibility and inclusivity. The challenge of *ramps and wheelchairs* emerged as one of the most pressing concerns. While the mall environment appears superficially accessible, the lack of visible, strategically located ramps and insufficient signage renders this infrastructure virtually invisible to those who rely on it. Interviewees frequently cited not only the scarcity but also the poor visibility of ramps as a critical issue.

This lack of visibility and signposting disorients users, forcing individuals to either endure physical discomfort or abandon their visit altogether. The absence of dedicated wheelchair stations further exacerbates this problem. Current mall designs do not accommodate spontaneous or assisted mobility needs an oversight that alienates a significant portion of older adults. The design implication here is not merely about adding more ramps but about integrating these elements into a coherent and intuitive spatial narrative supported by high-contrast visual markers, LED lighting, and digital tools such as navigation kiosks and mobile apps.

Seating within malls, while seemingly a basic provision, becomes a sophisticated accessibility requirement in the context of aging populations. The research highlights how inadequate seating compromises both comfort and dignity. The scarcity of seats in high-traffic zones such as near elevators, escalators, and shop entrances, where older adults frequently pause for rest, reflects a failure in empathetic spatial planning. Moreover, many of the available seats are poorly designed, too low, lacking armrests, or insufficiently padded, making them not only uncomfortable but potentially harmful [16]. The dismissive attitude of mall staff, who occasionally ask seniors to vacate seating areas, underscores a cultural shortfall in service ethics that compounds infrastructural deficiencies. The absence of inclusive seating undermines the social role of malls as communal spaces, depriving older citizens of opportunities to engage in simple pleasures like ‘people watching’ or resting mid-journey. Design interventions must include not just increased quantity, but also ergonomic and contextually placed seating arrangements that recognize seniors' physical and social needs.

The *navigation challenge* is deeply intertwined with issues of visibility, layout, and cognitive load. The mall’s current design, with its scattered elevator placement, complex floor layout, and symbol-heavy floor maps, creates an environment that is cognitively overwhelming and physically taxing for the elderly. Many seniors find the small-font signage unintelligible, and the absence of map legends or tactile elements restricts those with low vision or mild cognitive impairments. Seniors expressed a strong need for more legible, intuitive, and multimodal navigational aids [17]. This includes not only re-engineering physical maps to use larger fonts and clearer icons, but also introducing mobile apps, QR-based assistance, and staffed help points that are easily approachable. Some respondents proposed the innovative idea of staff escorts or volunteers trained specifically to assist older visitors, an intervention that transforms navigation from an isolating ordeal into a human-centered experience.

The *food court seating* emerged as a unique hybrid challenge, combining issues of availability, usability, and crowd navigation. The vastness of food courts, often filled during peak hours, creates an uncomfortable paradox: while food is available, the inability to find a place to sit and eat makes the experience hollow. Seniors are forced to meander through crowds while carrying trays, creating both physical strain and emotional frustration. The current system provides no visual or digital cues about real-time seat availability. This research proposes an innovative solution: an electronic display system showing live updates of available and reserved seating, with designated zones for seniors using distinctive color codes [18]. The integration of mobile-device-connected seat locators or tokens linked to the display would significantly reduce the stress associated with food court usage. This intervention not only addresses a practical challenge but also reinforces the mall’s identity as a responsive, tech-enabled, and compassionate environment. Figure 5 gives the architecture design for the food court in the mall.

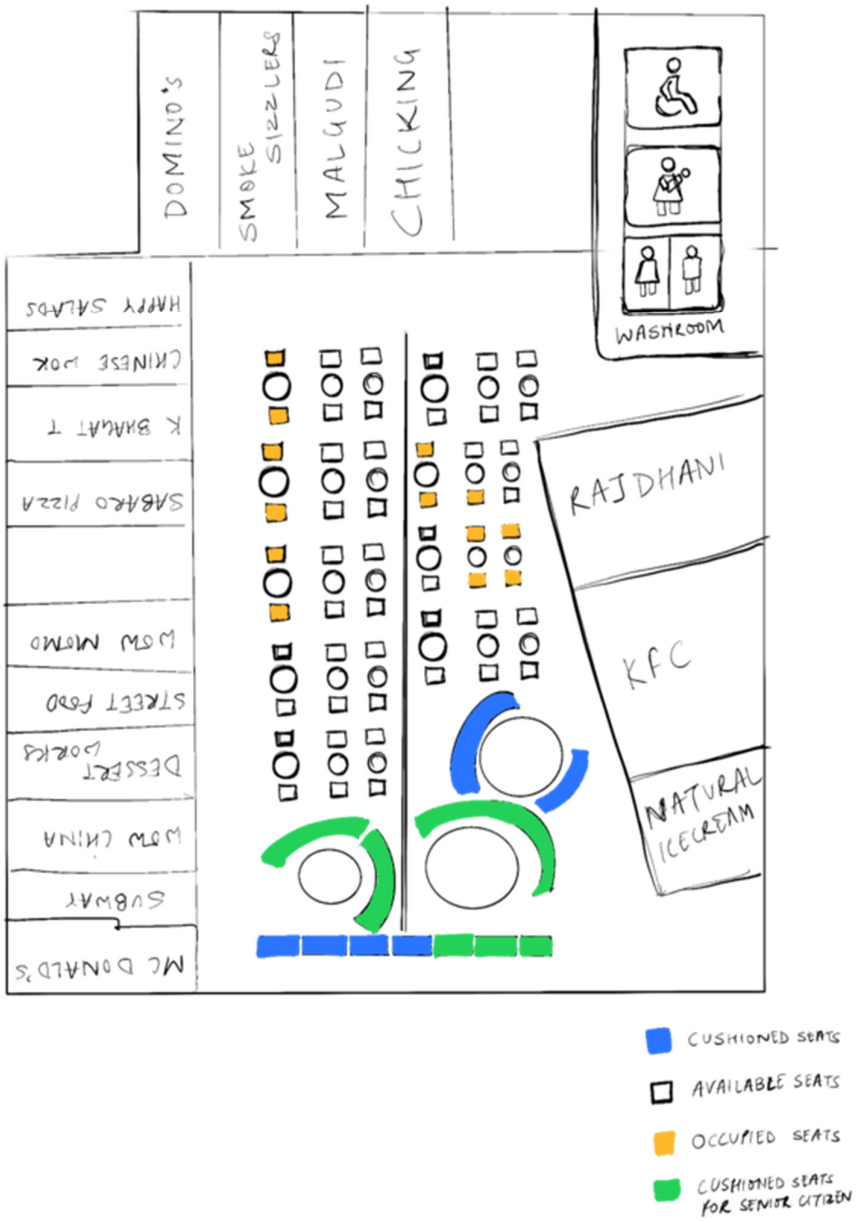

Figure 5: Provides the seating arrangements in the food court.

A thematic analysis of interview transcripts organized under broader codes, *Inclusive Spaces, Accessibility, Assistance, Safety, and Visitor Experience,* reveals a more systemic concern: senior citizens often feel invisible within mall design and management practices. The challenge is not merely architectural, but attitudinal. Complaints are ignored, needs are deprioritized, and the service experience is often marred by indifference or miscommunication. A senior-friendly mall must move beyond the mere installation of ramps or seats; it requires a fundamental redesign of both physical infrastructure and human interaction protocols [19]. This includes staff sensitization, operational flexibility (e.g., temporary assistance during peak hours), and spatial equity in the form of designated seating, toilet proximity, and elevator access. Figure 6 gives the design of ramps.

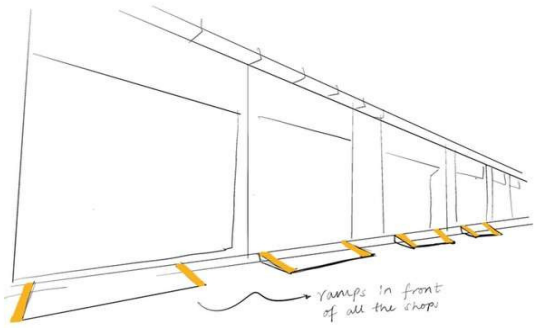

Figure 6: Shows the ramps in front of all shops.

The floor-wise analysis of Phoenix Marketcity, Kurla, reinforces these findings. The limited number of elevators, poor placement of restrooms, absence of marked seating areas, and the use of symbols instead of textual signage create a navigational maze that actively discourages senior participation. The second floor, with only one washroom and one elevator, becomes a microcosm of spatial exclusion, congested, confusing, and fundamentally unwelcoming [20], [21]. The study's solutions, particularly the concept of integrating technology with physical design like real-time seating displays, app-based navigation, and volunteer-staffed guidance services, pave the way for a forward-thinking, universally accessible commercial environment. Figure 7 provides the solutions for the key issues in the mall.

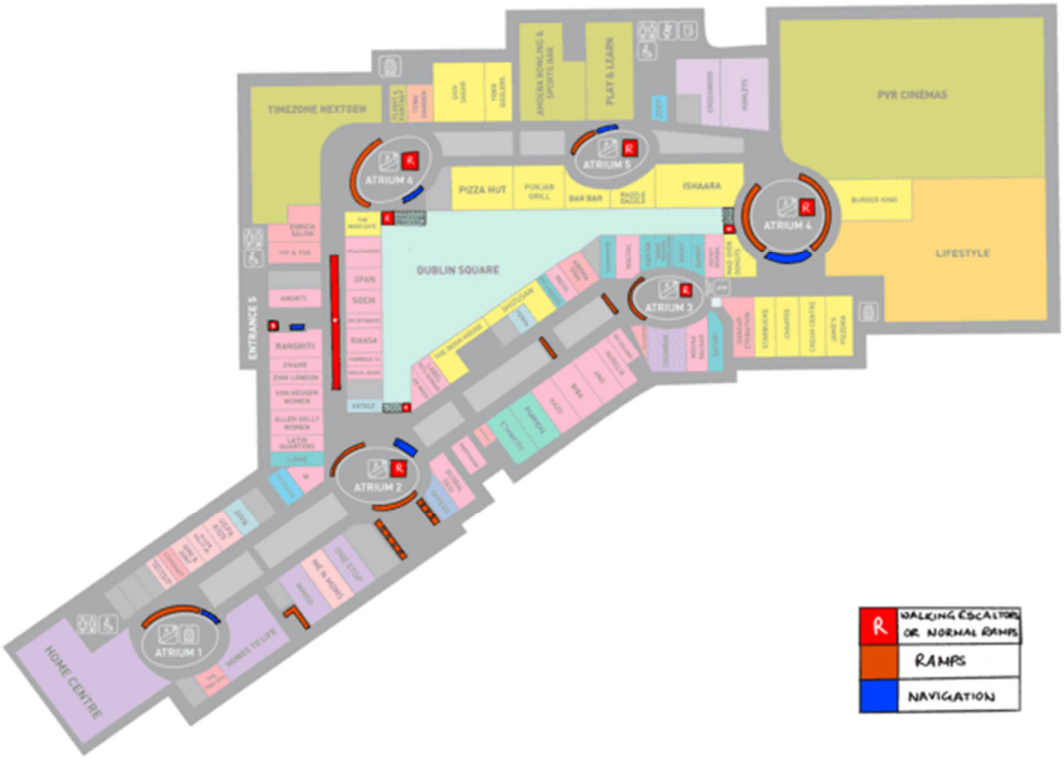

Figure 7: Presents the solutions to the mall's main problems.

These design suggestions are not merely fixes; they represent a paradigm shift towards empathic infrastructure that acknowledges diversity in age, ability, and expectation. In conclusion, the findings underscore that senior-friendly mall design must begin with an

inclusive mindset, translate into participatory planning, and be sustained through technological and human-centered solutions. The physical space must no longer be treated as a neutral backdrop but as an active agent in shaping experience, dignity, and access. Malls that rise to meet this challenge will not only expand their user base but also set benchmarks in social architecture, design innovation, and customer-centric thinking.

5. CONCLUSION

In conclusion, the lack of a cohesive and senior-friendly support system within mall environments presents a significant barrier to accessibility and convenience for older citizens. Their challenges are compounded by the limited visibility and availability of mobility aids, scattered placement of elevators and escalators, insufficient accessible restrooms, and minimal on-ground assistance. Addressing these concerns demands targeted, human-centric interventions that enhance both physical accessibility and overall user experience. Implementing centralized accessibility solutions, such as strategically placing wheelchairs and mobility aids at visible and convenient points, is essential for promoting independent movement. Enhancing wayfinding through digital tools and clear signage can significantly ease navigation for seniors. Deploying dedicated volunteers or mobile assistance staff ensures that help is readily available when required. Equally important is the reconfiguration of mall layouts to minimize travel distances between critical facilities. While these measures address immediate functional gaps, their long-term success depends on continuous engagement with senior citizens through field research and feedback-driven iteration. This approach ensures that mall design evolves in alignment with their actual preferences and lived experiences, creating spaces that are not just accessible but truly inclusive. Only through this sustained commitment to empathetic, user-focused design can malls become welcoming and functional environments for aging populations.

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CHAPTER 5

ACHIEVING EQUILIBRIUM ON EXTRACURRICULAR ACTIVITIES IN DESIGN EDUCATION

Disha Gulwani1, Riyaa Khanna[2], Vithika Agrawal[3], Prasad Anaokar[4]
[1,2,3]Student, [4]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3,4]Atlas Skilltech University, Mumbai
Email: disha.gulwani.bdes2026@atlasuniversity.edu.in[1],
riyaa.khanna.bdes2026@atlasskilltechuniveristy.edu.in[2], vithika.agrawal.bdes2026@atlasuniversity.edu.in[3],
prasad.anaokar@atlasuniversity.edu.in[4]

ABSTRACT:

The systemic challenges that design students face, particularly how the structure of design programs restricts their participation in extracurricular activities vital for personal and professional development. Through secondary research, the study situates these challenges within the broader context of higher education, identifying key barriers such as demanding academic workloads, limited time, lack of institutional support, and insufficient awareness or availability of relevant extracurricular options. Many students report that rigid schedules and academic priorities leave little room for engagement beyond coursework, while logistical issues and a lack of interesting opportunities further discourage participation. Additionally, the absence of inclusive institutional policies and support mechanisms exacerbates these barriers, often forcing students to choose academics over holistic growth. The findings suggest that addressing these systemic issues requires a more integrated approach-one that values and facilitates extracurricular involvement as an essential part of design education. By understanding and responding to these barriers, institutions can better support students' holistic development, fostering environments where academic achievement and personal growth are not mutually exclusive. The study calls for future strategies that amplify student voice, improve communication, and restructure academic frameworks to enable balanced and enriching experiences for design students.

KEYWORDS:

Design Students, Extracurricular Activities, Higher Education, Personal Development, Systemic Barriers.

1. INTRODUCTION

College life is a crucial period for both personal and academic growth, where students are expected to balance demanding coursework with extracurricular activities that contribute significantly to their overall development. This balance is particularly challenging for students enrolled in design programs [1]. The rigorous studio hours, tight project deadlines, and the constant pressure to engage in creative problem-solving often leave little time for involvement in extracurricular activities [2]. Yet, these activities are essential for career networking, skill development, and personal growth. Secondary research highlights the importance of extracurricular involvement in enriching students' college experience. Activities outside the classroom-such as student clubs, workshops, sports, and internships-offer opportunities to develop leadership skills, gain practical experience, and build professional networks.

These experiences also foster communication, teamwork, time management, and resilience, all of which support academic success and emotional well-being. However, design students frequently face a paradox: the very structure of their education limits their ability to participate in these valuable activities [3]. Many report feeling disconnected from extracurricular offerings due to overwhelming academic demands. This gap between what institutions offer and students' priorities presents a significant challenge. Understanding these challenges from the students' perspectives is essential to addressing them effectively. This research aims to explore how the current structure of design programs affects students' participation in extracurricular activities and to identify the key obstacles they face in balancing academic and extracurricular commitments [4]. By doing so, it seeks to inform strategies that can better support design students in achieving a well-rounded college experience.

There is a noticeable gap between what colleges offer in terms of extracurricular activities and what students want or can participate in. This gap is especially clear for students in design programs, who often find it hard to join clubs, workshops, sports, or internships because their academic schedules are very demanding [5]. Design students spend many hours in studios working on projects, meeting tight deadlines, and solving creative problems. These responsibilities take up most of their time and energy, leaving little room for activities outside the classroom. Even though extracurricular activities are important for building skills, making friends, and preparing for future careers, many design students feel disconnected from these opportunities [6]. They want to be involved but struggle to find the time or balance between schoolwork and other interests.

This research focuses on understanding these challenges directly from the students' point of view. It aims to explore how the way design programs are organized affects students' chances to take part in extracurricular activities. By listening to students, the study hopes to find out what makes it hard for them to balance their studies with other activities and what the most important problems are. Understanding these issues is important because it can help colleges improve their programs and support systems [7]. If colleges know what students need and what stops them from joining extracurricular activities, they can make changes to help students have a better college experience. This could include adjusting schedules, offering more flexible options, or creating activities that fit better with the busy lives of design students. Overall, this research aims to give students a voice and find ways to help them enjoy both their academic work and extracurricular involvement.

2. LITERATURE REVIEW

Murzyn *et al.* [8] studied that role in making fashion more sustainable because they can influence many areas like the economy, the environment, society, and culture, both in good and bad ways. Fashion design education is a great opportunity to teach future designers about the challenges and possibilities of creating sustainable fashion. It can give them the knowledge and skills they need to use eco-friendly and responsible methods in their work. With this idea in mind, a study was done to look at how sustainability topics are taught in post-secondary schools with fashion programs in Poland. This is an important area because it has not been studied much before. The researchers conducted interviews and analyzed the information to understand how these schools include sustainability in their teaching and how they prepare students to design in ways that help protect the planet and society.

Zhang *et al*. [9] discussed the social needs for education and student characteristics to design an effective talent training structure. Using game theory and linear programming methods, researchers created a model to optimize talent training based on balancing benefits for all involved. The model's solutions rely on equilibrium theory to find the best outcomes. Results from a teaching quality monitoring system show strong student performance, with scores of 9.7 in innovation awareness and 9.5 in practical ability. Additionally, the one-time signing rate reached 8.9, and the employment rate was 7.7. These findings confirm that the proposed talent cultivation strategy improves the quality of education and better prepares students for the job market. Overall, this approach uses big data and mathematical modeling to align education programs with social and economic demands, ensuring students develop the skills employers need while supporting national development goals.

Sun *et al.* [10] studied that innovation and entrepreneurship are at the heart of successful entrepreneurship, and bringing together innovation education with collaborative experimental platforms in colleges is a powerful way to help students develop entrepreneurial skills and improve their job prospects. In this study, the authors introduce a new system called the 3D-IVF intelligent sensor overlay algorithm wisdom laboratory, which is designed to support innovation and entrepreneurship education through advanced technology and collaborative learning environments. By carefully examining collaborative labs, they built a framework for managing these experimental platforms, considering the needs and challenges of integrating innovation and entrepreneurship education with students' main fields of study.

Mathiphatikul *et al.* [11] discussed creative thinking skills by using the engineering design process in STEM education, focusing on the topic of equilibrium. The study used classroom action research, involving 44 students. To collect information, researchers used worksheets, posters, students' projects, classroom observation forms, and interviews. The data was then carefully analyzed to see how students responded. The results showed that teaching students through the engineering design process within STEM lessons helped improve their creative thinking. Students were more engaged, came up with new ideas, and could solve problems better. This approach not only made learning more interesting but also helped students understand the topic of equilibrium more deeply and practically. Overall, the study suggests that using creative and hands-on methods in the classroom can help students develop important skills that are useful for solving real-world problems.

3. METHODOLOGY

3.1. Design:

Several methods that go beyond just asking questions, since people often find it hard to fully explain what they need or may act differently than what they say. Observation, also known as ethnography, was included so we could watch students' real behaviors and interactions in their everyday environment, giving us a more honest picture of their lives as shown in Figure 1. In the preparation stage, we chose a mix of students: some who were very active in extracurricular activities and others who were not involved at all. By selecting these "extreme users," we hoped to see a wide range of challenges and experiences among design students, which could help us find important insights for making better support systems.

Structured interview scripts to explore how students manage their time, what motivates them to join activities, and what obstacles they face. Along with interviews, we used visual prompt cards showing popular activities like football, debate, dance, and music. Students ranked these

activities by their involvement or interest and explained their choices [12]. This helped them think more deeply about their priorities and reasons for participating or not. The visual prompts and open conversations encouraged students to share personal stories about time management, academic stress, and extracurricular involvement. The goal was to get richer, more honest insights into what truly affects their participation in extracurricular activities.

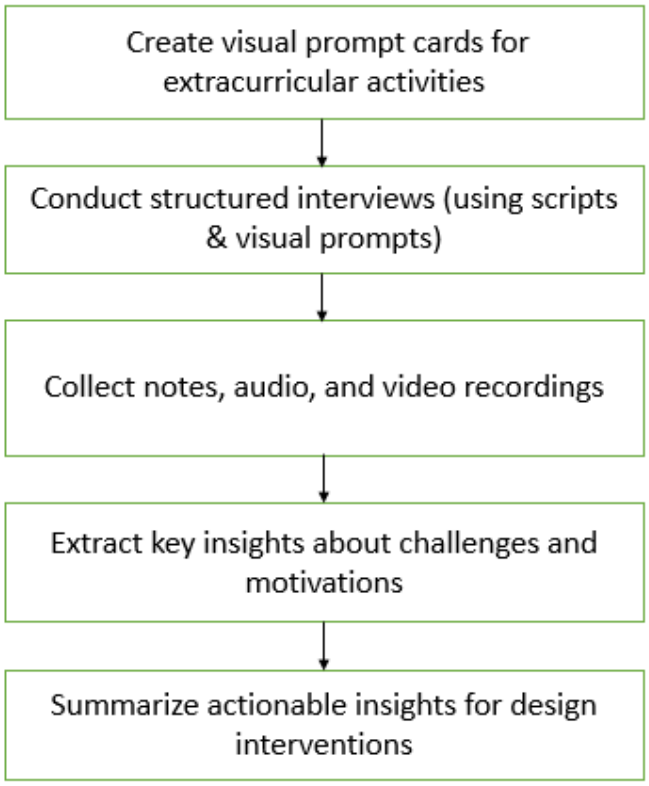

Figure 1: Illustrates the analytical approach for finding the perspective in design education.

3.2.Sample:

During the research sessions, participants were presented with visual prompt cards representing various extracurricular activities such as football, debate, dance, and music. Each participant was asked to rank these activities according to their level of involvement or interest and to explain the reasons behind their rankings. This exercise was designed to encourage students to think about their true priorities and to explore the deeper motivations or barriers influencing their participation in extracurricular activities [13]. The visual prompts served as conversation starters, helping students recall and share personal stories about how they manage their time, how much they engage in extracurriculars, and how academic pressures affect their choices. This method aimed to trigger more thoughtful and honest reflections, providing the research team with richer and less biased insights into the real factors that impact student involvement. One member acted as the interviewer, leading the discussion with the help of the prepared scripts and visual prompts [14]. Another member took detailed notes and recorded key observations, while the third managed the audio and video equipment to document the session

accurately. This team-based, organized method ensured that all important insights were captured from multiple viewpoints, resulting in a thorough and reliable collection of data.

3.3.Data Collected:

Many students tend to focus more on their academic work than on extracurricular activities because they feel there is not enough support from their college and no special allowances or exemptions for participating in such activities, as shown in Table 1. With heavy academic workloads and tight schedules, students often struggle to find time for anything beyond their studies. This makes it hard for them to join clubs, sports, or other activities, even if they are interested. They also feel that participating in extracurriculars does not help them with their grades or career development in a clear way, so they do not see it as a priority. Another problem is the lack of a strong community or social connection within extracurricular groups.

Table 1: Observation shows the theme response with different codes.

Theme	Codes
Students prioritize academic work over extracurriculars due to a lack of institutional support and relevant exemptions.	Academic priority, workload, time management, and career development.
Workload and time constraints make it difficult for students to engage in extracurricular activities.	Workload, time management, career development, and limited choice.
Lack of community and social connection within extracurricular activities	Lack of community building, disorganization, fairness, and leadership.
Lack of recognition and tangible outcomes from extracurricular participation	Career development, benefits and advantages of participation, leadership, and college communication.

Sometimes, these activities are not well-organized, and students feel there is unfairness or weak leadership, which makes it less appealing to join. Lastly, students notice that their efforts in extracurricular activities are rarely recognized or rewarded by the college. They do not receive certificates, credits, or any official acknowledgment that could help them in their future careers. Because of this, many students feel that the benefits of joining extracurriculars are not clear or valuable enough [15]. Overall, these challenges make it difficult for students to balance academics with other interests, leading them to focus mainly on their studies and miss out on the personal growth and opportunities that extracurricular activities can offer.

3.4.Data Analysis:

Extracurricular activities as a waste of time because they don't lead to clear, visible results like academic credits, better grades, or direct help with getting a job. This makes them feel that joining clubs or taking part in events doesn't count towards their future goals. To make extracurricular participation more meaningful, colleges could introduce systems where students earn academic credits for their involvement or receive career-oriented certificates through workshops linked to these activities. This would show students that their efforts outside the classroom are valued and can help them academically or professionally. Another problem

is that students often feel dissatisfied with the limited options available for extracurricular activities. Many colleges only offer a small range of clubs or groups, so if a student's interests don't match what's on offer, they feel left out or uninterested. The timing and structure of these activities can also be inflexible, making it hard for students with busy schedules to join in. Sometimes, students simply aren't aware of all the activities available because there isn't enough information shared by the college [16]. This lack of awareness and choice makes students feel restricted and less likely to participate. Overall, students want more variety, flexibility, and recognition for their extracurricular involvement, so they can find activities that match their interests and see real benefits for their academic and career goals.

4. RESULT AND DISCUSSION

Many students do not participate in extracurricular activities simply because they are not aware of the opportunities available to them. The main codes found in the first analysis were academic priority, awareness, workload, suggestions and ideas, time management, repeated learning, personal growth, resources, favorite activities, management and organization, limited choices, leadership, and lack of community building, as shown in Figure 2. Information about clubs, events, or activities is scattered across different notice boards, emails, websites, or social media pages, making it hard for students to know what is available [17].

Without a single, easy-to-access source of information, many students miss out on activities that could match their interests or help them grow as individuals. Another reason is that extracurricular activities are not always actively promoted. If activities are not advertised in a way that grabs students' attention, they remain hidden [18]. Passive channels like emails or bulletin boards do not engage students effectively-unless a student is already searching for something specific, they may never find out about the range of options open to them. As a result, students tend to stick to activities they already know or those that are most visible, such as sports or music, while missing out on less-publicized clubs or events.

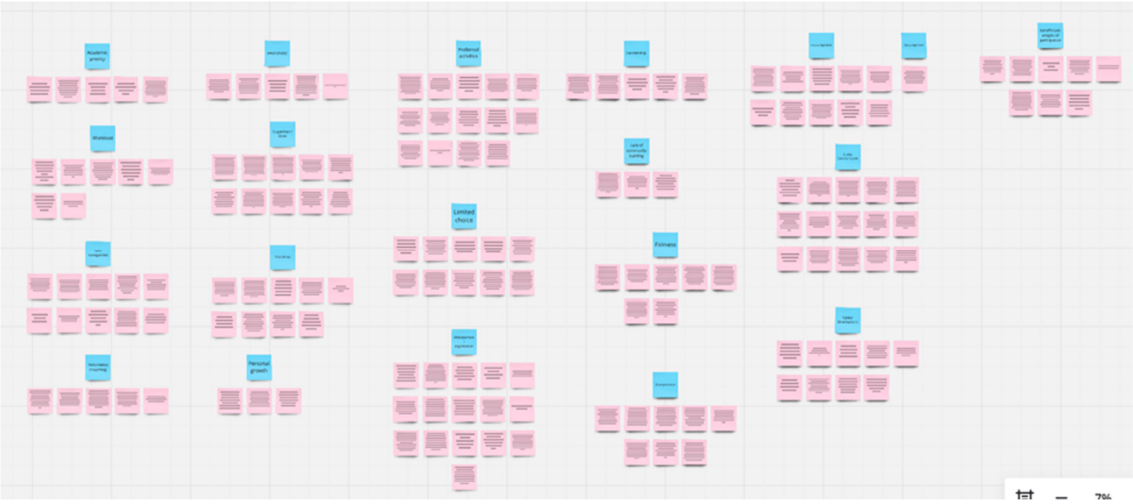

Figure 2: Illustrate the organizing quotes under codes and analyze the information.

Resources also play a big role. Sometimes, there are not enough funds, spaces, or staff to organize and promote extracurricular programs. Without proper resources, activities cannot be run effectively or made visible to all students. This can lead to inequality, where only students with certain privileges or connections are aware of and able to join these activities. College

communication systems often do not prioritize extracurriculars. The main focus is usually on academics, with extracurricular involvement seen as optional or secondary [19]. This is reflected in the lack of policies that formally encourage or reward participation in such activities. When institutions do not recognize the value of extracurriculars as part of student development, students feel pressured to focus only on their studies, fearing that time spent on other activities might harm their academic performance.

The overall culture in many institutions reinforces this problem. Academic achievement is considered the top priority, and personal growth through extracurriculars is not seen as equally important. As a result, students are caught in a difficult situation: they want to join clubs, sports, or creative groups to develop new skills and make friends, but they feel forced to choose academics over these opportunities [20]. This leads to missed chances for creativity, leadership, and social connection, all of which are important for a balanced and fulfilling student life.

To solve these problems, colleges and schools could create a central online platform or app listing all extracurricular activities, making it easy for students to browse and find what interests them. Regular fairs or promotional events could also help raise awareness. Institutions should also recognize extracurricular participation as an important part of student development, possibly making it part of graduation requirements or offering academic support for those involved. By shifting the culture to value both academics and extracurriculars equally, students would feel encouraged to participate and develop in all areas, not just in the classroom. This would help students balance their academic and personal growth, leading to a more engaging and rewarding college experience.

5. CONCLUSION

The lack of institutional support and flexibility remains a core challenge for design students, often forcing them to choose academic achievement over personal growth through extracurricular activities. This imbalance not only limits their creative and social development but also restricts opportunities to build essential life skills. By adopting the Integrated Growth Hub (IGH) framework, institutions have the potential to transform this experience. The IGH's personalized growth tracks, recognition of extracurricular contributions through credits, integrated collaborative spaces, gamified rewards, and a holistic timing grid collectively create a nurturing environment where academic and extracurricular pursuits can coexist. These strategies empower students to explore their interests, develop new skills, and become well-rounded individuals without compromising their academic goals. For lasting impact, future research should focus on adapting and testing these interventions across different student groups to ensure inclusivity and effectiveness. By doing so, institutions can pave the way for a more balanced, engaging, and fulfilling educational journey for design students, ultimately preparing them for success in both their professional and personal lives.

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CHAPTER 6

DYNAMICS OF HOUSEHOLD AND THEIR EFFECT ON SUSTAINABLE LAUNDRY BEHAVIORS AMONG COLLEGE STUDENTS

Atharv Khatri[1], Raoul D'mello[2], Kanchi Malhotra[3]
[1,2]Student, [3]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3]Atlas Skilltech University, Mumbai
Email: atharv.khatri.bdes2027@atlasuniversity.edu.in[1], raoulgeorgedmello@gmail.com[2], kanchi.malhotra@atlasuniversity.edu.in[3]

ABSTRACT:

This chapter explores how the type of household college students live in affects the sustainability of their laundry habits. As people become more concerned about the environment, even simple chores like doing laundry can have a significant impact. The research examines how factors such as the number of people in a household, the kind of washing machines available, and students' awareness of eco-friendly practices influence detergent use, washing frequency, and knowledge of sustainable laundry methods. Data was collected from undergraduate students living in urban areas using a culture probe kit and an online survey. The results show that students in larger households usually use more detergent and wash clothes more often, which is less sustainable. In contrast, students in smaller households are more likely to use environmentally friendly habits, such as air-drying clothes. The study also points out that colleges can help promote sustainability by providing energy-efficient laundry appliances and educating students about green laundry practices. However, more research is needed to fully understand how different living situations, especially in cities, affect the sustainability of laundry habits among college students. This research suggests that both individual choices and institutional support are important for encouraging sustainable laundry practices in student communities.

KEYWORDS:

College Students, Detergent Use, Energy-Efficient Appliances, Household Type, Sustainability.

1. INTRODUCTION

Sustainability becomes an ever-growing priority in today's society, and the significance of everyday household habits in shaping our environmental impact cannot be overstated. Among these, laundry- often perceived as a mundane chore- plays a surprisingly pivotal role in determining an individual's ecological footprint. For college students, laundry is a routine necessity, yet its environmental consequences are frequently overlooked [1]. The choices students make in how, when, and where they wash their clothes can collectively influence energy consumption, water usage, and even the release of microplastics into the environment. This intersection of daily habit and environmental responsibility is particularly pronounced in the context of student living arrangements, where the type of household, it a shared dormitory, communal apartment, or private residence-can shape both the resources available and the

behaviors adopted [2]. In shared dormitories and off-campus apartments, students typically rely on communal laundry facilities. While these spaces offer convenience and cost-sharing, they may inadvertently foster less sustainable habits. Older, less efficient machines are common in such settings, and the lack of individual accountability can lead to practices like running small, frequent loads or excessive use of hot water and chemical detergents [3]. These behaviors, multiplied across a campus population, can have a substantial cumulative effect on energy and water consumption. In contrast, students living in private apartments with access to newer, high-efficiency front-loading machines are often better positioned to adopt greener practices. These appliances use significantly less water and energy per load, and the autonomy of a private space can encourage more mindful habits, such as waiting for full loads, using cold water, and selecting eco-friendly detergents [4].

The impact of these choices is far from trivial. Research shows that traditional top-loading washing machines with agitators can consume up to 40 gallons of water per load, while modern front-loading models may use as little as 13 gallons. The difference in energy use is equally striking: heating water accounts for up to 90 percent of the energy consumed in a typical wash cycle [5]. By simply switching to cold water, students can drastically reduce their laundry-related carbon emissions-potentially cutting hundreds of pounds of carbon output per household each year. Furthermore, the environmental benefits extend beyond energy and water savings. Cold water washing reduces the breakdown of synthetic fibers, which in turn decreases the release of microplastics growing concern as laundering synthetic textiles is estimated to contribute 16–35% of global microplastic emissions [6]. Detergents, too, play a role, with conventional products contributing to waterway pollution and eutrophication, underscoring the value of biodegradable and low-impact alternatives.

Yet, technology and access alone do not guarantee sustainable outcomes. User behavior, awareness, and cultural attitudes are equally critical in determining the overall environmental impact of laundry routines. Studies have found that even when energy-efficient machines are available, habits such as over-washing, using excessive detergent, or defaulting to hot water persist-often driven by perceptions of cleanliness or convenience. The so-called “yuck factor,” or the fear of being perceived as unclean, can lead to more frequent washing than necessary, further escalating resource use [7]. This highlights the importance of education and awareness initiatives that not only inform students about the environmental consequences of their laundry habits but also address the social and psychological factors that shape these behaviors. Colleges and universities have a unique opportunity to influence sustainable laundry practices through infrastructure choices, targeted awareness campaigns, and practical training for students. Simple interventions as promoting the use of cold water, encouraging full loads, providing guidance on detergent use, and supporting line drying-can collectively yield significant reductions in energy, water, and chemical consumption [8]. Furthermore, integrating sustainability education into orientation programs or residence life initiatives can empower students to make informed choices, bridging the gap between knowledge and action.

Ultimately, the sustainability of student laundry practices is shaped by a complex interplay of household setting, technology, behavior, and awareness. By examining variables such as appliance type, water and energy usage, and the motivations behind student choices, researchers and policymakers can identify actionable strategies to foster greener habits in everyday life. As the global emphasis on sustainable living intensifies, even the smallest changes in routine-like how we do our laundry-can contribute meaningfully to reducing our

collective environmental footprint. In this context, the humble act of washing clothes becomes not just a personal responsibility but a vital component of the broader movement toward environmental stewardship and sustainable living.

2. LITERATURE REVIEW

Lopes *et al.* [9] studied that personal and physical injuries are major costs for hospitals, and hospital laundries contribute to these costs because workers face health and safety risks from handling dirty clothes and doing physically demanding tasks. Besides these risks, running hospital laundries uses a lot of water and energy, creates waste, and can cause environmental problems, all of which add to the hospital's expenses. This research looked at three hospital laundries in Brazil to understand the social, environmental, and economic risks involved. The study found that these laundries use a lot of resources and produce a lot of waste, but actions like sharing laundry services between hospitals and using different materials can help reduce costs. Common risks include injuries from sharp objects thrown away incorrectly, as well as exposure to harmful chemicals and germs. To make hospital laundries more sustainable, it's important not just to improve the equipment and buildings, but also to raise awareness among staff and leaders about saving resources and reducing waste.

Cortez *et al.* [10] discussed that the laundry process uses a lot of energy, especially because heating water takes so much power, making it a key area for reducing the environmental impact of households. Studies show that most of the environmental harm from laundry comes from the energy used during washing, not from making or throwing away the machines or detergents. However, making laundry eco-friendlier isn't just about better machines or detergents-it also depends on people's habits and beliefs about cleaning. This study looks at whether people change how they do laundry and how satisfied they are with the results when they use a eco-friendlier detergent that doesn't clean as strongly as a regular, heavy-duty detergent. These two types of detergents show different ways the detergent industry is trying to be more sustainable: one by making powerful cleaners that work well even in tough conditions, and the other by focusing on being more environmentally friendly, even if they don't clean as aggressively.

Jack *et al.* [11] examined the resources as part of our daily habits, like doing laundry, makes it hard to practice sustainable living. Laundry is one of the most environmentally harmful parts of owning clothes because it uses a lot of water, energy, and chemicals. Even though laundry has a big impact, people often don't think about it when talking about sustainable fashion, since washing clothes feels like a normal, boring task. This study surveyed 263 Australians about how they wash their jeans and how much water and energy they use, to understand what people expect when it comes to cleanliness and how they act on those expectations. The researchers also interviewed people who hadn't washed their jeans for three months to learn more about what affects their laundry habits. The study explains the different reasons and ways people do their laundry, showing how everyday routines can affect the environment.

Laitala *et al.* [12] explored taking care of clothes is important to keep them usable and looking good, but it also affects the environment because it uses energy, water, and chemicals. This article looks at whether clothes made from different materials are washed in different ways and if that changes their impact on the environment. By studying how people care for their clothes in countries like China, Germany, Japan, the UK, and the USA, the article provides useful details about the real-life use of clothing, which helps make environmental studies more accurate. The research found that the best way to lower the environmental impact of clothing

care is to wash clothes less often and to choose more efficient ways to wash and dry them. This shows that simple changes in how we do laundry can make a big difference for the environment.

3. METHODOLOGY

3.1.Design:

The design framework process begins by clearly defining what we want to find out about laundry habits and sustainability among college students. Next, we select students from different types of households, such as those living in dormitories, shared apartments, or private apartments, to make sure we get a variety of perspectives. After that, we do some background research by reading about sustainable laundry habits and the different types of washing machines and methods people use, like front-load, top-load, or hand washing. With this information, we design surveys and interview questions that ask about how often students do laundry, how much they wash, what products they use, how much energy and water they use, and what they think about sustainability, as shown in Figure 1.

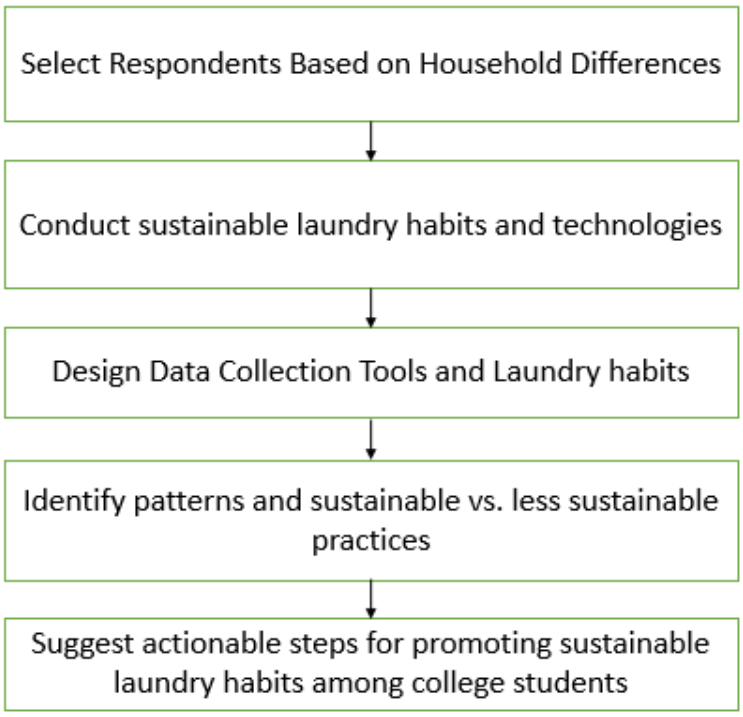

Figure 1: Illustrates the sustainable laundry approach with different categories.

We also collect details about their households, such as how many people live together and what kind of appliances they have. Once the surveys and interviews are ready, we collect data by reaching out to the students and recording their answers. After gathering all the information, we analyze it to spot patterns, compare different household types, and see which habits are more or less sustainable. We then interpret the results to find out what factors have the biggest impact on sustainable laundry practices and how students understand sustainability. Finally, we report our findings and suggest practical steps colleges and students can take to encourage eco-friendlier laundry habits.

3.2.Sample:

The sampling period was chosen to capture a comprehensive snapshot of typical laundry routines, regardless of how often laundry was done each week. The probe kit was designed to be interactive and engaging, using visual prompts and creative tasks to encourage participants to reflect on and document their laundry habits, choices, and perceptions of sustainability in real-time. This approach provided rich, qualitative insights into the day-to-day realities of laundry practices [13]. In parallel, an online survey was administered to a broader sample of approximately 50 college students. The survey questions were adapted from the culture probe kit, focusing on aspects that could be answered without ongoing participation. This allowed us to gather quantitative data from a larger and more diverse group, ensuring a robust sample size for statistical analysis.

3.3.Data Collection:

Sustainability survey, we began by asking students about their current understanding and attitudes toward sustainability. We wanted to know which aspects of sustainability, saving water, reducing energy use, or cutting down on waste, were most important to them, and where they already try to make sustainable choices in their daily lives, as shown in Table 1. We also asked who they believe should be responsible for spreading awareness about sustainability, such as schools, families, or the media. This helped us get a clear picture of how students relate to sustainability in general. Next, in the Family Tree section, we collected basic information about each student's household, including how many people they live with and what their relationships are, like living with parents, siblings, or roommates.

Table 1: Observation shows the sustainable laundry parameters.

Respondent ID	Sustainability Factors Important (Energy/Water/Waste)	Current Sustainable Practices	Who Is Responsible for Awareness?	Laundry Equipment Type	Sustainability Game Score
1	Water, Energy	Uses cold water, full loads	School, Family	Front-load	8/10
2	Energy, Waste	Line dries clothes	Media, Friends	Top-load	6/10
3	All	Eco detergent, cold wash	University	Hand wash	9/10
4	Water	Short cycles	Government	Front-load	5/10
5	Waste, Energy	Uses less detergent	Family	Top-load	7/10

This information is key to understanding if household setup affects how sustainably they do laundry. The Laundry Look section focused on practical details, such as what kind of washing machine they use, how often they do laundry, and what products they use. This helps us see which physical factors might help or hinder sustainable habits. The Laundry Log gave us a closer look at each laundry cycle, including when they did laundry, how much they washed,

and how long it took [14]. Finally, the Sustainability Game tested their knowledge about eco-friendly laundry practices and offered tips, helping us both measure and improve our understanding of sustainable laundry in a fun, interactive way.

3.4.Data Analysis:

The Sustainability Game section of our research serves a dual purpose: it both measures participants' existing knowledge of sustainable laundry practices and acts as an educational tool to increase awareness by sharing practical, easy-to-adopt tips [15]. By analyzing the responses and scores from the game, we can determine how much students already know about eco-friendly laundry methods, such as using cold water, washing full loads, or choosing biodegradable detergents. Comparing these results with their actual laundry habits (recorded in the Laundry Log) allows us to identify gaps between knowledge and practice [16]. For instance, if a respondent scores high in the game but still uses hot water for every wash, it suggests that knowledge alone may not be enough to change behavior, and other factors like convenience or habit may be at play. The broader research approach is designed to connect the dots between what students know (survey and game), their household environment (family tree and laundry look), and what they do (log cards). This structured data collection enables us to analyze whether unsustainable laundry habits are more closely linked to a lack of awareness, a lack of practical knowledge, or perhaps to physical or social constraints within the household.

4. RESULT AND DISCUSSION

Upon tabulating the results from our online survey, several key patterns and insights emerged regarding college students' laundry practices and their relationship to household size and sustainability, as shown in Figure 2. To begin with, the majority of respondents identified energy consumption and waste management as the two most important areas where sustainability should be applied in daily life [17]. This suggests a growing awareness among students about the environmental impact of their actions, especially in resource-intensive activities like laundry.

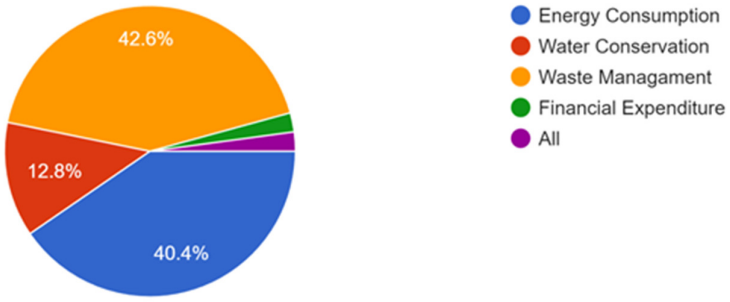

Figure 2: Illustrates the energy parameters for laundry sustainability.

Figure 3 shows that many respondents pointed to a lack of time and insufficient access to appropriate resources-such as energy-efficient machines or eco-friendly detergents the main obstacles preventing them from consistently practicing sustainable habits. This highlights the gap between knowledge and action, a recurring theme in sustainability research. Focusing on our main research, the link between household size and laundry habits-our data revealed some intriguing trends. The use of liquid and powder detergents was almost evenly split across all household types, with a slight preference for powder detergents (55%). This is a positive

finding, as powder detergents generally have a lower environmental footprint due to more efficient transportation and packaging, aligning with sustainable consumption goals. When examining laundry frequency, the expected direct relationship between household size and the number of laundry cycles per week was only partially observed.

Figure 3: Illustrates the sustainable habits for laundry.

Two-member households washed clothes the least frequently, averaging once a week or even once every two weeks. Three-member households increased their frequency to three to four times a week, while four-member households surprisingly washed less often (two to three times a week) than both three-member and five-plus-member households, the latter of which reported the highest frequency at four to six times per week, as shown in Figure 4.

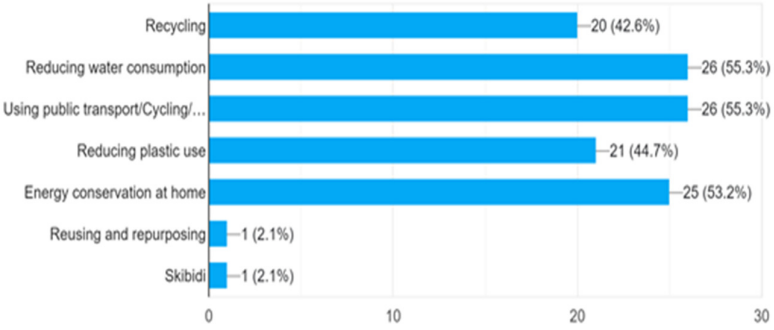

Figure 4: Illustrates the energy conservation for laundry parameters.

This deviation in four-member households can be attributed to their greater tendency to sort laundry by type-such as separating whites from colors or delicates from regular items-resulting in fewer, larger loads rather than many small cycles. In contrast, five-plus-member households often forgo sorting and simply wash whatever is dirty, leading to more frequent but potentially less efficient cycles [18]. The practice of sorting laundry not only affects frequency but also reflects a higher level of organization and possibly greater awareness of sustainable practices, as sorting can allow for more efficient washing and better care of clothing, thereby extending garment life and reducing waste.

Top-load washing machines with agitators use a lot more water compared to front-load washers because of their design. Front-load machines are made to use water much more efficiently, which helps save water and energy, as shown in Figure 5. Washing clothes in cold water instead of hot water also saves a lot of energy. These simple changes, like choosing a front-load washer and using cold water, can make a big difference in reducing the environmental impact of doing

laundry. By using energy-efficient appliances and adopting better laundry habits, people can help protect the environment and lower their carbon footprint. Small changes in how we wash clothes can add up to big benefits for the planet.

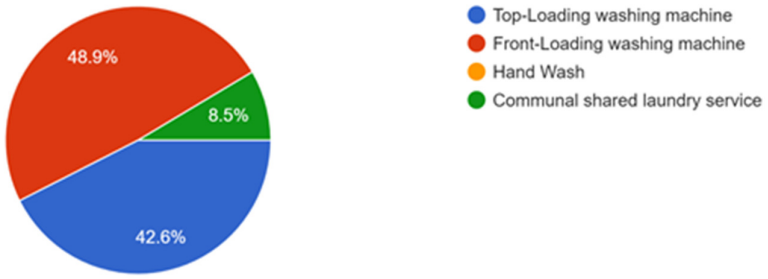

Figure 5: Illustrates the user of the washing machine.

When it came to knowledge of sustainable laundry practices, four-member households again stood out. These respondents were more likely to know the ideal temperature for washing clothes-typically favoring cold water, which saves energy. Meanwhile, two-member households showed the highest awareness of the benefits of air-drying, which is the most sustainable method for drying clothes. Detergent usage per cycle increased with household size, which is expected, but it also raises questions about whether larger households are using detergent efficiently or simply using more because of larger loads [19]. Regarding laundry routines, three-member households were most likely to adhere to a set schedule, while four- and five-plus-member households had a 70-30 split between scheduled and as-needed washing. Interestingly, the small sample size for two-member households showed an even higher tendency towards scheduled laundry, but this result should be interpreted with caution due to limited data.

The findings suggest that four-member households tend to have higher levels of knowledge, awareness, and sustainable laundry practices. This may be due to their unique household dynamics, such as more structured routines and shared responsibilities, often found in "full house" family settings in urban areas [20]. Further research is needed to explore the cultural, social, and logistical factors that contribute to these trends, particularly how parental influence and household organization shape sustainable behaviors. This study underscores the importance of targeting interventions not only at individuals but also at household units, especially those with the potential to model and reinforce sustainable habits.

5. CONCLUSION

The important relationship between the type of college household and the sustainability of its laundry practices. By examining different living situations, we found that household size and composition play a key role in shaping laundry routines and their environmental impact. Larger households, as expected, tend to wash clothes more frequently and use more detergent, which can lead to less sustainable outcomes, especially when sorting laundry is prioritized over efficiency. Smaller households, on the other hand, often make more eco-friendly choices, such as air-drying clothes and using detergent more efficiently. Interestingly, four-member households stood out in our research for their higher awareness and commitment to sustainable laundry practices, suggesting that certain household dynamics can encourage greener habits. However, despite these positive trends, significant challenges remain. Many students face

barriers such as lack of time, limited access to efficient appliances, and insufficient knowledge about sustainable options. These factors can prevent even the most well-intentioned individuals from adopting eco-friendly laundry habits. Overall, our findings suggest that promoting sustainability in college laundry practices requires not only raising awareness but also addressing practical obstacles and supporting students with better resources and information. By understanding the unique needs and behaviors of different household types, colleges and policymakers can design more effective interventions to encourage sustainable laundry habits and reduce the ecological footprint of student living.

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CHAPTER 7

EXAMINING THE DESIGN INTERVENTION FOR WASTE SEGREGATION AND DISPOSAL IN HOUSING SOCIETIES

Arushi Gupta[1], Bhavika Surana[2], Kavya Shah[3], Prasad Anaokar[4]
[1,2,3]Student, [4]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3,4]Atlas Skilltech University, Mumbai
Email: arushi.gupta.bdes2026@atlasuniversity.edu.in[1], bhavika.surana.bdes2026@atlasuniversity.edu.in[2], kavya.shah.bdes2026@atlasuniversity.edu.in[3], prasad.anaokar@atlasuniversity.edu.in[4]

ABSTRACT:

This research investigates waste segregation and disposal practices in urban housing societies, emphasizing the interplay between individual behaviors, systemic challenges, and socio-cultural dynamics. In light of increasing municipal waste burdens and the inefficacy of conventional awareness campaigns, this study explores design-based interventions as a transformative tool to enhance household-level waste management. Employing a qualitative methodology, data were collected from 20 demographically varied households through semi-structured interviews, ethnographic observations, and participatory tools such as interactive games. These methods enabled a holistic understanding of daily practices, decision-making rationales, and the embedded cultural perceptions that shape waste disposal behavior. Findings reveal a persistent disconnect between residents' environmental awareness and their actual practices. Structural constraints such as inadequate infrastructure, unclear instructions, and time limitations compound behavioral inertia, despite a general willingness to participate in sustainable efforts. Moreover, social stigma, hierarchical labor roles, and communal norms further inhibit consistent segregation practices.

The study underscores the limitations of one-size-fits-all solutions and proposes design interventions tailored to local context, community values, and behavioral triggers. The research advocates for an interdisciplinary approach where design becomes a mediator between policy and practice. By embedding behavioral cues, user-centered systems, and interactive engagement tools, the study demonstrates the potential of design thinking in facilitating sustainable transformation at the micro-community level.

KEYWORDS:

Behavioral Design, Ethnographic Research, Household Waste, Sustainability, Waste Segregation.

1. INTRODUCTION

Waste disposal is a pivotal element of environmental sustainability, yet household-level waste practices remain fragmented, inconsistent, and often misaligned with ecological standards. Despite the proliferation of global environmental discourses and policy frameworks emphasizing sustainable waste management, a significant gap persists between theoretical advocacy and actual practices at the domestic level [1], [2]. Urban households, which are

substantial contributors to municipal solid waste (MSW), frequently struggle with segregating, disposing of, and managing waste effectively [3]. This disparity stems from a complex web of behavioral, infrastructural, informational, and socio-cultural barriers that undermine the success of conventional waste management strategies.

The alarming trajectory of global waste generation underscores the urgency of addressing these challenges. As per the World Bank (2018) report, the world's urban centers generate approximately 2.01 billion tons of MSW annually [4]. Shockingly, only about 19% of this waste is adequately recycled or composted. The rest contributes to overflowing landfills, water contamination, air pollution, and the depletion of urban living conditions. Much of this inefficiency is attributed to poor household waste segregation, a lack of clarity in operational processes, and minimal integration of user behavior into waste management systems. In rapidly urbanizing nations like India, where socio-economic diversity, population density, and urban planning gaps converge, managing waste responsibly becomes an even more daunting proposition.

India's urban waste dilemma is further exacerbated by the rapid growth of its cities, shifting consumption patterns, and evolving lifestyles. The explosion in packaging waste, disposable products, and convenience-driven consumer behaviors has created a burden on existing municipal infrastructures, which are often ill-equipped to handle the increasing complexity and volume of domestic waste [5]. Despite legislative efforts, including the Solid Waste Management Rules (2016), implementation remains uneven, particularly at the grassroots level of housing societies and residential clusters [6]. These local communities serve as critical touchpoints for waste segregation and disposal, yet they remain inadequately studied in terms of behavioral dynamics and socio-cultural resistance to sustainable practices.

This research emerges from the growing need to design interventions that go beyond regulatory imposition and infrastructural provisioning. Instead, it seeks to address the more nuanced, human-centered dimensions of waste management, how people perceive, engage with, and make decisions about their waste. The core focus of the study is to explore and understand household waste disposal practices, identifying the behavioral patterns, contextual challenges, and socio-cultural factors that govern them [7], [8]. The aim is not only to assess the level of knowledge and awareness among residents but also to investigate how demographic variables such as age, education, and family size correlate with waste-related behaviors. Ultimately, this study seeks to inform the design of sustainable and context-sensitive waste management interventions.

The methodology employed in this study is rooted in qualitative research traditions, leveraging semi-structured interviews, ethnographic observations, and participatory techniques such as interactive games to elicit rich, grounded insights from a diverse set of respondents. Twenty households, carefully selected to represent a range of demographic profiles, participated in the study. Their narratives and behaviors offer a microcosmic view of the challenges and possibilities that lie within urban domestic waste practices. The lived experiences of three respondents, Chaitali Shah, Sunita, and Somya Bangard, offer a window into the layered realities of household waste management. Chaitali Shah, a 40-year-old homemaker, exemplifies internalized behavioral change, shaped by past mandates within her community. Her commitment to basic two-category segregation reflects an intersection of habit, environmental consciousness, and spiritual motivation. She navigates waste disposal with both

efficiency and ethical grounding, finding comfort in manageable routines without being overwhelmed by complexity. In contrast, Sunita, a 43-year-old resident, demonstrates a compliance-based attitude. Her behavior is primarily driven by external enforcement rather than intrinsic motivation. While she adheres to segregation when it is mandated by society, she discontinues the practice when oversight diminishes. She raises concerns about systemic inefficiencies, such as unclear labeling and inconsistent collection practices, highlighting the fragile dependence of sustainable behaviors on structural support.

Somya Bangard, a 20-year-old student, brings a younger, more analytical lens to the issue. Though newly relocated to her current housing society, she displays awareness about the environmental significance of segregation, influenced by media exposure and educational narratives. Yet her experience is marked by skepticism about the feasibility of widespread change in the Indian context. She recognizes the role of domestic workers and housing society staff in maintaining the integrity of waste systems and advocates for clearer responsibilities and stricter enforcement mechanisms. Her reflections underscore the importance of equipping both residents and support staff with the knowledge and resources needed to practice effective waste disposal.

The diversity in these perspectives reflects the multiplicity of attitudes, knowledge levels, and operational realities that intersect within a single housing community. While some residents exhibit high degrees of motivation and environmental awareness, others operate within a framework of minimal compliance, constrained by a lack of time, infrastructure, or clear incentives. In several cases, cultural perceptions of waste as something dirty, disposable, or someone else's responsibility further distance individuals from actively participating in waste management processes [9], [10]. Against this backdrop, the research articulates a central problem statement: despite growing awareness of waste management principles, many urban households struggle to translate knowledge into consistent, effective waste disposal practices due to a confluence of behavioral inertia, infrastructural inadequacies, and cultural predispositions. This gap between awareness and action is critical to understanding why waste segregation efforts often falter in residential societies, despite sustained efforts by civic bodies, NGOs, and environmental advocates.

This study is thus driven by the following primary objective: to explore and understand household waste disposal practices, identifying behaviors, challenges, and socio-cultural influences, to provide actionable insights for improving sustainable waste management systems. In doing so, the research aims to go beyond diagnostic analysis and contribute to solution-building by foregrounding the role of design interventions that are tailored to user needs and local contexts. The background and context of this inquiry emphasize the necessity of incorporating user-centered design approaches in environmental interventions. While secondary literature provides ample documentation of waste-related challenges, much of it remains detached from the lived realities of urban households. Policies that focus solely on infrastructural upgrades or punitive measures often fail to achieve long-term behavioral change because they neglect the user's perspective. By engaging directly with residents and observing their habits, choices, and constraints, this study generates empirical insights that can be used to craft targeted design strategies ranging from better communication systems and visual cues to gamified engagement and participatory waste systems.

The findings point to the importance of not merely disseminating information but embedding waste segregation practices into the rhythm of everyday life. This entails designing systems that are intuitive, accessible, and aligned with existing routines. For example, color-coded bins with culturally relevant symbols, reminder-based mobile applications, or incentive-based neighborhood programs can play a transformative role. Moreover, involving domestic workers, children, and community leaders as active participants rather than passive stakeholders can foster collective accountability and shared ownership of environmental outcomes. In sum, this research frames waste management not only as a technical or administrative challenge but as a behavioral and design challenge that demands empathy, creativity, and cultural sensitivity. The study asserts that sustainable change in waste practices will not arise from top-down mandates alone but from collaborative, user-informed strategies that recognize the multiplicity of urban experiences. By centering the voices and behaviors of household members, the research sets the foundation for interventions that are not only effective but also meaningful and enduring.

2. LITERATURE REVIEW

Victoire *et al.* [11] aimed to evaluate solid waste management challenges and their effects on livelihoods in the Kinyinya sector. It assessed waste collection, transportation, and disposal practices by households and companies. The study revealed significant issues, including poor waste disposal, inability to pay collection fees, inadequate landfill site assessments, and poor working conditions for waste handlers. Only 33.25% of households practiced waste segregation, while 66.75% did not. Health problems linked to waste mismanagement were reported. A strong positive correlation ($r = 0.845$) was found between waste management challenges and adverse livelihood impacts. The study concluded that improving household segregation, strengthening waste companies, and training landfill workers could mitigate these issues.

Dolipas *et al.* [12] investigated the waste management practices of students at Benguet State University (BSU), Philippines. It found that students commonly generated vegetable waste, paper, and plastic wrappers, and generally practiced waste segregation at home. Segregation behavior did not differ significantly by sex or family origin, but lower-level students were less consistent compared to upperclassmen. Students living in university dormitories demonstrated better segregation habits than those in boarding houses. Female students were more likely to utilize truck collection services, while lowlanders more often used compost pits. Waste segregation was influenced by environmental concern, legal compliance, personal image, and the perceived utility of recycling. The study recommended stricter adherence to LGU policies.

Chattopadhyay *et al.* [13] highlighted that Kolkata, one of India's four metropolitan cities, faced significant challenges in managing municipal solid waste due to rapid urbanization and industrial expansion. With a daily waste generation of approximately 3,000 tons, the city lacked source segregation, relied heavily on open vats, and operated with an outdated and inefficient waste transport fleet. Only about 60% of households received direct waste collection, and recently added municipal areas experienced even poorer services. A composting plant initiated in 2000 failed by 2003, and open dumping practices posed severe environmental risks. The Kolkata Environmental Improvement Project provided limited relief, necessitating comprehensive systemic reforms in segregation, transport, and disposal.

Mohammed *et al.* [14] highlighted significant environmental threats stemming from inadequate collection and disposal systems. It found that only 65% of daily solid waste was

collected and disposed of, while 5% was recycled, another 5% composted, and 25% remained uncollected, often dumped in unauthorized areas. Domestic waste was identified as the primary contributor. The study examined waste sources, impacts, and existing management practices through field visits, document reviews, and stakeholder discussions. It reported a waste generation rate of 0.45 kg/capita/day and 100,000 m³ of domestic wastewater produced daily. The city's reliance on the Reppi dumpsite and limited sewer coverage highlighted urgent needs for policy, infrastructure, and capacity improvements.

Adzawla *et al.* [15] investigated the persistent challenge of solid waste management in Ghana's peri-urban and urban areas, focusing on the socioeconomic determinants influencing household waste disposal choices. Utilizing a multinomial logit model with data from 16,767 households in the Ghana Living Standard Survey round six, the study found that factors such as household education, housing characteristics, and geographical location significantly shaped the selection of waste disposal methods. It was observed that unapproved disposal practices, like open dumping and burning, were influenced more by socioeconomic attributes than by income levels. The study recommended sustained advocacy efforts by local governance bodies to promote improved waste management practices across communities.

3. METHODOLOGY

3.1.Design:

This study adopts a mixed-methods approach rooted in three dimensions: 'what people do', 'what people make', and 'what people say' to critically evaluate the gap between declared intent and actual behavior concerning household waste management. By integrating qualitative techniques such as semi-structured interviews, ethnographic observations, and interactive games, this research design offers a robust framework for understanding lived waste disposal practices in urban households. The qualitative research design enabled detailed, context-rich exploration of behaviors and perceptions. Semi-structured interviews were conducted with 20 purposively selected participants across various demographics to surface individual knowledge, challenges, and motivations surrounding waste disposal. Questions focused on awareness of segregation practices and the fate of unsegregated waste, revealing limited understanding and minimal regulatory knowledge. Ethnographic observations were implemented to validate verbal accounts by directly monitoring domestic disposal routines. This highlighted significant discrepancies between claimed practices and real-life actions, particularly in segregating and disposing of waste. Interactive games were designed to simulate common waste disposal scenarios through engaging, reflective exercises. These included categorizing household waste, recognizing environmental consequences, and sequencing waste collection processes. Collectively, the games revealed knowledge gaps, cognitive dissonance, and systemic constraints that impede sustainable behavior, offering a holistic lens into the practical and psychological dimensions of waste management.

3.2.Sample:

Age-wise, the group includes 5 young adults (18–35 years), 10 middle-aged adults (36–55 years), and 5 elderly participants (56+ years), ensuring generational perspectives are captured. Income levels are represented by 14 participants from middle-income and 6 from high-income households. All 12 households were situated in urban areas, aligning with the study's focus on housing societies. Family structures include 12 nuclear families, 2 joint families, and 6

bachelors, offering insights into varying domestic dynamics. Culturally, participants were purposefully selected from diverse regional backgrounds to account for the influence of socio-cultural factors on waste disposal behaviors. Table 1 shows that the demographic profile of the study participants reflects a balanced and diverse sample.

Table 1: Provides the balanced and diverse sample with their demographic profiles for the study.

Demographic Category	**Subcategory**	**Number of Participants**
Age	Young adults (18–35 years)	5
Middle-aged adults (36–55 years)	10	
Elderly adults (56+ years)	5	
Income Level	Middle-income households	14
High-income households	6	
Geographic Location	Urban households	12
Family Type	Nuclear families	12
	Joint families	2
	Bachelors	6
Cultural Background	Diverse cultural and regional mix	Qualitative Representation

3.3.Instruments:

The primary sources of information in this research include first-hand data collected through semi-structured interviews, ethnographic observations, and interactive participant-based games. These tools were selected to elicit qualitative insights into household waste disposal behaviors.

The interviews served as a key instrument to capture verbal responses, beliefs, and attitudes. Observations enabled the documentation of actual practices, while interactive games acted as cognitive and behavioral probes to assess environmental awareness and decision-making. Audio recorders, field notebooks, cue cards, pictorial charts, and sorting tools (cups, labeled bins) were employed to facilitate accurate and engaging data collection, ensuring triangulation and reliability of the insights derived from multiple respondent interactions.

3.4.Data collection:

Ms. Chaitali Shah exemplifies proper segregation with a clear understanding, supported by long-term habit formation from her previous residence. Ms. Alisha Vartak has some knowledge but is still adapting, reflecting partial awareness without full practice. Those who somewhat segregate or have done so once include Ms. Rita Patasia and Sunita, showing limited but inconsistent engagement. Participants like Ms. Somya Bangard, Naina Shah, and Vivaan fall

into the "never segregated" category, demonstrating minimal to no knowledge or practice despite varying lengths of residence and backgrounds. This distribution reveals a spectrum of awareness and adherence, highlighting the need for targeted educational interventions. Table 2 categorizes participants based on their waste segregation behavior and level of knowledge.

Table 2: Displays the participants based on their waste segregation behavior and level of knowledge.

Segregation Behavior	**They Know How To**	**Has Some Knowledge**	**No Knowledge**
Properly Segregates	Interviewee 4 – Ms. Chaitali Shah - 40 y/o homemaker - Vegetarian diet - Just moved into the society - Lived in a previous society for 20 years	Interviewee 5 – Ms. Alisha Vartak - 17 y/o student - Vegetarian diet - Moved into the society one year ago	Not Applicable
Somewhat Segregates / Segregated Once	(No entry)	Interviewee 1 – Ms. Rita Patasia - Working as a nanny - Vegetarian diet - Originally from Calcutta	Interviewee 7 – Sunita - New mother - Homemaker - Vegetarian diet
Has Never Segregated	Interviewee 3 – Ms. Somya Bangard - 20 y/o - Vegetarian diet - College student - Living in the society for 3 months	Interviewee 6 – Naina Shah - New mother - Homemaker - Vegetarian diet - Living in the building for 7 years	Interviewee 2 – Vivaan - 15 y/o (8th standard) - School-going boy - Living in the society for 3 years - Non-vegetarian diet

3.5.Data analysis:

The data analysis employed a systematic, qualitative approach integrating semi-structured interviews, ethnographic observations, and interactive games. Utilizing a Miro board, the research team efficiently organized and visualized data to identify key themes across demographic groups. Interview transcripts were coded to reveal patterns around knowledge, barriers, and societal influences on waste segregation. Ethnographic observations cross-validated participants' stated behaviors with actual practices, highlighting discrepancies. Insights from interactive games exposed knowledge gaps and decision-making challenges. Recurring themes included confusion over bin labels, the role of habit and external motivation,

and the need for practical education and system efficiency. Participants emphasized the importance of meaningful incentives and government intervention to enhance segregation compliance.

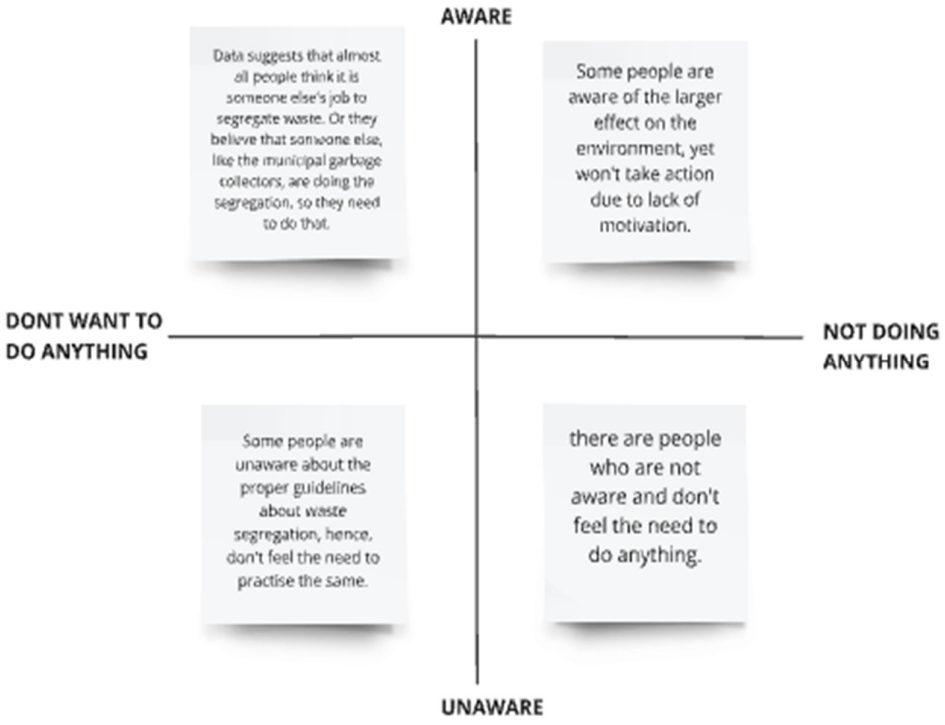

Figure 1: Represents Quadrant Analysis of Public Attitudes Toward Waste Segregation Behavior.

Design criteria emerged, inspiring innovative solutions such as gamified society apps, waste-separating kitchen sinks, and professional housekeeping training. This multifaceted analysis provided a comprehensive understanding of household waste management behaviors and practical pathways for improving sustainable practices. This diagram in Figure 1 categorizes individuals based on their awareness of waste segregation and their willingness to act. It highlights four behavioral archetypes: (1) aware but apathetic individuals who rely on others, (2) environmentally conscious but unmotivated individuals, (3) uninformed individuals who feel disengaged, and (4) those unaware of guidelines and thus uninclined to participate. The matrix provides a nuanced understanding of psychological and behavioral barriers to sustainable waste management practices.

4. RESULT AND DISCUSSION

The data transcription process involved systematically labeling responses collected from semi-structured interviews and surveys, revealing prevalent patterns around household waste segregation behaviors. Key terms such as “habit,” “mandates,” and “self-fulfillment” emerged as primary drivers for waste segregation. Participants often segregated waste either out of established routine behaviors, societal rules, or intrinsic personal satisfaction. These recurring patterns allowed the classification of responses into broader thematic groups that articulate the current state of waste management practices among households.

A dominant theme identified was the perception that two types of dustbins, commonly termed "wet" and "dry" waste bins, are sufficient for segregation purposes. This binary classification, while prevalent, was accompanied by considerable confusion among participants regarding the nomenclature. Many found the labels "wet" and "dry" ambiguous, which likely impacts the efficiency of segregation efforts. The majority associated wet waste predominantly with kitchen waste, reinforcing a limited but consistent understanding of waste categories. Notably, participants expressed concern for the safety of waste collectors, indicating an awareness of the broader social implications of waste management practices. Another significant insight pertained to the motivation behind segregation behavior. The data indicated that segregation is mostly practiced due to external enforcement, such as housing society mandates or societal norms, rather than voluntary action. Many participants emphasized that they would comply with segregation protocols only if mandated by their housing society, underscoring the critical role of governance and regulation. Conversely, a large segment reported no segregation behavior in the absence of clear incentives or penalties. This highlights a motivation deficit, where personal convenience and effort outweigh environmental considerations in influencing behavior.

Education and infrastructure deficits emerged as important barriers. Participants lamented the lack of practical education about waste segregation in schools, signaling a systemic gap in awareness-raising efforts. Moreover, the unavailability of adequate disposal systems was cited as a practical obstacle preventing effective segregation, suggesting that behavioral change alone is insufficient without enabling infrastructure. The thematic analysis revealed that knowledge and awareness levels varied widely, with many participants expressing confusion about the rationale behind the three-bin segregation system recommended by waste management authorities. Simplifying this understanding emerged as a crucial prerequisite for improving compliance. Habit formation was identified as a powerful factor; once segregation becomes routine, individuals tend to continue the practice regardless of initial motivations. However, without external motivators, initiating this habit remains challenging. Figure 2 shows the data collected from the survey regarding the practice of partial waste segregation. Surveys show that only 15% of the collected database practice partial waste segregation (segregation between wet & Dry waste) in their routine.

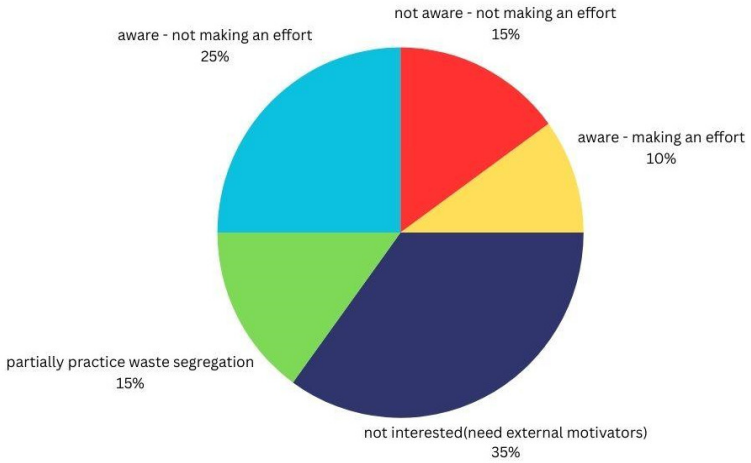

Figure 2: Displays the survey results about the partial waste segregation practice.

Participants also emphasized the need for external motivation mechanisms, whether rewards or penalties, to sustain regular segregation behaviors. The existing bin labeling system was frequently described as confusing and requiring simplification to enhance user-friendliness. An interesting and often overlooked insight was the role of domestic workers in waste handling. Their involvement is essential for effective segregation, given their routine contact with household waste. This points to the necessity of inclusive education and training programs targeting all household members. Concerns regarding system efficiency were frequently voiced. Participants noted that segregation efforts become futile if waste is mixed during subsequent handling stages. An effective waste management infrastructure is thus critical to maintain the integrity of segregation practices. Finally, participants preferred waste segregation processes that integrate smoothly into existing household routines without adding excessive workload. This preference for minimal disruption implies that interventions must be pragmatic and user-centric.

The findings reveal a complex landscape of household waste segregation behavior influenced by knowledge, motivation, social norms, and systemic factors. Fundamentally, the study illustrates that waste segregation in Indian households is often more a function of external compulsion than intrinsic motivation. Participants demonstrated a general reluctance to engage in segregation voluntarily, citing the inconvenience and effort involved as significant deterrents. This attitudinal inertia suggests that current strategies relying solely on awareness campaigns may not be sufficient to effect meaningful behavioral change. The dominance of habit and societal mandate as motivators highlights the critical role of regulation and enforcement. Despite the existence of housing society rules and government mandates on segregation, enforcement appears weak or inconsistent. The lack of actionable, tangible incentives results in low compliance. Thus, an extrinsic motivator, whether positive (rewards) or negative (penalties), is essential to catalyze the necessary behavioral shift. This aligns with broader behavioral economics principles, where habits form most effectively when reinforced by consequences that residents perceive as significant.

The data underscore the importance of moving beyond mere compliance to fostering sustainable habit formation. Habitual segregation reduces cognitive load and resistance over time, making environmental responsibility a normalized behavior. The challenge lies in initiating this habit amidst existing apathy and logistical barriers. Introducing mechanisms that create immediate, meaningful impacts, such as gamified reward systems, public recognition, or fines, could establish the initial momentum required for habit internalization. The confusion around bin nomenclature and waste categories emerged as a critical bottleneck. The general public's limited understanding of waste segregation nuances, especially the complexity of the three-bin system, necessitates clearer communication and educational reforms. Simplifying bin labels to terms such as "compostable," "recyclable," and "non-recyclable" might enhance comprehension and compliance [16], [17]. Moreover, embedding practical waste management education into school curricula could build foundational awareness and cultivate environmentally responsible behavior from an early age.

Another vital insight pertains to the role of infrastructure in facilitating segregation. Many participants indicated that even willing individuals are hampered by inadequate waste disposal systems, which hinder effective segregation efforts. This points to the systemic nature of the challenge, where behavioral change initiatives must be complemented by investments in accessible, user-friendly waste management infrastructure. Involving all household members,

particularly domestic workers, in waste segregation emerged as an often-neglected but necessary strategy. Since domestic workers frequently manage household waste, their awareness and training directly impact segregation quality. Inclusive programs that engage all stakeholders within a household could thus improve segregation outcomes. System inefficiency also poses a substantial risk to the overall effectiveness of segregation practices. Participants expressed frustration that segregation efforts are negated if mixed by downstream handlers. This calls for the establishment of an end-to-end waste management ecosystem that preserves segregation integrity through collection, transport, and processing stages. Without such systemic coherence, household efforts risk becoming symbolic rather than substantive.

The research also highlights a preference for minimally disruptive interventions integrated with existing routines. Waste segregation initiatives that demand significant additional effort are unlikely to gain traction. User-friendly designs, whether in bin labeling, collection logistics, or incentive mechanisms, should prioritize convenience to maximize participation. Based on these findings, several actionable recommendations emerge [18], [19]. First, government agencies must strengthen enforcement mechanisms by implementing clear penalties and rewards linked to segregation behaviors. Strict rules combined with public awareness campaigns would increase accountability and normalize segregation as a civic duty.

Second, leveraging technology through a gamified society app could incentivize residents effectively. By tracking segregation performance and offering rewards, points, and public recognition, such platforms create social motivation and engagement. Public leaderboards and tangible perks encourage healthy competition and sustained behavior. Third, introducing innovative products like a garbage disposal sink that segregates and processes kitchen waste could reduce the burden on households while promoting composting [20], [21]. Marketing such products based on convenience and cleanliness, rather than just segregation, may enhance adoption rates. Fourth, training and professionalizing housekeeping services to strictly follow segregation protocols ensures that domestic workers are competent and motivated to maintain segregation standards. This systemic approach addresses a critical weak link in household waste management.

In conclusion, this study demonstrates that waste segregation practices in Indian households are influenced by a combination of habit, regulation, knowledge, and systemic factors. The current low adoption rates are symptomatic of inadequate enforcement, poor awareness, confusing nomenclature, and insufficient infrastructure. Behavior change requires externally motivated habit formation supported by practical education and seamless integration with existing routines. Future interventions must be multifaceted, combining policy enforcement, technological innovation, education, and infrastructural support to drive sustainable waste management behaviors. The proposed design solutions offer promising pathways to address these challenges, ultimately contributing to more effective and socially responsible waste disposal systems.

5. CONCLUSION

The findings of this study underscore the deeply rooted behavioral, cultural, and systemic challenges that hinder effective waste segregation in Indian urban societies. Despite widespread acknowledgment of the importance of segregating waste, practical implementation remains limited due to confusion, lack of incentives, and systemic inefficiencies. Most individuals are reluctant to make the additional effort unless compelled by strict societal norms

or tangible rewards. This inertia, compounded by cultural habits and a perception of inconvenience, has rendered most segregation efforts inconsistent or symbolic. To address these entrenched barriers, the proposed Society Garbage Disposal Application provides a robust, dual-interface platform for both residents and society committees. By integrating government-backed incentives such as tax rebates and penalties with community-based gamification features like leaderboards and performance tracking, this system fosters accountability while promoting social motivation. The application not only simplifies enforcement but also instills a sense of responsibility and pride among participants. A cultural shift is both necessary and achievable. Through strong policy enforcement, targeted awareness campaigns, and seamless technological integration, communities can transition toward a sustainable waste management ecosystem. This collaborative, incentive-driven model presents a viable path toward cleaner neighborhoods and more environmentally conscious urban living, aligning individual behaviors with broader ecological goals.

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CHAPTER 8

EXPLORING THE BALANCING ACT OF EQUILIBRIUM IN DESIGN EDUCATION

Disha Gulwani[1], Riyaa Khanna[2], Vithika Agrawal[3], Prasad Anaokar[4]
[1,2,3]Student, [4]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3,4]Atlas Skilltech University, Mumbai
Email: disha.gulwani.bdes2026@atlasuniversity.edu.in[1], riyaa.khanna.bdes2026@atlasskilltech.univeristy[2], vithika.agrawal.bdes2026@atlasuniversity.edu.in[3], prasad.anaokar@atlasuniversity.edu.in4

ABSTRACT:

This research delves into the intricate tension between academic rigors and extracurricular engagement within the context of design education. It investigates the underlying structural and pedagogical frameworks of design programs that often prioritize intensive studio work, time-bound project submissions, and competitive output-driven curricula, leaving little room for students to engage in non-academic activities that foster interpersonal, leadership, and entrepreneurial skills. Relying on a comprehensive review of secondary literature, the study situates the issue within the broader ecosystem of higher education, where the cultivation of holistic competencies is increasingly seen as indispensable for professional readiness. The analysis brings systemic constraints restricting student agency, such as rigid course schedules, lack of institutional flexibility, and undervaluation of non-curricular contributions. Through this exploration, the research articulates the urgent need to rethink how equilibrium can be achieved where academic excellence coexists with spaces for self-exploration, collaborative practice, and skill diversification. It calls attention to the pedagogical shift required to align design education with the evolving expectations of the creative industries and the complex societal roles future designers are expected to assume.

KEYWORDS:

Academic Flexibility, Curriculum Design, Design Education, Holistic Development, Student Engagement.

1. INTRODUCTION

The college environment serves as an incubator of multidimensional growth, blending academic pursuits with opportunities for self-discovery, social engagement, and skill acquisition beyond the classroom. Within this critical phase, students are expected to navigate multiple responsibilities, ranging from academic commitments to participation in extracurricular activities that shape their emotional intelligence, leadership acumen, and professional readiness [1]. These non-academic engagements are not peripheral luxuries but essential components of a well-rounded educational experience [2]. In the realm of higher education, the increasing emphasis on producing graduates who are not only technically proficient but also emotionally agile and socially competent underscores the imperative of fostering a balanced ecosystem where academic and extracurricular domains complement one another.

For students enrolled in design programs, the challenge of striking this balance becomes particularly acute. Design education, by its very nature, is rooted in time-intensive studio work, iterative project-based learning, constant critique, and the demand for sustained creative output. The structure of such programs is often rigid, leaving minimal flexibility in terms of schedule,

workload, or intellectual bandwidth. As a result, students are frequently consumed by academic obligations that operate on tight deadlines and performance-driven assessments [3], [4]. This intense academic atmosphere leaves little breathing room for engagement in activities outside the studio, be it student organizations, interdisciplinary workshops, volunteering, sports, or internships that are equally vital for long-term professional success and personal fulfillment.

The disconnect between academic expectations and extracurricular involvement is not merely an issue of time management. It represents a deeper, structural misalignment within the educational model itself. Design curricula are often constructed around immersive, full-time learning, where students are expected to be mentally and physically present for extended hours [5]. Unlike other academic disciplines where modular coursework or lecture-based teaching allows some degree of flexibility, design programs rely heavily on collaborative workspaces, iterative development, and peer critique processes, which demand a continuous presence [6]. As a result, students often experience exhaustion, reduced motivation, and a narrowing of their developmental scope. These consequences ripple through their college life, restricting not only their social engagement but also limiting their exposure to real-world professional networks and skill-building environments that lie outside the confines of academic studios.

Secondary research provides compelling evidence regarding the value of extracurricular engagement in the lives of college students. These engagements are shown to improve interpersonal communication, foster adaptability, and nurture emotional resilience. Participation in clubs, sports, student-led initiatives, volunteer programs, and external internships enhances a student's profile and introduces them to diverse perspectives and disciplines [7]. For design students, whose future careers hinge on collaboration, empathy, storytelling, and interdisciplinary fluency, these engagements are not ancillary but deeply relevant. They form the bedrock for understanding social narratives, user-centric design, and the behavioral dimensions that modern design problems demand. Yet, despite the acknowledged benefits, many design students struggle to bridge the gap between what the academic system demands and what their broader developmental needs require.

This schism between institutional offerings and student priorities points to a failure in curricular inclusivity. Most institutions tout extracurricular programs as essential aspects of campus life, highlighting them in brochures and orientation speeches. Yet, they seldom adapt their academic structures to accommodate meaningful student participation in these activities [8]. The problem becomes one of systemic exclusion, where the very design of the program inadvertently sidelines opportunities for personal growth. This is especially problematic in creative disciplines, where real-world engagement and exposure to diverse social contexts play a vital role in informing the design process [9].

Design education is meant to cultivate more than just visual aesthetics or functional products; it aims to shape designers as empathetic thinkers, capable communicators, and agents of change. These qualities are best developed through a blend of academic rigor and real-world experiences, not through studio isolation.

Interviews, case studies, and narrative analyses from prior research illustrate that the pressures of design school often leave students feeling overwhelmed and isolated. The constant requirement to meet creative expectations without sufficient mental rest or exposure to diverse experiences leads to burnout, creative stagnation, and in some cases, disengagement. This erosion of creativity contradicts the core philosophy of design itself, which thrives on observation, collaboration, experimentation, and reflection. Without sufficient interaction with the world outside the classroom, students risk developing solutions in a vacuum, disconnected from the social and cultural contexts in which their designs are meant to operate. Therefore,

the problem extends beyond personal stress to professional deficiency. Graduates may leave with strong portfolios but without the adaptability or interpersonal nuance required in contemporary design professions.

From an administrative perspective, the challenge lies in redefining the structural parameters of design education to enable a more inclusive, balanced, and responsive learning environment. This does not imply a dilution of academic standards, but rather a reimagining of how educational outcomes are achieved [10], [11]. Alternative scheduling, interdisciplinary credits, embedded co-curricular requirements, and flexible workload policies are some of the innovations that merit exploration. Moreover, faculty attitudes play a critical role. In many institutions, extracurricular engagement is still viewed as a distraction or a deviation from academic focus. Such mindsets reinforce the dichotomy between academic performance and holistic development, further marginalizing the value of student-led initiatives and personal exploration.

This research seeks to unpack these tensions through a qualitative lens, emphasizing the lived experiences of students within design programs. By focusing on how institutional structures, pedagogical approaches, and time allocation models shape or constrain extracurricular participation, the study aims to reveal the structural inequities embedded in design education. The intention is not to undermine the importance of academic excellence, but to question its current configuration in light of the developmental needs of students preparing for dynamic, socially embedded careers in design. Through secondary research, the study builds a narrative that challenges traditional assumptions and encourages educational stakeholders to reconsider how balance can be built into the design of education itself.

2. LITERATURE REVIEW

Dumitrascu [12] examined the impact of students' participation in extracurricular activities on skill and competency development through factorial analysis. The author utilized a questionnaire-based approach and collected responses from 728 students across five Romanian universities. The gathered data was analyzed using the SPSS statistical software. Through factorial analysis, the study identified key associations between extracurricular involvement and the enhancement of organizational skills, communication abilities, social competencies, and integration capacity. The findings suggested that such activities contributed meaningfully to personal and professional growth, demonstrating their relevance within academic settings for fostering essential soft skills among university students.

Assante *et al.* [13] examined the influence of autonomous motivation, cognitive engagement, and emotional self-regulation on students' participation in extracurricular activities (ECAs). They proposed that individual psychological attributes, such as positive refocus, positive reappraisal, and emotional regulation, influenced motivation and engagement, which subsequently enhanced involvement in ECAs. A structural equation model was used to test these relationships. The findings revealed that positive refocus and reappraisal significantly predicted ECA participation. Emotional self-regulation was found to positively affect both autonomous motivation and cognitive engagement, which in turn increased ECA involvement. The study discussed the broader implications for student development and outlined several limitations that could guide future research.

Ginosyan *et al.* [14] examined the role of extracurricular activities in supporting foundation program students at Sultan Qaboos University, Oman. This paper explored how teachers perceived their impact on student development in eight key areas, including language skills, academic performance, communicative competence, motivation, self-esteem, and transitional challenges. Teachers believed these activities helped students better adjust to higher education

and improve their English proficiency. They also recognized benefits in boosting students' confidence, engagement, and cross-cultural understanding. The study highlighted the need for increased student involvement and more structured support to enhance motivation and deepen learning experiences through such extracurricular initiatives.

Manuas [15] investigated how effective English extracurricular activities were in improving students' speaking skills, with a focus on gender and age. It was carried out at SMA X and included 105 students from grades 10 to 12 across both IPA and IPS streams. Using a questionnaire adapted from Fatash (2008), the findings revealed a high involvement rate among students, with an average score of 3.83. A significant difference in perceptions based on gender was observed, with a p-value of .000, suggesting male and female students viewed the activities differently. No significant difference was found based on age ($p = .50$), indicating uniform perception across age groups.

Chapman *et al.* [16] explored the motivations driving higher education students to participate in extracurricular activities as a means to enhance their value in competitive job markets. Through 46 in-depth interviews at a widening-participation university, four key motivations emerged: extrinsic, intrinsic, social, and pro-social. These motivations varied by activity type; extrinsic motives were linked to employment-focused activities, intrinsic and social motives to sports and societies, and pro-social motives to volunteering and academic societies. The study also revealed differences between early- and late-stage students, indicating that motivations evolved throughout the university journey. The findings contributed new insights into how motivations shape extracurricular engagement in a marketised higher education context.

3. METHODOLOGY

3.1.Design:

The methodology employed in this research draws upon a human-centered approach integrating three core methods: what people say, what people do, and what people make, to holistically explore the challenges faced by design students in engaging with extracurricular activities. Recognizing the complexity of student experiences, particularly where verbal expression may not fully capture latent needs or behaviors, this approach combined structured interviews, observational ethnography, and visual prompts. In the preparation phase, a sample of extreme users was deliberately chosen to represent both ends of the participation spectrum: students deeply involved in extracurriculars and those largely disengaged. Interview scripts were meticulously designed to elicit reflections on time management, participation motivations, and perceived barriers, supplemented by visual prompt cards representing popular extracurricular categories like football, debate, music, and dance. These tools catalyzed richer discussions, encouraging participants to articulate personal priorities and contextualize their engagement. The research team rotated roles, interviewer, note-taker, and recording assistant, to ensure comprehensive and unbiased data capture. During the execution phase, contextual inquiries were conducted in comfortable, familiar settings with four selected design students. Interviews were thematically anchored around students' journeys, information-gathering behaviors, and actual involvement practices. These conversations were complemented by unobtrusive observations during studio hours and leisure breaks, enabling real-time insights into behavioral patterns. Post-interview feedback ensured interpretive accuracy and reinforced data validity.

3.2.Sample:

Table 1 outlines the demographic and engagement profiles of four design students selected for qualitative research. It reflects a deliberate spread across years of study, gender, and levels of extracurricular involvement. DS01 and DS04 are highly engaged, balancing academics with

activities like dance, hackathons, and sports. DS02 shows minimal participation, citing burnout from studio work. DS03, moderately involved, joins debates and volunteers to enhance her resume.

Time spent on studio work varies, influencing participation levels. Academic performance is mostly average to high across the sample. Each participant's motivation, ranging from social networking to stress management, offers critical insight into the varied reasons students choose to engage or withdraw from extracurricular activities.

Table 1: Displays the engagement profiles of the four students taken as a sample for the research.

Participant Code	Year of Study	Level of Extracurricular Engagement	Type of Activities Involved (if any)	Academic Performance (Self-reported)	Remarks on Participation Motivation
DS01	2nd Year	High	Dance Club, Design Hackathons	Above Average	Seeks visibility and networking, enjoys multitasking
DS02	3rd Year	Low	None	Average	Feels overwhelmed, prefers downtime post-studio work
DS03	4th Year	Moderate	Debate Team, Volunteering Events	High	Participates for resume value and skill development
DS04	1st Year	High	Sports, Campus Design Projects	Above Average	Values peer interaction and practical exposure

3.3.Instruments:

The primary sources of information for this research included academic journals on design education, institutional reports, student feedback surveys, and case studies from universities promoting holistic development. Secondary data was gathered from educational policy documents, curriculum structures, and extracurricular program frameworks. Tools and instruments utilized in the research involved structured questionnaires, focus group discussions, and in-depth interviews with design students and academic coordinators. The analysis was supported by qualitative coding software (NVivo) to identify recurring patterns, and comparative matrices were developed to assess institutional flexibility. These methods provided a comprehensive understanding of existing gaps and helped conceptualize the Integrated Growth Hub as a multidimensional solution.

3.4.Data collection:

The bar graph in Figure 1 illustrates the percentage of students engaged in various extracurricular activities. Physical Activities lead with the highest participation at 35%, followed by Cultural Events at 30%. Clubs attract 25% of students, while Spiritual Activities have the lowest involvement at just 10%. This data suggests a strong student inclination toward physically engaging and culturally enriching experiences, with comparatively limited interest in spiritual involvement. The overall distribution reflects diverse interests, but also highlights potential areas where institutional encouragement could boost underrepresented forms of participation.

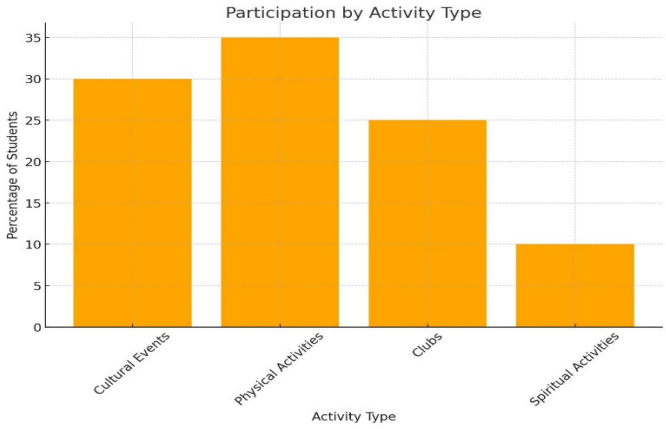

Figure 1: Shows the percentage of students participating in various activities.

Similarly, Figure 2 presents how students distribute their weekly time for non-academic engagements. The majority, 50%, dedicate between 1 to 10 hours per week. Meanwhile, 25% of students report spending no time at all, indicating either academic overload or lack of interest. Another 25% invest over 11 hours weekly, signifying a strong commitment to extracurricular involvement. This distribution emphasizes that while most students maintain moderate participation, a significant segment either neglects or intensely engages in such activities, highlighting a potential imbalance that institutions must address.

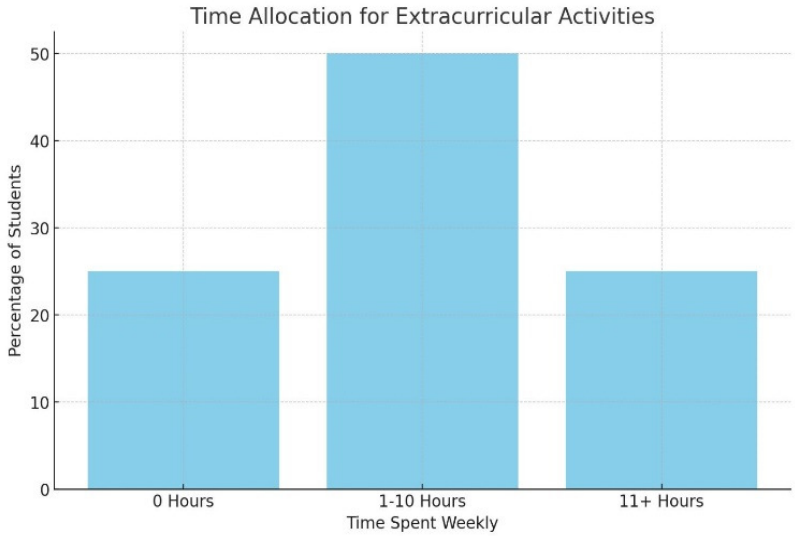

Figure 2: Represents the time distributed by students for non-academic engagements.

3.5.Data analysis:

The data analysis commenced with transcribing interviews and coding the responses to identify recurring themes. Using ATLAS.ti, the research team extracted key codes such as academic priority, time management, awareness, career development, and community building. These codes were visually structured into thematic clusters through digital tools like Miro, allowing for deeper pattern recognition. Participant quotes were mapped under corresponding codes to ensure contextual relevance and accuracy. This analytical structure enabled the emergence of higher-level insights, which were then distilled into provocations and actionable design criteria. The entire process was instrumental in translating raw qualitative input into meaningful findings that informed the core conclusions and design implications of the study. Figure 3 presents the codes obtained from the thematic analysis.

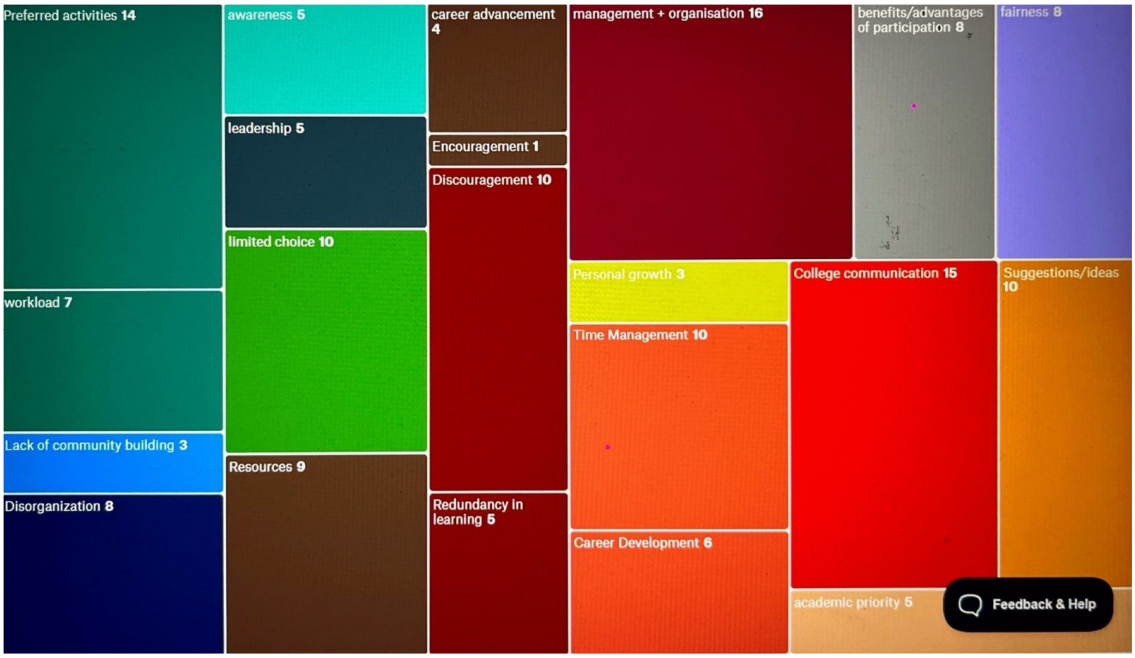

Figure 3: Depicts the extracted key codes from the data analysis.

4. RESULT AND DISCUSSION

The analysis of student engagement in extracurricular activities reveals a persistent tension between academic priorities and personal development pursuits. The dominant theme emerging from this study is that students overwhelmingly prioritize academic work due to institutional constraints that limit the value and feasibility of extracurricular involvement. This prioritization is not a reflection of disinterest but rather a direct consequence of overwhelming academic workloads, lack of institutional recognition, and inadequate support structures that fail to integrate extracurricular activities meaningfully into the broader educational framework [17]. The findings articulate that students feel compelled to focus on academic responsibilities because these are directly tied to tangible outcomes such as grades, credits, and career advancement, whereas extracurricular activities are often perceived as secondary or optional, lacking formal acknowledgment or relevance.

Students consistently reported that their academic workload is intense and often unmanageable, leaving little room for extracurricular participation. This overload is compounded by the absence of mechanisms that could allow them to balance these two dimensions effectively. The institutional culture, which tends to prioritize academic achievement above all else, reinforces

this pressure. The lack of flexible academic structures or policies that acknowledge extracurricular engagement creates a scenario where students feel forced to sacrifice personal growth opportunities for academic success. This dynamic foster an environment where time management becomes a critical challenge, and students struggle to find equilibrium, often resulting in extracurricular activities being sidelined. This highlights the urgent need for systemic reforms that recognize extracurricular involvement as an integral component of the educational experience rather than an ancillary activity.

The research also highlights a significant deficit in community building and social cohesion within extracurricular programs. Many students experience a lack of meaningful interaction and a sense of belonging in these activities. This disconnect arises from poor organization, limited collaborative opportunities, and a mismatch between available activities and students' interests. The absence of structured mentorship or peer-led initiatives further exacerbates feelings of isolation and disengagement [18]. These findings underscore the importance of designing extracurricular programs that emphasize community formation, inclusive participation, and peer support to enhance student engagement and satisfaction. Creating environments where students can build lasting relationships through team-based projects or mentorship models could transform the extracurricular experience into a more compelling and rewarding part of student life. Figure 4 shows a sense of belonging towards the extracurricular activities among the students.

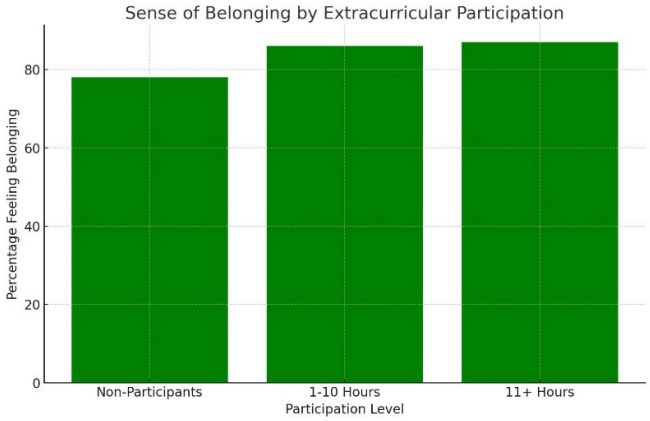

Figure 4: Provides a sense of belonging by participation level.

Another critical barrier identified is the lack of tangible outcomes from extracurricular participation. Students express skepticism regarding the value of these activities when they do not translate into academic credits, career certifications, or direct skill development linked to their professional goals. Without formal recognition or clear relevance to their future careers, extracurriculars are viewed as peripheral and, at times, an inefficient use of limited time. This perception is particularly pronounced among design students who are acutely aware of the competitive academic environment and career pressures. Addressing this gap requires institutions to develop frameworks that integrate extracurricular accomplishments into academic records and career development pathways. Providing official certificates, credit points, or linking activities to employable skills would enhance motivation and legitimize extracurricular involvement as a meaningful investment in students' futures. Figure 5 depicts the barriers to extracurricular participation.

The limited variety and flexibility of extracurricular options also emerged as a significant concern. Students feel constrained by the narrow scope of activities offered, which often fail to align with their diverse interests or passions. This lack of choice restricts engagement and

fosters dissatisfaction. Additionally, rigid scheduling and timing conflicts further limit accessibility. Many students remain unaware of the full range of opportunities due to fragmented communication strategies that rely heavily on passive information dissemination [19]. These factors collectively create barriers to participation, even among students who are interested and motivated to engage beyond their academic duties. To counter this, institutions must adopt a student-centric approach by expanding the portfolio of extracurricular activities based on ongoing feedback, enabling student-driven initiatives, and implementing transparent, centralized communication platforms that improve awareness and accessibility.

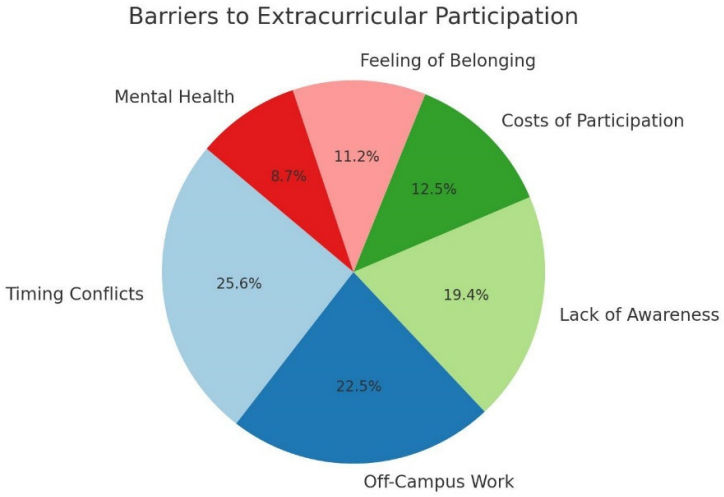

Figure 5: Shows the challenges to the challenges to extracurricular participation.

Organizational inefficiencies within extracurricular programs contribute significantly to student discouragement. Disorganization, poor management, and lack of clear leadership structures generate confusion and frustration. These issues lead to perceptions of extracurricular activities as chaotic or unproductive, diminishing student enthusiasm to participate. Furthermore, inadequate institutional promotion and recognition exacerbate these challenges, as students often feel their efforts go unnoticed or undervalued. The fear of social judgment or failure in leadership roles, amplified by the absence of supportive communities or mentorship, discourages many from stepping into extracurricular involvement. This calls for professionalizing the management of extracurricular programs through the establishment of clear organizational frameworks, designated coordinators, and improved communication channels. Such reforms would create a more supportive and motivating environment, encouraging broader student participation.

Communication gaps are another significant impediment to extracurricular engagement. The scattered nature of information dissemination across various platforms and departments makes it difficult for students to obtain a comprehensive understanding of available opportunities. The lack of active promotion and reliance on passive channels such as emails or bulletin boards further reduces visibility [20], [21]. This fragmentation results in many students remaining unaware of activities that might align well with their interests or academic schedules. Addressing these issues requires the development of centralized, user-friendly platforms where students can easily access detailed information about all extracurricular opportunities. Regular promotional events and active marketing strategies would also increase visibility, ensuring that students remain informed and engaged. At the core of these challenges lies an institutional culture that prioritizes academic achievement over holistic student development. Many educational institutions do not actively promote or integrate extracurricular participation within

their curricula or institutional policies. This narrow focus leads to insufficient resource allocation, a lack of dedicated staff, and the absence of formal mechanisms to encourage and reward participation in extracurricular activities. Without systemic endorsement, extracurricular programs are relegated to peripheral status, perceived as optional rather than essential components of a well-rounded education. To shift this culture, institutions must redefine their values to embrace holistic development as equally important to academic success. This can be operationalized by embedding extracurricular requirements within graduation criteria, providing dedicated funding and staffing, and cultivating a campus-wide ethos that celebrates diverse achievements.

The cumulative insights from this research point to the necessity of reimagining how institution's structure and support extracurricular involvement. A promising solution lies in the creation of integrated systems that harmonize academic and extracurricular pursuits, enabling students to flourish across multiple domains. The proposed Integrated Growth Hub (IGH) exemplifies such innovation. By offering personalized growth plans that blend academic goals with extracurricular ambitions, powered by AI-driven recommendations, students gain tailored pathways that acknowledge their unique aspirations. Recognizing extracurricular contributions through a credit system linked to real-world skills provides tangible incentives and career benefits. The establishment of collaborative spaces encourages interdisciplinary interaction, while a gamified currency system motivates sustained engagement through rewards and exclusive opportunities. Dynamic scheduling systems alleviate timing conflicts, allowing students to adapt their participation in response to academic demands without forfeiting extracurricular involvement.

This holistic model addresses the multifaceted barriers uncovered in this study by embedding flexibility, recognition, community, and integration into the student experience. It transcends traditional silos between academic work and extracurricular engagement, fostering a balanced environment conducive to personal growth, skill development, and career readiness. The Integrated Growth Hub aligns with broader educational research emphasizing the importance of extracurricular activities for well-rounded development and workforce preparedness. It also directly tackles unique challenges identified in design education, such as workload intensity and the need for creative collaboration, positioning institutions to support student success comprehensively.

5. CONCLUSION

In conclusion, this research has underscored a pressing and often overlooked concern within design education: students' persistent struggle to reconcile academic demands with meaningful extracurricular involvement. The rigid structure of existing academic frameworks leaves minimal room for students to explore personal interests, creative collaborations, or holistic self-development. Such an imbalance not only restricts innovation and interdisciplinary growth but also impacts students' mental well-being, motivation, and real-world readiness. To address this systemic challenge, the proposed Integrated Growth Hub (IGH) offers a transformative institutional blueprint. By embedding personalized development pathways, formally recognizing extracurricular efforts through academic credits, facilitating interdisciplinary collaboration through dedicated spaces, introducing a gamified ecosystem to incentivize participation, and aligning academic calendars with a holistic timing grid, IGH fosters an environment where academic and extracurricular pursuits are not mutually exclusive but mutually reinforcing. This model empowers students to flourish intellectually, creatively, and socially, promoting a more dynamic and sustainable educational experience. Future inquiry should rigorously test the IGH framework across varied institutional and cultural contexts to validate its adaptability, impact, and scalability. Such research will not only enhance the model

but will also set the stage for a paradigm shift in academic policy, enabling institutions to nurture well-rounded, resilient, and innovative design professionals prepared for the complexities of a rapidly evolving world.

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CHAPTER 9

EXAMINING THE EFFECTIVE WASTE MANAGEMENT AND SEGREGATION IN RESIDENTIAL APARTMENTS

Aahna Jain[2], Shruti Rahane[2], Tanishk[3], Prasad Anaokar[4]
[1,2,3]Student, [4]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3,4]Atlas Skilltech University, Mumbai
Email: aahna.jain.bdes2026@atlasuniversity.edu.in[1], shruti.rahane.bdes2026@atlasuniversity.edu.in[2], prasad.anaokar@atlasuniversity.edu.in[4]

ABSTRACT:

Effective waste management and segregation in residential apartments have emerged as critical imperatives in the pursuit of sustainable urban living. The challenges of improper waste handling in densely populated apartment complexes extend beyond environmental degradation to include public health hazards and inefficiencies in recycling and disposal systems. This study critically examines the dynamics of waste segregation within residential communities, employing a comprehensive qualitative methodology encompassing ethnographic fieldwork, semi-structured interviews with residents, sanitation personnel, and municipal officials, as well as usability testing of existing waste disposal mechanisms. The findings reveal systemic shortcomings, including limited public awareness, inadequate infrastructural provisions such as bins and signage, and fragmented implementation of municipal segregation policies. Furthermore, the study identifies behavioral resistance and communication gaps among stakeholders as key barriers to achieving compliance. The absence of continuous engagement and feedback mechanisms exacerbates these issues, undermining even well-intentioned policies. Based on these insights, the study proposes strategic interventions, such as community-centered awareness drives, integration of smart waste tracking technologies, and enforcement protocols tailored to residential settings. Policy recommendations emphasize the need for a multi-stakeholder, data-driven approach that combines regulatory oversight with behavioral nudges. This research not only highlights the urgency of rethinking urban waste governance but also provides a pragmatic roadmap to streamline segregation efforts and promote ecologically responsible urban lifestyles.

KEYWORDS:

Behavioral Compliance, Infrastructure, Municipal Policy, Sustainability, Waste Segregation.

1. INTRODUCTION

Urban environments today are grappling with the complexities of sustainability amid rapid population growth, lifestyle changes, and infrastructure stress. Among these pressing urban challenges, the effective management of municipal solid waste (MSW) has become a defining test of sustainable governance [1]. Waste generated by residential apartment complexes, which are high-density hubs of urban habitation, constitutes a significant fraction of this mounting problem. As cities expand vertically and horizontally to accommodate swelling populations, the volume of household waste generated in these settings has grown exponentially. Yet, waste segregation at the source, a critical prerequisite for sustainable disposal, recycling, and processing, remains largely ineffective in these contexts [2]. Despite municipal efforts and sporadic awareness campaigns, urban apartments continue to exhibit patterns of non-

compliance, unawareness, and poor infrastructural facilitation. This inefficiency not only undermines the economic viability of recycling systems but also imposes adverse effects on the environment and public health, leading to increased landfilling, emissions, groundwater contamination, and unhygienic conditions for sanitation workers. Figure 1 shows the process of solid waste management.

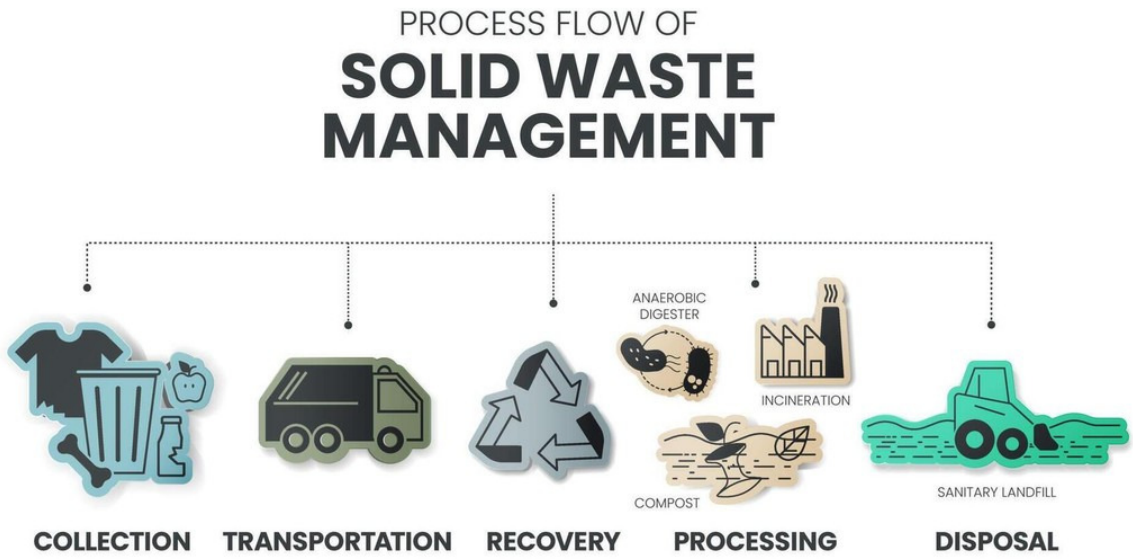

Figure 1: Represents the entire process of solid waste management.

The broader global context underscores the gravity of this issue. According to the World Bank, urban areas globally generate over 2.01 billion tons of municipal solid waste annually, a figure projected to rise to 3.40 billion tons by 2050. Within India alone, urban regions contribute over 62 million tons of waste each year. Yet, disconcertingly, nearly 60% of this waste remains unprocessed, indicating a glaring gap between generation and responsible disposal. This chasm is widest at the foundational level of source segregation. Residential apartment complexes are particularly prone to systemic and behavioral inefficiencies in managing waste [3], [4]. Overflowing garbage bins, inconsistent collection schedules, lack of color-coded segregation bins, and absence of real-time monitoring are typical manifestations of this crisis. Equally concerning is the general lack of awareness or willingness among residents to participate in waste segregation practices. The failure to segregate waste at the source leads to contamination of recyclable materials, rendering them unfit for recovery and reintegration into circular supply chains. As a result, the burden on landfill sites increases, and opportunities to convert waste into energy or compost are lost.

At the micro level, source segregation refers to the initial sorting of waste into distinct categories such as biodegradable, recyclable, and non-recyclable waste streams. This seemingly simple process is the linchpin of an efficient waste management system. Yet, urban realities suggest otherwise [5]. A multitude of barriers impede source segregation, ranging from cognitive dissonance and lack of sensitization among residents to infrastructural inadequacies and poor policy enforcement. Behavioral apathy towards sustainable disposal, often exacerbated by the absence of immediate consequences, remains a principal challenge. Residents may find segregation cumbersome, time-consuming, or unnecessary due to the absence of tangible incentives or regulatory consequences [6]. On the other hand, sanitation

workers, the unsung enablers of urban hygiene are compelled to manually sort mixed waste, exposing them to hazardous substances, infections, and unsafe working conditions. These workers often operate without protective gear, adequate training, or social security, making the system exploitative and unsustainable.

The institutional framework within which residential apartments function also contributes to segregation inefficiency. While municipal corporations mandate segregation at source and enforce fines for non-compliance, the ground-level implementation is fraught with inconsistencies. Many apartment associations lack the administrative capacity or motivation to enforce segregation norms uniformly. There is also an observable disconnect between policy formulation at the municipal level and ground-level execution. Infrastructural bottlenecks, such as the non-availability of designated bins, poor signage, and insufficient collection vehicles equipped for separate compartments, further dilute the efficacy of the segregation mandate [7]. Waste once segregated by residents is often recombined during collection, creating disillusionment and discouraging sustained efforts. In this challenging landscape, the current research endeavors to systematically examine the dynamics of waste segregation and management in urban residential apartments. The focus is three-pronged: understanding the behavioral tendencies of residents towards waste segregation, evaluating the infrastructural and systemic preparedness of residential complexes to support effective segregation, and assessing the perspectives and working conditions of sanitation personnel and municipal officials involved in waste collection and processing. By synthesizing these insights, the study aims to uncover the underlying reasons behind the low rates of effective segregation despite well-established policies and technical guidelines.

The methodology integrates ethnographic observation, semi-structured interviews, and usability testing of segregation systems. Residents, sanitation workers, and municipal officers form the core stakeholder groups whose lived experiences and operational challenges are captured and analyzed. Ethnographic engagement allows for a grounded understanding of the day-to-day practices and social dynamics within residential complexes, while interviews provide depth and narrative to individual and collective behaviors. Usability testing of waste disposal tools, bins, and systems provides a functional assessment of infrastructure and its alignment with user behavior [8]. The research identifies several converging factors that inhibit effective segregation. On the behavioral front, lack of knowledge, resistance to behavioral change, misconceptions about waste categories, and the absence of accountability mechanisms dominate. Infrastructurally, the absence of designated bins, improper placement, insufficient bin capacity, and lack of signage are prominent issues. From a systemic perspective, weak policy enforcement, irregular monitoring, and limited coordination between housing societies and municipal bodies emerge as critical limitations. The interplay between these factors creates a fragmented and ineffective waste segregation ecosystem that struggles to achieve compliance or sustainability.

Despite these challenges, the study also reveals opportunities. Positive deviance in some residential complexes where high segregation compliance has been achieved through sustained awareness campaigns, resident engagement, digital monitoring, and incentivization demonstrates the potential of targeted, community-driven interventions. These success stories form the basis for scalable models that can be adapted to other settings with similar demographic and infrastructural profiles [9], [10]. The objectives of this study are thus clearly outlined: to investigate the behavioral and systemic barriers to effective waste segregation; to

evaluate the usability and acceptance of segregation tools and practices within residential settings; and to formulate actionable, user-centered, and policy-aligned recommendations that can improve compliance and sustainability.

These objectives are anchored in the broader aim of empowering urban governance frameworks, municipal authorities, and community stakeholders to move toward an integrated, accountable, and resilient waste management system. In essence, this research is driven by the urgency to recalibrate urban waste governance through a granular understanding of the on-ground realities. It seeks not only to identify gaps but also to co-create solutions with stakeholders. The expected outcome is a set of evidence-based, pragmatic strategies that can serve as policy inputs, operational blueprints, and educational tools to advance the cause of sustainable urban living. As cities continue to grow, the burden on their waste systems will only increase unless proactive, intelligent, and inclusive waste segregation strategies are adopted at the residential level, beginning right at the point of waste generation.

2. LITERATURE REVIEW

Saari *et al.* [11] examined waste segregation and recycling practices among residents of high-rise buildings in Sentul, Kuala Lumpur, focusing on their knowledge, attitudes, and challenges. Using a cross-sectional design, data were collected through online questionnaires from 375 residents. The findings revealed that 57% had moderate knowledge and 61% faced notable challenges, yet 81% displayed a positive attitude toward waste sorting. Sociodemographic factors such as education, ownership status, marital status, and floor level significantly influenced behavior. A positive correlation existed between knowledge and attitude ($r = 0.57$), while a negative correlation was found between knowledge and challenges ($r = -0.25$). The study concluded that a lack of information hindered effective segregation, indicating a need for targeted interventions.

Sahoo *et al.* [7] explored household waste segregation practices in Ujjain city, India, emphasizing the need for socially acceptable, affordable, context-specific, and participatory approaches. Using the Motivation-Opportunity-Ability-Behaviour (MOAB) framework, the study conducted ten focus group discussions and eight in-depth interviews with male and female residents from both slum and non-slum areas. Data were digitally recorded, transcribed, and analyzed thematically. The findings revealed that while residents were motivated to segregate waste, many feared making mistakes. Waste segregation was observed to be emerging as a social norm, supported by improved infrastructure and social support systems. The study recommended educational interventions and the engagement of women's self-help groups to enhance community participation and literacy in sustainable waste segregation practices.

Sundaralingam *et al.* [12] addressed the pressing issue of unsegregated residential waste in India, which contributes approximately 36.5 million tons of solid waste annually. It identified that most household waste was discarded in a single bin and dumped in public containers without segregation, leading to landfill overload and environmental degradation. To tackle this, the study developed an automated household waste segregator using the TensorFlow object detection model integrated with an Arduino microcontroller. The SSD MobileNet V2 model, trained on categories like paper, plastic, metal, organic waste, glass, and an empty class, classified waste and directed it into designated bins. The system achieved a mean Average Precision of 86.5% and recall of 88.3%, promoting efficient source-level segregation.

Fereja *et al.* [13] assessed the status of solid waste management (SWM) practices in Dilla town, Southern Ethiopia, by quantifying and characterizing municipal solid waste through surveys and repeated field investigations. The average per-capita waste generation was found to be 0.475 kg/day, with organic waste comprising 68.40% by weight. Recyclables included 1.90% plastics and 1.50% paper. Key challenges identified were poor household segregation, limited public awareness, ineffective fee systems, lack of trained personnel, and inadequate infrastructure. The study emphasized composting organic waste as a viable solution and urged municipal authorities to enhance policy implementation. It provided a foundational benchmark for future SWM interventions and environmental health policy re-evaluation in the town.

Jaglan [14] examined the decarbonization potential of university campuses by integrating scientific waste management and circular economy principles. Conducted at the Residential University Campus (RUC) in Kharagpur, West Bengal, an environmental life cycle assessment compared existing municipal solid waste (MSW) practices with two proposed scenarios. The baseline system had the highest global warming potential (1388 kg CO_2 eq), while scenario S2 (50% sorting) and S3 (90% sorting) reduced emissions by 50.9% and 86.5%, respectively. Adopting anaerobic digestion and engineered landfills without energy recovery demonstrated notable environmental gains. The study highlighted that capital goods significantly influenced emission reductions and emphasized that infrastructure investment in S2 and S3 could lower long-term environmental costs.

3. METHODOLOGY

3.1.Design:

This study employed a user-centered ethnographic methodology to examine waste segregation practices in urban residential apartments. The approach was designed to generate an in-depth understanding of user behavior, infrastructural gaps, and systemic inefficiencies. The methodology was structured in two phases: preparation and execution, each critical in capturing qualitative insights across key stakeholder groups. The scope of the study was clearly defined, and stakeholders were identified based on their direct involvement with residential waste management. A purposive sampling strategy was employed to include extreme users, both compliant and non-compliant residents, across age, income, and household size. Sanitation workers and municipal officials were selected to capture operational and administrative perspectives. The research team was segmented into interviewers, observers, and transcribers to ensure rigorous data collection and documentation. Data were collected through 15 semi-structured interviews, five with each stakeholder group to explore experiences, challenges, and attitudes toward segregation. Ethnographic observations were conducted in five apartment complexes to monitor interactions with bins, disposal behavior, and worker responses to mixed waste. Usability testing was also conducted using multi-compartment bins, signage systems, and mobile apps to evaluate their functionality and user-friendliness. All participants were briefed on the study objectives, and informed consent was obtained. Anonymity and confidentiality were strictly maintained to ensure ethical compliance.

3.2.Sample:

A total of 15 semi-structured interviews were conducted, evenly distributed among three stakeholder groups: residents, sanitation workers, and municipal officials, each contributing five interviews. This triangulated approach was designed to ensure comprehensive insights

from varied perspectives within the waste segregation ecosystem. Interviews with residents aimed to capture behavioral patterns and household attitudes toward segregation practices. Sanitation workers were interviewed to understand operational challenges and health risks faced in the field. Municipal officials provided administrative and policy-level viewpoints. This multi-stakeholder engagement strategy enriched the dataset, offering a holistic view of systemic, behavioral, and operational dynamics in urban waste management. The table outlines the structure of the qualitative data collection process used in the study. Table 1 shows the structure used for the data collection of the research.

Table 1: Shows the structure used for the data collection of the research.

Stakeholder Group	Number of Interviews Conducted	Method Used	Purpose
Residents	5	Semi-Structured Interview	Understand household behaviors and attitudes
Sanitation Workers	5	Semi-Structured Interview	Capture frontline operational experiences
Municipal Officials	5	Semi-Structured Interview	Gain insights into policy, administration, and enforcement
Total Interviews **15**			

3.3.Instruments:

This research utilized both primary and secondary data sources. Primary data was gathered through structured surveys and in-depth interviews with residents, sanitation workers, and municipal officials across multiple residential complexes. Observational field visits were conducted to assess waste collection practices and infrastructure. Secondary data included municipal records, policy documents, academic journals, and reports from environmental NGOs. Tools and instruments employed included digital survey forms (Google Forms), audio recorders for interviews, and field notebooks for real-time observations. Data coding and analysis were performed using Microsoft Excel and NVivo software for thematic categorization. These combined methods enabled a comprehensive, evidence-driven understanding of behavioral patterns and systemic inefficiencies in urban waste segregation.

3.4.Data collection:

Five interviews per group revealed distinct yet interconnected insights. Residents acknowledged limited adherence to segregation, influenced by spatial constraints, insufficient knowledge, and mistrust of waste handling systems. Those in RWA-governed communities

showed higher compliance. Sanitation workers emphasized daily exposure to unsegregated waste, frequent health hazards, lack of protective gear, and emotional stigma, underscoring infrastructure and logistical challenges.

Municipal officials highlighted weak enforcement mechanisms, budgetary limitations, and gaps in public awareness. Collectively, the findings triangulate the behavioral, operational, and institutional factors impeding effective waste segregation and offer a comprehensive foundation for policy and practice reforms. The table offers a synthesized summary of findings from 15 semi-structured interviews conducted across three key stakeholder groups: residents, sanitation workers, and municipal officials. Table 2 shows the results obtained from the interviews.

Table 2: Provides the results obtained from the interviews.

Stakeholder Group	Number of Interviews Conducted	Key Findings (Results Obtained)
Residents	5	25% reported regular segregation; barriers included space constraints, limited knowledge, and distrust in the system. Positive behavior was observed in RWA-active communities.
Sanitation Workers	5	Reported exposure to hazardous waste due to poor segregation, a lack of PPE faced fatigue, and stigma; infrastructure inefficiencies were common.
Municipal Officials	5	Highlighted enforcement gaps, budget limitations, and insufficient infrastructure; recognized the need for better policy design and citizen engagement.
Total Interviews	15	Provided a multi-dimensional understanding of behavioral, operational, and systemic inefficiencies in segregation practices.

3.5.Data analysis:

The analysis revealed critical behavioral, systemic, and operational challenges undermining effective waste segregation in urban residential apartments. Only 25% of residents actively segregated waste, driven by environmental awareness, community participation, and RWA influence. Most residents failed to comply due to space constraints, lack of awareness, and distrust in waste collection systems, believing segregated waste is eventually mixed. Sanitation workers, pivotal to waste handling, faced serious occupational hazards from unsegregated waste, including health risks due to poor PPE availability, fatigue from manual sorting, and stigmatization. Systemic inefficiencies exacerbated the issue: unlabeled or overflowing bins, irregular collection, and inadequate infrastructure discouraged segregation. Policy gaps, weak enforcement, and insufficient municipal funding hampered large-scale implementation and outreach. These intersecting barriers emphasize the urgent need for integrated behavioral, infrastructural, and regulatory reform in urban waste management.

4. RESULT AND DISCUSSION

This research, utilizing thematic coding techniques, presents a comprehensive analysis of waste segregation behaviors, systemic inefficiencies, and challenges faced by sanitation workers in urban residential apartments. Drawing on qualitative data from interviews, observations, and usability testing, the findings reveal not only granular insights into everyday practices but also structural deficits in the broader waste management ecosystem. The overarching results are categorized into four interconnected domains: behavioral insights among residents, the operational context of sanitation workers, systemic inefficiencies, and insights gained through usability testing of segregation tools. The behavioral dimension of waste segregation is central to the success of any waste management initiative. Data revealed a distinct dichotomy between residents who actively segregate their waste and those who do not, with only about 25% identified as consistent segregators. These individuals often demonstrated heightened environmental awareness and were motivated by both personal values and collective action mechanisms.

Environmental stewardship was a recurring theme among compliant residents. A substantial number of these individuals engaged in composting at home or participated in local clean-up drives, driven by a strong sense of civic duty. Community reinforcement further amplified these behaviors. Residential complexes with active Resident Welfare Associations (RWAs) reported markedly higher segregation compliance [15]. Peer pressure, frequent educational campaigns, and collective norm-setting played a pivotal role in this dynamic. Conversely, the majority of residents failed to adhere to segregation norms. Interviews revealed several intertwined barriers. Space constraints, particularly prevalent in compact apartments, made the use of multiple waste bins impractical. Residents reported that traditional single-compartment bins were easier to manage within limited kitchen or utility areas.

A considerable number of non-compliant residents displayed a lack of knowledge about what constitutes recyclable or hazardous waste. Many failed to distinguish between wet and dry waste or between biodegradable and non-biodegradable materials. Misconceptions such as the belief that all waste is ultimately dumped together regardless of initial segregation deepened this nonchalance. This skepticism significantly eroded trust in the system and discouraged meaningful participation. This behavioral split underscore a crucial insight: environmental knowledge alone is insufficient unless reinforced by practical convenience, social accountability, and institutional trust. Sanitation workers operate at the crux of the waste management cycle, yet face multifaceted challenges that severely undermine their efficiency and well-being. Unsegregated waste imposes severe occupational hazards. During waste collection and sorting, workers regularly encounter sharp materials, improperly disposed of medical waste, and putrefying organic matter [16]. The health risks are exacerbated by the absence of basic Personal Protective Equipment (PPE), such as gloves, boots, and masks, leading to infections, injuries, and chronic health issues.

Logistically, sanitation workers face daunting workloads. Manual sorting of unsegregated waste is both labor-intensive and inefficient. Workers reported spending inordinate amounts of time sifting through piles of mixed garbage to retrieve recyclables or separate hazardous materials. This task is further complicated by infrastructure failures: overfilled bins, improper waste labeling, and inadequate segregation at the source extend collection cycles and fatigue workers. Beyond physical challenges, a deeper, more insidious problem emerges: social

stigma. Interviews revealed that many sanitation workers feel marginalized and unappreciated. Their work, despite its essential contribution to public health, is often rendered invisible by societal attitudes that treat them as expendable. This demotivation has profound implications for worker morale, retention, and service delivery standards.

Systemic dysfunctions in policy execution, infrastructure provisioning, and regulatory enforcement compound the challenges at both the user and operational levels. Infrastructure lapses are particularly glaring. Shared bins in residential complexes were frequently found to be unlabeled or mislabeled. This lack of clarity confused even well-meaning residents, leading to unintentional non-compliance. Moreover, inconsistent collection schedules often resulted in overflowing bins, which mixed otherwise segregated waste and negated the efforts of compliant residents. Policy gaps further aggravate the issue. The absence of strong enforcement mechanisms emboldens non-compliant behavior. Residents reported a lack of inspections or penalties for improper waste disposal, creating a perception of impunity. Budgetary constraints also emerged as a core issue. Municipal authorities cited insufficient funding as a barrier to executing sustained awareness campaigns or investing in advanced segregation and collection infrastructure. Figure 2 shows the Average annual composition of MSW in Algeria.

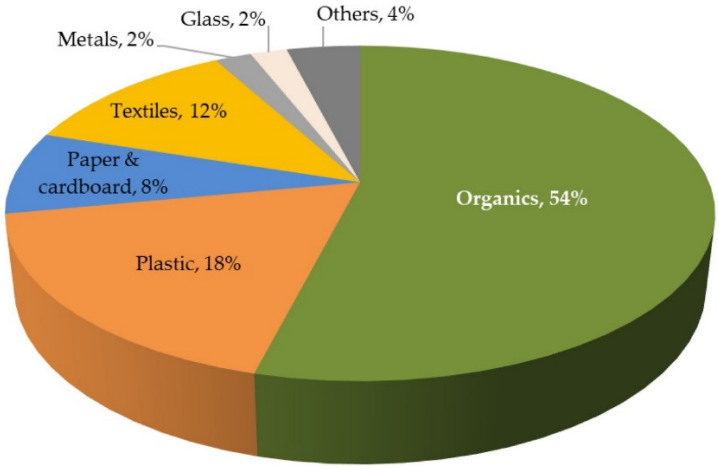

Figure 2: Provides the composition of the MSW in Algeria.

This institutional inertia fosters a negative feedback loop lack of enforcement and poor infrastructure discourages compliance, which in turn perpetuates inefficiencies and degrades system performance. Usability testing of various waste segregation tools unearthed critical feedback regarding their practicality and design. Multi-compartment bins, although conceptually appreciated by residents, were deemed unsuitable for small living spaces. Residents of compact apartments struggled to accommodate these bulky units, often defaulting to single-bin disposal. Labeling issues on bins created another layer of confusion. Inaccurate or vague descriptions led to improper waste segregation, undermining the intended utility of these tools. Similarly, signage used to guide segregation practices was either inconsistently placed or poorly designed. This lack of visual clarity reduced the effectiveness of instructional materials and diminished the impact of informational interventions.

Mobile applications intended to guide users in segregation practices were found largely ineffective. Issues such as unintuitive user interfaces, language limitations, and a lack of synchronization with municipal waste management systems led to minimal adoption. Residents

expressed frustration over app design and indicated that digital tools were more effective when integrated with existing community platforms or smart bin systems. The interplay of behavioral, systemic, and technological factors highlights the complexity of urban waste segregation. Each stakeholder, residents, sanitation workers, and municipal authorities, operates within a context shaped by their respective challenges, motivations, and constraints. Synthesizing these findings reveals both the root causes of the current inefficiencies and actionable pathways toward resolution.

One of the most salient insights is the behavioral gap between knowledge and action. While environmental awareness is growing, actual compliance remains sporadic. Structural interventions such as redesigned bins and smart feedback systems must work in tandem with behavioral nudges, such as community recognition and peer influence. Community-led models emerged as highly effective, with RWAs serving as micro-governance units capable of enforcing norms and fostering a culture of sustainability. Systemic inefficiencies, particularly in infrastructure and enforcement, create barriers that even motivated residents struggle to overcome. When bins are mislabeled or overflowing, segregation efforts are rendered futile. These tangible shortcomings breed skepticism and erode public trust, an intangible but critical element of system success. Therefore, infrastructural and policy reforms must be prioritized. Sanitation workers' experiences expose a blind spot in urban waste policy, namely, the lack of protection and dignity afforded to frontline personnel [17]. Addressing these deficits is not merely a moral imperative but a strategic one. Enhanced safety, training, and recognition would lead to improved performance, lower attrition rates, and higher overall system efficacy. The usability testing reinforced the principle that tools must be designed with end-user contexts in mind. Bins, signage, and digital interfaces must align with the physical, cognitive, and behavioral realities of urban residents. Overly complex or misaligned tools only exacerbate non-compliance and diminish system coherence.

This study's findings corroborate existing global literature on urban waste management. The United Nations' 2020 report on urban India's waste treatment inefficiencies aligns with the observed low segregation compliance and systemic dysfunction [18], [19]. Studies advocating IoT-based waste management are validated by resident interest in real-time feedback and bin fill-level tracking. The influence of community engagement and peer behavior observed in this study complements behavioral economics research, which emphasizes social norms as powerful drivers of collective action. The contextual specificity, particularly insights from apartment settings, extends this literature by highlighting how built environment constraints affect participation.

To effectively communicate the findings, a series of visual representations is proposed. Pie charts could illustrate the ratio of compliant to non-compliant residents and delineate key reported barriers. Word clouds generated from interview transcripts can spotlight commonly cited challenges such as "space," "overflow," or "confusion." Bar graphs comparing segregation rates between RWA-active and inactive complexes would further underscore the value of community mobilization. The study's recommendations are grounded in the data and designed to tackle challenges at multiple levels. Awareness campaigns can bridge the knowledge-action divide, especially when supported by community outreach and digital engagement [20]. Infrastructure enhancements, such as smart bins and stackable units, directly address practical constraints. Policy reforms that combine incentives with penalties create a balanced framework for compliance. Supporting sanitation workers through PPE, training, and

public recognition would close a critical systemic loop, making the entire waste management chain more robust and humane. These interventions, if executed in a phased manner, are expected to yield sustained improvements in waste segregation compliance, public health outcomes, and environmental resilience. This study highlights the need for sustained multi-stakeholder engagement.

Future research should focus on the scalability of smart waste technologies, the longitudinal impact of awareness campaigns, and the formal integration of informal waste pickers. Urban India, with its demographic diversity and infrastructure complexity, presents both a challenge and an opportunity a test bed for scalable waste management innovations.

5. CONCLUSION

In conclusion, the study underscores the pivotal role of urban residential apartments in municipal solid waste generation and the urgent need for structured waste segregation practices. Despite existing infrastructure and regulations, systemic inefficiencies, behavioral resistance, and sanitation worker vulnerabilities hinder effective implementation.

The root of the problem lies in the absence of an integrated, user-centric waste management framework that combines public education, robust infrastructure, and strict policy enforcement. The findings suggest that successful waste management in urban housing must begin with sustained educational initiatives that reshape resident behavior, followed by investment in smart, user-friendly infrastructure and efficient, accountable collection mechanisms. Equally important is the welfare of sanitation workers, who face hazardous working conditions due to the mishandling of waste. Providing adequate training, protective gear, and institutional recognition would not only safeguard their health but also improve operational efficiency. Strategically, future studies must examine the scalability of these solutions across varied urban settings, assess the effectiveness of technology-led segregation systems over time, and explore the integration of informal waste workers into formal systems to strengthen recycling ecosystems. This multidimensional approach can serve as the foundation for a resilient, sustainable, and inclusive urban waste management system, crucial to achieving long-term environmental goals and protecting public health.

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CHAPTER 10

BRIDGING THE GAP BETWEEN ACADEMIC INSTRUCTION AND WORKFORCE DEMANDS IN THE TRANSITION FROM EDUCATION TO EMPLOYMENT

Ananya Singh[1], Nabitha Iqbal[2], Shruti Shirke[3], Prasad Anaokar[4]
[1,2,3]Student, [4]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3,4]Atlas Skilltech University, Mumbai
Email: ananya.singh.bdes2026@atlasuniversity.edu.in[1], nabitha.iqbal.bdes2026@atlasuniversity.edu.in[2], shruti.shirke.bdes2026@atlasuniversity.edu.in[3], prasad.anaokar@atlasuniversity.edu.in[4]

ABSTRACT:

The transition from academic instruction to meaningful employment has become a growing concern in today's rapidly evolving job market. While educational institutions aim to equip students with foundational knowledge, there often exists a noticeable mismatch between what is taught in classrooms and the practical skills required by employers. This research explores the underlying causes of this gap and highlights the challenges faced by both graduates and employers in aligning educational outcomes with workforce expectations. Factors contributing to this divide include outdated curricula, limited exposure to real-world applications, and insufficient collaboration between academic institutions and industry stakeholders. Through a comprehensive review of existing literature and case studies from various sectors, this study investigates how the disconnect impacts graduate employability, job satisfaction, and economic development. Additionally, the research emphasizes the need for reforms in educational policy and curriculum design to include more experiential learning, internships, and skill-based training that reflect current industry standards. By identifying successful models of cooperation between academia and the labor market, such as industry-academic partnerships and vocational training programs, the study proposes strategic recommendations for narrowing the education-to-employment gap. The findings aim to contribute to policy discussions and institutional reforms that prioritize career readiness and lifelong learning. Ultimately, this research underscores the importance of adaptive education systems that are responsive to the dynamic needs of the global workforce and committed to preparing students not only with theoretical knowledge but also with practical, job-relevant skills that enhance their employability and long-term career success.

KEYWORDS:

Curriculum Alignment, Employability Skills, Experiential Learning, Industry-Academia Collaboration, Workforce Readiness.

1. INTRODUCTION

The relationship between education and employment has long been regarded as fundamental to both personal development and societal progress. Traditionally, educational institutions have served as the foundational platform for equipping individuals with the knowledge and competencies required to enter and succeed in the labor market. However, in recent decades, there has been a growing recognition of the disconnect between what is being taught in academic settings and the actual skills and competencies demanded by contemporary employers. This gap has created significant challenges for new graduates, industries, and policymakers alike, prompting a global dialogue about how to realign educational outcomes

with labor market needs [1]. Globalization, technological advancement, and evolving labor market dynamics have significantly transformed the nature of work. Jobs today demand not only academic knowledge but also a complex mix of technical expertise, soft skills, digital literacy, critical thinking, and adaptability. Yet, many higher education curricula remain rooted in theoretical instruction, often outdated and disconnected from the practical realities of professional environments. As a result, employers frequently express concerns about the job readiness of graduates, while students and young professionals face increasing difficulties in securing meaningful employment despite holding academic credentials. This situation has led to widespread underemployment, skill mismatches, and an inefficient utilization of human capital, all of which negatively impact economic productivity and social well-being [2], [3]. At the heart of this issue lies a structural misalignment between educational institutions and labor market stakeholders. On one hand, academic programs are often designed with limited input from industry experts, making it difficult to integrate current trends and requirements into classroom instruction. On the other hand, industries may not communicate the specific skills they seek or may prioritize experience over formal education. This lack of synchronization results in graduates who are well-versed in theory but lack hands-on experience, problem-solving capabilities, and the agility to navigate complex work environments. Furthermore, the rapid pace of change in technology and business practices has shortened the shelf life of many skills, rendering traditional educational models less effective in preparing students for long-term career success.

Another contributing factor to the education-employment gap is the limited emphasis on employability skills within academic frameworks. While technical knowledge remains essential, employers increasingly value attributes such as communication, teamwork, leadership, creativity, and emotional intelligence. These competencies are rarely the focus of conventional academic assessments and may be underdeveloped in graduates who have not had opportunities for experiential learning, such as internships, cooperative education, or community engagement projects. Moreover, many students graduate without a clear understanding of the job market, professional expectations, or how to translate their academic achievements into workplace value, further complicating their transition from education to employment. The global nature of this issue underscores its complexity and significance [4]. In both developed and developing countries, the failure to align education systems with labor market needs contributes to youth unemployment and hinders sustainable economic development. In emerging economies, the situation is further exacerbated by limited access to quality education and training resources, as well as rapidly shifting employment landscapes driven by digital transformation. Meanwhile, in more industrialized nations, aging populations and skills shortages in critical sectors highlight the urgent need for a workforce that is both educated and adaptable. Thus, the challenge of bridging the education-to-employment gap is not only an academic concern but also a socio-economic imperative.

Governments and institutions around the world have begun to address this issue through a variety of reforms and initiatives. Some strategies include revising national curricula to include vocational training, promoting science, technology, engineering, and mathematics (STEM) education, and fostering partnerships between universities and industries. Work-integrated learning (WIL) programs, apprenticeships, and competency-based education models are also gaining traction as a means of providing students with practical experience and industry exposure. Additionally, there is growing interest in leveraging technology to personalize learning pathways, improve access to career information, and facilitate lifelong learning. However, while these initiatives represent important steps forward, significant gaps remain in implementation, scalability, and alignment with actual workforce needs [5], [6]. The private sector also has a critical role to play in bridging the gap. Businesses can support education

systems by offering internships, mentoring, collaborative projects, and real-world case studies that inform curriculum development. Employers can also invest in upskilling and reskilling programs for current and future employees, ensuring that talent pipelines remain aligned with business needs. Furthermore, greater collaboration between academia and industry in research and innovation can foster mutual understanding and contribute to the development of forward-looking education models. These collaborative efforts must be built on open communication, shared goals, and a commitment to continuous improvement to be truly effective.

Students, too, must be active participants in their professional development. They need to be empowered with tools and guidance to make informed career decisions, pursue opportunities for experiential learning, and cultivate transferable skills. Career services, academic advising, and mentoring programs play vital roles in helping students navigate their educational journey with clarity and purpose. Additionally, the cultivation of a growth mindset and the ability to learn continuously are essential attributes for career resilience in the face of evolving job requirements. Educational institutions should therefore focus not only on knowledge transfer but also on fostering critical self-awareness and adaptability among learners. In examining the causes and consequences of the education-employment gap, it is also important to consider the socio-cultural and policy dimensions [7]. Educational expectations, cultural attitudes toward vocational training, and national employment policies all influence how effectively education systems prepare students for work. In many societies, academic degrees are still valued above technical or vocational qualifications, leading to an underutilization of alternative career pathways that may offer more direct routes to employment. Similarly, fragmented or outdated policy frameworks may hinder innovation in education or fail to incentivize employer engagement in workforce development. A comprehensive and context-specific approach is therefore essential in designing effective strategies to bridge the gap.

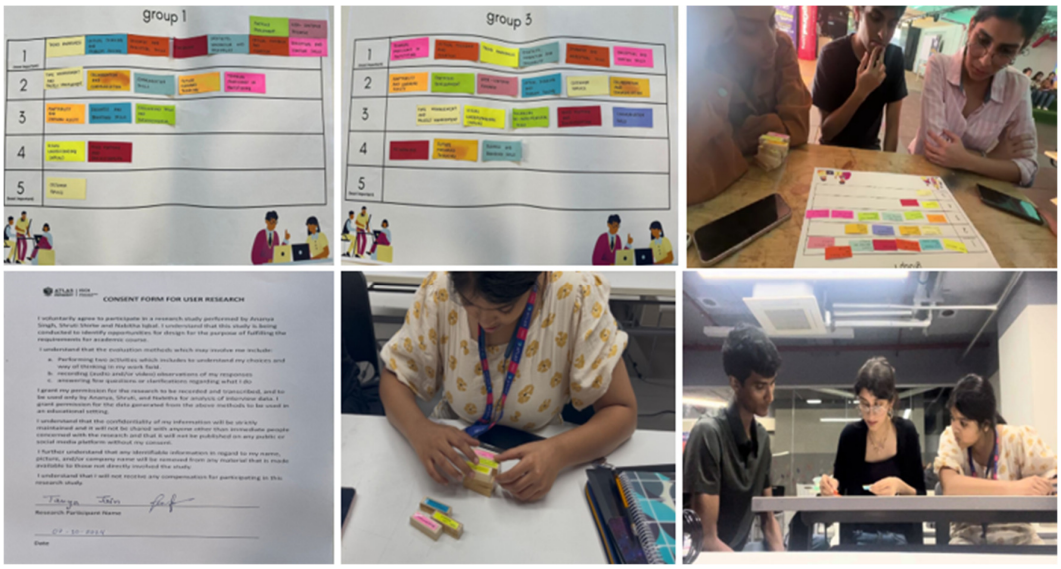

Figure 1: Illustrates A Participatory Educational or Research Activity Involving Students.

The COVID-19 pandemic further illuminated the fragility of the education-to-employment pipeline, as schools closed, internships were canceled, and labor markets contracted. Figure 1 illustrates a participatory educational or research activity involving students. It also accelerated the digitalization of education and the workplace, creating both new challenges and new opportunities. Remote learning and virtual internships have become more common, but they also underscore disparities in access to technology and digital literacy. At the same time, the

pandemic has prompted a reevaluation of what constitutes essential skills and how education can be made more flexible and resilient [8], [9]. The post-pandemic recovery offers a critical window for reimagining education systems that are more aligned with future workforce needs and more inclusive of diverse learning and career trajectories. This research aims to investigate the multifaceted nature of the gap between academic instruction and workforce demands, focusing on how educational institutions, employers, policymakers, and students can work together to create a more cohesive and responsive education-to-employment transition. Through an in-depth analysis of current literature, case studies, and policy initiatives, the study will identify key barriers and explore innovative approaches that have shown promise in narrowing the divide. Particular attention will be given to the role of experiential learning, industry-academic collaboration, curriculum reform, and digital tools in enhancing employability outcomes.

Ultimately, the goal of this research is to contribute to the ongoing dialogue around education reform and workforce development by offering practical insights and evidence-based recommendations. In a world where economic competitiveness, social equity, and individual fulfillment are increasingly tied to meaningful employment, ensuring that educational systems are effectively preparing students for the realities of the job market is of paramount importance. Bridging the gap between academic instruction and workforce demands is not a challenge that can be solved by any one stakeholder in isolation. Rather, it requires a systemic, collaborative, and forward-looking approach that embraces change and places learners at the center of the solution. In light of the growing urgency to address this issue, this research underscores the importance of building a dynamic, skills-oriented, and inclusive education system that empowers students to thrive in a rapidly changing world of work. By understanding the root causes of the disconnect and learning from successful models of alignment, societies can work toward creating education systems that do more than confer degrees they can cultivate the workforce of the future, equipped with the knowledge, skills, and adaptability needed to meet the evolving demands of the global economy.

2. LITERATURE REVIEW

M. W. Johnson [10] explained that job control refers to how much freedom and choice employees have when it comes to their work. It includes things like being able to decide what tasks to do, how to schedule and pace work, the physical work setting, how decisions are made, how much interaction is allowed, and the ability to move around. A web-based survey was given to academic librarians who are involved in teaching.

This survey used an already established set of questions to measure job control and included some key background and job-related questions thought to influence job control. A total of 307 academic librarians who teach completed the survey. When looking at each item in the job control section, it was found that factors such as teaching load, professional status, salary, years worked at their current institution and in libraries in general, training in teaching, union membership, and whether or not they have tenure, all had a meaningful impact on responses to at least one question.

H. Graham *et al.* [11] determined the purpose of this study was to find out the current state of school gardens in California. To do this, researchers created a survey that could be completed online or through the mail and sent it to all 9,805 school principals in California. Out of those, 4,194 principals responded to the survey. The survey gathered information about how schools use gardens, principals' views on the role of gardens in education, and what challenges schools face in starting or maintaining a garden. The study concludes that while school gardens are mostly used to support learning, there is a clear need for more resources and teacher training

focused on gardening and nutrition. Additionally, there is room for improvement in connecting school gardens with school meals. Using garden produce in school lunches or for taste-testing in the classroom could be a beneficial step forward.

L. P. Cantwell-Jurkovic and H. F. Ball [12] described "truth dies in four ways," which is a modern interpretation linked to Klemperer's Language of the Third Reich (1957). The researchers in this study related these four ways to how information literacy (IL) is taught but they wanted to know if other people would make the same connection. So, they surveyed academic librarians who teach IL to find out whether they thought their instruction touched on any of these four modes.

They also asked if the ACRL Framework for Information Literacy in Higher Education helps prevent any of these modes from happening. Around 150 librarians responded to the survey. While many said they were not familiar with the two books mentioned and gave a variety of opinions, a large number of them felt that their teaching and the Framework directly challenge Mode 1, which is described as "Open Hostility to Verifiable Reality." This paper looks at the survey findings and explores what they mean for how academic librarians who teach IL view their roles within today's social and political environment.

G. Dunlap *et al.* [13] explained Applied behavior analysis (ABA) plays a major and widely used role in helping improve academic instruction for all students, including those with autism spectrum disorder. This article highlights the valuable ways ABA supports teaching and learning. To show how ABA makes a difference in education, the article focuses on two key areas where behavior analysis methods are especially visible and commonly used: strategies that involve changing what happens before a behavior and tools used to check students' learning progress and needs.

A. Haas *et al.* [14] determined students with autism often struggle with social skills, which can lead to academic instruction being given less attention. Peer-mediated instruction where classmates help with learning has been widely researched and shown to improve both academic and social skills for students with autism spectrum disorder (ASD) and other disabilities. This study aimed to measure how well peer-mediated academic instruction (PMAI) works in improving academic skills for students with ASD.

The findings show that PMAI has a small to moderate positive impact. This means PMAI can be a helpful method for teaching academics to students with ASD, but more research is needed to understand which students benefit most and in what settings it works best.

3. DISCUSSION

The growing divergence between academic instruction and workforce demands presents a multidimensional challenge that affects educational institutions, employers, policymakers, and students alike. This section explores the key themes emerging from the literature and real-world observations, critically analyzing the systemic causes of the gap and examining possible strategies and reforms to bridge it effectively. The discussion emphasizes the importance of curriculum relevance, the role of experiential learning, industry-academic collaboration, soft skills development, and the need for dynamic policy interventions. One of the most pronounced findings in current educational discourse is the inadequacy of many academic curricula in equipping students with job-ready skills [15], [16]. This inadequacy is not necessarily due to a lack of rigor in education, but rather a mismatch between what is emphasized in academic settings and what employers prioritize in practice. Traditional curricula often prioritize theoretical knowledge and subject-specific mastery, which, while important, do not always align with the applied skills required in today's rapidly changing job markets. For instance,

graduates from fields such as business, engineering, and information technology frequently report feeling underprepared when it comes to problem-solving in real-world scenarios, handling team dynamics, or navigating organizational cultures.

Employers, on the other hand, frequently express concerns regarding the practical readiness of graduates. They seek individuals who not only understand the technical aspects of their roles but who can also demonstrate competencies such as adaptability, effective communication, critical thinking, and technological fluency. These expectations suggest a need for academic institutions to move beyond the conventional focus on lectures, exams, and rote learning, and to incorporate more holistic, skills-based, and outcome-oriented approaches. Curricular redesign, therefore, should not be an isolated event but a continuous process informed by evolving industry trends and labor market analyses. A critical strategy in addressing this gap is the integration of experiential learning within academic programs. Work-based learning opportunities such as internships, apprenticeships, cooperative education, service-learning, and capstone projects offer students invaluable exposure to workplace realities. These experiences allow learners to apply theoretical knowledge in practical contexts, develop professional behaviors, and build networks that can enhance employability. Furthermore, experiential learning provides a dual benefit: while students gain confidence and competence, employers can evaluate potential recruits in real-world conditions. Despite its recognized value, access to high-quality work-based learning remains uneven, particularly in under-resourced institutions or in regions where industry participation is limited.

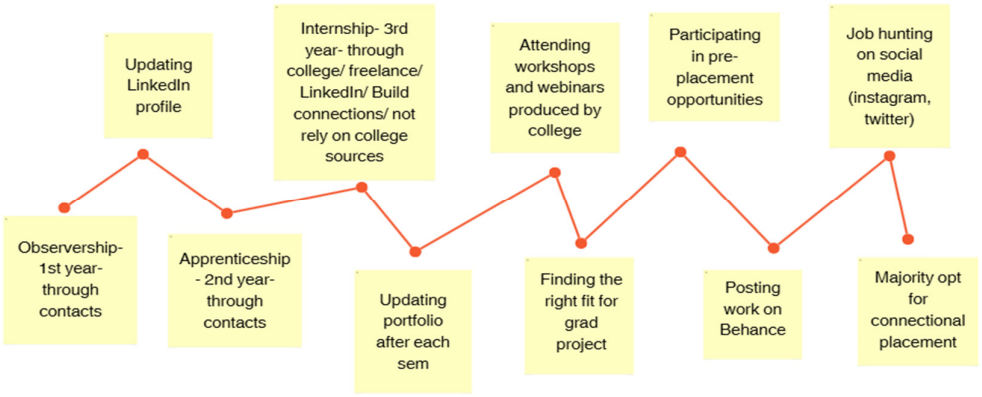

Figure 1: Represents Career Choices of Design Students at ISDI.

One underlying barrier to effective experiential learning is the lack of coordinated collaboration between academia and industry. Figure 1 represents the career choices of design students at ISDI. In many cases, educational institutions and employers operate in parallel rather than in partnership. The absence of structured dialogue between these sectors often results in educational offerings that do not reflect the realities of the workplace. To overcome this disconnect, mechanisms for continuous engagement must be established, such as advisory boards, curriculum co-development, industry-led seminars, and joint research initiatives. Educational institutions that involve employers in the learning process are better positioned to ensure that their programs remain relevant and responsive to labor market needs. The demand for soft skills in the workplace has increased significantly over the past two decades [17], [18]. While technical competencies remain essential, employers now place substantial emphasis on interpersonal skills, emotional intelligence, creativity, and leadership potential. However, these attributes are not always cultivated within traditional academic settings, which tend to emphasize individual achievement and cognitive ability. Soft skills are often developed

through collaborative learning, mentorship, group projects, extracurricular activities, and community engagement. Thus, institutions must rethink how they design student experiences, ensuring that learning environments foster these critical human competencies alongside technical education.

Digital literacy is another key area that cannot be overlooked. With digital transformation reshaping all sectors of the economy, the ability to engage with digital tools, platforms, and data is now a fundamental requirement across most professions. Yet, in many educational systems, digital skills are treated as supplemental rather than core competencies. This results in graduates who may be proficient in the subject matter but ill-equipped to use modern tools or adapt to digital workflows. Integrating digital education across disciplines rather than confining it to IT-related courses can enhance students' readiness for digitally enabled workplaces and promote a culture of continuous learning and innovation. Globalization has further complicated the education-employment transition by introducing new forms of competition and collaboration. Students today are not only competing within their national borders but also in a global labor market where skills and performance expectations are increasingly standardized. As a result, educational systems must consider global competency as part of their graduate attributes. This includes intercultural communication, foreign language proficiency, and the ability to work effectively in diverse teams. International internships, student exchange programs, and global case studies can help students prepare for such demands. However, access to these opportunities is often limited by socioeconomic barriers, highlighting the need for more inclusive and equitable education-to-employment strategies.

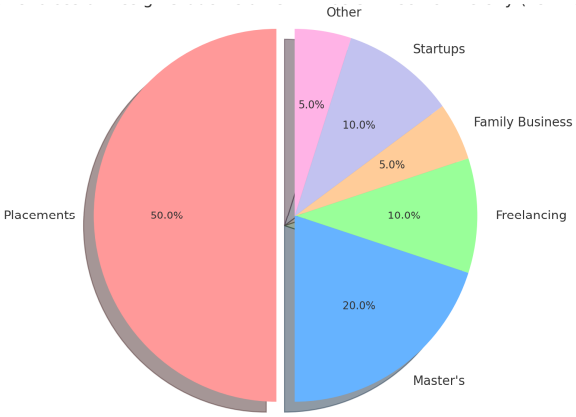

Figure 3: Illustrates A Rough Estimation Based On Typical Career Choices Observed in Design Schools Across India Using General Industry Trends.

One of the more concerning consequences of the education-employment gap is the rise in graduate underemployment and unemployment. Figure 3 illustrates a rough estimation based on typical career choices observed in design schools across India using general industry trends. Many students invest time and resources in obtaining degrees with the expectation that it will lead to gainful employment. When these expectations are unmet, it results in frustration, financial strain, and wasted human potential. This misalignment also impacts economic productivity, as businesses struggle to fill skill gaps despite an abundance of degree-holding job seekers. Addressing this problem requires a more transparent alignment of educational pathways with career opportunities. Career guidance services should be embedded early in the educational journey to help students make informed decisions about their academic and professional futures [19], [20]. Policymakers have a vital role in supporting systemic reforms to narrow the education-employment gap. National frameworks for skills development,

funding incentives for industry-academia partnerships, and quality assurance mechanisms that prioritize employability outcomes are some of the tools that governments can deploy. In addition, aligning labor market data with educational planning can help institutions design programs that are responsive to current and anticipated employment trends. Public investment in vocational and technical education must also be increased and destigmatized to ensure that students see these pathways as viable and respectable alternatives to traditional academic routes.

The importance of lifelong learning cannot be overstated in this context. Given the accelerating pace of technological change, no single degree can serve as a lifelong guarantee of employability. Continuous upskilling and reskilling are essential for individuals to remain competitive in the labor market. Educational institutions should therefore position themselves not only as places of initial learning but also as lifelong learning hubs that offer modular, flexible, and stackable credentials tailored to diverse learner needs. Micro-credentials, online courses, and certification programs can serve as important tools in enabling learners to adapt to new roles, industries, or technologies. One notable example of best practice in bridging the education-employment gap can be observed in dual education systems, such as those in Germany and Switzerland. These systems integrate academic study with vocational training in a structured and state-supported model. Students split their time between classroom instruction and hands-on training within companies, resulting in a highly skilled and job-ready workforce. The success of such systems demonstrates the potential of hybrid education models in preparing students for both immediate employment and long-term career development. While not all countries may be able to replicate these systems in full, elements such as strong employer engagement, standardized training, and supportive policy frameworks can be adapted to local contexts.

Technology also presents opportunities to innovate how we bridge the education-to-employment divide. Artificial intelligence, data analytics, and virtual simulations can be used to assess student competencies, personalize learning experiences, and simulate workplace scenarios. EdTech platforms can match students with employers, provide career guidance, and track the effectiveness of educational interventions in real-time. However, these innovations must be deployed thoughtfully, ensuring they complement rather than replace the human elements of education and career development. Despite numerous efforts and growing awareness, challenges remain in fully realizing a seamless transition from education to employment. Institutional inertia, resource constraints, and competing priorities can slow the pace of reform. Additionally, educational equity must remain at the forefront of these efforts. Bridging the gap should not be limited to elite institutions or urban centers; it must extend to marginalized communities, rural areas, and disadvantaged learners who often face the greatest barriers to employment. Ensuring inclusive access to quality education, career support, and job opportunities is essential for sustainable social and economic development.

The education-to-employment gap is a complex and evolving issue that requires a multifaceted response. It is not merely a question of updating curricula but of reimagining the entire learning ecosystem to be more connected, collaborative, and responsive. Institutions must embrace a learner-centered approach that values both academic excellence and practical competence. Employers must invest in workforce development and participate actively in shaping educational outcomes. Policymakers must provide enabling environments that support innovation and inclusivity. And learners themselves must be empowered to take ownership of their career paths through continuous learning and self-development. By fostering a shared vision of workforce readiness, supported by evidence-based policies and collaborative partnerships, stakeholders can create an education system that prepares individuals not only to

enter the workforce but to thrive in it. The goal is not just to bridge a gap but to build a robust and resilient bridge one that connects knowledge with application, aspiration with opportunity, and education with meaningful employment.

4. CONCLUSION

The growing disconnect between academic instruction and workforce demands presents a significant challenge for both graduates and employers in the modern labor market. As industries continue to evolve rapidly due to technological advancements and shifting economic needs, traditional education systems often struggle to keep pace. This misalignment results in a workforce that may be well-educated but not necessarily job-ready, leading to underemployment, prolonged job searches, and skill shortages in critical sectors. The findings of this study highlight the urgent need for a more integrated approach to education and employment preparation. Educational institutions must move beyond theoretical instruction and embrace a more practical, skills-based framework that includes internships, project-based learning, and collaboration with industry partners. Employers, on the other hand, should actively engage with academic institutions to help shape curricula that reflect current and future job requirements. By fostering stronger partnerships between education providers and the labor market, it is possible to create a more seamless transition for students entering the workforce. Additionally, promoting lifelong learning and continuous skill development can help individuals adapt to changing job roles and maintain their relevance in a dynamic employment landscape. This study emphasizes that bridging the education-to-employment gap requires a collective effort from educators, policymakers, and industry leaders. Only through such collaborative and adaptive strategies can we ensure that graduates are not only knowledgeable but also equipped with the competencies needed to thrive in today's and tomorrow's work environments.

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CHAPTER 11

EXPLORING BELIEFS AND PRACTICES IN HINDUISM CHRISTIANITY AND JAINISM ACROSS CULTURES WORLDWIDE

Calista Moraes[1], Srushti Tanaji Bhosale[2], Malvika Mahidar[3]
[1,2]Student, [3]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3]Atlas Skilltech University, Mumbai
Email: calista.moraes.bdes2027@atlasuniversity.edu.in[1], srushti.bhosale.bdes2027@atlasuniversity.edu.in[2], malvika.mahidhar@atlasuniversity.edu.in[3]

ABSTRACT:

This study examines the core beliefs, rituals, and cultural practices of Hinduism, Christianity, and Jainism, offering a comparative analysis to highlight both shared values and distinctive features. These three religions, while diverse in origin and theological frameworks, contribute significantly to shaping the moral and spiritual fabric of societies across the globe. Hinduism, with its deep philosophical roots and polytheistic traditions, emphasizes karma, dharma, and moksha as key guiding principles. Christianity, centered on the teachings of Jesus Christ, upholds monotheism, salvation through faith, and the importance of love and forgiveness. Jainism, an ancient Indian religion, stresses non-violence, truth, asceticism, and liberation from the cycle of rebirth. The study investigates how religious rituals, scriptures, and ethical codes influence followers' daily lives, community interactions, and social structures. It also explores how these religions have adapted to modern contexts while maintaining their foundational doctrines. Through a multidisciplinary approach incorporating theology, sociology, and anthropology, the research highlights how each religion fosters spiritual growth, community cohesion, and ethical living. The paper also reflects on the ways interfaith dialogue and mutual respect can be encouraged by understanding the rich traditions and philosophies inherent in each faith. Overall, the study aims to promote a deeper appreciation for religious diversity and the role of faith in fostering both individual well-being and collective harmony in an increasingly interconnected world. By focusing on these three influential religions, the paper contributes to the ongoing conversation about spirituality, coexistence, and cultural understanding in contemporary society.

KEYWORDS:

Ahimsa, Dharma, Liberation, Monotheism, Salvation.

1. INTRODUCTION

Religion plays a pivotal role in shaping the values, behaviors, and worldviews of individuals and societies. Among the vast array of global faiths, Hinduism, Christianity, and Jainism stand out as influential religious traditions that have significantly contributed to cultural development and human thought across centuries. This study delves into the beliefs and practices of these three religions, aiming to present a comprehensive understanding of how they guide their followers in navigating life, morality, and the quest for spiritual fulfillment. While these religions originate from distinct historical, geographical, and philosophical contexts, they all seek to provide answers to existential questions and establish ethical frameworks for harmonious living. Hinduism, one of the world's oldest known religions, is rooted in the Indian subcontinent and is characterized by its pluralistic nature, deep spiritual philosophies, and rich pantheon of deities [1]. It encompasses diverse schools of thought, including Vedanta, Yoga,

and Bhakti traditions, and is known for emphasizing the concepts of karma, dharma, samsara, and moksha. Rituals, festivals, scriptures such as the Vedas and Upanishads, and practices like meditation and devotion all contribute to the lived experience of Hinduism. It offers a highly individualized path to self-realization and ultimate liberation, encouraging tolerance and diversity of spiritual expression.

Christianity, on the other hand, originated in the first century CE in the Middle East and is founded on the life and teachings of Jesus Christ. As a monotheistic religion, it is centered around the belief in one God and the salvation of humanity through the life, death, and resurrection of Jesus. The Bible serves as its sacred scripture, guiding adherents in faith and practice. Christianity is built on principles of love, grace, forgiveness, and community. Through rituals such as baptism and communion, as well as moral teachings such as the Sermon on the Mount, it seeks to inspire ethical living and a commitment to social justice. Its message of hope and redemption has resonated across different cultures and continents, making it one of the most widespread religions in the world. Jainism, a less globally known but profoundly ethical and spiritual tradition, also emerged in ancient India around the same period as early Hinduism and Buddhism [2], [3]. It is distinguished by its strict adherence to the principles of non-violence (ahimsa), truth (satya), non-stealing (asteya), celibacy (brahmacharya), and non-possession (aparigraha). Jain philosophy stresses the importance of self-discipline and ascetic practices to achieve liberation from the cycle of birth and death. The religion does not believe in a creator god but emphasizes the potential of every soul to attain divine consciousness through purification and detachment from material concerns. Jain practices, including vegetarianism, fasting, and meditation, reflect a deep commitment to ethical conduct and spiritual advancement.

The comparison of Hinduism, Christianity, and Jainism reveals a spectrum of religious thought ranging from theistic devotion to self-realization and asceticism. This study does not aim to rank these religions or claim superiority but to appreciate their unique contributions to human civilization. Each of these religions has shaped the cultures in which they developed, influencing art, literature, politics, social structures, and daily life. Understanding their similarities and differences can foster greater interreligious appreciation and empathy. In today's globalized world, where cultural interactions are frequent and religious pluralism is a reality, such understanding is crucial. Hinduism, Christianity, and Jainism all offer insights into human nature and ethical living [4], [5]. Hinduism's cyclical view of time and rebirth contrasts with Christianity's linear eschatology, yet both emphasize moral responsibility and the consequences of actions. While Christianity teaches salvation through grace and faith in Jesus Christ, Hinduism, and Jainism emphasize self-effort and spiritual discipline as means to liberation. Despite these doctrinal differences, all three traditions promote the virtues of compassion, humility, selflessness, and inner transformation. Moreover, each religion has its unique methods of worship and spiritual practice. Hinduism incorporates a wide range of devotional activities such as temple rituals, chanting, yoga, and pilgrimage.

Christianity practices communal worship, prayer, scripture reading, and sacraments. Jainism encourages meditation, ethical vows, and ascetic living. These practices help adherents cultivate a sense of connection with the divine or the inner self and align their lives with higher spiritual ideals. Religious festivals and rituals also play a vital role in expressing the values and teachings of each faith. Hindu festivals like Diwali and Holi celebrate divine victories and cosmic harmony. Christian holidays such as Christmas and Easter commemorate the birth and resurrection of Jesus Christ, emphasizing hope and renewal. Jain festivals like Paryushana and Mahavir Jayanti highlight self-purification, reflection, and reverence for spiritual leaders [6]. These celebrations foster community bonding and serve as reminders of religious heritage and

moral purpose. Education and transmission of religious knowledge are also central to the continuity of these faiths. Hinduism relies on oral tradition, scripture study, and guru-disciple relationships. Christianity emphasizes catechism, Bible study, and church teachings.

Jainism upholds the teachings of Tirthankaras, preserved through scriptures like the Agamas and community-based learning. Through these educational processes, values and traditions are passed on to future generations, ensuring the persistence of religious identity and continuity. Furthermore, the role of religious institutions in guiding followers and engaging with societal issues is evident in all three religions. Hindu ashrams, Christian churches, and Jain temples serve not only as places of worship but also as centers for education, charity, and social service. These institutions contribute to community development and address social issues such as poverty, education, and healthcare [7]. Their involvement in humanitarian efforts demonstrates the practical relevance of spiritual teachings in addressing contemporary challenges. The evolution of these religions in response to historical events, modernization, and globalization also reveals their dynamic nature. Hinduism has incorporated reform movements, interfaith dialogue, and diaspora adaptations. Christianity has experienced theological debates, denominational diversity, and global missions. Jainism, though smaller in global reach, has maintained its core ethics while adapting to modern lifestyles and promoting environmental awareness [8]. These developments illustrate how religions can remain relevant by engaging with changing contexts while preserving their spiritual essence. Additionally, the study of these three religions invites reflection on the role of spirituality in fostering inner peace and global harmony.

In an age marked by materialism, conflict, and moral uncertainty, the teachings of Hinduism, Christianity, and Jainism offer guidance for ethical conduct, compassion, and inner transformation. They remind humanity of the interconnectedness of all life and the importance of living with awareness, responsibility, and purpose. This comparative exploration also highlights the importance of religious pluralism and the value of learning from diverse traditions. While differences exist in doctrine and practice, the underlying goals of spiritual growth, ethical living, and service to others create a common ground for dialogue and mutual respect. Promoting such understanding can help reduce prejudice, build bridges between communities, and encourage peaceful coexistence [9].

In conclusion, the beliefs and practices of Hinduism, Christianity, and Jainism offer rich and varied insights into the spiritual dimensions of human existence. By studying these religions in a comparative context, one can appreciate the diversity of religious thought and the shared aspirations for a meaningful and virtuous life. This introduction serves as a foundation for further examination of how these faiths continue to shape individuals, communities, and global society in profound and enduring ways.

2. LITERATURE REVIEW

M. R. Bennett *et al.* [10] explained religious diversity, people's sense of religious and national identity, and the level of trust in local neighborhoods are connected. It uses data from 6,089 people living in England, which is matched with census-based information from 300 different local areas. The findings show that when there is more religious diversity in a local area, people tend to have lower levels of trust in their neighborhoods. At the same time, they checked if living in a diverse area weakens people’s sense of national identity, and whether this weakened national identity is linked to less trust in their neighbors. The study used multigroup analysis to see if these patterns differ across different religious communities. The results show that among Christians, higher religious diversity is linked to a stronger sense of belonging to their religious group, which is then linked to lower trust in the neighborhood. However, there was

no link between religious diversity, national identity, and trust in the neighborhood. For people from other religious backgrounds, the study didn't find any meaningful connections between religious diversity, identity, and neighborhood trust.

S. Amin et al. [11] described diversity and financial inclusion have become key priorities for leaders in the financial services industry. An inclusive financial system makes sure that everyone has fair access to financial resources and opportunities. The findings show a strong positive link between financial inclusion and the presence of ethnic and religious diversity, whether considered separately or together. The results are consistent across countries of all income levels, including high-, middle-, and low-income nations. The research highlights that positive results from a diverse population can only be achieved if society is fair, united, and peaceful. It emphasizes the need for social harmony to fully benefit from diversity in the financial sector. The study also recommends that future research should build on these results by applying them to individual countries. This would help to better understand how ethnic and religious diversity affects financial inclusion in different local contexts and ensure that financial systems continue to grow in a way that includes everyone.

C. Lim and N. D. De Graaf [12] determined the mix of religious groups in a local U.S. community affects how actively individuals take part in religious activities. It revisits Berger's idea about how the presence of multiple belief systems in a society can influence personal faith, and it breaks this down in a few important ways. First, it examines religious diversity from the point of view of each religious group, since the same local religious setting can mean different things to people depending on their own beliefs. Second, it separates local diversity into two parts: how large the population of people from other religions is, and how varied that population is. Third, it includes people who do not identify with any religion when looking at the religious makeup of a community. The findings show that religious diversity especially when there are more people from different religions generally harms how involved someone is with their religion. However, this effect is not the same for everyone. The study points out that the connection between religious diversity and religious involvement varies among groups, with different outcomes for Protestants and Catholics. This highlights the importance of understanding the local religious environment in more detail when studying religious behaviors.

D. Ezzy *et al.* [13] explained Australia has experienced a religious revival, an increase in people who do not identify with any religion, and a growth in religious minority groups such as Muslims, Buddhists, Hindus, and Sikhs. These changes are often seen as a threat to social unity. This paper looks at how social cohesion and religious diversity have been defined and discussed in the Australian context. It argues that although the idea of social cohesion seemed promising at first, it can be problematic, especially when it is used to protect the interests of dominant or privileged groups. The paper also reviews how Australian policies have responded to religious diversity, pointing out that these responses are often inconsistent and incomplete. However, it notes that the state of Victoria, which is extremely diverse, has the most well-developed and thoughtful set of public policies related to religion. The paper ends by calling for more detailed and context-based research and policymaking when dealing with issues of religious diversity and social unity. It emphasizes that religious diversity can bring both benefits and challenges to society, and both sides need to be carefully considered when creating policies to promote harmony and inclusion.

J. Martínez-Ariño and S. Teinturier [14] determined the role of managing and responding to religious diversity. Most research on religion and education has looked at public secular schools, but there is still limited understanding of how faith-based schools handle growing religious differences. These schools are often rooted in a specific religion, so it's important to

explore how they deal with changes when their student populations are no longer mostly from the same faith. This shift means they must rethink how they present and teach their religious values, especially when there are now many different beliefs represented, even within the same religion. This introduction to the focused section gives an overview of key topics discussed in existing research and shows why it is valuable to study how faith-based schools are reacting to religious diversity. It points out that these schools are important spaces where people can learn how religious identity and education are being reshaped in a more diverse society.

3. DISCUSSION

The exploration of Hinduism, Christianity, and Jainism reveals intricate spiritual frameworks that have shaped societies and individual lives for centuries. This discussion presents a comprehensive analysis of the beliefs and practices of these religions, focusing on their theological foundations, moral philosophies, spiritual practices, and cultural impact. Despite their unique origins and doctrinal distinctions, they all emphasize the pursuit of spiritual growth, ethical living, and the establishment of harmonious societies. Hinduism is a complex and ancient religion rooted in the Indian subcontinent, with a broad array of philosophies, practices, and deities. It is characterized by its openness and tolerance, accommodating monotheism, polytheism, and even atheism. At the core of Hindu belief is the concept of Brahman, the ultimate, unchanging reality, which can be approached through various deities such as Vishnu, Shiva, and Devi [15], [16]. Individual souls, or atman, are seen as a part of this supreme reality, and the goal of life is to attain moksha, or liberation from the cycle of birth and rebirth (samsara). This liberation is achieved through various paths including the path of knowledge (jnana yoga), devotion (bhakti yoga), action (karma yoga), and meditation (raja yoga). The principles of karma and dharma guide moral conduct, promoting righteousness, duty, and social harmony.

Christianity, founded in the 1st century CE, is a monotheistic religion based on the life and teachings of Jesus Christ. It teaches that Jesus is the Son of God and the savior of humanity, whose death and resurrection provide the means for salvation and eternal life. Central to Christian doctrine are the concepts of love, grace, forgiveness, and faith. The Bible, consisting of the Old and New Testaments, serves as the sacred scripture, offering moral guidance and spiritual insight. Christian worship is typically communal, involving prayers, hymns, scripture readings, and sacraments such as baptism and the Eucharist. Christian ethics emphasize compassion, humility, and justice, encouraging believers to live following the teachings of Jesus and to contribute to the well-being of others. Jainism, another religion with ancient Indian origins, is distinct in its rigorous commitment to non-violence (ahimsa) and asceticism. It does not acknowledge a creator god but centers on the belief that every soul has the potential for divinity and liberation through ethical conduct and spiritual discipline. Jain philosophy is deeply dualistic, distinguishing between soul (jiva) and matter (ajiva), and sees the entanglement with material existence as the cause of suffering. Liberation (moksha) is achieved by freeing the soul from karmic particles through right faith, right knowledge, and right conduct. Jain ethical principles include truthfulness (satya), non-stealing (asteya), celibacy (brahmacharya), and non-possession (aparigraha). Jain practices involve strict dietary rules, meditation, fasting, and rituals aimed at purifying the soul and reducing attachment to the material world.

When comparing these three religions, several commonalities emerge. All emphasize the importance of ethical behavior, spiritual growth, and the pursuit of a higher reality or purpose. Compassion, self-control, and service to others are valued across the traditions. Each religion provides a framework for understanding human suffering and offers a path toward transcendence or liberation [17], [18]. Additionally, they all involve sacred texts, religious

leaders, rituals, festivals, and places of worship that play vital roles in religious practice and community life. Despite these similarities, the theological differences among Hinduism, Christianity, and Jainism are significant. Hinduism and Jainism both emerge from the Indian philosophical tradition, yet differ in their views of divinity and the soul. Hinduism allows for a personal god and worship through various forms, whereas Jainism focuses entirely on the self's liberation without invoking a creator deity. Christianity stands apart with its strong emphasis on monotheism, salvation through divine grace, and the historical role of Jesus Christ as savior. While Hinduism sees the divine as immanent and transcendent in many forms, and Jainism views divinity as an internal potential within each soul, Christianity teaches a personal God who is actively involved in the world and the lives of believers.

In terms of worship, Hinduism is marked by elaborate temple rituals, pujas, pilgrimages, and festivals that celebrate various deities. Daily worship can take place at home or in temples, and offerings of food, incense, and prayers are common. Christianity involves structured church services, sermons, hymns, and the celebration of sacraments. The communal aspect of worship is central, reflecting the belief in the Church as the body of Christ. Jain worship is more austere and meditative, focusing on self-purification and respect for the Tirthankaras rather than supplication or divine intervention. Rituals include fasting, recitation of sacred texts, and the practice of silence and restraint. Another significant area of comparison is the view of life and death. In Hinduism and Jainism, life is seen as a series of reincarnations, governed by the law of karma. Actions in one life affect the conditions of future lives, and liberation is the ultimate goal. Christianity teaches a linear view of life, with one earthly existence followed by eternal life in heaven or hell, based on one's faith and deeds. This difference influences attitudes toward suffering, morality, and the purpose of life. For Hindus and Jains, suffering is often seen as a result of past actions and an opportunity for spiritual growth. For Christians, suffering can be redemptive and a means of sharing in the experience of Christ.

The role of religious texts is central to all three traditions. The Vedas, Upanishads, Bhagavad Gita, and various epics form the core of Hindu scriptural authority. These texts contain philosophical discourses, hymns, and mythological stories that guide moral and spiritual practice. In Christianity, the Bible is the foundational text, offering historical narratives, teachings of Jesus, letters, and apocalyptic visions. Jain scriptures, such as the Agamas and commentaries by Acharyas, provide ethical guidelines and metaphysical insights [19]. These texts not only inform individual practice but also shape cultural norms, education, and law in communities where these religions are practiced. Religious education and the transmission of values from one generation to the next are important in sustaining these traditions. In Hinduism, the guru-shishya (teacher-student) relationship plays a crucial role in spiritual learning. Christian traditions often involve Sunday schools, catechism, and theological seminaries. Jain education includes scriptural study, community teachings, and rituals that instill ethical behavior from a young age. These processes ensure continuity and help maintain religious identity in both private and public life.

Social and cultural practices within these religions also reflect their core values. Hinduism's caste system, though controversial and undergoing reform, historically influenced social organization. Christianity has played a significant role in shaping Western legal and moral systems, promoting concepts such as human dignity and equality. Jainism's emphasis on non-violence has contributed to vegetarianism, animal welfare, and environmental ethics, with Mahatma Gandhi being a notable admirer of Jain principles. These contributions extend the influence of religious teachings beyond individual spirituality into societal structures and global ethics. Interfaith interactions and the impact of globalization are important aspects of contemporary religious life. Hinduism, Christianity, and Jainism have all encountered

challenges and opportunities in a globalized world. Christianity, being the most widespread, has adapted to diverse cultural contexts, resulting in varied expressions across denominations [20]. Hinduism has maintained its traditions while interacting with modern science, philosophy, and diaspora communities. Jainism, though smaller in number, has gained recognition for its environmental and ethical teachings, finding relevance in global discussions on sustainability and peace. Dialogue among these religions, though historically limited, has the potential to foster mutual respect and collaborative efforts toward common goals such as social justice, environmental stewardship, and human rights.

Table 1: Represents The Comparative Overview of Core Aspects of Hinduism, Christianity, And Jainism.

Aspect	Hinduism	Christianity	Jainism
Concept of God	Polytheistic and monistic; belief in Brahman and multiple deities	Monotheistic; belief in one personal God (Trinity)	Non-theistic; no creator God, emphasis on the soul's divinity
Goal of Life	Moksha (liberation from rebirth)	Salvation and eternal life with God	Moksha (freedom from karmic bondage and rebirth)
Path to Liberation	Karma Yoga, Bhakti Yoga, Jnana Yoga, Raja Yoga	Faith in Jesus Christ, grace, good deeds	Right belief, right knowledge, right conduct
Scriptures	Vedas, Upanishads, Bhagavad Gita, Ramayana, Mahabharata	Holy Bible (Old and New Testaments)	Agamas and commentaries by Jain Acharyas
Ethical Principles	Dharma (duty), karma, non-violence, truth	Love, compassion, forgiveness, justice	Ahimsa (non-violence), Satya (truth), Aparigraha (non-possessiveness)
Worship Practices	Temple rituals, puja, festivals, meditation	Church services, prayer, sacraments (e.g., baptism, Eucharist)	Fasting, meditation, self-discipline, prayer, veneration of Tirthankaras
Role of Afterlife	Reincarnation based on karma; eventual liberation	Heaven or hell based on belief and moral life	Reincarnation; liberation through karma reduction
View of Suffering	Result of past karma; part of the soul’s journey	Can be redemptive; a test or sharing in Christ’s suffering	Result of karmic accumulation; an opportunity for purification
Festivals	Diwali, Holi, Navaratri, Kumbh Mela	Christmas, Easter, Good Friday, Pentecost	Paryushana, Mahavir Jayanti, Diwali (celebrated differently from Hinduism)

The role of women in religious practice and leadership also varies among the three religions. In traditional Hinduism, women have played significant roles as devotees, priestesses, and spiritual guides, though often limited by patriarchal norms. Table 1 represents the comparative overview of the core aspects of Hinduism, Christianity, and Jainism. Christianity has seen increased participation of women in ministry and leadership, particularly in Protestant denominations. Jainism has both male and female monks, and women are respected for their spiritual potential, though certain restrictions apply in some sects. Across all traditions, there is a growing movement toward gender equality and the reevaluation of historical practices that have marginalized women. Religious festivals provide vibrant expressions of faith and community. Hindu festivals such as Navaratri, Ganesh Chaturthi, and Kumbh Mela draw millions of participants and highlight themes of divine victory, purification, and spiritual renewal. Christian celebrations like Christmas, Good Friday, and Easter mark key events in the life of Jesus and are celebrated with joy, reverence, and acts of charity. Jain festivals such as Paryushana and Diwali (marking Mahavira's liberation) focus on repentance, forgiveness, and self-discipline. These events not only reinforce religious values but also promote cultural identity and community cohesion.

In the modern world, the relevance of religion is often questioned, yet the teachings of Hinduism, Christianity, and Jainism continue to offer moral guidance and a sense of purpose. In times of crisis, such as natural disasters, social unrest, or personal suffering, religious faith provides comfort and direction. The rituals, prayers, and spiritual disciplines of these traditions help individuals cope with uncertainty and find meaning in adversity. Moreover, religious communities often play vital roles in humanitarian efforts, education, and advocacy for marginalized groups, reflecting the enduring power of faith to transform lives and societies. In conclusion, the discussion of Hinduism, Christianity, and Jainism reveals the profound diversity and depth of human religious experience. Each tradition offers a unique perspective on the divine, the self, and the moral order of the universe. By examining their beliefs, practices, and cultural expressions, it becomes clear that while differences abound, the shared human quest for truth, meaning, and transcendence unites these paths. In a world increasingly shaped by pluralism and global challenges, the insights from these religions can contribute to a more compassionate, just, and spiritually enriched future. Through dialogue, understanding, and mutual respect, the rich legacies of Hinduism, Christianity, and Jainism can continue to inspire and guide humanity toward higher ideals.

4. CONCLUSION

The exploration of Hinduism, Christianity, and Jainism across various cultural contexts reveals the profound impact these religions have on shaping personal identities, societal values, and global ethics. Each tradition, though distinct in origin and doctrine, offers a comprehensive worldview that addresses fundamental questions about life, morality, and the human relationship with the divine. Hinduism presents a complex and inclusive system that values spiritual progression through various paths, emphasizing harmony with cosmic order. Christianity promotes a personal relationship with God, centered on love, redemption, and community service. Jainism upholds strict ethical codes with a central focus on non-violence, self-discipline, and spiritual liberation. Despite differences in rituals and theological emphasis, all three religions contribute to the universal values of compassion, peace, and moral responsibility. The comparative analysis highlights how these belief systems respond to cultural change, adapt to globalization, and maintain relevance in modern societies. By understanding their unique philosophies and shared human concerns, it becomes possible to foster greater interreligious dialogue, mutual respect, and peaceful coexistence. This study

demonstrates that religious traditions are not static but dynamic forces that evolve while preserving their core teachings. The findings emphasize the importance of religious literacy in promoting tolerance and unity in diverse communities. Ultimately, embracing the spiritual richness and ethical insights of Hinduism, Christianity, and Jainism can inspire more inclusive, empathetic, and harmonious global interactions. Such understanding is essential for building bridges across faiths and ensuring that spiritual diversity is seen as a source of strength rather than division.

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CHAPTER 12

A COMPREHENSIVE APPROACH TO PACKAGING WASTE MANAGEMENT

Ishwari Sagare[1], Shruti Govalkar[2], Vedanti Panchal[3], Sangeeth Shankar[4]
[1,2,3]Student, [4]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3,4]Atlas Skilltech University, Mumbai
Email: ishwari.sagare.bdes2026@atlasuniversity.edu.in[1], shruti.govalkar.bdes2026@atlasuniversity.edu.in[2], vedanti.panchal.bdes20206@atlasuniversity.edu.in[3], sangeeth.sankar@atlasuniversity.edu.in[4]

ABSTRACT:

The escalation of packaging waste has become a global environmental and socio-economic challenge, exacerbated by rapid industrialization, urbanization, and the rise of e-commerce. While packaging plays a vital role in protecting goods and enabling logistics, its after-use impacts, particularly when composed of non-biodegradable or multi-material components, are significant and enduring. This essay explores a comprehensive approach to packaging waste management, emphasizing the need for systemic solutions that incorporate waste prevention, reuse, recycling, and regulatory enforcement. The discussion highlights the importance of extended producer responsibility (EPR), sustainable packaging design, advanced recycling technologies, and public awareness initiatives. Moreover, it considers the role of informal waste sectors, the necessity of inclusive policies, and the promise of emerging innovations such as smart packaging and circular business models. Through global case studies and critical analysis, the essay advocates for a collaborative, integrated framework that not only mitigates environmental harm but also fosters economic resilience and social equity in packaging waste management.

KEYWORDS:

Biodegradable Materials, Circular Economy, Consumer Awareness, Environmental Sustainability, Life-Cycle Assessment.

1. INTRODUCTION

The rapid growth of global consumerism, driven by industrialization, urbanization, and e-commerce, has led to a corresponding surge in packaging waste, posing severe challenges to environmental sustainability and public health. Packaging, while essential for product protection, distribution, and marketing, often ends up as a significant contributor to municipal solid waste, especially when composed of non-biodegradable and single-use materials [1]. This waste, if not properly managed, can persist in ecosystems for hundreds of years, contaminating land, waterways, and oceans, and adversely affecting wildlife and human populations. In light of escalating ecological concerns and the urgent need to transition to more sustainable practices, a comprehensive approach to packaging waste management has become imperative. Such an approach transcends traditional disposal methods, advocating for a holistic strategy that includes waste reduction at the source, the promotion of reusable and recyclable materials, improved waste segregation systems, and robust policy frameworks.

It emphasizes the importance of extended producer responsibility (EPR), innovation in eco-friendly packaging design, and public awareness campaigns that encourage responsible consumption and disposal behaviors. Tackling the packaging waste crisis requires the

concerted efforts of governments, industries, consumers, and environmental organizations, all of whom play pivotal roles in developing sustainable packaging solutions and building resilient waste management infrastructures [2]. This paper delves into the multifaceted dimensions of packaging waste, critically analyzing current management practices, exploring sustainable alternatives, and proposing a collaborative framework to mitigate the growing packaging waste burden while fostering a circular economy.

The exponential growth of global consumption, fueled by industrial advancement, urban expansion, and the proliferation of online commerce, has led to a staggering increase in packaging waste, which now poses one of the most pressing environmental and societal challenges of our time. Packaging plays a vital role in the modern economy by ensuring product safety, extending shelf life, facilitating transportation, and enhancing marketing appeal. The widespread use of single-use plastics, multilayer packaging, and other non-biodegradable materials has created an unsustainable dependency on disposables [3]. These materials often end up in landfills, incinerators, or as pollutants in terrestrial and marine ecosystems, where they persist for centuries and contribute to ecological degradation, climate change, and public health issues. The global packaging industry, while a key driver of economic activity, is now under increasing scrutiny for its environmental footprint, as mounting evidence links packaging waste to resource depletion, greenhouse gas emissions, and the destruction of biodiversity.

In many parts of the world, waste management systems are ill-equipped to cope with the growing volume and complexity of packaging waste. Traditional linear models of "take-make-dispose" are proving to be both economically and environmentally unsustainable. Recycling rates remain low, especially for complex materials, and informal waste sectors often operate under hazardous conditions without adequate support or recognition. Meanwhile, consumer awareness around packaging waste remains limited, and behavior change initiatives have not kept pace with the urgency of the problem [4]. In response, the concept of a comprehensive approach to packaging waste management has gained momentum, an approach that integrates the principles of sustainability, circular economy, and life-cycle thinking into every stage of packaging production, use, and disposal.

A truly comprehensive packaging waste management strategy requires a multi-dimensional effort involving all stakeholders, governments, producers, consumers, recyclers, and civil society. Policymakers must enact and enforce regulations such as Extended Producer Responsibility (EPR), deposit-return schemes, and plastic bans, which shift the responsibility of waste back to the manufacturers and incentivize innovation in sustainable packaging.

Industry players must invest in research and development to design materials that are recyclable, compostable, or reusable, while also reducing material usage through minimal and smart packaging [5]. Local governments and waste management authorities need to modernize infrastructure, improve waste collection and sorting systems, and ensure the integration of informal waste workers into formal recycling economies. At the same time, consumer education campaigns should be amplified to encourage eco-conscious purchasing choices and proper disposal habits.

In addition to systemic reforms, technology and innovation play a vital role in driving change. From biodegradable films and plant-based packaging to AI-powered waste sorting and blockchain-enabled traceability in recycling chains, emerging solutions offer immense potential to revolutionize the way packaging waste is managed [6]. The technology alone is not a panacea. Effective implementation demands institutional coordination, public-private partnerships, and robust monitoring mechanisms to ensure accountability and long-term impact. Importantly, packaging waste management must also be approached through the lens

of social equity, recognizing the disproportionate burden placed on low-income communities, many of whom live near landfills or work in informal recycling sectors without adequate protections.

The study explains urgency to develop a sustainable, inclusive, and future-proof approach to packaging waste management has never been greater. As the global community faces the dual crises of environmental degradation and climate change, packaging waste serves as both a symptom and a symbol of our unsustainable consumption patterns. Addressing it effectively requires a paradigm shift from viewing waste as an inevitable by-product of economic growth to understanding it as a design flaw that can be corrected through innovation, collaboration, and policy reform. This explores the key challenges associated with packaging waste, critically evaluates existing waste management practices, and proposes a comprehensive framework that aligns environmental goals with economic and social priorities. By doing so, it aims to contribute to the growing discourse on sustainable development and the circular economy, advocating for a future where packaging not only protects products but also protects the planet.

2. LITERATURE REVIEW

R. Kaur *et al.* [7] discussed that waste from vegetables is a significant issue in Indian markets & is brought on by several problems, such as improper handling, inefficient shipping, insufficient storage, and inconsistent packing and grading. This wastage results in large financial losses for farmers and traders as well as increased pollution, landfill waste, and greenhouse gas emissions for the environment. Vegetables that are going bad in stores endanger food safety and pose health risks. To address this issue, a comprehensive research study employing a mixed-method approach was conducted. Among both qualitative and quantitative methods employed in this study are structured surveys, in-depth interviews with relevant stakeholders, including a questionnaire survey of 100 residents.

B. Nabi *et al.* [8] analyzed that food waste is a continuous worry for the food industry as it leads to both environmental and economic issues. Along the food supply chain, a substantial amount of waste is produced from production to consumption. This waste includes non-edible food items, by-products of fruits and vegetables, and other waste materials. Reusing and recycling waste from perishable goods is turning into a vital multidisciplinary tactic in the context of the circular bioeconomy. Because it is rich in raw by-products, this waste might be used as an organic source of materials. Researchers are increasingly concentrating on biomass valorization to extract and use components that greatly boost value.

M. Sarkar *et al.* [9] explored the process to identify the environmental issues that e-commerce companies are most concerned about. A comprehensive framework for considering the complex relationships, such as cars and the emissions they generate, the ban on single-use plastics, the requirement for environmentally friendly packaging options, and the necessity of promoting the reduction of plastic pollution, was provided during the process. Finally, an attempt has been made to look at any possible connections between hiring, employee retention, and social and environmental sustainability. In addition to the financial benefits that sustainability policies provide, eco-friendly company activities such as trash reduction, recycling, energy conservation, and energy-efficient equipment can be more profitable and effective than traditional methods. Additionally, productivity and staff retention were found.

D. Clark *et al.* [10] examined that plastics, especially plastic packaging, have become more of a source of worry and curiosity. Because plastics are being used in larger amounts, more of them are entering the environment. Plastics are the ideal material for numerous packaging applications because they are less costly, offer better barrier characteristics to protect the freshness of objects, can shield items during transit, and are easy for customers. Concerns

about plastics and plastic packaging sustainability include resource consumption, waste, littering, and marine pollution. Suggested alternatives, such as using less packaging and bio-based, biodegradable packaging, are examined from the perspective of a package maker. Additionally, recent studies on these innovative methods and technologies have been considered. Increasing the use and recycling of more recycled plastics is one solution.

A. Singh *et al.* [11] investigated the most recent advancements in the sustainable and ecologically friendly recycling of post-consumer polyethylene terephthalate (PET) waste, as well as its importance in promoting and understanding the circular economy concept. This chapter also provides a comprehensive worldwide view of the conventional plastics business, especially PET, and its shift to the circular economy. PET is a polymer that is highly recyclable and has a variety of applications. Ethylene glycol (EG) and terephthalic acid undergo a polymerization process to create polyester, a thermoplastic that was developed in 1940 by DuPont researchers in North America. PET is inexpensive, lightweight, recyclable, resealable, and burst-resistant. PET's maximum strength, openness, and thermal ability made it the material of choice for packaging.

The above-mentioned studies do not explain that management of packaging waste has emerged as a critical global concern, closely intertwined with the broader challenges of environmental sustainability, climate change, and circular economy development. Packaging waste, particularly plastic-based packaging, constitutes a significant portion of municipal solid waste in both developed and developing countries.

This issue is compounded by the rise in e-commerce, urbanization, and changing consumer lifestyles, all of which have intensified the demand for convenient, lightweight, and durable packaging materials. While packaging serves important functions such as protecting goods, preserving freshness, and enabling branding and logistics, its environmental cost is immense when not properly managed.

3. METHODOLOGY

3.1 Design:

This study employs a qualitative research design to comprehensively investigate packaging waste management practices, focusing on dry packaging waste and considering the initial impact of wet waste contamination. The research design integrates qualitative and a little quantitative method approaches to provide a holistic understanding of current waste management challenges and potential solutions. Quantitative data were collected through structured surveys administered via Google Forms, targeting households in urban and suburban areas. These surveys addressed practices related to waste sorting, storage, disposal, and recycling awareness. In parallel, qualitative data were gathered through cultural probes and field surveys with households to explore behaviors, attitudes, and challenges in managing packaging waste. Field visits to recycling facilities and waste sorting centers provided insights into operational processes, identifying gaps in the handling of dry and contaminated packaging waste, and offering a comprehensive understanding of public engagement and the effectiveness of waste management infrastructure. Figure 1 illustrates the flowchart of the research framework.

3.2 Sample/Instruments used:

To gather initial insights, an online survey was conducted with a sample of 80 participants to collect preliminary data on waste segregation practices and primary concerns. This survey helped identify general trends and provided insight into common challenges faced by users in

waste management. A subsequent survey, with a sample size of 11, focused specifically on issues related to packaging waste, including respondents' willingness to pay a premium for sustainable packaging alternatives.

To gain deeper insights into waste management behaviors and attitudes, we conducted in-depth interviews with 10 participants representing various professions and age groups. This diverse sample allowed us to capture a broad range of perspectives, with interviews exploring participants' motivations, challenges, and experiences in waste management in a detailed and nuanced manner. A cultural probe study was also implemented, involving 11 participants over one week. Participants were asked to document their daily waste management practices, record any challenges encountered, and provide samples of the different types of waste they generated. This method facilitated an in-depth observation of real-life behaviors and specific challenges associated with various waste categories, particularly packaging materials.

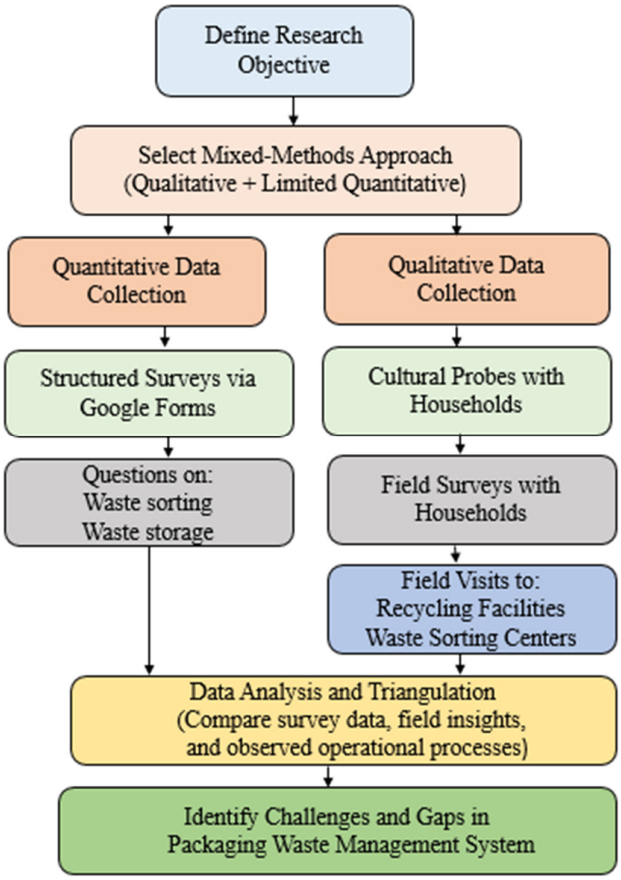

Figure 1: Illustrates the flowchart on the research framework.

3.3 Data Collection:

For the data collection process, we have both qualitative and quantitative methods. The qualitative approach included cultural probes and interviews, which provided in-depth insights into individual behaviors, emotions, and preferences related to time management. The quantitative method involved using Google Surveys to gather statistical data, allowing us to analyze trends, patterns, and generalizable findings, complementing the subjective insights from the qualitative approach.

3.4 Data Analysis:

For data analysis, we utilized Figma to create the cultural probe, allowing us to visually organize and present the data collected. The majority of our data was analyzed using ATLAS, where we coded and networked the inputs to identify key patterns and themes. This approach helped us refine our project, providing a clear understanding of the crucial points and insights necessary for moving forward with a focused, data-driven strategy. Table 1 illustrates the table on data analysis table.

Table 1: Illustrates the table on data analysis.

Themes	Codes	Quotations
Dry/ packaging waste recycling and reusing.	Reuse and Disposal of Cardboard Boxes Paper from packaging can be recycled or reused.	"Although the packaging paper could have been recycled or reused, it was thrown away." "Some cardboard boxes are kept to store something inside them, some are just kept empty in case they come in use someday, and others are flattened out and given to Raddiwala or recycled."
Barriers that make packaging waste management hard	Brands are not considering packaging waste produced as a concern The cause of the mess around the house Sustainable packaging is not yet a primary factor influencing purchasing decisions for most individuals.	"The amount of plastic or any packaging overused isn't looked into in detail much." "Huge boxes that come in, as they are not reused very often, and folding them is also a task, so it just ends up being on the floor outside, lying around." "The most frustrating waste to deal with will be plastic, especially single-use plastic. "No matter how much I try to avoid it, it seems to pile up: plastic bags, wrappers, and plastic packaging". Also, the cardboard boxes and newspaper pile would come second." "The convenience of the product as well as the service provided increases when Companies/Services consciously use materials based on their users' requirements effectively."
Expectations according to the need	Hard to segregate if the dry waste is mixed with perishable waste	"Especially in the perishable goods store, it is hard to segregate dry waste if mixed with this perishable waste."
Ideal packaging: consumer expectation	Concern for the entire product lifecycle, including disposal and potential repurposing. Packaging that dissolves in soil.	"Easy disposable/repurposeful, has a creative instruction manual or illustrations (refer to blinkit packaging), basically an interesting visual. Also, an interesting packaging layout itself is something I'd like to see, of course, without harming the learning curve." "Maybe a degradable packing that dissolves

	Reuse and recycling should have less effort than throwing it in the trash.	in soil, since I have many home-potted plants, it can be useful and sustainable too." "It depends because, regarding packaging material, people just want to get rid of it. If the reuse or repurposing design offers something more compared to the extra efforts in keeping the product, then it makes sense."
Thoughts and feelings towards the situation	Packaging reuse should go with the product for more benefits.	"The repurposing would work better if it's product-specific, I feel."

4. RESULTS AND DISCUSSION

One of the foundational pillars of a comprehensive strategy is waste prevention at the source, also known as source reduction. This involves minimizing the volume and toxicity of packaging materials before they enter the market. Businesses can achieve this through lightweighting (reducing material use while maintaining product integrity), switching to mono-materials that are easier to recycle, and eliminating unnecessary layers of packaging. Brands across industries are now investing in minimal and sustainable packaging designs, often guided by life-cycle assessments (LCA) that evaluate the environmental impacts associated with each stage of a product's life [12]. Product-to-packaging ratios are being optimized to reduce over-packaging and packaging waste. Governments and regulatory agencies can support these initiatives through policy incentives, tax reliefs, and certifications that reward eco-friendly design practices.

Another vital component is the promotion of reusable packaging systems. Reusability helps in reducing the need for single-use packaging and encourages a circular model where packaging can be returned, cleaned, and reused multiple times. Traditional reuse systems, such as glass bottle returns, are being revisited and modernized using digital technologies and logistics innovations. For example, the Loop initiative, a global platform that collaborates with brands and retailers, provides consumers with durable, reusable containers that can be picked up, cleaned, and refilled, mirroring the convenience of e-commerce while dramatically reducing packaging waste [13]. In developing countries, local informal systems of reuse, such as bottle collection and refill stations, are already in place, but require formal support and infrastructure to be scalable, hygienic, and efficient. Reusable packaging systems are particularly promising in business-to-business (B2B) settings and food delivery services, where packaging can be standardized and returned in closed-loop models.

Recycling remains a cornerstone of packaging waste management, yet its effectiveness depends heavily on the type of material, collection systems, consumer participation, and the end markets for recycled products. While paper and metals generally enjoy high recycling rates, plastics, especially multi-layered and flexible plastics, remain a major challenge due to contamination, separation difficulties, and low market value. Many countries still struggle with inadequate segregation at source, insufficient recycling infrastructure, and the economic unviability of recycling certain types of packaging [14]. To address this, investment in advanced recycling technologies, such as chemical recycling and AI-enabled material sorting,

is gaining traction. Unlike traditional mechanical recycling, chemical recycling can break down plastics to their molecular level, enabling the reuse of materials that were previously considered non-recyclable. These technologies are still emerging and must be critically evaluated for their energy use, emissions, and scalability.

Extended Producer Responsibility (EPR) is another key policy tool in a comprehensive approach to managing packaging waste. EPR mandates that producers take responsibility financially or physically for the treatment and disposal of packaging waste associated with their products. This not only internalizes the environmental costs of packaging but also incentivizes producers to design packaging that is easier to collect, sort, and recycle. EPR schemes have been implemented with varying degrees of success across countries. In the European Union, for example, EPR is a legal requirement under the Waste Framework Directive, and producers contribute to collective compliance schemes that fund waste management. In India, the Plastic Waste Management Rules have introduced EPR for plastic packaging, urging companies to meet collection and recycling targets. The effectiveness of these policies hinges on proper enforcement, clear guidelines, data transparency, and collaboration among stakeholders.

Consumer behavior and public awareness also play an indispensable role in packaging waste management. Even the most well-designed systems and policies can falter without public participation in waste segregation, recycling, and sustainable consumption. Education campaigns, labeling systems, and incentives are crucial in shaping consumer attitudes and habits. For instance, clear recycling labels on packaging can guide consumers in disposing of waste correctly. Deposit return schemes (DRS), where consumers pay a small deposit for packaging and receive a refund upon returning it, have proven highly effective in increasing collection rates for bottles and cans. Social media and influencer-driven campaigns can be harnessed to spread environmental messages, especially among younger demographics who are more attuned to sustainability concerns. Overcoming cultural habits and misinformation remains a significant challenge that requires consistent and localized outreach.

On the technological front, digital tools and innovations are transforming how packaging waste is monitored and managed. Smart packaging equipped with QR codes or RFID tags can provide information on recycling instructions, material composition, and even track the life cycle of packaging components. Waste management companies are adopting data analytics and machine learning to optimize collection routes, predict waste generation patterns, and improve material recovery rates. Blockchain technology is also being explored to improve transparency in supply chains and track the movement of recycled materials. These innovations, when integrated into broader waste management strategies, can significantly enhance efficiency, accountability, and traceability.

Globally, several countries and municipalities have demonstrated best practices in managing packaging waste through integrated policies, infrastructure investment, and public-private partnerships. For instance, Germany's Green Dot system has been a model of EPR-based recycling since the 1990s, leading to some of the highest packaging recycling rates in the world. South Korea has implemented mandatory food waste separation and strict packaging regulations that emphasize recyclability and minimalism. In Rwanda, a nationwide ban on plastic bags has not only curbed packaging waste but also improved urban cleanliness and tourism. These examples underline the importance of political will, community engagement, and context-specific strategies in tackling packaging waste effectively.

The one-size-fits-all model is unlikely to succeed across diverse economic, social, and geographic contexts. In low- and middle-income countries, where informal waste pickers play a vital role in recovering recyclable materials, any packaging waste strategy must be inclusive and supportive of livelihoods. Providing training, safety gear, formal employment opportunities, and access to waste processing facilities can improve both the efficiency and dignity of informal recycling sectors. International cooperation and knowledge exchange are essential in scaling successful models and harmonizing regulations, especially as packaging waste often crosses borders through trade and environmental flows. Figure 2 illustrates the waste management strategy regarding the level of education.

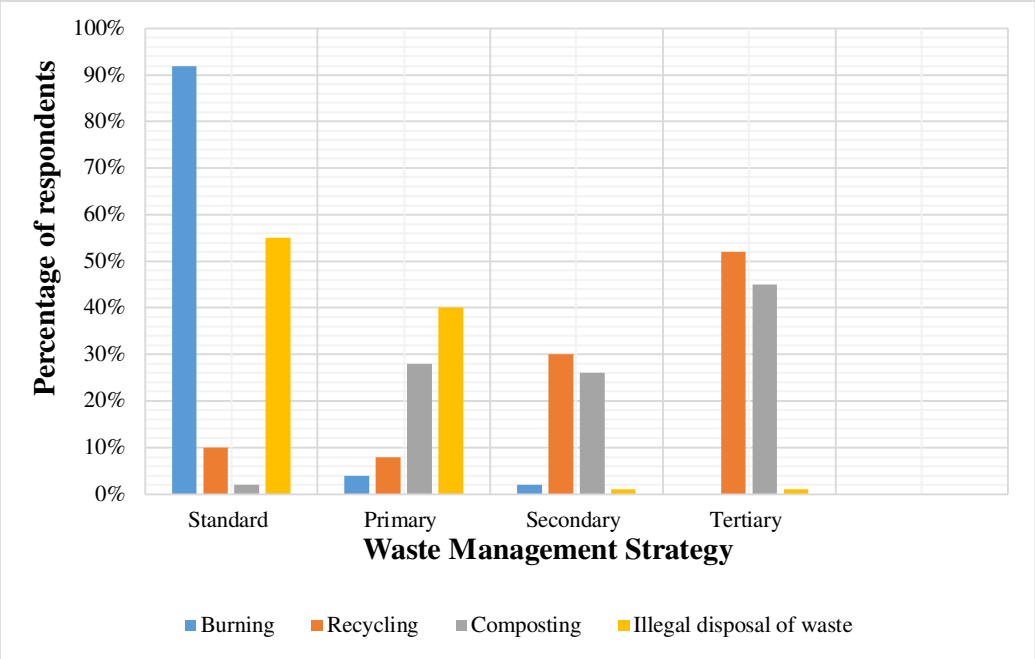

Figure 2: Illustrates the waste management strategy regarding the level of education.

The role of the private sector in a comprehensive waste management approach cannot be overstated. Companies must take proactive steps not only to comply with regulations but also to lead by example through innovation, transparency, and sustainability commitments. Many global brands are now pledging to make all packaging recyclable or reusable by certain target years, often aligned with the Ellen MacArthur Foundation's New Plastics Economy initiative. Retailers and manufacturers are exploring refill stations, packaging-free stores, and biodegradable alternatives such as seaweed-based wrappers or compostable films. However, greenwashing remains a risk, and it is critical to ensure that sustainability claims are verified and backed by measurable outcomes.

Economics also plays a central role in determining the feasibility and sustainability of packaging waste management. Recycling and reuse systems must be financially viable for both producers and processors. Governments can support this through subsidies, tax credits, and green public procurement. At the same time, environmental externalities such as pollution, resource depletion, and health impacts must be factored into the cost of packaging, creating a level playing field for sustainable alternatives. The development of circular business models where packaging waste is viewed not as garbage but as a resource can unlock new economic

opportunities, especially in green jobs, material recovery, and eco-innovation. Finally, packaging waste management must be framed as a dynamic, evolving field that requires continuous learning, adaptation, and collaboration.

The challenges are complex and interconnected, involving actors from across the packaging supply chain, government institutions, waste service providers, research communities, and civil society. Public policy must remain responsive to emerging trends such as biodegradable plastics, e-commerce packaging growth, and consumer pressure for ethical brands. Investments in research and development should continue to explore next-generation materials, alternative delivery models, and decentralized waste processing technologies. Equally, citizen participation should be institutionalized through participatory decision-making, environmental education, and feedback mechanisms.

Managing packaging waste effectively demands a comprehensive, systemic approach that addresses not only the symptoms of the problem but its root causes. It requires a shift from linear, throwaway systems to circular, regenerative ones that prioritize reduction, reuse, and responsible design. By integrating policy, technology, business innovation, and community engagement, societies can build resilient and inclusive systems that prevent packaging waste from polluting the environment and depleting resources. The path forward lies not in fragmented efforts but in collaborative, well-orchestrated strategies that align environmental imperatives with economic and social goals. As the global packaging waste crisis intensifies, the need for comprehensive solutions becomes more urgent and also more achievable through shared responsibility, bold leadership, and sustained commitment.

The analysis of dry waste reveals various sources, including paper, plastics, metals, and glass, primarily from packaging materials like boxes and cartons. The extensive use of disposables in food and product packaging significantly contributes to waste generation. Mixed-material packaging, such as laminated plastics, poses recycling challenges, while improper disposal and lack of segregation worsen the issue. This emphasizes the need for awareness campaigns, efficient recycling systems, and innovative packaging solutions. Addressing waste at its source is essential for effective waste management. The management of wet waste focuses on sustainable practices that repurpose organic materials effectively. Composting vegetable scraps and food leftovers enriches soil and reduces landfill contribution, while vermicomposting uses earthworms to break down biodegradable waste efficiently. Simple tools like indoor compost bins enable households to recycle nutrients back into the ecosystem and reduce reliance on chemical fertilizers. By separating wet waste from composting, communities can transform it into a valuable resource, promoting sustainable living and a healthier environment. Dry waste management involves sorting materials for effective recycling and reuse. Packaging materials are recycled, while items like boxes, glass jars, and bottles are repurposed for storage or crafts. Old clothes are converted into rags or mats, and high-quality materials are sold for income generation.

Creative upcycling of plastics and tins further reduces waste. Organic dry waste is often composted for use as fertilizer. These practices demonstrate how thoughtful segregation and innovative reuse can minimize environmental impact and promote sustainability. Waste segregation faces significant challenges due to inconsistent practices and systemic issues. At home, separating dry and wet waste is often neglected, with reliance on municipal services reducing personal accountability. Mixing dry and wet waste complicates sorting, leading to

practical difficulties like torn bags. Workplaces also face segregation issues due to inadequate systems or negligence. Poorly managed segregation often results in waste being dumped into landfills, undermining recycling efforts.

However, positive practices such as reusing packaging materials, recycling plastics, and utilizing wet waste as fertilizer demonstrate potential solutions. Addressing these challenges requires systematic improvements and active individual participation for effective waste management. Individuals play a vital role in waste management by adopting practices that reduce and manage waste efficiently. Key approaches include repurposing plastic jars for storage, reusing cardboard boxes, and participating in recycling initiatives, such as transforming tetra packs into furniture. Using cloth bags reduces packaging waste, while selling scrap materials promotes recycling. DIY projects with materials like plaster of Paris foster creativity and minimize waste. Increasing awareness has led individuals to track their waste production and adopt responsible disposal habits. These efforts collectively demonstrate the significant impact individuals can have in promoting sustainability and reducing environmental impact.

Expectations from the government regarding waste management emphasize the need for improved communication, awareness, and implementation of existing initiatives. Ineffective practices contribute to global warming and harm living organisms, highlighting the urgency of action. Citizens call for accessible recycling technologies, simplified waste sorting processes, stricter regulations, and public awareness campaigns to promote sustainable practices like composting and recycling. The growing population exacerbates waste management challenges, underscoring the need for proactive measures to prevent unmanaged waste. A comprehensive strategy integrating policy, technology, and community engagement is essential to address these issues effectively. The mind map also highlights key aspects of consumer expectations and actions toward reducing packaging waste. It emphasizes mindful purchasing, where individuals consider both cost and packaging to minimize waste. Reusable packaging should provide long-term benefits, and sustainable practices should extend throughout the product lifecycle, including disposal and repurposing. Ideal packaging solutions, such as biodegradable options, reduce environmental impact. Consumers are increasingly willing to pay more for sustainable packaging if the price increase is justified by added value. Ultimately, individual awareness and transformation are crucial for promoting sustainable waste management practices.

5. CONCLUSION

A comprehensive approach to packaging waste management is not only a necessity but an urgent imperative in the face of escalating environmental degradation and resource depletion. The multifaceted nature of packaging waste demands a shift from linear consumption models to circular systems grounded in reduction, reuse, and recovery. This transformation requires active participation from all stakeholder's governments, industries, communities, and consumers working together to enforce regulations, innovate sustainable materials, improve waste infrastructure, and promote responsible behavior. While promising practices and technologies are emerging globally, their success hinges on strong policy support, economic incentives, and inclusive frameworks that recognize the role of marginalized groups such as informal waste workers. Ultimately, the path toward sustainable packaging waste management lies in reimagining waste not as an inevitable by-product of progress, but as a design failure

that can be corrected through thoughtful planning, systemic change, and collective commitment. By embracing this holistic vision, societies can not only reduce their environmental footprint but also build resilient economies and healthier communities for future generations.

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CHAPTER 13

FROM GROUND TO GREAT HEIGHTS: RE-THINKING FURNITURE MOBILITY IN MULTISTORY BUILDINGS

Anvita Sushil Patade[1], Zainab Bagasrawala[2], Sangeeth Sankar[3]
[1,2]Student, [3]Faculty
ATLAS ISDI- School of Design & Innovation
[1,2,3]Atlas Skilltech University, Mumbai
Email: anvitapatade@gmail.com[1], zainu0504@gmail.com[2], sangeeth.sankar@atlasuniversity.edu.in[3]

ABSTRACT:

The rise of multistory buildings in response to rapid urbanization has fundamentally transformed how people live and interact with space. However, while architectural design has evolved vertically, furniture mobility within these structures has often lagged. Traditional furniture, typically designed for ground-level dwellings, presents significant challenges when transported through narrow elevators, tight stairwells, and compact entryways of high-rise buildings. This paper explores the pressing need to rethink furniture design and mobility for multistory living. It examines the role of modular, lightweight, and sustainable furniture solutions, alongside technological innovations such as augmented reality and furniture-as-a-service models. It also emphasizes the importance of architectural planning that supports furniture movement and addresses the socio-cultural, economic, and psychological implications of furniture logistics. The discussion advocates for a multidisciplinary approach that aligns furniture design with the unique demands of vertical urban environments, ultimately aiming to create more livable, adaptable, and future-ready high-rise spaces.

KEYWORDS:

Augmented Reality, Building Design, Compact Living, Design Innovation, Digital Tools.

1. INTRODUCTION

In the rapidly urbanizing world of the 21st century, the vertical expansion of cities has become not just a choice but a necessity. With limited horizontal space and an ever-growing population, multistory buildings have emerged as architectural marvels that define modern skylines. These towering structures, ranging from residential high-rises to sprawling commercial complexes, symbolize progress, density management, and urban efficiency. However, amidst this vertical revolution, one crucial aspect has often been overlooked: the mobility and logistics of furniture within these multistory environments [1]. From the initial stages of interior furnishing to later modifications, relocations, or renovations, the challenge of moving large, often cumbersome pieces of furniture through elevators, staircases, and narrow corridors presents both logistical and design hurdles. Traditional furniture designs, primarily tailored for single-story living or low-rise access, often fail to meet the needs of vertical dwellers. The stress and costs associated with moving heavy or oversized items up and down buildings can deter residents and businesses alike, especially when damage to property or furniture is a potential risk.

This calls for a fundamental shift in how we perceive and design furniture in the context of high-rise living. The idea of "furniture mobility" must evolve beyond mere transportation convenience and become an integrated element of both furniture design and architectural planning. As cities grow upwards, furniture must become more adaptive, modular, lightweight,

and ergonomically suited for tight vertical movement [2]. This rethinking goes beyond convenience, it addresses sustainability, economic efficiency, user experience, and even the mental well-being of residents who must grapple with the complexities of vertical logistics. The modern consumer, now more mobile than ever, demands flexibility and ease of use in every product they interact with, and furniture is no exception. The rise of rental homes, co-living spaces, and frequent job-related relocations necessitates furniture that is not only aesthetically pleasing and functional but also easy to transport, assemble, and disassemble within high-rise environments.

The concept of flat-pack furniture introduced by global brands like IKEA was a game-changer in this regard, but even this model presents challenges when faced with elevators that are too small or stairwells that are too tight. Furthermore, in many parts of the world, especially in developing urban centers, building infrastructure is often outdated or inadequately planned to accommodate modern furniture transport needs [3]. As such, there is an urgent need for a harmonized dialogue between architects, interior designers, furniture manufacturers, and urban planners to reimagine furniture mobility for the vertical age. Moreover, as environmental concerns continue to dominate the global discourse, sustainable design principles must be embedded in this rethinking process.

Reducing the need for excessive packaging, minimizing material wastage during transportation, and creating reusable or reconfigurable furniture systems can significantly lower the carbon footprint of urban living. Smart design innovations such as collapsible components, embedded wheels, modular systems, and digital tools like augmented reality for pre-fitting simulations can further revolutionize how we handle furniture in multistory contexts [4]. Notably, technology can also enable new service models, such as furniture-as-a-service (FaaS), where ownership is replaced by subscriptions, allowing users to rent, exchange, or upgrade furniture based on their needs, greatly simplifying the mobility problem in high-rise dwellings.

The study explains that cultural and economic dimensions also influence the conversation around furniture mobility. In densely populated countries like India or China, where multigenerational households often coexist, the demand for both compact and multifunctional furniture has surged. At the same time, the logistical burden of moving in or out of apartments remains disproportionately high, with many relying on manual labor due to a lack of automated solutions. In Western cities, while technology and service support may be more accessible, the issues of cost, space constraints, and tenant turnover still challenge traditional furniture paradigms.

2. LITERATURE REVIEW

G. Lelli *et al.* [5] discussed that promoting healthy mobility and active aging among elders is a global concern. The widespread use of electric tricycles, mobility scooters, and e-bikes has opened up new possibilities for older persons to travel far later in life and with less effort than they had previously thought. Because electric micro-mobility helps older adults stay active and less isolated, it may also force towns and cities to build better, more people-centered infrastructure to serve them. This will benefit commuters and locals of all ages. In this context, this chapter outlines the goals and first findings of an applied study on Internet of Things-based urban services that was commissioned by a top Italian utility that works in the environmental sector and addresses the design.

M. Zach *et al.* [6] examined an explanation of the project's theoretical and methodological underpinnings, including its research goals. Its main goal is to educate the professional community about the findings of the study, which focused on identifying the needs for furniture intended for kids with mobility impairments. The process for evaluating school furniture is then based on the specified standards. There are three layers to these needs, and they are all related in some way. The methodology's overall application is quite broad and may be used in any Czech educational institutions that have students in the target demographic. A report of every product that has been tested is the evaluation's result.

J. Kaczor *et al.* [7] proposed innovative subassembly and element movement methods used in kitchen furniture for those with limited mobility. Innovative design solutions created by the local business JATI are presented in the article. These solutions improve the usability of kitchen furniture meant for wheelchair users and the elderly, and they also allow for the installation of mounted cabinets on the wall in situations where partition walls lack the necessary load-bearing capacity. The design options include a drawer underneath the work surface that can be pushed out and raised upwards, a top kitchen cabinet that may be lowered and moved closer to the user, and a mechanism for elevating and supporting a huge countertop with associated parts.

A. Kapoor *et al.* [8] analyzed how customers may now rent from a variety of suppliers with only a button click or finger tap thanks to online furniture rental platforms, which are increasing choice and convenience.

As new online platforms compete for consumers and markets in India's capital cities, the online furniture rental industry is changing quickly. Through the proposal and empirical testing of a platform attributes-conversion model, the study seeks to explore attributes of online furniture rental platforms, analyzing how platform features impact a consumer's renting choice and how that influences conversion. Pilot research with 341 respondents was conducted as part of the project's mixed-methods approach.

M. Hersh *et al.* [9] investigated the involvement of 28 deafblind individuals in six different nations to discuss autonomous travel for deafblind individuals, both accompanied and unattended. Interviews conducted as part of a broader study on travel-related topics provided these experiences. The goal of the study was to better understand how they travel, including whether they prefer to use sighted guides or travel aids, how they are represented spatially, the need for accessible public spaces and information systems, cross-country comparisons, and the adjustments needed to make daily and vacation travel easier for (deaf)blind people. Recommendations in the areas of communication and information access, international standardization to facilitate foreign travel, crossing (indicators), street furniture, orientation, and mobility training were developed via the study of their experiences.

The above-mentioned studies do not explain that a universal solution to furniture mobility in multistory buildings must be inclusive, adaptable, and context-sensitive, responding to diverse user needs while aligning with global trends in sustainability, urban development, and technological innovation. As they continue to build upwards, it is imperative that our thinking about furniture design and mobility keeps pace with architectural advancements. The future of urban living will depend not just on how tall they build, but how thoughtfully they design the life within those walls. Reimagining furniture mobility from ground to great heights is not merely an issue of convenience; it is a necessary step toward making our vertical cities more livable, resilient, and future-ready.

3. METHODOLOGY

3.1 Design:

Demographic details in this research refer to characteristics of the target population, such as the type of buildings without lifts, the variety of staircases and layouts, and the profile of movers, including their age, physical capacity, and level of experience in handling heavy or bulky furniture.

The research design for "From Ground to Great Heights: Re-thinking Furniture Mobility in Multistory Buildings" follows a qualitative and exploratory approach, aimed at understanding the multifaceted challenges and opportunities associated with furniture mobility in high-rise environments. This study employs a mixed-method strategy combining literature review, case studies, expert interviews, and observational analysis. The literature review provides a theoretical foundation by examining existing research on urbanization, interior design, furniture innovation, and architectural constraints in multistory buildings. Case studies of modern high-rise residential and commercial complexes are analyzed to understand how furniture logistics are currently managed, highlighting gaps and best practices. Figure 1 illustrates the flow structure of methodology.

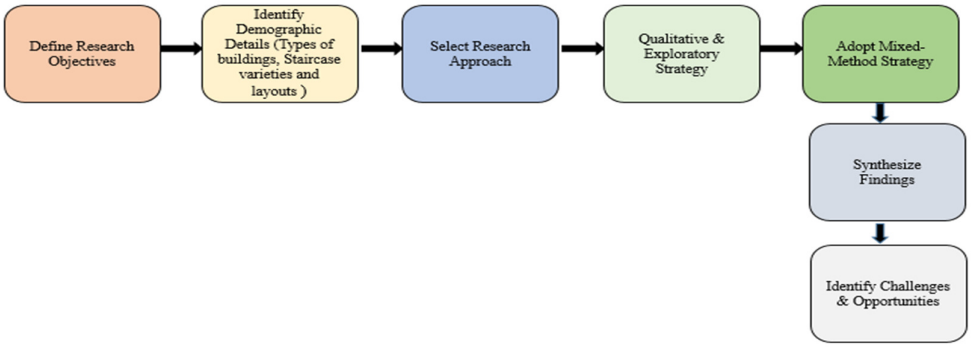

Figure 1: Illustrates the flow structure of methodology.

3.2 Sample/Instruments used:

The primary sample includes 25 residents living in multistory buildings, specifically ranging from mid-rise (5–10 floors) to high-rise structures (over 20 floors), located in urban centers such as Mumbai, Delhi, Bengaluru, and Pune. These residents were selected based on their experience with recent furniture relocation, interior redesign, or apartment moves. In addition, 10 professionals comprising architects, interior designers, furniture manufacturers, and logistics experts were interviewed to gain expert insights into the practical, technical, and design challenges of furniture mobility in high-rise buildings. The study also includes observational data from 5 furniture delivery and relocation companies operating in urban high-rise markets, offering real-time perspectives on logistical constraints. Together, this diverse sample ensures the study reflects both user experience and industry knowledge, allowing for a holistic examination of furniture mobility in vertical living environments.

3.3 Data Collection:

Conducting in-depth user interviews with movers to gather detailed insights into their personal experiences, difficulties, and specific needs. These interviews aim to uncover the physical

strain, safety concerns, and any suggestions for improving the process, ensuring the solution is practical and user-friendly. Observing the entire furniture-moving process, paying close attention to the different stages involved, such as lifting, carrying, and navigating stairs, to identify any physical or logistical challenges that might arise. This helps in understanding how movers interact with heavy furniture and the environment around them. Table 1 shows the table on data collection.

Table 1: Illustrates the table on data collection.

Data Collection Method	Focus Area	Details Captured	Purpose
In-depth User Interviews	Personal Experiences	Movers' individual stories and real-life scenarios	To understand the lived experiences and context of furniture mobility
Physical Strain	Fatigue, body pain, repetitive stress, and injuries	To identify ergonomic and health-related challenges	
Safety Concerns	Risks, accidents, lack of safety gear or protocols	To address gaps in safety practices	
Improvement Suggestions	Tools, techniques, or systems that movers wish they had	To inform user-driven design improvements	
Observational Analysis	Process Stages	Steps like lifting, carrying, adjusting furniture, and navigating stairs	To break down the workflow and identify key pressure points
Interaction with Environment	Building layouts, stair width, angles, obstacles	To assess environmental constraints impacting mobility	
Physical & Logistical Challenges	Slips, poor grips, narrow corners, need for teamwork	To document real-time issues that may not surface during interviews	

3.4 Data Analysis:

ATLAS.ti enables researchers to code textual data by labelling segments with tags like "physical strain," furniture damage, or difficulty navigating stairs. This process helps categorize and organize large amounts of qualitative data for easier analysis. ATLAS.ti also allows for network views that link different codes or concepts, visualizing how themes like

injury risk relate to factors such as heavy furniture or narrow staircases, revealing interdependencies between issues. Involves identifying patterns or themes within qualitative data. ATLAS.ti helps by allowing researchers to code data into themes like challenges with stairs or safety concerns and explore how these themes appear across different data sources. Content Analysis systematically analyzes texts to identify specific words or concepts. Using ATLAS.ti, researchers can create codes for issues like physical strain and quantify their frequency to assess the importance of different concerns. Comparative Analysis allows researchers to compare data sets to identify common or unique challenges based on context, leading to more targeted solutions. Table 2 illustrates the table on data analysis table.

Table 2: Illustrates the table on data analysis.

Analysis Method	Function in ATLAS.ti	Example Codes / Themes	Purpose / Outcome
Thematic Coding	Tagging and labeling text segments with specific codes	"Physical strain", "Furniture damage", "Difficulty navigating stairs"	To categorize data for better understanding and retrieval
Network View Analysis	Visualizing relationships between codes or concepts	Link: "Injury risk" → "Heavy furniture", "Narrow staircases"	To uncover interdependencies and visualize systemic relationships
Thematic Analysis	Identifying recurring patterns or themes across data sources	"Challenges with stairs", "Safety concerns"	To explore how themes are distributed and interlinked across interviews or observations
Content Analysis	Quantifying frequency of specific codes to assess significance	Frequency of "Physical strain", "Slips", "Back injuries"	To determine which concerns are most commonly reported or observed
Comparative Analysis	Comparing themes across different data sets (e.g., different buildings or movers)	Compare: "Stair-related challenges" in residential vs commercial buildings	To identify context-specific vs universal problems, aiding in targeted solutions

4. RESULTS AND DISCUSSION

As urban populations swell and land availability becomes increasingly constrained, the trend toward vertical living in multistory buildings is accelerating across the globe. High-rise residential towers, commercial complexes, and mixed-use developments are reshaping cityscapes, offering a practical response to space limitations. However, this vertical expansion

brings with it a set of complex logistical challenges, particularly concerning the movement and adaptability of furniture [10]. The task of transporting, assembling, disassembling, and rearranging furniture in multistory environments has become a significant concern for residents, architects, designers, and movers alike. Rethinking furniture mobility within this context is not just an issue of convenience, but one of functionality, sustainability, and future-readiness. As we move from ground to great heights, the way we conceptualize, design, and interact with furniture must evolve in tandem with the architectural innovations of our built environment.

Traditionally, furniture was designed with a flat, expansive ground-level layout in mind. Large dining tables, rigid sofas, heavy beds, and ornate wardrobes were all built assuming easy horizontal access. These designs, often passed down through generations or embedded in cultural preferences, are inherently incompatible with the compact, vertical access points of modern skyscrapers. In multistory buildings, elevators and staircases are the primary means of transport, but they are frequently narrow, restrictive, or structurally limited [11]. This disconnect often results in situations where large furniture items must be disassembled (if possible), carried up several flights of stairs, or even hoisted via cranes or ropes from windows or balconies, a costly and potentially hazardous exercise.

The evolution of furniture mobility in this context demands a deep reexamination of design principles. Modern urban furniture must prioritize modularity, collapsibility, lightweight materials, and tool-free assembly. These features not only make transportation easier but also enhance user autonomy and adaptability [12]. For example, modular sofas and sectional seating allow residents to reconfigure layouts based on space constraints or lifestyle needs. Similarly, beds that fold into walls (Murphy beds), extendable tables, and stackable chairs are gaining popularity among urban dwellers for their space-saving attributes and mobility. Importantly, these innovations should not sacrifice comfort or durability; rather, they must strike a balance between flexibility and function. Designers must embrace a user-centric philosophy, considering who will move the furniture, how often it will be moved, and under what constraints it will operate.

Another critical factor in rethinking furniture mobility is material innovation. Traditional furniture is often made from hardwood, metal, or other heavy, rigid substances that are not conducive to vertical movement. New-age materials such as engineered wood, composites, lightweight metals, recycled plastics, and sustainable fabrics offer alternatives that are both durable and easier to handle. Additionally, using environmentally friendly and recyclable materials contributes to the broader goal of sustainable urban development. Lightweight yet strong aluminum frames, foldable polymer structures, and smart textiles are being explored to create furniture that not only meets mobility needs but also supports green building certifications and carbon reduction targets. Beyond the furniture itself, the design of buildings plays a vital role in facilitating or hindering furniture mobility. Architects and developers must collaborate more closely with interior designers and logistics experts to integrate mobility into the blueprint of a building. This includes designing wider elevators, service lifts with furniture-friendly dimensions, spacious corridors, and modular walls or doors that can be temporarily removed to ease movement. Buildings that are purpose-built with furniture mobility in mind will significantly enhance the user experience while reducing the long-term maintenance and repair costs associated with moving bulky items through tight spaces.

Moreover, technology is becoming an enabler of new possibilities in furniture mobility. Augmented reality (AR) applications now allow users to visualize furniture in their spaces before making a purchase, reducing instances of size mismatches and the need for returns. 3D printing is opening doors to customizable, on-demand furniture that can be produced locally or even within the premises, eliminating the need for large-scale transportation. Robotics and automation are also beginning to influence furniture design, with prototypes of self-assembling furniture and motorized components that adjust height, orientation, or position for maximum comfort and mobility. The use of digital inventory and logistics platforms further streamlines the delivery and assembly process, ensuring better coordination between delivery personnel and building management. Figure 2 illustrates the flowchart of the recommendations to improve usability or user experience.

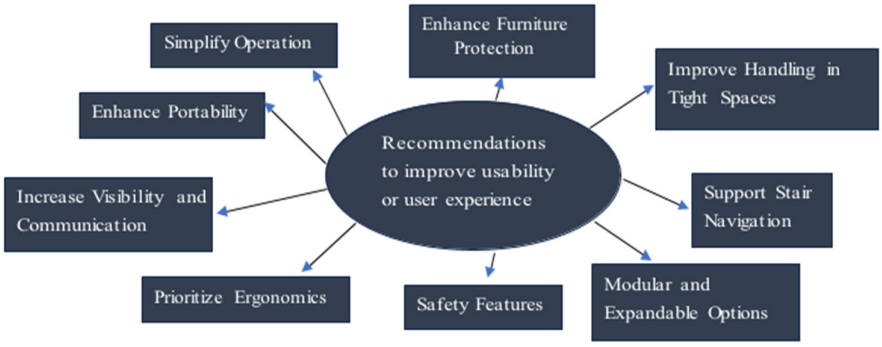

Figure 2: Illustrates the flowchart of the recommendations to improve usability or user experience.

Cultural dynamics also shape the need for furniture mobility in high-rise buildings. In regions like South Asia, the Middle East, and parts of Africa, extended families often live together in shared spaces, requiring multifunctional and movable furniture to accommodate daily life transitions from sleeping arrangements at night to work or social spaces during the day. In contrast, in many Western countries where nuclear families or single-person households dominate, there is a preference for minimalist, modular designs that suit compact apartments. Understanding these regional and cultural preferences is essential for manufacturers and designers aiming to cater to diverse global markets.

Economically, rethinking furniture mobility has the potential to create cost efficiencies and new business models. The rise of urban nomads, young professionals, and students who frequently change residences due to education or employment opportunities has fueled the growth of the furniture rental market. Companies offering furniture-as-a-service (FaaS) are thriving in cities where the high cost of moving, owning, and storing furniture makes renting a more attractive option. These services often deliver pre-assembled or easily movable furniture to customers, with the promise of reverse logistics (pickup and return) when needed. As a result, the financial burden of owning and moving furniture is alleviated, and users enjoy flexibility and lower environmental impact through shared usage models.

In this evolving ecosystem, government and policy stakeholders also have a role to play. Urban planning regulations should consider logistical access for furniture and goods movement in building codes and zoning laws. Offering incentives for buildings that include smart design elements to facilitate mobility, such as wider freight elevators, modular loading docks, or

furniture-friendly entryways, can encourage developers to prioritize these features. Additionally, public awareness campaigns and guidelines around sustainable, modular furniture options can influence consumer behavior toward smarter choices. The discussion would be incomplete without acknowledging the psychological and emotional impact of furniture mobility on individuals. For many, the stress of relocating to a multistory building is compounded by the anxiety of furniture transportation. Delays, damages, and unexpected expenses can sour the experience of moving into a new home. Conversely, furniture that is easy to handle, assemble, and rearrange promotes a sense of control, comfort, and empowerment among residents. This becomes particularly important for the elderly, single parents, or people with disabilities, for whom heavy or rigid furniture presents a barrier to independence. As such, rethinking furniture mobility is also a matter of inclusivity and accessibility.

Looking ahead, the future of furniture mobility in multistory buildings lies at the intersection of design innovation, urban planning, technological integration, and sustainable thinking. The vision is clear: furniture that is built not just for aesthetic appeal or basic function, but for fluid movement within and between the vertical spaces we increasingly inhabit. Manufacturers must invest in research and development to test new mobility mechanisms and durable yet lightweight structures. Educational institutions offering architecture and design programs should include mobility-oriented curricula to sensitize students to this emerging need. Meanwhile, consumers must also be educated about the long-term value and convenience of choosing mobile, modular solutions over traditional, immobile furnishings. As urban centers continue their vertical ascent, the imperative to rethink furniture mobility becomes increasingly urgent. It is no longer enough to ask how furniture looks or feels; we must also ask how it moves. This rethinking is not merely about solving logistical issues but about embracing a more agile, sustainable, and human-centered approach to living in high-rise spaces. The challenge of vertical furniture mobility offers a unique opportunity to innovate at the intersection of design, engineering, and lifestyle, and to ensure that as our buildings rise higher, our standards of livability rise with them.

5. CONCLUSION

As cities continue to grow upward in response to space constraints and population density, the challenge of furniture mobility in multistory buildings becomes increasingly significant. The conventional models of furniture design and transportation are no longer adequate for the realities of vertical living. To address this gap, a paradigm shift is required, one that reimagines furniture not merely as static objects but as dynamic, mobile elements of urban life. The integration of modular design, lightweight and sustainable materials, and digital technologies offers a path toward more efficient and user-friendly solutions. Moreover, the collaboration between architects, designers, manufacturers, and policymakers is essential to embed mobility into both furniture and building design. Rethinking furniture mobility is not just about convenience; it is about enhancing quality of life, promoting sustainability, and ensuring that our vertical spaces remain accessible and adaptable for all. By embracing innovation and inclusivity, we can build a future where furniture effortlessly keeps pace with the architectural heights we continue to reach.

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