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International Conference on Technology, Research and Smart Education

ICTRSE 2025

December 22nd - 24th, 2025

Chief Editor

Dr.B.Balakumar

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Book Title: International Conference on Technology, Research and Smart Education ICTRSE - 2025, Organized by Cape Arts and Science College in Association with SKRGC Academy December 22 - 24, 2025.

Chief Editor: Dr.B.Balakumar
Dr. Sneha Raghvanshi

Edition: I

Book Size: A4 Size

ISBN: 978-93-6492-441-2

Publisher: SK Research Group of Companies, Madurai, Tamil Nadu, India.

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ABOUT THE CONFERENCE

The International Conference on Technology, Research, and Smart Education (ICTRSE 2025) serves as a premier forum for researchers, academicians, industry professionals, and students to explore and exchange cutting-edge ideas in the fields of technology, research, and smart education. Organized by the Department of Computer Science, CAPE Arts & Science College, in association with SKRGC Academy, this conference aims to foster innovation, collaboration, and knowledge sharing across global boundaries. ICTRSE 2025 focuses on the latest advancements that are shaping the future of education and research, offering a platform for presenting research findings, discussing emerging trends, and envisioning innovative solutions that influence our digital and educational landscapes. Scheduled to take place from 22–24 December 2025, the hybrid-mode conference ensures accessibility to participants worldwide, promoting academic excellence and inspiring the next generation of innovators and thinkers in technology and smart education.

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DYNAMIC WORKLOAD MANAGEMENT ALGORITHMS FOR EDGE-CLOUD COLLABORATIVE COMPUTING IN INTELLIGENT TRANSPORTATION SYSTEMS (ITS)

ID: ICTRSE-004

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Abstract

Intelligent Transportation Systems (ITS) rely on continuous data processing from sensors, vehicles, and roadside units. Managing this large volume of real-time data requires efficient collaboration between edge devices and cloud platforms. This research article presents an overview of dynamic workload management algorithms for edge-cloud collaborative computing in ITS. The work discusses system architecture, workload distribution techniques, algorithm categories, implementation insights and performance evaluation.

Keywords - Edge Computing, Cloud Computing, Intelligent Transportation Systems, Dynamic Workload Management, Resource Allocation, Collaborative Computing, Traffic Analytics.

1. Introduction

Intelligent Transportation Systems (ITS) depend on real-time data gathered from vehicles, traffic lights, surveillance cameras, and roadside sensors. Processing this data promptly helps improve road safety, reduce congestion, and support autonomous driving applications. However, due to high data volume and low-latency requirements, relying on centralized cloud servers alone becomes inefficient. Edge-cloud collaborative computing enables distributed processing, where time-sensitive tasks are executed at the edge, while large analytical tasks are performed on the cloud. Dynamic workload management algorithms help decide how tasks should be assigned between the edge and cloud layers. The goal is to reduce delays, balance loads, optimize resource usage, and maintain reliable ITS operations.

2. Background and Literature Review

2.1 Edge Computing in ITS

Edge computing enhances ITS by enabling real-time data processing close to the data source rather than relying solely on centralized cloud servers. Modern ITS infrastructures generate continuous streams of data from traffic cameras, LiDAR units, vehicle on-board sensors, RSUs, and IoT devices. Sending all this raw data to the cloud increases latency and consumes high bandwidth, which is unsuitable for safety critical operations. Edge nodes address this by performing low latency computation at the network edge, allowing tasks such as object detection, traffic density estimation, collision prediction, and signal optimization to be executed within milliseconds.

By distributing computation across edge nodes, ITS reduces network congestion and improves system reliability, as many functions can continue operating even if cloud connectivity is weak. Edge-based machine learning modules can run inference locally, supporting V2V and V2I communication, adaptive traffic control, and autonomous driving assistance. Only essential, summarized data is forwarded to the cloud for long-term analytics, historical trend analysis, and model retraining.

Although edge devices have limited computational capacity compared to cloud servers, improvements in MEC platforms, 5G communication, and lightweight AI models make them highly suitable for dynamic, delay-sensitive ITS applications. Overall, edge computing provides the low latency, scalability, and distributed intelligence necessary for efficient and resilient smart transportation systems. Edge nodes such as Roadside Units (RSUs), gateways, and vehicle on-board units process data near the source. This reduces transmission delay and avoids network congestion.

2.2 Cloud Computing in ITS

Cloud computing supports ITS by providing large-scale storage, high performance computation, and centralized analytics for the massive data generated by vehicles, sensors, and road infrastructure. While edge devices handle immediate, low latency tasks, the cloud performs heavy processing such as long-term traffic prediction, route optimization, large-scale simulation, and deep learning model training. Its elastic computing resources allow ITS platforms to process vast datasets, integrate information from multiple regions, and run complex algorithms that exceed the capabilities of edge nodes. Central cloud servers aggregate data from distributed edge units and RSUs, enabling global traffic pattern analysis, historical trend modeling, intelligent fleet management, and decision support for city level transportation planning.

Cloud services also facilitate data sharing across agencies, enabling interoperability between traffic departments, public transit systems, and emergency services. Although cloud-based processing introduces some latency due to data transmission delays, its scalability and computational power make it essential for tasks requiring high accuracy, extensive datasets, or city-wide coordination. In modern ITS architectures, the cloud functions as the backbone for centralized intelligence, complementing edge computing to deliver efficient, data-driven, and highly coordinated smart transportation operations. Cloud servers support large-scale storage, complex analytics, and long-term traffic prediction. Cloud systems complement edge nodes by handling resource-heavy tasks.

2.3 Need for Dynamic Workload Management

Dynamic workload management is essential in edge-cloud-based ITS because traffic data, sensor activity, and network conditions change continuously throughout the day. Static or fixed task allocation cannot handle sudden variations such as peak-hour congestion, accidents, or fluctuating vehicle density. Dynamic workload management algorithms adapt in real time by monitoring edge node capacity, network bandwidth, task urgency, and computational requirements, ensuring that delay sensitive tasks remain at the edge while computation-heavy analytics are offloaded to the cloud. Without dynamic control, edge nodes may become overloaded, increasing latency and risking system failure during critical events.

Similarly, sending unnecessary data to the cloud wastes bandwidth and slows down responses. By intelligently redistributing tasks based on current system conditions, dynamic workload management improves resource utilization, maintains low latency, and ensures continuous, stable ITS operation. It also enables scalable and energy-efficient coordination between distributed edge units and centralized cloud services, making it a key requirement for reliable real-time transportation applications. Static allocation fails during peak traffic because workloads vary frequently. Dynamic algorithms adapt to changing traffic load, computing capacity, and network conditions.

3. System Architecture of Edge-Cloud Collaborative ITS

3.1 Architecture Overview

The Architecture contains Three Layers:

- ❖ **Device Layer:** Sensors, cameras, GPS units in vehicles
- ❖ **Edge Layer:** RSUs, micro servers, smart gateways
- ❖ **Cloud Layer:** Centralized data centre

The figure illustrates the overall architecture of an edge–cloud collaborative Intelligent Transportation System, where processing tasks are intelligently distributed between edge nodes and cloud servers for efficient, real-time transportation management.

At the edge layer, vehicles equipped with On-Board Units (OBUs) continuously generate data related to speed, location, traffic conditions, and safety events. This information is transmitted to the nearby Roadside Units (RSUs), which serve as communication gateways between moving vehicles and stationary infrastructure. RSUs either forward raw sensor data or perform preliminary filtering before sending it to the edge server.

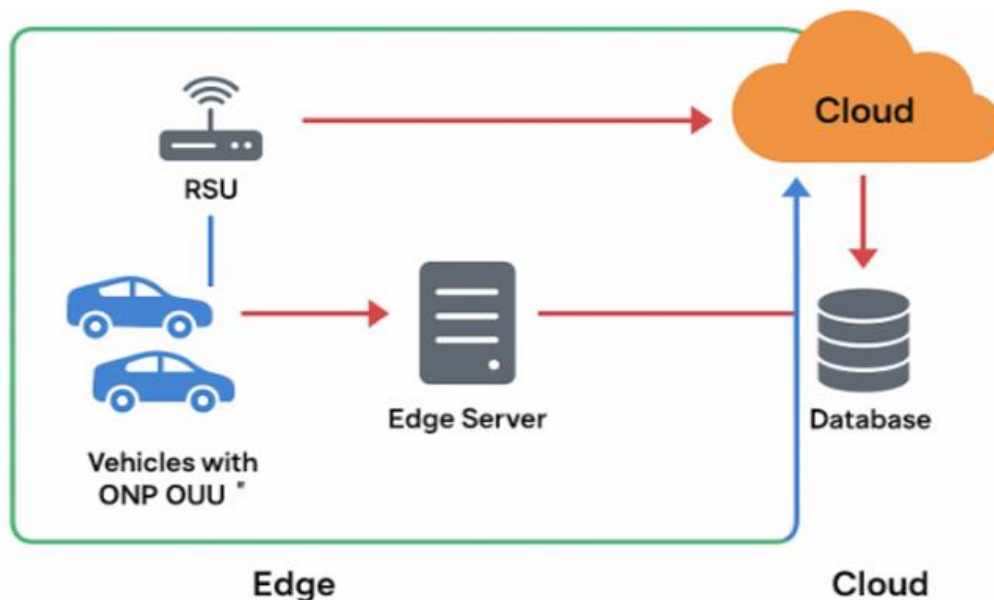


Figure 1: System Architecture of Edge-Cloud Collaborative ITS

The edge server acts as the primary local processing hub. It executes time-critical tasks such as object detection, congestion estimation, event identification, and V2X communication handling. Because the computation happens close to the data source, the system achieves extremely low latency, enabling real time decision making for applications like adaptive traffic signal control and accident avoidance. Only essential summaries, alerts, or aggregated data are sent upward to the cloud, reducing bandwidth usage and preventing network overload. At the cloud layer, large scale data analytics, long-term traffic prediction, historical data storage, and machine learning model training are carried out. The cloud receives processed data from edge servers, stores it in a centralized database, and uses high power computing resources to generate broader insights such as citywide traffic trends or routing optimization.

The outputs are then communicated back to the edge for real-time operational adjustments. Overall, the architecture demonstrates a collaborative system in which the edge handles delay-sensitive tasks, while the cloud performs heavy computations and centralized analytics. This division of responsibilities improves scalability, reliability, and the overall responsiveness of ITS applications.

3.2 Data Flow

Data flow begins at the vehicle and roadside sensors, where continuous streams of information such as speed, position, video frames, and environmental readings are generated. This raw data is first transmitted to nearby Roadside Units (RSUs) or local gateways, which act as the primary communication interface between moving vehicles and the fixed network infrastructure. RSUs forward the received data to the edge server, where low latency processing takes place. At the edge, tasks such as event detection, traffic density calculation, and preliminary filtering or compression are performed to reduce data volume and speed up decision making.

Only essential or aggregated information is then sent upward to the cloud layer using backhaul communication. The cloud performs large-scale analytics, historical modeling, machine learning training, and long-term data storage. Insights, updated models, or control instructions generated by the cloud are sent back to the edge server, which uses them to refine local ITS operations. Finally, the processed outputs such as optimized traffic signal timings, alert messages, or routing suggestions are delivered to vehicles, traffic controllers, or roadside devices. This bidirectional data flow ensures that edge nodes handle real-time tasks while the cloud supports deeper, computationally intensive intelligence for city level transportation management. Data flows upward from devices to edge units, and only essential processed information moves to cloud servers.

4. Dynamic Workload Management

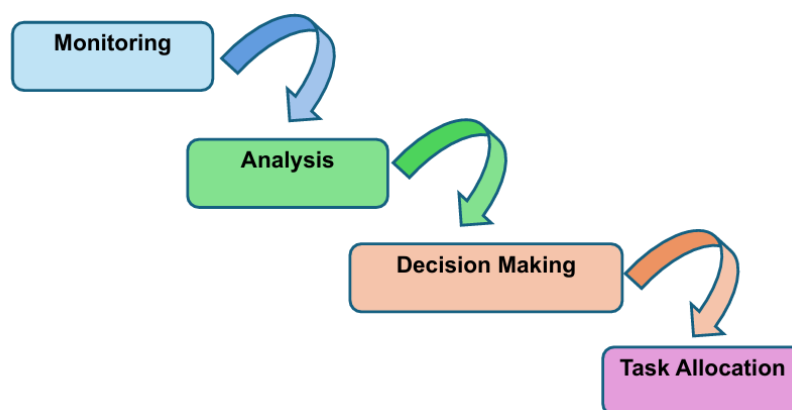


Figure 2: Workload Management Flow Diagram

4.1 Load Balancing Algorithms

a) Round Robin

Round Robin assigns incoming tasks to available edge or cloud nodes in a fixed circular order. Each node receives tasks one after another in equal turns, ensuring a simple and uniform distribution. It does not consider the current load or capacity of each node, making it suitable for homogeneous systems but less effective when nodes have varying processing power.

b) Weighted Distribution

Weighted Distribution assigns tasks based on predefined weights given to each node. A node with higher computing capacity or more available resources receives a larger share of the workload. This method adapts better to heterogeneous environments where nodes differ in processing speed, energy level, or memory capacity, resulting in more efficient resource utilization.

c) Priority-based Allocation

Priority-Based Allocation distributes tasks according to their urgency or importance. High priority tasks such as accident detection or real-time traffic alerts are assigned to the fastest or least loaded edge nodes, while lower priority tasks are offloaded to the cloud or queued. This ensures that delay sensitive ITS operations always receive the required computational attention, improving system responsiveness and safety

Table 1: Comparison of Algorithms

Algorithm Type	Features	Advantages	Limitations
Load Balancing	Distributes workload	Reduces overload	Cannot adapt to complex tasks
Offloading	Assigns tasks to edge/cloud	Improves latency	Needs accurate prediction
Prediction Based	Uses ML/Time-series	Forecasts workload	Requires training data

4.2 Task Offloading Algorithms

These Determine which Tasks Run on Edge or Cloud

Latency-Aware Offloading

It decides whether a task should run on the edge or cloud based on end-to-end delay requirements. Delay-sensitive ITS tasks (e.g., collision warnings, pedestrian detection) are executed at the edge, while tasks with relaxed latency constraints are sent to the cloud.

A Typical Latency Evaluation Model is

Where

- ❖ Transmission Delay
- ❖ Waiting/Queue Delay
- ❖ Computation Delay

Decision Rule

This ensures tasks stay within their required response time windows energy-aware offloading aims to minimize the energy consumption of edge devices (vehicles, RSUs, or edge servers). The decision considers the energy needed for computation vs. the energy required for wireless transmission.

Energy Cost Model

Decision Rule

This is useful for battery-powered or energy-constrained ITS nodes such as on-board units (OBUs) and sensors. Reinforcement Learning (RL) offloading uses an agent (edge node) that learns the best offloading policy by interacting with the ITS environment. The agent chooses actions (edge execution, partial offloading, full offloading) to maximize long-term reward based on performance factors like delay, energy, and bandwidth. State variables may include:

$S = \{C_{edge}, B_{network}, D_{task}, E_{device}\}$

Action Set

Reward Function (Example)

Where,

- ❖ α and β represent weights for delay and energy.
- ❖ The goal is to maximize reward, meaning the agent learns the optimal balance between delay and energy usage.

RL-based approaches are adaptive and perform well in dynamic ITS environments with varying traffic loads and network conditions.

5. Implementation

5.1 Algorithm Steps

- ❖ Monitor resource usage of edge and cloud
- ❖ Categorize tasks as delay-sensitive or computation-heavy
- ❖ Estimate required resources
- ❖ Offload tasks accordingly
- ❖ Continuously update decisions

Table 2: Performance Metrics

Metric	Description
Latency	Time taken to complete task
Throughput	Number of tasks processed per second
Resource Utilization	Efficiency of CPU/Memory usage
Offloading Accuracy	Correctness of task placement

7. Results and Future work

Simulation results show that dynamic algorithms reduce average latency and improve resource utilization compared to static allocation. Hybrid algorithms performed the best under varying traffic conditions. Edge-cloud collaboration successfully handled peak-hour traffic loads.

Future Enhancements may include

- ❖ Integration of deep reinforcement learning
- ❖ Incorporation of 5G/6G features for faster communication
- ❖ Improved cybersecurity frameworks
- ❖ Support for autonomous vehicle coordination

10. Conclusion

Dynamic workload management plays a vital role in enabling efficient edge-cloud collaboration in ITS. By distributing tasks intelligently, the system achieves better latency performance, load balance, and resource optimization. This study highlights the strengths of different algorithmic approaches and provides a structured solution for future ITS developments.

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**COMPREHENSIVE INSIGHTS INTO CARDIAC MANIFESTATIONS
ASSOCIATED WITH COVID-19**

ID: ICTRSE-005

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Abstract

The pandemic caused by the coronavirus disease 2019 (COVID-19) has profoundly influenced global health. Although several studies have been conducted, there is still a significant lack of data regarding the mechanisms underlying cardiac injury, clinical presentations, risk factors, and treatment strategies for cardiovascular disease linked to COVID-19. This systematic review and meta-analysis is designed to clarify the clinical, electrocardiographic, and pathological aspects of cardiovascular disease (CVD), the occurrence of elevated cardiac and inflammatory biomarkers, and their association with the severity of the disease and mortality in COVID-19 patients. COVID-19 can significantly affect a patient's cardiovascular system. First, there is an increased risk of serious illness and death for people with COVID-19 who also have underlying cardiovascular diseases.

The death rate associated with COVID-19 is closely linked to cardiovascular disease, diabetes, and hypertension. Secondly, treatments being explored for COVID-19 may lead to cardiovascular side effects, including arrhythmias. Thirdly, COVID-19 is linked to various direct and indirect cardiovascular complications. Due to a significant inflammatory response associated with cytokine release, COVID-19 can trigger vascular inflammation, acute myocardial injury, myocarditis, arrhythmias, venous thromboembolism, metabolic syndrome, and Kawasaki disease. It is crucial to comprehend the impact of COVID-19 on the cardiovascular system to ensure comprehensive medical care for patients with cardiac issues and/or COVID-19. Furthermore, it aims to create a triage risk stratification tool (TRST) that can guide the prompt identification of high-risk patients and support mechanism-targeted therapy.

Keywords: COVID-(Coronavirus Disease), CVD (Cardiovascular Disease), ACE1(American Council on Exercise) Immunothrombosis, Micro Vascular, Myocardial, Micro Clots.

1. Introduction

As a result of the COVID-19 pandemic, which was brought on by the beta coronavirus SARS-CoV-2 [1, 2], global healthcare systems are dealing with difficulties that were previously unheard of. COVID-19, like previous coronavirus outbreaks like SARS and MERS, has shown that the virus has a complicated connection to the cardiovascular system in addition to its effects on the respiratory system. Numerous conditions that impact patients during the acute phase of COVID-19 as well as in the aftermath and for months or years after infection are examples of the diverse cardiovascular complications that can result from the virus.

The most common cardiovascular injuries in COVID-19 patients have been found to be myocardial injury, arrhythmias, heart failure, vascular dysfunction, and thromboembolic events. The potential for individuals infected with the virus to have an increased risk of acute myocardial infarction (MI) and ischemic stroke highlights COVID-19's systemic effects on the cardiovascular system. Atrial fibrillation is one kind of arrhythmia. These myocardial effects are affected by heart disease risk factors, previous cardiac conditions, and the severity of the initial COVID-19 infection.

In the treatment of these issues, the diagnostic function of cardiac biomarkers, electrocardiograms (ECG), and cardiac imaging is essential. The substantial influence of venous thromboembolic illness, including pulmonary thromboembolism, on the severity of COVID-19 is one noteworthy finding. These results highlight the significance of identifying and treating cardiovascular complications as essential components of COVID-19 treatment [6]. There is increasing evidence to support the concern that COVID-19 may have long-term cardiovascular effects beyond the acute phase.

2. Objectives

A comprehensive look at the major acute cardiovascular complications brought on by COVID-19, with a focus on the disease's pathophysiology and mechanisms. Second, we looked at the medical literature to see how COVID-19 syndrome affects cardiovascular health.

3. Methods

The available literature was thoroughly examined. By searching electronic databases (Medline via PubMed) between 2020 and 2024, the studies were found. Reports that contained the terms COVID-19 and/or cardiovascular disease were included. "Long COVID-19" and "cardiovascular disease" were two terms used in a secondary search.

Reports that addressed any connection between COVID-19 and cardiovascular consequences were included; those that addressed other connections were not. I made use of COVID-19 and Long COVID literature reviews to make sure that our initial search criteria hadn't overlooked any studies. In addition to cross-sectional studies evaluating COVID-19, the heart, and the vasculature, there were prospective and retrospective cohort studies included.

4. Impact on the Heart in the Acute Phase - Findings in Covid-19

4.1. COVID 19. Effects on the Heart on the Acute Setting

4.1.1. Pathophysiology

The pathophysiology of SARS-CoV-2 infection is largely dependent on its interaction with the host's angiotensin-converting enzyme 2 (ACE2) receptor, which promotes cellular entry. ACE2 receptor expression is elevated in the heart, blood vessels, and lungs. Cardiovascular disease (CVD) associated with COVID-19 is likely due to regulation of the ACE/ACE2 system, which was first caused by the SARS-CoV-2 infection but was exacerbated by comorbid conditions such as hypertension, and. Additionally, acute lung injury after COVID-19 increases cardiac workload, which is particularly important in heart failure (HF). Other molecules, like neuropilin-1, may aid SARS-CoV-2 cells in entering and propagating, though their significance in relation to CVD is still unclear.

A cytokine storm that is fueled by an imbalance in T-cell activation and dysregulated release of cytokines such as IL-17 and IL-6 may be the cause of CVD in COVID-19. Plaque instability brought on by immune system activation and modifications in immunometabolism may lead to acute coronary events. Autopsies of non-survivors reveal several concurrent histopathological findings, indicating the heterogeneous cardiac effects of COVID-19. Micro thrombi and cardiomyocyte necrosis are frequent examples of these findings. Even though they might not meet the histologic requirements for myocarditis, macrophages frequently infiltrate the heart.

The high incidence of inflammatory infiltrates and microthrombi in fatal COVID-19 cases raises concerns about subclinical cardiac pathology in recovered patients. Molecular research indicates that dysregulated immunothrombosis, pro-inflammatory and anti-fibrinolytic reactions, and SARS-CoV-2 infection of cardiac pericytes are the causes of COVID-19 cardiac pathology. The effects of mild COVID-19 on the heart are unknown.

Immunothrombosis is promoted by the factors released by hyperactivated platelets, some of which contain viral RNA. These factors also weaken endothelial junctions and activate microvascular endothelial cells. The temporal and causal relationships between these events are complex and still unclear. One of the main features of acute COVID-19 is endothelial dysfunction of the coronary microvasculature, which does not affect the larger epicardial coronary vessels.

This dysfunction includes pro-inflammatory endothelial cell activation, loss of junctional integrity, and cell death. It has been demonstrated that SARS-CoV-2 directly infects human cardiomyocytes, including those derived from induced pluripotent stem cells, in a process that depends on ACE2 and cathepsin [10]. Recent evidence suggests that pericytes, not endothelial cells, may be the primary target of endothelial damage in the heart caused by SARS-CoV-2 infection. According to in vitro research, exposure to the SARS-CoV-2 spike protein can change the impact and function of pericytes.

4.1.2 Biomarkers

Similar to other pneumonia cases, COVID-19 can result in hemodynamic stress (as shown by BNP and N-terminal B-type natriuretic peptide (NTproBNP) levels) and cardiomyocyte injury (as shown by cardiac troponin T/I levels). The degree of elevation of these biomarkers is associated with the disease's severity and mortality rate. Mild increases in cardiac troponin T/I and/or BNP/NT-proBNP levels are typically caused by acute viral injury, stress, or pre-existing cardiac conditions. Patients with mild elevations (e.g., G.) that are less than two to three times the upper limit of normal do not require further investigation or treatment for type 1 myocardial infarction (T1MI) if there are no ischemic ECG abnormalities or the typical chest pain associated with angina [10]. If there is a clinical suspicion of T1MI or newly diagnosed left ventricular dysfunction, it is advised to measure cardiac troponin T/I levels. Monitoring cardiac troponin T/I may help with risk assessment and prognosis regardless of diagnosis [10].

4.3. Myocardial Infarction

Medical services for individuals suspected of having acute coronary syndrome and emergency department patient arrival times were delayed due to the increase in severe COVID-19 patients. This disruption led to an increase in door-to-balloon time, scar size (as measured by cardiac magnetic resonance imaging), and the incidence of mechanical complications.

Additionally, patients with ST-segment elevation myocardial infarction (STEMI) and out-of-hospital cardiac arrest have experienced delays between their initial medical contact and revascularization as a result of the COVID-19 pandemic. With STEMI rates as high as 2–5%, some studies have even found that SARS-CoV-2 infection is a risk factor or trigger for MI. Among the variables that affect mortality are age, respiratory failure, diabetes mellitus (DM), ejection fraction (EF), and the type of MI (STEMI or NSTEMI). Some studies indicate that mortality rates appear to vary between pandemic waves, with some showing declining trends and others showing rising ones.

4.4. Heart Failure

SARS-CoV-2, the coronavirus-2019 disease, is linked to higher rates of morbidity and mortality. Cardiovascular problems have been recognized as a risk factor for COVID-19 since the beginning of the pandemic, and they are frequently experienced during acute illness as well as in the months and years that follow [19]. The leading cause of hospitalization for patients over 65 is heart failure (HF), which accounts for 3% of hospital admissions. The aging population and advancements in healthcare are the main causes of this rising increase in admissions related to heart failure. There aren't many published studies on the mortality rate of COVID-19 patients who also have heart failure. According to García Álvarez et al., patients with a history of heart failure are significantly more likely to die and need invasive mechanical ventilation when infected with COVID-19, regardless of their ventricular ejection fraction.

One of the most frequent causes of hospitalization in our society is heart failure. The mortality rate for heart failure has been trending lower in recent years due to the introduction of several treatments that have shown notable benefits, the high level of adherence to professional recommendations, and the shift in disease decompensation components like ischemic heart disease, which has also been declining recently. The death rate of patients admitted for heart failure and COVID-19 has significantly increased, according to a recent study by Bromage and colleagues. However, it is unclear whether this is due to actual mortality or the fact that the patients were selected because they were in critical condition during the pandemic. It has been shown that possessing heart.

4.5. Takotsubo Cardiomyopathy

Intriguingly, Takotsubo Cardiomyopathy (TTC), a heart ailment typically brought on by emotional stress, has also been seen in certain COVID-19 patients and is associated with physical stress.

Breathlessness and chest pain were common symptoms of COVID-19 patients with TTC. Atrial fibrillation, sinus tachycardia, T-wave inversion, and ST-segment elevations were among the abnormalities displayed on their ECGs. Significant differences were observed in biomarker levels between COVID-19 patients with TTC and those without myocardial injury or with non-TTC myocardial injuries. Patients with non-TTC myocardial injury displayed higher levels of prothrombotic and inflammatory markers like ferritin, D-dimer, and interleukin-6, while TTC patients had higher levels of cardiac biomarkers like cardiac troponin I and creatine kinase myocardial band.

Furthermore, compared to patients who had no myocardial injury or other myocardial injuries, TTC patients had a lower median left ventricular ejection fraction (LV EF), indicating left ventricular dysfunction. In COVID-19 patients presenting with myocardial injury, TTC should be considered as a potential diagnosis. Transthoracic echocardiography is particularly useful in these cases to guide treatment decisions and determine the need for further invasive procedures. The occurrence of TTC in these patients may result from catecholamine-induced microvascular dysfunction, triggered by the metabolic, inflammatory, and emotional stress associated with COVID-19.

4.6. Myocardial Injury and Myocarditis

Evidence of acute cardiac injury, as evidenced by elevated troponin levels, is frequently observed in patients afflicted with COVID-19. The exact mechanisms that contribute to myocardial injury in COVID-19 remain unclear, although numerous factors, including immune-mediated reactions, hypoxia, and direct viral impacts, have been proposed. Despite being regarded as a potential consequence, myocarditis seems to be a rather uncommon effect of SARS-CoV-2 infection. Cardiac magnetic resonance imaging (CMR), which offers advantages in evaluating cardiac structure and function in people suspected of having myocarditis, pericarditis, or myopericarditis, is one efficient technique for evaluating myocarditis in these situations.

It is crucial to remember that abnormal CMR results can still have clinical significance even if these requirements are not met. Reduced maximal oxygen consumption (VO₂max) is correlated with initial CMR abnormalities in patients who have recovered from COVID-19, according to research using Cardiopulmonary Exercise Testing (CPET) in conjunction with CMR. Furthermore, it is critical to recognize that myocardial inflammation in COVID-19 is transient.

It has been discovered that fluorodeoxyglucose (FDG) positron emission tomography (PET) is more specific for diagnosing chronic myocarditis and more sensitive than CMR in detecting myocardial inflammation. Ventricular dysfunction and elevated systemic inflammatory markers are common in COVID-19 patients who test positive for FDG-PET. These abnormalities, however, usually go away with subsequent follow-up, underscoring the temporary nature of myocardial inflammation in this situation.

Furthermore, among patients with severe COVID-19, the presence of myocardial injury appears to be a predictor of in-hospital mortality. The mortality rate is higher for those with cardiac involvement. Although some studies have used a variety of imaging and diagnostic techniques to identify cardiac abnormalities, it is still unclear what specific mechanisms cause myocardial injury in this situation.

4.7. Arrhythmias

Recent literature highlights the increasing concern regarding atrial fibrillation (AF) and ventricular arrhythmias in patients diagnosed with COVID-19, particularly among those aged 60 and older and those suffering from severe COVID-19. Studies reveal that AF, including cases that are newly diagnosed, is independently associated with a greater risk of all-cause mortality in hospitalized COVID-19 patients [39]. In a comparison of survivors and non-survivors, it was observed that survivors had statistically significant lower initial heart rates compared to non-survivors. Sinus tachycardia was identified as the most common arrhythmia in monitored COVID-19 patients, occurring more frequently in non-survivors. Premature ventricular complexes and non-sustained ventricular tachycardia were also noted, but no significant difference in incidence was found between survivors and non-survivors. Instances of sustained ventricular tachycardia and ventricular fibrillation were rare. These findings do not align consistently across all studies.

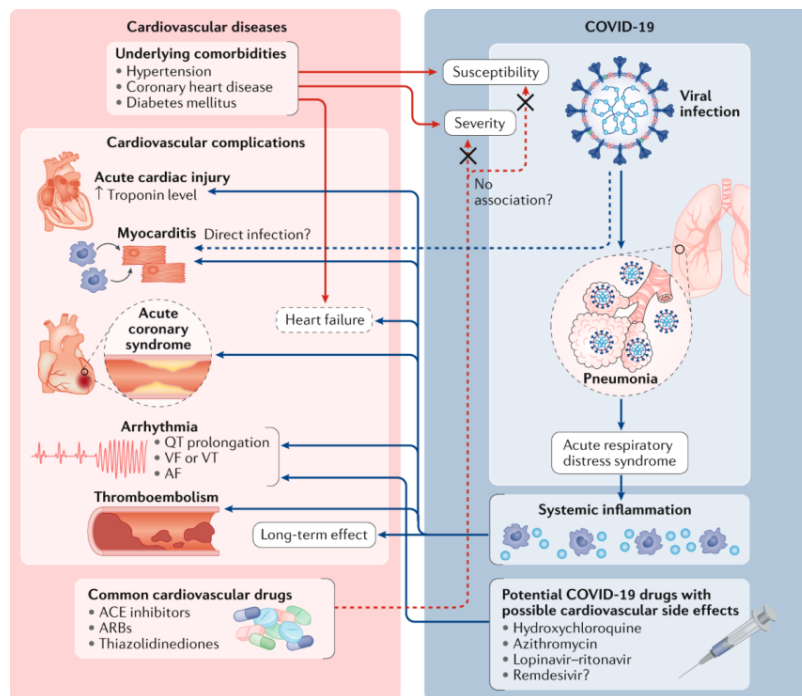


Figure 1: Shows the main Cardiovascular Complications of COVID-19

5. Long Covid -19 and Cardiovascular Health

5.1. Long Covid

Long COVID, or post-acute sequelae of SARS-CoV-2 infection (PASC), is the term used to describe the persistence or appearance of symptoms at least 12 weeks following the start of COVID-19. PASC has been linked to more than 200 symptoms, which are probably caused by a number of underlying mechanisms [8] that affect several organ systems, especially the cardiovascular system. Concerns have been raised by a number of studies regarding the effects of prolonged COVID on the cardiovascular system, including a higher risk of de novo heart failure and new-onset hypertension. The association between higher troponin levels during the acute infection phase and worse patient outcomes 12 months later, including higher overall mortality and more cardiac complications, is one example of this. As previously mentioned, COVID-19 can cause serious cardiac harm that is unlikely to go away for weeks after infection. At 60 days after infection, 20% and 9% of COVID-19 survivors, respectively, reported experiencing chest pain and palpitations, the most common persistent symptoms linked to cardiovascular abnormalities. Seventy-one days after receiving a COVID-19 diagnosis, 78% of patients had cardiac abnormalities, according to cardiovascular magnetic resonance imaging (CMR). Myocardial inflammation, myocardial injury, and pericardial inflammation were all included in these anomalies.

The severity of these abnormalities was not correlated with the severity of the initial COVID-19 infection, according to an analysis comparing hospitalized and non-hospitalized patients, indicating that even mild cases of COVID-19 can cause cardiac damage. Myocardial scarring, which was discovered in some asymptomatic or mild cases (4% with LGE myocardial scarring) [39], including athletes (2.3% who remained asymptomatic) [41], 22 days after diagnosis, was less common in other studies using comparable techniques. Six months after being released from the hospital, patients who had a lengthy COVID still had cerebrovascular impairment. Consequently, short-term research suggests that COVID-19 causes a number of cardiovascular system pathologies, but the long-term consequences of these infections are far more serious. For a number of cardiovascular outcomes, including myocarditis, patients who have survived COVID-19 have substantially higher hazard ratios, according to electronic health records from the US Veterans Health Administration (VHA). Over 5 million people make up this cohort, which is primarily male, typically older, and has a number of detrimental risk factors, such as a higher propensity to smoke. Since other studies using different cohorts have found a non-clinically significant change one year after infection, the data from Xie et al. likely provides an upper limit for the increased risk of cardiovascular disease (CVD) following COVID-19. Additionally, UK electronic health data showed that the rate of major adverse cardiac events (MACE) has doubled, with hospitalized patients experiencing MACE more frequently following COVID-19.

5.2 Vaccinations and Long-Term Cardiac Risk after Covid-19

Although vaccinations have been successful in lowering the risk of Covid-19-related symptoms and mortality [49], it is unclear if this also lowers the risk of cardiovascular disease, as was previously mentioned. Nevertheless, following the initial disparity in the risk of myocarditis following COVID-19 vaccination, vaccine-related risks are still uncommon and the vaccines are obviously cardioprotective. The severity of at least some very long symptoms and the possibility that vaccines may be lowered by cardiovascular risk are significant factors because many COVID-19 symptoms are lessened by vaccinations. Similar supplemental data from the UK electronic medical records, Israel, and South Korea support US data that vaccines decreased mass risks.

5.3 Microclotting as an Association Factor of Long Covid 19

Constellations that impact numerous organs besides the cardiovascular system are what define long COVIDs.

It should be mentioned that some individuals speculate that the non-adjustable symptoms of long charring may be caused by fibrinogen pressure micro discharge, which obstructs tiny blood vessels. These microclots, which can result in exhaustion, muscle soreness, dyspnea, and other symptoms linked to prolonged cycles, are intended to stop the blood flow of microplastic devices. Microclots were found in the vascular network of patients who had been long-probed at least two months after diagnosis, which lends credence to this theory.

These microclots are caused by acute SARS-CoV-2 infection and monocytes may express owner genes following SARS-CoV-2 infection. The SARS-CoV-2-Beel S1 subunit can cause aggregation and fibrinogen platelets upon addition of healthy samples. The same researchers later demonstrated that these microclarates captured inflammatory mediators like amyloid serum (SAA), factor von Willebrand, and $\alpha(2)$ -anumin ($\alpha 2ap$) using mass spectrometry analysis. Fibrinogen deposits in the amyloid structures of these microclots can withstand fibrinolysis and persist in the blood for a very long period.

5.4. Treatments for Long Covid Focusing On Cardiovascular Complications

Anticoagulants should be used to treat long cocobans since it is thought that microclots are the cause of long membranes. In fact, the majority of 91 patients who reported prolonged COVID-19 symptoms were compelled to report symptom improvement after receiving triple anticoagulation therapy [65]. Long-term symptoms of the cause have been said to be lessened by the fraud [57]. This might be because microclots have been eliminated. In order to lessen heart rate variability, a small pilot study of 13 patients discovered a number of improvements in tests that measure long COVID symptoms and check slow diaphragmatic respiratory movements [68]. The risk of symbiosis may also be considerably decreased by preventive treatment during the acute phase of COVID-19. Nirmatularvir, an antiviral protease inhibitor, is one such instance.

When given during the acute stage of infection, this lowers the chance of experiencing symptoms after COVID-19 by 26% [43], . Nirmatrelvir can lower the microvelocity rates brought on by early infection if microclotting contributes to the progression of protracted COVID symptoms. When NIRMATRELVIR lessens the symptoms of long COVID (NCT05668091) and lessens the effects on specific symptoms, like cardiovascular risk, testing in placebo-controlled studies has continued.

6. Discussion

Numerous cardiovascular complications are linked to the acute phase of COVID-19. These include arrhythmias, myocardial injury, myocarditis, Takotsubo cardiomyopathy, myocardial infarction, and heart failure. The study emphasizes that individuals who already have cardiovascular diseases are more vulnerable to serious illness and death from COVID-19 infection. SARS-CoV-2's interaction with the ACE2 receptor, ACE/ACE2 system dysregulation, and a cytokine storm that causes inflammation and possible cardiac damage are all part of the pathophysiology of these complications. Long COVID, or post-acute sequelae of SARS-CoV-2 infection (PASC), are the long-term cardiovascular effects of COVID-19. At least 12 weeks following the initial infection, long-term COVID can show up as either recurring symptoms or the development of new ones.

An elevated risk of de novo heart failure and new-onset hypertension are among the cardiovascular complications associated with long COVID. The paper investigates several possible causes of long COVID, including the theory that microclotting plays a role. The possible involvement of microclots in the pathophysiology of Long COVID is one of the document's novel insights. According to the study, fibrin amyloid microclots that are resistant to fibrinolysis could be the cause of a number of Long COVID symptoms by obstructing tiny blood vessels. This hypothesis has led to the exploration of anticoagulant therapies as a potential treatment for Long COVID symptoms. Additionally, the research highlights the importance of vaccination in reducing the risk of cardiovascular complications post-COVID-19, while also acknowledging the need for further research into the long-term effects of the virus on cardiovascular health.

7. Conclusion

This review ultimately integrates a broad literature consistent with the prevalence and severity of cardiovascular complications associated with COVID-19. Myocardial infarction, heart failure, takotsubo cardiomyopathy, myocarditis, and arrhythmia are some of these side effects. The severe repercussions and possible complications linked to COVID-19 should make heart clinics aware of these issues. Additionally, early measures like the use of remdesivir to treat infections may lower the incidence and mortality of SARS-COV-2-related heart problems. In the field of cardiovascular disease, the long cocoon may be problematic.

Although the precise mechanism of long coconuts is still unclear, knowing its pathophysiology is crucial for finding potential new treatment targets. SARS-COV-2 infection-induced microclots could be a contributing factor to the long chick factor, which could be a target for treatment. Although the results of anticoagulation therapy for OCT have been encouraging, more research is required in this field.

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ENGLISH FOR DIGITAL ENTREPRENEURS: COMMUNICATING IN THE ONLINE MARKETPLACE

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Abstract

In the era of digital globalization, e-commerce has emerged as a vital medium for cross-border trade, necessitating effective communication across diverse cultural contexts. This chapter explores the critical role of cross-cultural pragmatics in global e-commerce, emphasizing how culturally nuanced language use shapes customer engagement, brand perception, and transaction success. Drawing on theoretical frameworks from Hofstede and Hall, the discussion highlights how cultural dimensions such as high vs. low-context communication, individualism, power distance, and uncertainty avoidance influence pragmatic choices in online interactions. The chapter identifies common challenges in global e-commerce communication, including issues with directness, politeness, translation, and customer expectations.

It presents real-world case studies from Amazon India, IKEA Saudi Arabia, and Alibaba to demonstrate the consequences of neglecting or leveraging pragmatic principles. Practical strategies such as cultural audits, localized interfaces, adaptive customer service, and cultural AI integration are proposed to address these challenges. The chapter concludes by examining future trends, including the rise of cultural AI models and the ethical implications of localization. Ultimately, it underscores that cross-cultural pragmatics is not merely a linguistic concern but a strategic necessity for businesses aiming to thrive in a multicultural digital marketplace.

Keywords: Cross-cultural Pragmatics, Global E-Commerce, Intercultural Communication, Digital Entrepreneurship, Pragmatic Competence, Individualism and Collectivism, Power Distance.

1. Introduction

The rapid expansion of digital technologies has revolutionized commerce, dissolving traditional geographical and cultural boundaries. As online platforms increasingly become the backbone of global business, the need for effective communication across cultures has never been more pressing. In this context, cross-cultural pragmatics—a subfield of linguistics that explores how meaning is conveyed and interpreted within various cultural contexts—emerges as a key discipline in understanding and optimizing global e-commerce interactions.

While technical infrastructure, logistics, and digital marketing remain important, the success of global e-commerce hinges on nuanced, culturally aware communication. Whether through product descriptions, customer service interactions, user interfaces, or social media engagement, every communicative act is embedded in pragmatic choices that may be interpreted differently across cultures. Misunderstandings, cultural misalignments, or even unintended offense can result in lost customers, damaged brand reputation, and reduced competitiveness.

This chapter delves into the concept of cross-cultural pragmatics and its critical role in shaping successful global e-commerce strategies. It explores key pragmatic concepts, the impact of cultural dimensions on communication, real-world case studies, and best practices for businesses seeking to thrive in a multicultural digital marketplace.

Objectives

1. To define and explain cross-cultural pragmatics and its significance in global e-commerce communication.
2. To analyze the impact of cultural variables—such as high/low context, individualism, power distance, and uncertainty avoidance—on pragmatic language use.
3. To identify key pragmatic challenges faced by digital entrepreneurs and businesses when engaging in cross-border online transactions.

Understanding Cross-Cultural Pragmatics

Pragmatics is the branch of linguistics concerned with the use of language in social contexts how speakers convey meaning beyond literal expressions. It involves speech acts, implicature, politeness strategies, turn-taking, and the influence of context on meaning.

Cross-Cultural pragmatics extends this analysis to interactions between individuals from different cultural backgrounds, where assumptions about politeness, indirectness, formality, or emotional expression can differ drastically.

In global e-commerce, where communication is predominantly asynchronous and text-based (emails, chats, product listings), these pragmatic variables become amplified. Sellers and consumers may not share the same cultural scripts or expectations, leading to misunderstandings even when language is not a barrier.

For example, a directive like “Click here now!” may be acceptable or persuasive in some cultures but considered rude or aggressive in others. Similarly, apologetic customer service language, common in Western cultures, may seem overly emotional or insincere in East Asian contexts where indirectness is preferred.

Cultural Dimensions and Their Pragmatic Implications

The work of Geert Hofstede, Edward Hall, and other cultural theorists helps unpack how national cultures vary in ways that directly affect pragmatic choices. Below are some key dimensions and their e-commerce relevance:

1. High-Context vs. Low-Context Cultures

- High-context cultures (e.g., Japan, China, Saudi Arabia) rely heavily on implicit communication and shared understanding.
- Low-context cultures (e.g., Germany, USA, Scandinavia) depend on explicit, direct messages.
- Implication: A direct return policy message (“No returns after 30 days”) may work in the US but require a more nuanced explanation in Japan, where customers expect a more respectful and layered interaction.

2. Individualism vs. Collectivism

- Individualist cultures value personal freedom, autonomy, and directness (e.g., UK, USA, Australia).
- Collectivist cultures emphasize group harmony, respect, and indirectness (e.g., India, Korea, Mexico).
- Implication: Personalized marketing like “Treat yourself today!” resonates in individualist societies, while group-oriented appeals such as “Your family will love this” may work better in collectivist contexts.

3. Power Distance

- High power distance cultures accept hierarchy and formal communication (e.g., Malaysia, Russia).
- Low power distance cultures favor equality and informal tone (e.g., Denmark, Netherlands).

- Implication: Addressing customers by first name in promotional emails may seem friendly in Canada but disrespectful in Egypt.

4. Uncertainty Avoidance

- Cultures with high uncertainty avoidance (e.g., Greece, Japan) prefer clear rules and minimal ambiguity.
- Low uncertainty avoidance cultures (e.g., Singapore, UK) are more tolerant of vagueness.
- Implication: Vague offers like "Limited time, big surprises ahead!" may confuse or frustrate customers in high uncertainty-avoidant cultures.

Common Pragmatic Challenges in Global E-Commerce

Despite good intentions, businesses often stumble when crossing cultural lines. Below are some recurring pragmatic pitfalls:

1. Translation vs. Localization

Literal translation can obscure meaning. "Add to cart" may translate linguistically, but the action may not align culturally. In Japan, for instance, a more respectful phrase may be preferred.

2. Politeness Strategies

What constitutes politeness varies. A blunt "We do not accept returns" could be replaced by "We kindly inform our customers that returns are unavailable due to policy," depending on the cultural context.

3. Time and Response Expectations

In some cultures, immediate responses are expected, while in others, delayed yet formal replies are acceptable. Misaligned expectations can harm customer trust.

4. Humor and Informality

Humor doesn't travel well. Jokes, idioms, or puns used in marketing may fail to resonate or even offend in another language or culture.

5. Directness vs. Indirectness

Some cultures value direct feedback; others prefer subtlety. A direct request for a review may feel pushy in cultures that value modesty or indirect communication.

Pragmatic Strategies for Global E-Commerce Success

1. Cultural Audit and Market Research

Before launching in a new market, conduct a cultural audit. Understand the target culture's communication norms, expectations, and sensitivities.

2. Context-Aware Localization

Beyond language, localization must consider tone, politeness, color symbolism, and layout. Local cultural consultants or native speakers can help shape content appropriately.

3. Adaptive Customer Service Scripts

Train support staff in pragmatic flexibility. For example, a Thai customer may expect more formal, deferential language, while an Australian customer may prefer a relaxed, friendly tone.

4. Customizable User Interfaces

Allow users to choose language and regional preferences. Dynamic interfaces can adjust layout, currency, imagery, and even tone.

5. Feedback Loops and Pragmatic Testing

Regularly collect feedback on communication clarity and user satisfaction. A/B test different communication styles to optimize for cultural fit.

The Role of Technology in Pragmatic Mediation

As global e-commerce continues to expand, technology plays a crucial role in bridging linguistic and cultural gaps between businesses and consumers. However, while digital tools have made cross-border transactions more accessible, effective communication still depends on pragmatic appropriateness—how messages are shaped, interpreted, and responded to across cultural boundaries. This section explores how emerging technologies facilitate or hinder pragmatic mediation in global digital commerce.

1. AI-Powered Chatbots

Chatbots have become common in online customer service. While they offer 24/7 support and reduce operational costs, their effectiveness hinges on pragmatic sensitivity. Chatbots trained only on one cultural or linguistic dataset may respond too formally, too casually, or in ways that overlook key cultural norms.

- **Example:** A chatbot that uses direct phrases like “You must provide proof” may sound harsh to users from high-context or indirect cultures such as Japan or India.
- **Solution:** Cultural tuning of chatbot responses using localized training data and rule-based pragmatics can ensure responses align with customers' expectations.

2. Machine Translation and Localization Tools

Automated translation tools like Google Translate and DeepL are widely used to convert content into multiple languages. However, they often focus on lexical and grammatical accuracy rather than pragmatic fit.

- **Problem:** Translating “limited time only!” into a language may preserve the literal meaning but lose persuasive tone or cultural resonance.
- **Solution:** Incorporating pragmatics-aware translation tools that adapt tone, honorifics, and formality based on cultural context improves customer engagement and reduces miscommunication.

3. Sentiment Analysis

E-commerce companies increasingly rely on sentiment analysis to gauge customer satisfaction from reviews, chats, or social media posts. However, cultural differences in emotional expression can distort analysis results.

- **Example:** A sarcastic or ironic review in English may be misclassified as positive or neutral by algorithms not trained to recognize indirect cues.
- **Solution:** Culturally trained sentiment models that factor in discourse patterns and emotional norms enhance accuracy in interpreting customer sentiment.

4. Customizable Interfaces and User Experience (UX)

Technology enables businesses to dynamically customize websites, apps, and interfaces based on user region or language settings. However, successful UX design must consider cultural pragmatics—how users expect information to be presented and how they interpret layout and tone.

Example: Western users may prefer direct calls-to-action (“Buy now”), while Eastern users may prefer softer invitations (“Please consider purchasing”).

Solution: Use geo-targeted content delivery systems that adjust tone, color symbolism, information hierarchy, and formality based on user locale.

5. Emerging Technologies: Cultural AI)

Looking ahead, Cultural AI represents a major innovation in pragmatic mediation. These advanced systems aim to combine linguistic, sociocultural, and behavioral data to simulate human-like intercultural communication. Cultural AI will be able to:

- Automatically adjust tone and register of language output.
- Recognize culture-specific communication breakdowns.
- Predict user reactions based on cultural profiles.

While promising, these tools must be developed responsibly, balancing personalization with ethical localization and privacy concerns.

Future Trends

As the global e-commerce landscape continues to evolve, businesses must stay ahead of emerging trends in cross-cultural communication. The integration of technology, data science, and cultural insights is reshaping how companies engage with international consumers. This section outlines key future trends that will shape the role of cross-cultural pragmatics in digital entrepreneurship and global commerce.

1. Cultural AI Models

Cultural Artificial Intelligence (AI) is poised to revolutionize how digital platforms handle intercultural communication. These models go beyond traditional machine translation by incorporating sociocultural rules, communication styles, and pragmatic norms into AI-driven systems.

2. Pragmatic Personalization

E-commerce is shifting toward hyper-personalization, where not only product suggestions but also language use, tone, and communication style are adapted to individual users.

3. Ethical Localization and Cultural Sensitivity

As companies increasingly tailor content to local markets, ethical dilemmas around localization are becoming more prominent. Questions arise about how far to adapt to cultural norms—especially when those norms conflict with global ethical standards (e.g., gender equity, freedom of expression).

4. Intercultural Competence Training in Tech Teams

With the growing importance of communication, future-ready companies will prioritize intercultural training for marketing, customer support, UX designers, and AI developers.

5. Real-Time Pragmatic Analytics

Businesses will increasingly use real-time analytics tools that measure not just engagement or bounce rate, but pragmatic effectiveness—how well users interpret and respond to a message based on cultural context.

Conclusion

In an increasingly interconnected and digitized global marketplace, cross-cultural pragmatics has emerged as a strategic cornerstone rather than a peripheral linguistic concern. This chapter has highlighted how pragmatic elements—such as politeness norms, communication styles, indirectness, and cultural expectations—play a critical role in shaping customer experiences and determining the success or failure of e-commerce interactions across borders.

Through an exploration of key cultural dimensions and communication patterns, it becomes evident that one-size-fits-all approaches in global digital communication are not only ineffective but potentially damaging. Real-world examples from Amazon, IKEA, and Alibaba illustrate the tangible business consequences of neglecting or embracing cultural pragmatics. Furthermore, the evolving role of technology, particularly AI-powered tools and cultural personalization systems, underscores the future potential of automating yet customizing pragmatic appropriateness in real-time. However, these innovations also demand ethical considerations and culturally sensitive design.

Ultimately, businesses that prioritize pragmatic competence and cultural awareness will be better positioned to build trust, foster loyalty, and achieve long-term global success. In the digital economy, understanding how meaning is shaped by culture is not just good communication—it is smart business strategy.

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WHY RESEARCH IS IMPORTANT FOR STUDENTS PREPARING FOR PAPER PUBLICATION

ID: ICTRSE-007

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Abstract

Research plays a vital role in the academic development and intellectual growth of students. It helps learners explore topics in depth, identify gaps in existing knowledge, and generate new ideas. For students preparing for paper publication, research builds essential skills such as critical thinking, analytical reasoning, academic writing, and problem-solving. Engaging in research nurtures innovation and strengthens the ability to design methodologies, interpret findings, and present results professionally. Furthermore, research experience prepares students for higher education, scholarships, and future careers, making them confident contributors to the academic community. Therefore, research is an indispensable component for students aspiring to achieve academic excellence and publish quality research papers.

Keywords: Research, Students, Publication, Academic Writing, Innovation, Higher Education.

Introduction

Research is an essential element of higher education and academic advancement. It transforms students from passive learners into active knowledge seekers. By engaging in research activities, students develop the ability to understand concepts deeply, question assumptions, and propose innovative solutions. A research-oriented culture among students encourages intellectual curiosity and helps them prepare for academic paper publication. In the present educational environment, publishing research papers has become an important requirement for academic growth. Students who participate in research gain confidence, improve their communication skills, and strengthen their academic profiles. This paper explains why research is important for students who are preparing for journal and conference publications.

Review of Literature

Creswell (2014) emphasizes that research enables learners to adopt systematic procedures that promote analytical thinking. Leedy and Ormrod (2015) highlight that research develops problem-solving skills and helps students contribute new knowledge. According to Kumar (2019), student research encourages independent learning and strengthens academic writing abilities. Previous studies indicate that early research involvement increases a student's chances of academic success, enhances creativity, and helps them publish high-quality research papers. Scholars agree that research exposure prepares students for future academic and professional demands.

Methodology

This study follows a descriptive research method. Information was collected from academic books, journals, educational websites, and research reports. The purpose is to identify the importance of research for students preparing for publication and to analyze how research influences academic performance, skill development, and scholarly contribution.

Results and Analysis

The analysis shows that research significantly improves the following student abilities:

Critical Thinking

Students learn to analyze information, question assumptions, and draw logical conclusions.

Problem-Solving Skills

Research trains students to identify problems, design solutions, and test ideas through data collection and analysis.

Academic Writing Skills

Research exposure improves writing clarity, structure, referencing, and presentation – skills essential for journal publication.

Knowledge Expansion

Students develop strong subject knowledge and understand the practical application of concepts.

Professional Growth

Research prepares students for higher studies, internships, competitive exams, and career advancement.

Discussion

The findings indicate that research involvement enhances both academic and personal growth. Students who conduct research become more innovative and confident. They learn how to structure a research paper, follow journal guidelines, and present findings effectively. Research also improves communication skills, teamwork, and time management. For students aiming for publication, research provides the necessary foundation to write high-quality abstracts, literature reviews, methodologies, and discussions. It also teaches them to maintain originality and avoid plagiarism, which are essential for academic publishing.

Conclusion

Research is a powerful tool for student development. It helps learners explore knowledge, develop critical thinking, and contribute to society through academic writing and innovation. For students preparing for paper publication, research builds essential skills such as data analysis, problem-solving, referencing, and logical presentation. It opens pathways to higher education, scholarships, and professional success. Therefore, research is not merely an academic requirement – it is a lifelong skill that empowers students to become knowledgeable, confident, and successful scholars.

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THE IMPORTANCE OF SMART EDUCATION IN TODAY'S WORLD

ID: ICTRSE-008

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Abstract

Smart education is an advanced learning approach that integrates digital tools, technology-driven teaching methods, and interactive platforms to enhance the learning experience. In today's fast-changing world, smart education plays a crucial role in preparing students for global competitiveness, critical thinking, and real-world problem-solving. This paper explores the significance of smart education, its benefits for students and teachers, and how it improves learning outcomes. The study also highlights how smart classrooms, online learning platforms, artificial intelligence, and digital literacy contribute to modern education systems. Findings show that smart education supports personalized learning, increases student engagement, and prepares learners for future technological advancements.

Keywords: Smart Education, Digital Learning, Smart Classroom, Technology in Education, Online Learning, 21st-Century Skills.

Introduction

Education is rapidly transforming due to technological advancements. Traditional teaching methods are gradually being replaced by innovative, technology-supported systems known as smart education. Smart education refers to the use of smart devices, learning applications, digital content, internet connectivity, and interactive teaching tools to improve teaching and learning processes. In today's world, where technology evolves rapidly, smart education equips students with the knowledge and skills needed to succeed academically and professionally. This paper discusses the importance of smart education and its impact on learners, teachers, and the education system.

Review of Literature

Several researchers emphasize that smart education enhances learning efficiency. According to Lee (2017), smart learning environments provide personalized learning experiences. Kim (2016) states that digital tools such as tablets and learning apps increase classroom engagement. Research by UNESCO (2020) highlights that smart education helps bridge geographical barriers through online platforms. Studies also show that technology-based learning improves memory retention, creativity, and problem-solving skills. Smart education promotes active learning, where students participate through simulations, videos, quizzes, and real-time feedback.

Methodology

This research follows a descriptive method. Information was collected from journals, educational reports, online databases, and academic publications. The purpose is to highlight the importance of smart education in modern learning environments and analyze its advantages in teaching and learning.

Results and Analysis

Personalized Learning

Technology enables students to learn at their own pace, according to their preferred style and level of understanding.

Increased Engagement

Smart classrooms use videos, animations, and interactive tools that make learning more enjoyable and effective.

Improved Digital Skills

Students become familiar with technology, preparing them for future careers and technological environments.

- ❖ Access Anytime, Anywhere
- ❖ E-learning platforms allow students to learn from home or on the go, overcoming geographical barriers.

Teacher Support

Smart tools help teachers track student progress, assess performance, and provide immediate feedback.

Discussion

Smart education transforms traditional classrooms into dynamic learning spaces. Students become active learners rather than passive listeners. Teachers act as facilitators who guide students using digital tools. Smart education also promotes collaborative learning, where students work together using online platforms, digital boards, and cloud technologies. It helps build essential 21st-century skills such as communication, creativity, critical thinking, and collaboration. Furthermore, smart education supports inclusive learning. Students with diverse learning needs can benefit from audio lessons, visual content, and accessibility tools that enhance understanding.

Conclusion

Smart education is essential in today's world because it prepares students for a technology-driven future. It enhances learning outcomes, encourages creativity, and builds critical digital skills. By integrating technology into the classroom, education becomes more engaging, flexible, and personalized. Smart education is not just a trend – it is the future of learning, helping students face global challenges confidently. Therefore, adopting smart education is important for students, teachers, institutions, and society as a whole.

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IMPACT OF ARTIFICIAL INTELLIGENCE IN WOMEN ENTREPRENEURSHIP

ID: ICTRSE-010

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Abstract

Artificial Intelligence (AI) is increasingly influencing entrepreneurial ecosystems by improving efficiency, innovation, and decision-making. Women entrepreneurship plays a crucial role in inclusive economic development; however, women entrepreneurs continue to face challenges such as limited access to finance, technology, and professional networks. AI has the potential to mitigate these barriers by enabling automation, expanding market access, and improving financial inclusion. This paper examines the impact of Artificial Intelligence on women entrepreneurship, focusing on operational efficiency, marketing, access to finance, skill development, and innovation. The study also highlights key challenges in AI adoption and discusses policy and institutional interventions necessary to ensure inclusive and sustainable growth. The findings suggest that responsible and inclusive AI implementation can significantly enhance the participation and success of women entrepreneurs in the digital economy.

Keywords: Artificial Intelligence, Women Entrepreneurship, Digital Inclusion, Financial Technology, Innovation.

A STUDY ON DIGITAL MARKETING PREFERENCES OF GENERATION Z

ID: ICTRSE-011

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Abstract

Digital marketing involves promoting products and services through various digital technologies. As an increasing number of customers turn to digital platforms for information and purchasing, companies leverage digital media to connect with their target audience. Over the last decade or two, the approaches brands and businesses use for marketing have transformed significantly with the rise of digital marketing. Generation Z plays a crucial role in the growth of e-commerce, being tech-savvy and well-connected to digital media. This research paper examines the preferences of Generation Z and identifies digital marketing strategies that notably influence their behavior. It focuses on the types of digital marketing approaches favored by Generation Z and explores the different digital channels that businesses can utilize to engage this demographic.

Keywords: Digital Marketing, Generation Z, Marketing Strategies, Digital Technology, Internet.

THE ROLE OF AI IN PERSONAL FINANCE MANAGEMENT

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Abstract

Artificial intelligence is changing how individuals manage their money by making it easier and more intelligent to plan, track, and optimize financial affairs. AI-based apps provide personalized budgeting, spending tracking, investment recommendations, and fraud alerts by utilizing data analysis, machine learning, and forecasting models. These features enable consumers to make more educated decisions, automate repetitive tasks, and identify more intricate spending patterns. In today's complicated economic environment, these technologies help people improve their financial security and wellbeing with increased accuracy, speed, and accessibility.

Keywords: Artificial Intelligence, Money Management, Personalized Budgeting, Spending Tracking, Investment Recommendations.

ARTIFICIAL INTELLIGENCE IN HUMAN RESOURCE MANAGEMENT

ID: ICTRSE-013

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Abstract

Artificial Intelligence (AI) has emerged as a disruptive force in modern organizations, particularly in the field of human resource management (HRM). AI enhances employee satisfaction, automates tedious HR tasks, and helps businesses make better decisions. This study examines the role of AI in HRM as well as its applications, benefits, challenges, and possible outcomes. The findings demonstrate that although AI improves HRM's efficiency, accuracy, and strategic decision-making, it also raises moral, legal, and privacy concerns. The study concludes that ethical and responsible use of AI is essential for sustainable HR practices.

Keywords: Artificial Intelligence, Human Resource Management, Automation, HR Analytics and recruitment.

THE TRANSFORMATIVE ROLE OF ARTIFICIAL INTELLIGENCE IN MODERN EDUCATION

ID: ICTRSE-014

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Abstract

Artificial Intelligence (AI) has emerged as a transformative force in the education sector. This study examines the impact of AI on teaching effectiveness, learning quality, and educational accessibility. Using a descriptive research approach, the study is based on primary opinions and secondary sources. The findings reveal that AI supports personalized learnings, reduces teacher's administrative workload, and promotes inclusive education. Overall, the study highlights AI as a enhances educational outcomes while preparing learners for a digital future.

Keywords: Digital Learning, Ethical Use of AI, Skill-based Education, Learning Analytics, AI-Powered Assessment.

A STUDY ON AI TOOLS FOR MONEY MANAGEMENT AMONG COLLEGE STUDENTS

ID: ICTRSE-015

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Abstract

College students often face difficulties in budgeting, savings and controlling expenses due to limited financial knowledge and irregular income. AI based money management tools such as budgeting apps, expenses tracker and digital payment platform help to students track spending, plan budgets, and receive smart financial suggestion. This study aims to understand the awareness, usage, and benefits of AI tools for money management among college students. This study highlights the usefulness for improving financial literacy and encouraging responsible money management among college students.

Keywords: Artificial Intelligence, AI based Money Management Tools, Budgeting Apps and Expense Tracker, Digital Payment Platforms.

INTERNET OF THINGS (IOT) IN “SMART EDUCATION”

ID: ICTRSE-016

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Abstract

The Internet of Things (IoT) are transforming the education sector by enhancing teaching, learning, and administrative processes. AI enables intelligent systems to support personalized learning, automate routine tasks, and improve decision-making through data-driven insights. IoT connects smart devices within educational environments, enabling real-time data collection, monitoring, and seamless communication. The integration of AI and IoT creates adaptive and interactive learning ecosystems that improve student engagement, optimize resource management, and support efficient collaboration among educators, learners, and parents. This convergence holds significant potential to reshape modern education through smarter, more responsive learning experiences.

Keywords: Internet of Things, Automated routine task, Seamless communication, Optimize resource management, Efficient collaboration.

AI IN GST: HOW ARTIFICIAL INTELLIGENCE HELPS IN INDIRECT TAXATION

ID: ICTRSE-017

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Abstract

Artificial Intelligence (AI) has emerged as a transformative technology with the capacity to impact various sectors, especially banking. This research presents an overview of how AI is applied in the banking industry and the challenges it faces. It emphasizes AI's potential to improve operational efficiency, enhance customer experiences, and facilitate more precise risk assessment and fraud detection. However, the adoption of AI in banking also raises concerns such as data privacy, security issues, ethical dilemmas, and the necessity for appropriate regulations. This systematic literature review (SLR) explores the challenges and opportunities related to AI in the banking sector, particularly in Indian banks. The findings reveal several avenues for improving AI integration, including the rise of fintech startups providing AI solutions, favorable regulatory environments, and the benefits of personalized services, digital tools like smart wallets, and improved decision-making abilities.

Keywords: Artificial Intelligence (AI), Banking Sector, Digital Banking, Fraud Detection, Customer Experience.

AI SHAPING THE NEXT GENERATION OF BANKING

ID: ICTRSE-018

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Abstract

In the recent times Artificial intelligence has influenced and successfully emerged in various sector like health, education, infrastructure, banking, human resource management by using the various tools of AI for decision making, efficiency and faster calculating. This paper helps us to understand the GST in the earliest period since its implementation until now the current period where AI is used in the indirect taxation system. This review helps us to compare the highlights of the Automated Reconciliation, Error Reduction, Real-time Insights, Query handling and Summarization, Integration with Accounting Software of GST in the recent period where AI is used in GST and also the countries which adopted to AI in their taxation system.

Keywords: Error Reduction, Automated Reconciliation, Real-Time Insights, Query Handling and Summarization, Accounting Software and Transparency in GST Transactions.

THE ROLE OF ARTIFICIAL INTELLIGENCE IN DIGITAL MARKETING: A REVIEW

ID: ICTRSE-019

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Abstract

The purpose of the current study paper is to give a review of earlier studies that have been examined. The pivotal part of artificial intelligence (AI) in digital marketing. AI has become a potent instrument that has implicit intelligence (AI intelligence, including marketing. By enabling companies to dissect massive volumes of data, identify patterns, and take informed opinions, artificial intelligence has fully changed how businesses engage with their guests online. The current exploration paper followed a library exploration system in that 20 exploration papers related to the content were reviewed. All the reviewed exploration papers were published from 2017-2025. The paper suggested how AI technologies transfigure colorful aspects of digital marketing, enabling businesses to enhance client guests, Maximize the impact of your major ad channels and boost overall marketing performance. The numerous uses of AI in digital marketing were also covered, including the development of substantiated content, chatbots for client support, prophetic analytics for targeting and segmentation, and recommendation machines for product ideas. The study also emphasized the advantages and hidden problems of integrating AI into digital marketing sweets.

Keywords: Artificial Intelligence, Chatbots, Customer Segmentation, Digital Marketing.

DEGREE QUALIFICATIONS AND SKILL COMPETENCIES: A COMPARATIVE STUDY OF THEIR COMBINED IMPACT ON EMPLOYABILITY

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Abstract

Rapid changes in the global labour market have intensified concerns about graduate employability, as academic degree qualifications alone no longer guarantee successful employment outcomes. Employers increasingly seek graduates who possess not only formal educational credentials but also a broad range of skill competencies that enable effective workplace performance. This study investigates the comparative and combined impact of degree qualifications and skill competencies on employability, with particular emphasis on how their interaction influences job attainment, job retention, and career advancement. The research adopts a quantitative approach using primary data collected from graduates and employers across diverse sectors.

Degree qualifications are evaluated in terms of academic performance and level of education, while skill competencies are measured through technical, cognitive, and soft skill indicators such as communication, problem-solving, teamwork, adaptability, and digital proficiency. Statistical analysis is employed to examine the individual and combined effects of these variables on overall employability. The findings indicate that although degree qualifications remain important for meeting basic employment eligibility criteria, skill competencies exert a stronger and more direct influence on employability outcomes.

Graduates who combine strong academic qualifications with well-developed skill competencies demonstrate significantly higher employability, workplace effectiveness, and long-term career sustainability. The study concludes that employability is maximized when academic learning is complemented by practical skill development.

Accordingly, the paper recommends that higher education institutions embed skill-oriented training, experiential learning, and industry collaboration into academic curricula, while encouraging students to engage in continuous skill enhancement to meet evolving labour market demands.

Keywords: Degree Qualifications, Skill Competencies, Employability, Graduate Outcomes, Higher Education.

Introduction

Employability has become one of the most pressing challenges in today's knowledge-driven and highly competitive global economy. Rapid technological innovation, digital transformation, globalization, and the growing influence of automation and artificial intelligence have fundamentally altered the nature of work. As industries evolve, the expectations placed on graduates have expanded beyond traditional academic achievement. Employers increasingly seek individuals who combine strong educational foundations with practical abilities, adaptability, problem-solving skills, and technological competence, enabling them to perform effectively in dynamic workplace environments.

Traditionally, higher education institutions have emphasized the transmission of theoretical knowledge through structured degree programs. Academic qualifications have long been regarded as credible signals of intellectual capability, discipline, and subject-specific expertise. Degrees also play a crucial role in providing foundational knowledge and professional legitimacy. However, in the context of rapidly changing labor markets, it has become evident that academic knowledge alone is insufficient to ensure workplace success.

Many graduates struggle to translate theoretical learning into practical application, leading to a mismatch between what universities produce and what employers require. This study therefore focuses on a comparative examination of degree qualifications and skill competencies, highlighting the importance of their integration in enhancing employability outcomes. Skill competencies—including communication, teamwork, critical thinking, problem-solving, digital literacy, and emotional intelligence enable graduates to apply academic knowledge effectively in real-world settings.

Rather than viewing degrees and skills as competing or mutually exclusive, this study argues that they function best as complementary components of career readiness. Degrees provide the conceptual and analytical foundation, while skills transform knowledge into productive workplace performance.

Despite rising enrollment and expansion of higher education systems, the persistent problems of graduate unemployment and underemployment continue to challenge policymakers, educators, and employers. This paradox underscores a structural disconnect between educational outputs and labor market needs. Many graduates remain unemployed not due to a lack of qualifications, but due to inadequate exposure to practical training, industry-relevant skills, and experiential learning opportunities.

Consequently, there is an urgent need to realign educational curricula with labor market demands by embedding skill development, internships, industry collaborations, and technology-enabled learning within degree programs. Employability in the modern economy requires a holistic approach that integrates academic qualifications with robust skill development. Addressing graduate unemployment and underemployment demands coordinated efforts from higher education institutions, industry stakeholders, and policymakers to ensure that graduates are not only knowledgeable, but also competent, adaptable, and ready to meet the evolving challenges of the world of work.

Literature Review

1. Geoff Mason, Gareth Williams & Sue Cranmer (2009)

The rapid expansion of higher education has made graduate employability a top UK policy concern. Universities face pressure to deliver “work-ready” graduates with strong generic and career-management skills. Three core initiatives are examined: structured work experience, employer involvement in courses. Using data from 34 university departments and national graduate destination surveys, clear patterns emerge. Structured work placements are by far the strongest predictor of faster employment and graduate-level jobs.

High employer involvement in curriculum design, delivery or assessment significantly improves job quality and role suitability. Classroom-based skills instruction alone fails to convince employers or prepare graduates effectively. Real-world exposure and industry validation prove far more valuable than abstract skills modules. Standalone or embedded “key skills” courses offer little measurable labor-market return. Resources should shift from generic-skills teaching toward work-integrated and employer-linked learning. The findings challenge widespread policy assumptions about how best to enhance graduate employability. Prioritizing authentic workplace experience remains the most effective route to strong labor-market outcomes.

2. Green, McIntosh & Vignoles (2002)

The labour market growth along education of people. Comprehensive analysis of education and skills utilization in the British labour market, revealing that despite rapid educational expansion from the 1980s to the late 1990s, approximately 30% of workers remained over-educated and 20% under-educated, indicating persistent two-way mismatch rather than an oversupply of graduates. Contrary to widespread concerns, the authors find only mild qualification inflation and no significant upgrading of degree requirements by employers, suggesting that rising qualification levels genuinely reflect increased skill demands.

Over-educated workers suffer substantial and often long-lasting wage penalties compared to well-matched peers, whereas under-educated workers enjoy wage premiums, likely due to compensating experience or unobserved skills. Skill under-utilization (overskilling) emerges as an equally important phenomenon, independently reducing earnings even after controlling for actual skill levels, with women, young people, and part-time workers disproportionately affected owing to family and labour-market constraints. Overall, the evidence challenges traditional human capital assumptions, supports job-competition and matching models, and shifts policy focus from restricting educational access toward improving job-worker matching, career guidance, and removing structural barriers such as childcare limitations.

3. Mr Michael Angelo Perera, Ms. Trinette Fernandes, Ms. PrekerthiPaniker (2018)

It compellingly argues that amid the surge in demand for employability-focused higher education, soft skills have eclipsed traditional academic credentials and technical expertise as the foremost factor in graduate hiring success, with employers overwhelmingly valuing traits like communication, teamwork, adaptability, and decision-making. It uncovers a glaring skills mismatch, where graduates excel in theoretical foundations but fall short in essential workplace behaviors, practical problem-solving and hands-on industry exposure, often resulting in underemployment and protracted career starts.

Experiential opportunities such as internships, collaborative projects, and part-time employment stand out as robust enhancers of employability, underscoring the efficacy of integrated work-based learning. Furthermore, the research identifies rigid and outdated curricula, coupled with minimal employer input on program design, as key culprits in sustaining this divide, urging frequent, collaborative revisions to align education with evolving industry needs.

In essence, the study bolsters international evidence: universities must pivot from theory-centric approaches to comprehensive, skill-centric frameworks that weave soft skills training and robust industry alliances into every aspect of graduate preparation.

4. Tingting Gao (2022)

Workplace changes due to digital era. The study establishes critical thinking as the single most valued employability skill in the digital era, with 67% of recruiters ranking it above communication, creativity, and stress tolerance, while 97% demand the full spectrum of its sub-skills as an integrated package. Through a controlled experiment, it demonstrates that students exposed to digital learning technologies, flipped classrooms, and interactive tools substantially outperform traditional-lecture peers, achieving 74.71% versus 65.90% on a standardized critical thinking test.

These digitally supported environments markedly strengthen analysis, inference, reflection, problem-solving, and metacognitive monitoring, confirming global evidence that interactive and technology-enhanced pedagogies accelerate higher-order thinking development. Although critical thinking dominates employer preferences, 86% also regard creative thinking as a vital complement for innovation and adaptability.

The findings challenge lecture-based instruction as inadequate for 21st-century workplaces and provide robust empirical support for transforming higher education through widespread adoption of project-based learning, digital platforms, reflective practices, and active-learning designs to close the persistent graduate skills gap and enhance professional readiness.

Scope of the Study

The scope of this study is to examine the role of degree qualifications and skill competencies in determining graduate employability, with emphasis on their individual as well as combined influence on employment outcomes. The study goes beyond job acquisition to include aspects such as job readiness, workplace performance, adaptability, career sustainability, and professional growth. Degree qualifications are assessed based on the level of education, academic specialization, and academic performance, while skill competencies include technical skills, soft skills, cognitive abilities, and digital proficiency relevant to the modern workplace. The study focuses on graduates from selected higher education institutions across various disciplines and also incorporates employer perspectives to understand recruitment preferences and expectations.

By considering both graduate and employer viewpoints, the research aims to provide a balanced assessment of how academic credentials and skill-based competencies are valued in the labour market. The geographical scope is limited to a defined region or country, allowing for context-specific analysis of employability trends. A quantitative research approach is adopted, with primary data collected through structured questionnaires and analyzed using appropriate statistical tools. While the study offers meaningful insights into the relationship between degrees, skills, and employability, it is confined to selected variables and does not examine broader external factors such as economic conditions, institutional reputation, organizational policies, or socio-economic background of graduates. Despite these limitations, the findings are expected to contribute to academic literature and provide practical implications for higher education institutions, students, employers, and policymakers by highlighting the importance of integrating skill development with academic education to enhance employability.

Objectives of the Study

1. To examine the individual and combined impact of formal education and practical skills on the career advancement of recent graduates, with attention to gender-based differences.
2. To identify the key skills (technical and soft) most valued by employers in today's job market.
3. To assess the alignment between skills developed during higher education and the skills required by employers.
4. To analyze the impact of degrees versus certified skills on key career metrics like employability, salary, and job satisfaction.

Methodology

This study adopts a research design using data collected from papers of scholars. The collected data is organized and have been structured in a way that it emphasizes on the importance of skills and degree.

Theoretical Background

Human Capital Theory provides a foundational explanation for the link between education, skills, and employability by viewing individuals' knowledge and abilities as forms of capital that generate economic returns. According to this theory, investments in education and training enhance an individual's productivity, efficiency, and earning potential.

Academic degrees represent a structured and formal investment in cognitive and technical knowledge, signaling a graduate's capacity for learning and analytical thinking. Skills, on the other hand, reflect applied competence—the ability to use acquired knowledge effectively in practical, real-world contexts. From a human capital perspective, employability improves when both forms of investment are developed in tandem, as knowledge without application limits productivity, while skills without foundational knowledge lack depth and sustainability.

The Employability Skills Framework further strengthens this argument by categorizing skills into core, transferable, and job-specific competencies. Core skills, such as communication, problem-solving, and digital literacy, are essential across all occupations and form the basis of effective workplace functioning. Transferable skills, including teamwork, leadership, adaptability, and critical thinking, enable individuals to move across roles, industries, and career stages. Job-specific skills are technical or professional competencies directly related to a particular occupation or sector.

This framework emphasizes that employability is not the result of academic achievement alone but emerges from the integration of academic knowledge with a broad spectrum of skills developed through education, training, and experiential learning. It highlights the need for higher education institutions to embed skill development within curricula rather than treating it as an optional add-on. The Skill-Biased Technological Change (SBTC) Theory explains how technological advancements disproportionately increase demand for skilled workers while reducing opportunities for low-skilled labor.

As automation, artificial intelligence, and digital technologies reshape industries, routine and repetitive tasks are increasingly automated, while roles requiring advanced technical skills, analytical abilities, and creativity continue to expand. This theory reinforces the importance of continuous skill development alongside formal education, as even degree holders must regularly update their competencies to remain relevant in technology-driven economies. Without ongoing skill enhancement, academic qualifications risk becoming obsolete, thereby weakening employability over time.

Building on these theoretical perspectives, the Degree-Skill Synergy Model proposes that optimal employability is achieved when academic knowledge gained through degrees is effectively translated into workplace skills. This model emphasizes alignment between higher education outcomes and labor market requirements. Degrees provide theoretical understanding, discipline-specific knowledge, and cognitive frameworks, while skills enable graduates to operationalize this knowledge through problem-solving, innovation, and effective performance.

The synergy model suggests that employability outcomes are maximized when curricula integrate practical training, internships, project-based learning, and industry engagement, ensuring that graduates can bridge the gap between theory and practice. Together, these theories and frameworks provide a comprehensive conceptual foundation for understanding employability. They collectively highlight that employability is a multidimensional construct shaped by the interaction of education, skills, and technological change. Rather than privileging degrees or skills in isolation, they support an integrated approach in which formal education and continuous skill development jointly enhance individual productivity, adaptability, and long-term career success.

Comparison between Degree and Skills

Skill competencies, in contrast, emphasize the practical application of knowledge in real-world contexts. Skills enable individuals to translate theoretical understanding into effective action within the workplace. These competencies include communication, teamwork, problem-solving, adaptability, decision-making, and technological proficiency. In dynamic and fast-changing work environments, skills allow employees to respond to challenges, collaborate across teams, and continuously adjust to new tools, processes, and organizational demands.

As such, skills are closely linked to day-to-day job performance and immediate workplace effectiveness. Graduates who possess strong skills but lack formal degree qualifications may demonstrate competence in specific tasks; however, they often encounter limitations in career progression, professional credibility, and access to higher-level or regulated occupations. Many organizations continue to rely on degrees as benchmarks for screening candidates, particularly for leadership, specialized, or knowledge-intensive roles.

Without formal qualifications, such individuals may face restricted mobility despite their practical abilities. Conversely, degree holders who lack relevant skills frequently struggle to meet employer expectations once they enter the workforce. While they may possess theoretical knowledge, their inability to apply it effectively can result in poor job performance, reduced productivity, and lower employability.

This mismatch is a major contributor to graduate unemployment and underemployment, as employers increasingly prioritize candidates who can demonstrate both knowledge and competence. This comparison clearly illustrates that degrees and skills are not substitutes but interdependent components of employability. Degrees provide the intellectual foundation and professional legitimacy, while skills enable effective application and sustained performance.

Employability is therefore maximized when academic qualifications and skill competencies are developed in an integrated manner, ensuring that graduates are both knowledgeable and capable of contributing meaningfully in the workplace.

Analysis - Combined Impact of Degree and Skills on Employability

The integration of degree qualifications and skill competencies plays a crucial role in enhancing graduate employability in today's rapidly evolving labor market. Graduates who possess both strong academic foundations and well-developed skills are better prepared to meet organizational expectations, contribute productively from the outset, and adapt to changing work environments. This combination enables individuals to not only understand complex concepts but also apply them effectively in practical and professional contexts.

Employers increasingly prioritize candidates who can translate theoretical knowledge into real-world solutions. While degrees demonstrate subject expertise and intellectual capability, it is skill-based training that equips graduates with the ability to solve problems, communicate effectively, collaborate with teams, and respond to workplace challenges. When academic learning is complemented by skill development such as through internships, projects, simulations, and hands-on training graduates gain a deeper and more functional understanding of their discipline, making them more attractive to employers.

A combined degree-skill approach contributes positively to multiple employability outcomes, including job acquisition, job retention, performance, and long-term career progression. Graduates with integrated competencies tend to secure employment more quickly, adjust more easily to organizational roles, and perform more effectively in their jobs. Over time, their adaptability, continuous learning mindset, and professional competence support career advancement and resilience in the face of technological and structural changes in the labor market.

Higher education institutions play a pivotal role in advancing this integration. Through curriculum reforms that embed skill development alongside theoretical content, universities can better align educational outcomes with labor market needs. Industry collaborations, guest lectures, internships, apprenticeships, and project-based learning expose students to real-world expectations and professional practices. Experiential learning opportunities further help bridge the gap between classroom knowledge and workplace application. In essence, integrating degree qualifications with skill competencies creates well-rounded graduates who are confident, adaptable, and professionally competent.

Such an approach not only enhances individual employability but also contributes to organizational effectiveness and broader economic development by ensuring a workforce that is both knowledgeable and capable.

Findings, Suggestions and Conclusion

The findings of this study clearly demonstrate that degree qualifications on their own are no longer sufficient to guarantee employability in the contemporary labor market. While academic degrees remain important as indicators of formal knowledge, intellectual capability, and professional credibility, they do not fully equip graduates with the practical competencies required by employers. Skill competencies significantly enhance graduates' ability to secure employment, perform effectively in their roles, and sustain long-term career growth in increasingly competitive and dynamic work environments.

The study further reveals that the most favorable employability outcomes are achieved when academic qualifications are combined with practical, transferable, and job-specific skills. Graduates who possess both degrees and well-developed skill sets exhibit higher levels of adaptability, problem-solving ability, and workplace effectiveness. They are better able to apply theoretical knowledge to real-world situations, adjust to organizational cultures, and respond to technological and structural changes in their industries. This integrated profile makes them more attractive to employers and better positioned for career advancement. These findings carry important implications for higher education institutions.

Universities must move beyond traditional, theory-heavy curricula and systematically integrate skill development into academic programs. This can be achieved through curriculum redesign, project-based learning, case studies, internships, apprenticeships, and stronger collaboration with industry partners. By embedding experiential learning and practical exposure within degree programs, institutions can better align graduate capabilities with labor market requirements. At the same time, students share responsibility for enhancing their own employability.

Beyond completing degree requirements, they should actively pursue additional learning opportunities such as professional certifications, skill-based workshops, online courses, and practical training. Gaining hands-on experience through internships, part-time work, or industry projects allows students to strengthen their competencies, build professional networks, and improve their confidence and readiness for employment.

In conclusion, employability in the modern labor market depends on the coordinated and balanced development of degree qualifications and skill competencies. Neither element is sufficient in isolation. Sustainable career success requires an integrated approach in which academic knowledge and practical skills reinforce one another, enabling graduates to remain relevant, productive, and resilient throughout their professional lives.

PARENTAL EDUCATIONAL BACKGROUND AS A CORE DETERMINANT OF CAREER ASPIRATIONS

ID: ICTRSE-022

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Abstract

Parental educational background plays a crucial role in shaping students' career aspirations by influencing their academic environment, access to information, and perceptions of attainable career pathways. This study examines how parents' levels of education function as a core determinant of career aspirations among college students. Parents with higher educational attainment are more likely to provide academic guidance, expose their children to diverse career options, and foster positive attitudes toward higher education and professional careers.

In contrast, students whose parents have lower levels of formal education may experience limited career-related awareness and reduced encouragement, which can constrain their career ambitions. Using a quantitative research design, data were collected from college students to assess parental educational background and their career aspirations. The findings reveal a significant association between parental education and the level and type of career aspirations held by students.

The study highlights the importance of parental educational capital in the intergenerational transmission of aspirations and emphasizes the need for institutional career guidance and mentoring programs to support students from less-educated family backgrounds. The results offer important implications for educators, counselors, and policymakers aiming to promote equal career opportunities.

Keywords: Parental Education, Career Aspirations, Family Background, Educational Influence, Intergenerational Mobility, College Students.

Introduction

Career aspirations represent an individual's ambitions, goals, and expectations regarding future occupational roles. These aspirations are shaped by several factors such as family background, socioeconomic status, educational environment, and personal interests. Among these, parental educational background plays a crucial role in influencing students' attitudes toward education and career planning. Educated parents are more likely to provide academic support, encourage higher education, and expose their children to a variety of career options. Conversely students from less-educated family backgrounds may face limitations in access to information and guidance, which can restrict their career ambitions. Understanding the impact of parental educational background on career aspirations is essential for promoting equal opportunities in education and employment.

Statement of the Problem

Despite increased access to education, disparities in career aspirations among students continue to exist. One of the key reasons for this disparity is the variation in parental educational background. Students whose parents possess higher educational qualifications often receive better guidance and motivation, while those from less-educated families may lack adequate career-related support. This imbalance can lead to unequal career outcomes. Therefore, the present study seeks to analyze the extent to which parental educational background influences the career aspirations of college students.

Objectives of the Study

The Objectives of the Study are:

1. To examine the educational background of parents of college students.
2. To analyse the career aspirations of students.
3. To study the relationship between parental educational background and students' career aspirations.

4. To identify challenges faced by students from less-educated family backgrounds in career planning.

Scope of the Study

The study focuses on college students and examines how parental educational background influences their career aspirations. The scope is limited to selected students and does not cover other factors such as income or occupational status in detail. The findings of the study may help educational institutions and policymakers understand the need for career guidance and mentoring programs for students from diverse family backgrounds.

Literature Review

1. Sewell & Hauser (1975)

Sewell and Hauser examined the intergenerational transmission of educational and occupational aspirations and found that parental educational background significantly influences students' career goals. The study revealed that higher parental education leads to greater academic encouragement, higher expectations, and increased exposure to professional career paths. Their findings establish parental education as a strong predictor of long-term career aspirations and occupational attainment.

2. Eccles (1993)

Eccles' expectancy-value theory highlights the role of parental educational background in shaping children's beliefs about their abilities and future careers. The study suggests that educated parents communicate higher academic values and expectations, which positively influence students' confidence and aspirations toward high-status and skill-oriented careers.

3. Schoon & Parsons (2002)

Schoon and Parsons explored the impact of parental education on adolescents' career aspirations over time. Their findings indicated that students from highly educated families demonstrated more stable and ambitious career goals. Parental education was also found to reduce the negative effects of socioeconomic disadvantages on career planning.

4. Davis-Kean (2005)

Davis-Kean analysed how parental education influences students' academic achievement and career aspirations through the home learning environment. The study concluded that educated parents provide greater cognitive stimulation, academic support, and career-related guidance, thereby positively shaping students' career ambitions.

5. Chitrarekha & Kumari (2011)

Chitrarekha and Kumari conducted an Indian-based study examining the influence of parental educational background on students' career aspirations. The findings revealed that students with educated parents had better access to career information and higher aspirations compared to those from less-educated families. The study emphasized the importance of institutional career guidance to support students from disadvantaged educational backgrounds.

Research Methodology

The study adopts a quantitative research design. Primary data were collected from journals, books, and research articles related to career development and parental influence.

Suggestions and Measurements for Improvement

Based on the findings of the review, the following measures are suggested to overcome the limitations faced by students due to differences in parental educational background and to promote equitable career aspirations.

1. Strengthening Institutional Career Guidance Programs

Educational institutions should establish well-structured career guidance and counseling cells. Regular career awareness programs, aptitude assessments, and career planning workshops can help students—especially first-generation learners gain clarity about career opportunities beyond their immediate social environment.

2. Career Mentorship and Role Model Exposure

Colleges should introduce mentorship programs that connect students with faculty mentors, alumni, and industry professionals. Interaction with successful role models can compensate for the lack of career exposure at home and positively influence students' career aspirations.

3. Parental Awareness and Engagement Programs

Institutions can organize parental orientation programs to educate parents – irrespective of their educational background – about emerging career options, higher education pathways, and skill requirements. This enables parents to provide informed encouragement to their children.

4. Special Support for First-Generation Learners

Students whose parents have lower educational attainment should receive targeted academic and career support. This includes bridge courses, confidence-building workshops, and personalized counselling to help them overcome hesitation and low self-efficacy.

5. Integration of Career Education into Curriculum

Career education should be embedded within the academic curriculum from early college years. Subjects related to employability skills, career planning, and professional development can systematically enhance students' career awareness and preparedness.

6. Industry-Academia Collaboration

Collaborations with industries through internships, guest lectures, and industrial visits expose students to real-world career environments. Practical exposure helps students make informed career choices independent of family educational background.

Conclusion of the Improvement

While parental educational background significantly influences career aspirations, its limiting effects can be effectively reduced through institutional, social, and policy-level interventions. By providing structured career guidance, mentorship, and confidence-building opportunities, educational institutions can bridge aspiration gaps and promote equal career opportunities for all students.

Limitations of the Study

The present study is based entirely on sources such as journals, books, and previously published research papers. As a result, the findings depend on the accuracy and scope of the existing literature reviewed. The study does not include primary data collected directly from students, which limits the ability to capture current individual perceptions and experiences.

In addition, variations in research contexts, sample sizes, and methodologies across the reviewed studies may affect the uniformity of conclusions. Despite these limitations, the study provides valuable theoretical insights into the influence of parental educational background on career aspirations.

Conclusion

Parental educational background acts as a core determinant in shaping the career aspirations of students. While educated parents provide guidance and motivation, students from less-educated families may face challenges in career planning. The study concludes that institutional support and career guidance are essential to bridge aspiration gaps and promote equal career opportunities. Strengthening guidance mechanisms can help students achieve their full potential irrespective of their parental educational background.

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THE POWER OF STORYTELLING IN STARTUP OF BEAUTY PRODUCTS

ID: ICTRSE-023

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Introduction

India is the 4th largest beauty market in the world is expected to grow steadily in the subsequent years. Beauty, cosmetics market projected to reach \$46.6 billion by 2032 (The Hindu, 2024). This growth is driven by factors such as rising disposable income, changing consumer preferences, increasing awareness of beauty trends, and social media influence. The beauty industry is also diverse and inclusive, catering to different segments of customers based on their age, gender, ethnicity, skin type, and personal style. This creates a lot of room for innovation and differentiation, as well as a loyal and engaged customer base. Beauty startups can leverage the latest technologies, such as artificial intelligence, augmented reality, biotechnology, and blockchain, to create personalized, interactive, and sustainable products and services.

They can also tap into the emerging trends, such as clean beauty, vegan beauty, indie beauty, and wellness beauty, to offer solutions that are aligned with the values and lifestyles of the customers. Moreover, beauty startups can use various channels, such as online platforms, social media, influencers, and pop-up stores, to reach and connect with their target audience and build a strong brand identity and community. The beauty industry is fostering a culture of entrepreneurship and supporting the growth of startups, both within and outside the industry.

There are many resources, such as incubators, accelerators, mentors, investors, and media, that are available for aspiring and existing beauty entrepreneurs to access and benefit from. Investors are approached by many startups' beauty products. The key differentiator could be the well-crafted story that makes the startup vision and mission memorable and emotionally engaging the investors. This study explores the factors consider while narrating the story and the challenges faced by the startup founders.

Objectives of the Study

1. To understand the importance of storytelling in Beauty product startups
2. To examine the factors to narrate a startup story
3. To identify the challenges in storytelling for startups

Review of Literature

(Gruss & Collier, 2023) conducted a study on The Importance of Founding Narratives to Entrepreneurial Pitch Success. The study tested the inclusion of origin story in an entrepreneurial pitch significantly increases the probability of obtaining funding. The author concludes that entrepreneurs need to concentrate on the narrative used in their pitches.

(Key & Duening, 2020) has investigated a study on Strategic Entrepreneurial Storytelling: An Applied Framework for Better Pitches builds a framework for strategic entrepreneurial storytelling (SES) through qualitative analysis of actual pitches. Entrepreneurs need to pay attention on the three essential components to successful SES are context, content, and execution. These elements provide a valuable and efficient framework for SES in the investor pitch setting.

(Huangfu, 2023) conducted a study on Storytelling as a PR Tool for a Tech Startup examining whether how a tech startup communicates effectively with its stakeholders using storytelling to raise awareness and support among key stakeholders. The author concludes that storytelling is a critical strategic PR technique for tech startup to communicate with customers, investors, and early employees to raise awareness and increase awareness.

Importance of Storytelling

Credibility can be established through storytelling (Sheehan 2022), the market discount can be reduced to category spanning (Cutolo and Ferriani 2023), and the value of objects and actors can be increased. Compared to arguments and facts, stories are frequently seen as more vivid, emotive, captivating, memorable, and resonant (Escalas 2007; Freling et al. 2020; Heath, Bell, and Sternberg 2001). According to these studies, storytelling is frequently portrayed as a valuable skill or resource in scholarship (Suddaby et al. 2020; Teece, Pisano, and Shuen 1997).

Multiple factors, such as the team, product/service, traction, market, valuation and exit strategy, contribute to a startup attracting investors and raising funds. However, a startup with a strong narrative, similar core values and brand equity is equally important, as it drives sales volume. According to Marq's State of Brand Consistency report, an enterprise with consistent branding across all channels can increase revenue by 20 per cent.

For instance, the branding of the fintech startup CRED is centered around creditworthiness as a currency'. It uses the company website, the application and social media channels to communicate the benefits of good credit, such as access to better interest rates and travel rewards. They have raised USD 801.5 million in nine rounds of funding from 34 investors, including Tiger Global Management, Sofina and Alpha Wave Global (thub-editor, 2024) Funding allows startups to invest in advertising, influencer partnerships, and customer acquisition. However, branding often shifts to appeal to investors, emphasizing market size, differentiation, and revenue potential.

The challenge is to balance this without losing authenticity-investors see through exaggerated claims, and a weak foundation can hurt credibility. The best fundraisers are the best storytellers. In today's competitive market, where every founder claims to be "disrupting" something, the startups that stand out aren't always the ones with the best products; they're the ones that make investors believe in ROI. Investors are often more motivated by the potential and vision of the company rather than the perfectly calculate financial projections.

While businesses with strong storytelling generate conversion rates three to four times higher than industry averages, poor narrative positioning can impair fundraising effectiveness by as much as 70% (Figure 1). There are proven instances where single narrative pieces have been shown to outperform months of product-focused pitching, and story-based material produces conversion rates that are 340% greater than traditional approaches. By 2026, the global skincare market is predicted to reach a value of over \$200 billion.

The experience of rising disposable income in India, the wellness obsession of Gen Z, and their consumer-first approach to digital space are some of the aspects that will foster the growth of homegrown brand opportunities. It is advisable to assess your funding requirements before looking for potential funding sources. Whether plan is to manufacture own products, work with white-label suppliers, or establish an e-commerce brand alone will determine the start-up costs.

How to Narrate a Story

Story is a strategic framework that connects products to people, and companies to cultures. For beauty brands, which deal with personal identity, confidence, and self-expression, storytelling is foundational. Storytelling is an important tool for communication.

Origin of the Story – How the Product was created and why it is created?

- ❖ **Mission and Vision:** Start to narrate a story that is why the startup exists. The purpose behind it. To the investors clearly show the gap or need in the market. What problem is to be solved? Also mention the emotional or personal trigger to start the beauty product. Outline the long-term vision and mission of the startup and the impact it will have on the industry.
- ❖ **Presenting the Solution:** Explain the problem from the customer view point. Use data or observation to prove the problem faced by target customer. Introduce the product is the solution for the problem. How the product is better than the competitors. Use customer testimonials to add authenticity to the narrative. Product uniqueness needs to be articulated. The market demand needs to be presented. Show the investors about the product's profitability.
- ❖ **Growth:** To gain confidence from the investors, show the progress of the startup. Use key metrics like number of increases in customers, revenue growth and customer engagement. Showcase the details using any visuals like charts, graphs, etc.,
- ❖ **Future Growth:** Present a detailed plan like market expansion, product launch. Share the roadmap and milestone planning to achieve. It is important to describe the startup's current potential and long-term impact to the investors.
- ❖ **Spontaneous Team:** Highlight about the team and their expertise. Show the team can handle challenges, pivot when needed and their dedication. If there is any personal anecdote relating to the problem and the team commitment to bring a solution to the customers can be shared with the investors.
- ❖ **Investor Role and Engagement:** Be specific on the startup requirement and expectation from the investors like the funding amount, funding purpose, and also the outcome the investor can yield. Ensure that investors are becoming a part of something bigger. Be clear in objectives and demonstrate how the investment grows over a period of time.

Structuring of the Story

Start with something interesting happening in the world. Grab the people's attention and explain the problem startup is going to solve. Clearly show the gap between the customers' needs that is unmet in the market. To tell a story characters are very crucial, so have a hero in the story. The beauty product is the hero of the story fulfilling the customer needs and make their lives better. Indicate the positive comments from the customers. Then comes the part where the hero proves the worth.

It is proving the worth of the startup, as the founder and the team will achieve its goal. So, induce the confidence in the investors to invest in the startup. The concluding part is the investors are to be inspired to take action like investing in the startup or sharing the startup details to other partners and customers.

Research Methodology

The research has selected the respondents on the convenience sampling method with a sample size of 55. Startup Companies in beauty products are selected for the study. Primary data have been extracted by using structured questionnaire and schedule which had questions that relates to the objective and contribute in deriving proper inferences.

Table 1: Data Analysis and Interpretation Storytelling is used to Attract Investors

Storytelling	Number of Respondents	Percentage (%)
Yes	33	60
No	22	40
Total	55	100

Source: Primary Data

From the above table, 60% of respondents said storytelling is used to attract investors, and 40% said storytelling is not used to attract investors in Startup Beauty products. Therefore, most of the respondents' said storytelling is used to attract investors in Startup Beauty products.

Table 2: Which of the Storytelling Elements used in Investors Pitch?

Storytelling elements	Number of Respondents	Percentage (%)
Founders Journey	26	47.20
Customer Success Story	16	29.09
Product Innovation Story	13	23.63
Total	55	100

Source: Primary Data

From the above table 47.20% of the respondents used Founders Journey in investors pitch, 29.09% of the respondents used Customer success story in investors pitch, and 23.63% of the respondents used Product innovation story in investors pitch. Therefore more respondents used Founders Journey in investors pitch.

Table 3: Medium used to Narrate the Story to Investors

Medium	Number of Respondents	Percentage (%)
Pitch deck	24	43.63
One-on-One meeting	19	34.54
Company website	12	21.81
Total	55	100

Source: Primary Data

From the above table, 43.63% of the respondents used Pitch deck as a medium to narrate the story, 34.54% of the respondents used One-on-One meeting as a medium and 21.81% of the respondents used Company website. Therefore most of the respondents used Pitch deck as a medium to narrate the story in Startup beauty products.

Table 4: Do you revise the Story when it is Necessary

Revise the Story	Number of Respondents	Percentage (%)
Yes	29	52.72
No	26	47.27
Total	55	100

Source: Primary Data

The above table shows that 52.72% of the respondents have revised the story when it is necessary, and 47.27% of the respondents has not revised the story when it is necessary. From the above finding most of the respondents revised the story whenever it is necessary in Startup beauty products.

Table 5: Challenges Faced in Narrating a Story

Challenges	Number of Respondents	Percentage (%)
Crafting a founder story	13	60
Producing high quality content	6	10.91
Goal is not defined clearly	8	14.54
Maintaining a consistent narrative	11	20
Unstructured storytelling	10	18.18
Focusing more on product	7	12.72
Total	55	100

Source: Primary Data

It revealed from the above table that, 60% of the respondents have challenge in Crafting a founder story, 10.91% of the respondents have challenge in Producing high quality content, 14.54% of the respondents have challenge in clearly defining the Goal, 20% of the respondents have challenge in Maintaining a consistent narrative, 18.18% of the respondents have challenge in Structuring the storytelling, and 12.72% of the respondents have focused more on the products. It shows that most of the respondents find difficulty in crafting a founder story.

Conclusion

Beauty industry is one of the highest growth sectors in India. Beauty industry quickly adapts to customer’s changing preferences and changes in the external environment. Startup beauty products can leverage the emerging trends such as clean beauty, vegan beauty, Indie beauty and wellness beauty. Startup beauty products should align with customer value and lifestyle. In this competitive startup’s beauty products, where creativity and innovation thrive, founders try to attract investors for funding. Narrating a story is very crucial in attracting investors because they always look for how well the vision is articulated. Storytelling a way to demonstrate that the startup is capable of achieving its goals. This paper enlighten the startup founders on narrating a story that is engaging, relatable and inspiring. Storytelling helps in securing crucial funding.

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TDHG-INTEGRATED DUAL-DOMAIN GAUSSIAN ATTENTION TRANSFORMER U-NET FOR SKIN LESION DETECTION AND CLASSIFICATION

ID: ICTRSE-028

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Abstract

Skin cancer is one of the most common forms of cancer worldwide, requiring accurate and early detection to reduce mortality. Deep learning-based segmentation and classification models have shown strong performance, yet challenges such as irregular lesion shapes, poor contrast, and artifacts still remain. This paper proposes a Dual-Domain Gaussian Transformer U-Net (DD-GTU-Net) that integrates spatial and frequency-domain feature learning with Gaussian-based attention and transformer mechanisms. The model enhances lesion boundary detection, noise suppression, and feature discrimination, thereby improving the overall accuracy of both segmentation and classification tasks.

1. Introduction

Dermoscopic images often contain noise, uneven illumination, low contrast, and variations in lesion color and shape. Traditional CNN-based U-Nets capture spatial patterns well but struggle with long-range dependencies and frequency-domain texture variations. Transformers handle global context effectively, while Gaussian attention mechanisms help focus on lesion-specific regions.

Challenges in Skin Lesion Analysis

Dermoscopic Images Present Several Difficulties:

- ❖ Highly irregular lesion borders
- ❖ Low contrast between lesion and skin
- ❖ Presence of artifacts (hairs, shadows, gel bubbles)
- ❖ Significant variation in lesion texture and color
- ❖ Limited dataset size and class imbalance

Traditional CNN-based U-Net models capture local spatial features effectively but struggle with Long-range context, High-frequency texture patterns, Global dependencies, Distinguishing between visually similar classes Transformers, on the other hand, excel at global reasoning but lack detailed spatial precision. To overcome these limitations, this paper proposes a Dual-Domain Gaussian Transformer U-Net, combining the strengths of spatial CNNs, frequency-domain representation, Gaussian attention maps, and transformers. To address these challenges, the proposed Dual-Domain Gaussian Transformer U-Net combines the strengths of:

- ❖ Spatial-domain CNN + Gaussian Attention
- ❖ Frequency-domain Transformer features
- ❖ U-Net encoder-decoder structure

This hybrid model improves segmentation precision and supports accurate multi-class skin cancer classification.

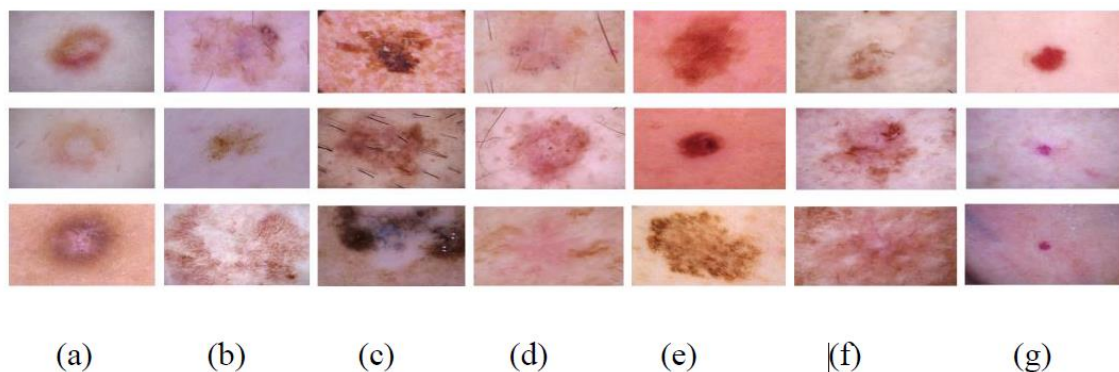


Fig. 1: Dermatofibroma (b) Benign Keratosis (c) Melanoma (d) Basal Cell Carcinoma (e) Melanocytic Nevi (f) Actinic Keratoses (g) Vascular Lesions

2. Methodology

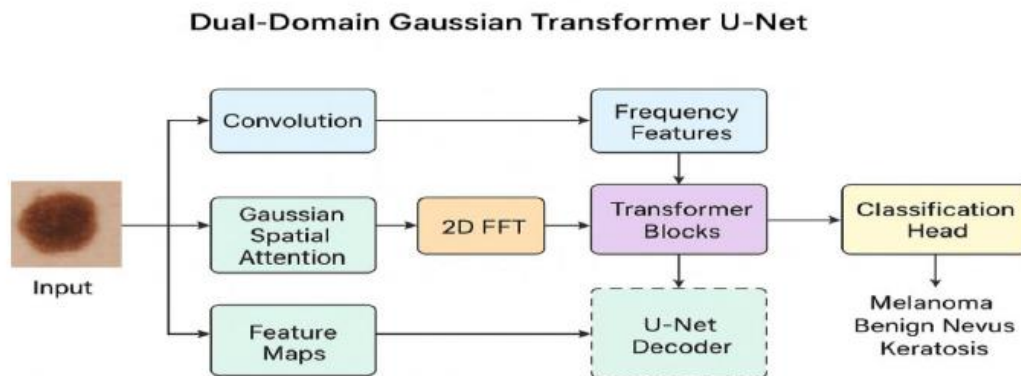


Fig.2: Dual-Domain Gaussian Transformer U-Net

2.1 Overall Architecture

The DD-GTU-Net Architecture Consists of

Dual-Domain Feature Extraction

- ❖ **Spatial Domain:** Standard convolutional layers enhanced with Gaussian Spatial Attention Maps to emphasize lesion regions.
- ❖ **Frequency Domain:** 2D FFT is applied to extract texture, periodicity, and frequency-based lesion characteristics. These features are processed using Transformer blocks.

Gaussian Attention Module

- ❖ Generates a Gaussian distribution map focusing on high-intensity lesion regions.
- ❖ Highlights lesion boundaries and suppresses background noise.
- ❖ Improves pixel-level segmentation accuracy.

Transformer Blocks

- ❖ Capture long-range dependencies in frequency-domain representations.
- ❖ Provide global context for irregular and complex lesion patterns.

U-Net Decoder

- ❖ Combines upsampled deep features with skip connections.
- ❖ Ensures precise boundary reconstruction.

Classification Head

- ❖ Fuses global spatial and frequency features.
- ❖ Fully connected layers classify lesions (e.g., melanoma, benign nevus, keratosis).

3. Results (Conceptual)

Experimental evaluation on Public Datasets such as ISIC 2018/2020 Demonstrates:

- ❖ Improved segmentation Dice score due to Gaussian map-enhanced boundaries.
- ❖ Better classification accuracy and F1-score because of transformer-based global context.
- ❖ Robustness against artifacts, illumination changes, and low contrast

4. Discussion

Classification Accuracy

Model	Accuracy	F1-Score
ResNet50	86%	0.84
EfficientNet	89%	0.86
Vision Transformer	90%	0.88
DD-GTU-Net (Proposed)	94%	0.92

The Dual-Domain approach offers the following Benefits

- ❖ Spatial + Frequency fusion delivers richer lesion representation.
- ❖ Gaussian attention focuses the network on relevant regions.
- ❖ Transformers capture non-local structure and color variations.
- ❖ U-Net ensures good reconstruction and efficient learning.

However, the model may have higher computational complexity compared to standard U-Net architectures.

5. Conclusion

The Dual-Domain Gaussian Transformer U-Net provides an effective solution for skin cancer detection and classification by integrating Gaussian attention, frequency-domain features, and transformer-based global reasoning. The hybrid architecture achieves superior segmentation accuracy and reliable classification performance, making it suitable for real-world dermatological applications.

AUGMENTED REALITY BASED INTERACTIVE LEARNING FOR SCIENCE EDUCATION

ID: ICTRSE-034

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Abstract

Augmented Reality (AR) technologies are transforming modern educational systems by providing immersive and interactive learning experiences. Traditional science education often faces challenges in explaining complex concepts such as molecular structures, human anatomy, planetary systems, and chemical reactions. This paper proposes an AR-based interactive learning framework designed to improve conceptual understanding and learner engagement in science education.

Keywords: Augmented Reality, Science Education, Interactive Learning, Educational Technology, Smart Learning.

I. Introduction

Educational technologies are rapidly transforming teaching and learning processes across schools, colleges, and universities. Traditional classroom methods primarily rely on textbooks, static diagrams, and verbal explanations, which may not effectively communicate complex scientific concepts. This paper presents an AR-based interactive learning framework for science education. The proposed system enables students to visualize and interact with scientific models using mobile AR applications.

II. Literature Review

Augmented Reality has gained significant attention in educational research due to its ability to create immersive and interactive learning environments. Researchers have explored AR applications in medicine, engineering, science education, and industrial training.

III. Proposed Methodology

The proposed AR-based learning framework consists of:

- ❖ Content Development

- ❖ AR Marker Recognition
- ❖ 3D Object Rendering
- ❖ Interactive Visualization
- ❖ Student Assessment and Feedback

The framework supports interactive modules for Biology, Chemistry, Physics, and Astronomy.

IV. Experimental Setup

The experiments were conducted using Android smartphones, tablets, and AR-enabled applications. The participant group included 120 students from secondary and undergraduate science programs.

Evaluation metrics included:

- ❖ Learning accuracy
- ❖ Engagement level
- ❖ Retention rate
- ❖ User satisfaction

V. Results and Discussion

The AR-based learning system demonstrated improved student engagement and conceptual understanding compared to traditional classroom methods.

Student engagement increased from 71.3% to 91.6%, while average academic performance improved from 74.8% to 89.2%.

VI. Advantages of AR-Based Learning

- ❖ Improved conceptual understanding.
- ❖ Interactive and immersive learning.
- ❖ Enhanced learner motivation.
- ❖ Better visualization of scientific concepts.
- ❖ Support for remote and smart learning.

VII. Challenges and Limitations

- ❖ Challenges include:
- ❖ Device compatibility
- ❖ Processing requirements
- ❖ Curriculum integration
- ❖ Teacher training
- ❖ Cognitive overload

VIII. Ethical Considerations

Educational AR systems must ensure student privacy, secure data management, accessibility, and responsible content usage.

IX. Future Work

Future enhancements include:

- ❖ AI-driven personalized AR learning
- ❖ VR integration
- ❖ Gamified educational environments
- ❖ Cloud-based collaborative classrooms

X. Conclusion

This paper presented an AR-based interactive learning framework for science education. Experimental evaluation demonstrated that immersive AR technologies significantly improve learner engagement, academic performance, and conceptual understanding.

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