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EDITORIAL

We are pleased to present the December Issue of the "International Journal of Technology, Innovation and Management" (IJTIM) as a special issue entitled ‘contemporary issues in technology, innovation and management’. This special issue is published by Global Academic Forum on Technology, Innovation and Management (GAF-TIM).

It’s always a big challenge to introduce a new journal into the world, especially when the journal aims to publish good quality papers. Moreover, although scholars urged to bring the most of us contemporary issues and many scholars understand this value, we are supporting those kink of scholars. Based on that, "International Journal of Technology, Innovation and Management" (IJTIM) aims to provide readers worldwide with high quality peer-reviewed scholarly articles on a wide variety of issues related to Technology, Innovation and Management.

The inaugural special issue1, volume1, of IJTIM includes six articles. In this special issue, the integration of blockchain technology with internet of things and its efficiency is discussed. Information technology competencies and fleet management practices lead that lead to effective service delivery also introduced. The best practice of teach computer science students to use paper prototyping also highlighted. The special issue shed the light on covid-19 detection from CBC using machine learning techniques. As well as, treatment response prediction in hepatitis c patients using machine learning techniques. And finally, the innovative and interactive teaching methods is discussed.

IJTIM is here to help. Apart from organizations, IJTIM is also serving the academic world, where researchers are participating in generating new ideas every day. IJTIM is providing a platform and a stage to all those researchers and academics to voice their ideas. IJTIM is also for those who are just here as the audience.

This versatile range of articles being published in the first special issue is proof that IJTIM is aimed for high achievements. But the team of IJTIM is highly motivated to make sure that IJTIM achieves great results and reader and viewership within its first year. This can only be done, if the quality of articles is not being compromised at any cost.

IJTIM appreciates all the support that it is receiving from its members as well as from its readers.

Dr. Haitham M. Alzoubi and Dr. Taher M. Ghazal
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INTEGRATING BLOCKCHAIN TECHNOLOGY WITH INTERNET OF THINGS TO EFFICIENCY

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Abstract

The research study focused on integrating blockchain technology with the internet of things. The study is necessitated by the need to come up with practical and feasible means to improve the accuracy, accountability and trust among various parties involved in blockchain transactions. The research recognizes the fact that there has been an increasing using of the cryptocurrency in the global market. This has lead to the emergence of blockchain, which is one of the disruptive technologies in the information and technology sector. The research study indicates that there is a need to improve on the architecture of blockchain and the IoT system. It shows that there is a need to develop a new model to improve its efficiency and accuracy. This research paper recommends the use of decentralized model to enhance the efficiency of the integration of the blockchain technology and IoT.

Keywords: Blockchain Technology, Internet of things, IoT Efficiency

Introduction

Internet of things IoT has emerged as one of the popular technologies with the aim of connecting various applications and devices to the internet. Currently, the convergence of the wireless communication, sensors and Radio Frequency Identification has led to the evolution of Internet of Things devices [1]. The use of smart features together with IoT platforms has proved useful in providing the smart services, electro-mechanical system, and controllers to establish integration between the physical world and cyber space. There are typically various types of IoT protocols that include Message Queuing Telemetry Transport (MQTT), Blur Low Energy and Constrained Application Protocol (Co-AP) [2]. As a result of the heterogeneity of the IoT protocols, the standards of the protocols and the IoT devices, there are several challenges and problems that have emerged such as scalability, flexibility and lack of interoperability. Besides, there are several IoT systems designs, architectural patterns that have been adopted and include microservices architecture and services-oriented architectures (SOA), which plays important roles in services-oriented solutions. The solutions provide by the IoT designs these solutions use communication protocol and the IoT devices to provide service to other applications and devices

[43]. The service offered is known as an availability of business functionality via a service contract. On the other hand, the service contracts incorporates various documentations, QoS, service policies, and a service interface that are useful in monitoring and ensuring enhanced performance of QoS and IoT transactions [3].

The architecture of the emerging IoT technology is primarily adopted by many companies across different industry, which leads to new sources of incomes for the various industries. Over the past years, the application of IoT solutions in the industrial sector has experienced a rapid growth. Cyptocurrency has led to invention of the Blockchain, a technology which is regarded as the most innovative transaction system [4]. The Blockchain technology enables the collection of transaction data between different individuals and business entities. The data from the regular transactions done by huge number of devices and users is normally stored in the decentralized applications. The decentralized applications arise from the cryptocurrency. The IoT is able to comprehend various networks of communications by allowing the devices to interact with each other via internet.

Blockchain has been branded as the most disruptive technology of all the times. The blockchain technology has been applied in different sectors and industries that include finance, utilities, healthcare, agriculture, supply chain management and real estate [38]. The use of blockchain technology across different sectors is due to trusted intermediaries serving as the gatekeepers for some applications can be eliminated and the same applications can be run in decentralized manner without using the centralized authority [5]. This can be done efficiently and effectively without compromising the security which was a not possible in the past times.

The emergence and implementation of the blockchain technology have led to the establishment of the peer-to-peer networks that allows users on the network to share data and perform certain transactions without the need to trust each party. According to [6], third party trusted intermediaries have been known to cause certain delays during transactions across several industries. In essence, the absence of the intermediaries can imply that there is fast transaction and reconciliation between different parties and participants involved.

Blockchain technology operate with a significant reliance on cryptographic system and scheme and mixed up function which attempt to bring high level authoritativeness and security to transactions, and interactions within the network system. Over the past years, blockchains in were merely viewed as distributed databases or ledgers [7]. However, blockchain have now been empowered using smart contracts. Smart contracts refer to the independent and self-executing scripts that normally reside on blockchains and help it achieve high level of autonomy combining all the important features to provide a favorable distributed platform [39]. As a result, it has earned and attracted the attention of many developers and industry players in the Internet of Things (IoT) domain.

Theoretical Framework

The research is based on the theoretical framework that focuses on general framework architecture. The general framework architecture is designed to help in monitoring and surveillance of activities to address the issue of trust among the parties transacting via blockchain. The general framework was developed by [8] to reduce the threats and vulnerabilities regarding the internet of things. The research paper will meet most of the requirements of IoT systems and block technology by design appropriate architecture that combines the IoT and the block chain [37]. The main layers of the system architecture include devices, data, applications, security, integrity, IoT, SQL and program interface [9]. The framework developed for this research study follows the nomenclature of the International Electro-technical Commissions or the System Committee Acted Assisted Learning [10].

Operational Definitions

- IoT is used to refer to the Internet of Things
- Blockchain implies the technology used to perform transactions in cyptocurrency market
- MQTT is used to refer to the Message Queuing Telemetry Transport
- Co-AP refers to the Constrained Application Protocol
- SOA means services-oriented architectures

Industry description

Blockchain is emerging as a powerful industry that supports the operation of many firms and businesses across different sectors. The emergence of blockchain as an innovative and disruptive technology has evidently helped revolutionize the information, communication and transactions [36]. Currently, there are several attempts and research studies aimed at integrating blockchain technology with IoT [9]. The research thus considers various models that have been used to align the blockchain technology with the past and recommend the best model that can help improve the accuracy and accountability of the blockchain technology.

Literature Review

The idea of rapid expansion IoT device to convey it towards a decentralized architecture was advanced by [10] so that it maintains its suitability and sustainability. Based on the customer's point of view, to address some of the privacy and trust issues, it is necessary to improve the information and technology infrastructure to solve the problems [32]. In maintaining the current centralized model, majority of businesses and manufacturer have spent huge amount on measures to help in the maintenance and improvement [11]. In essence, the blockchain has been used to successfully address the issue since it operates and works on a scalable peer-to-peer network, which functions accurately and transparently as well as spread data securely. The goals of blockchain and IoT integration range from decentralization framework to scalability [12]. The

decentralization framework is an approach that is similar in Internet of Things and blockchain. It has led to the elimination centralized system thus provides platform that supports decentralized network system [13]. In addition, the developed architecture is important as it can enhance the security of the system. In blockchain the system will ensure that the transactions within the node are secured. It is a useful communication strategy that enables the users to effectively and securely interact and performs various transactions. In the IoT frameworks, all the connected devices and system are identified with a unique identification [14]. In addition, each block in the blockchain is also uniquely identified. This implies that the designed blockchain becomes trusted technology that can provide uniquely identified data that is stored in the public ledger. The connected blockchain and IoT will also be fitted with the feature that ensures reliability of data and information for the users. The IoT nodes in the blackchain typically have the capabilities to authentic certain information passed within the network [35]. The contained data passed on the IoT infrastructure is reliable since it is verified by the miners before it enters in the blockchain. In essence, only the verified blocks are allowed to enter in the blockchain network system. The autonomous is another important features that blockchain and IoT framework [15]. It implies that all the nodes included in the infrastructure are free to communicate with any of the nodes in the network system without the need for the centralized system [30]. Lastly, the scalability is important feature in the blockchain and IoT device, which plays an important role in communication within a highly available distributed and intelligent network connecting with destination devices to exchange information in real-time [31].

Problem statement & Research Gap & Research Contribution

Several research studies have focused on the integration of the blockchain technology with IoT devices [16.] Many of these research studies have focused in specific areas such as health [17], finance [18] and agriculture [19] among others. Although there have been successful integration of blockchain with IoT, the adoption of this new technology has faced various challenges that compromises its effective operation in the market [29]. As a result, there is a need for the current research studies to address these challenges and identify the opportunity for improvements. The current research study attempts to identify the challenges and opportunities to come up with the best architecture that can help improve their accuracy and accountability.

Research MODEL & Hypotheses

The research model considers in the study is analytical approach. In the analytical research approach various architecture used to integrate the IoT and the blockchain technology are analyzed based on different factors that include the scalability [28], accuracy, trust and efficiency. In addition, it will also assesses and analyze the challenges and opportunities that impact on the IoT technology. This proves vital in developing an appropriate model that can improve the accuracy of transactions in blockchain.

Methodology & Research Design

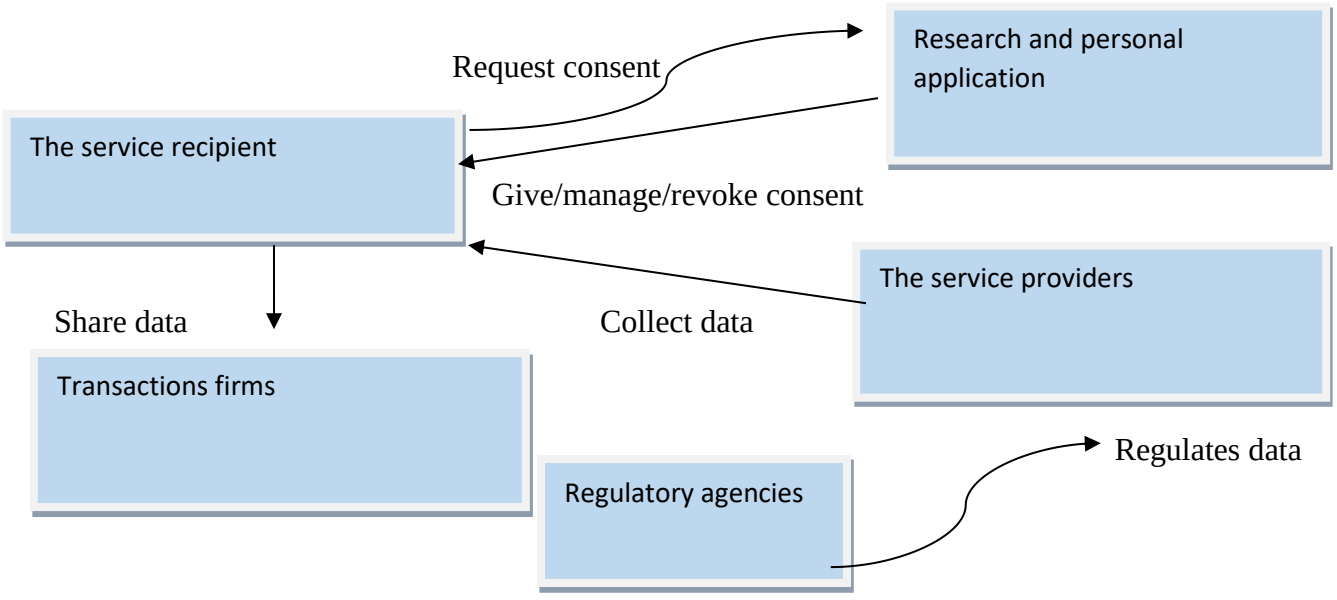
The research study to adopt IoT in blockchain considered the exploratory research design. It investigates different versions of integrating IoT in blockchain companies. It starts by assessing the literature review on IoT so as to identify the challenges and opportunities as indicated in [42]. The study uses the challenges and opportunities to develop a new model that can help improve the effectiveness of integrating IoT Ain blockchain. The primary focus of the study willto improves the effectiveness and efficiency of the IoT.

The main method used in the study design is mapping of trust issues. [20] Identified the general methodology used to identify trust of relations among parties connected through an integrated blockchain and Internet of Things devices [26]. The approach mainly involves various sequential steps relevant to this research study [27]. The sequential procedure followed to accomplish this research study is as shown below.

1. Identification of the participants involved and the relations between them. If the identified relations fail to meet the required standard or level of trust that is necessary to accomplish the desired objectives of the relationship, then it noted and marked s a trust issue.
2. Designing the minimal and standard blockchain internet system that can help solve and address the trust issue
3. Migrate all the other existing features in the system to the newly developed blockchain network.

The current research study followed this methodology used to model the consent management process for certain data and information contained in the network system.

Figure 1: Conceptual Model



Population & Sample & Unit of Analysis

The population and sample unit of analysis was considered integral conducting the research study. The research identified ten firms that use integrated blockchain technology and IoT of things. The ten firms were assessed on various issues that include the opportunities and challenges they face. It identified the challenges that this firms face in the adoption of IoT platforms for the various block chain companies [25]. The measure used in the study is to determine the efficiency of the proposed approach in improving the rate of transactions in blockchain companies. The efficiency in this case is determined as a percentage of the security, trust and number of transactions and denominated as following.

Where security of transactions = s

Trust of the transactions = t

Number of transactions = n

Efficiency of transaction = s + t + n

The model also assumed that the three measurements have the same relative weight of 100 % in determining efficiency. Thus the sum of the three variables forms the average weight. In essence, the selected participants were required to show the rate of trust and efficiency for the new models, which was eventually converted to the relative weight.

Analyzing Data

The equation= s + n + t was used in the analysis of the data. Once the proposed model for the integrated blockchain and IoT is in place, it was subjected to a series of test to determining its accuracy in addressing the challenge faced by the previous block chain model.

The first test calculated the trust of transaction, which was mainly aimed at its ability of improving the customers trust in proposed blockchain model [24]. This was achieved by seeking the perception of the various users regarding its ability to meet their expectation. Since it was conducted online, it was easy to get the perception of the customer on time and analyzed the data.

The customer trust = (number of successful transaction (Yt) + Number of failed transaction (ft)) divide by number of total transactions (tt)

Trust of transactions (t) = (yt + ft)/tt

Security of transactions (S) = number of threats detected (td) – number of threats solved (ts) divide by total number of threats identified

S= (td – ts)/td

Number of transactions (n) = Days transaction (dt)/average daily transaction (adt)

N = 9dt/adt)

Discussion of the Results

The result of the research study was based on the three main measures which include the frequency of the transactions, trust of transactions, the security of transactions. The three measures were combined to determine the accuracy of the transaction as a percentage using the formula discussed in the analysis section.

Table 1: Comparison of the Models

Number	Model	Accuracy
1	Decentralized architecture	87 %
2	System architecture	82 %
3	General framework architecture	79 %
4	Centralized architecture	81 %

From the table, it is noted that the different architecture of integrated blockchain and IoT yields to different accuracy. It shows that the decentralized architecture has 87 % accuracy, system architecture has 82 %, General Framework architecture has 79 %, and centralized architecture has 81 %.

From the result, there is no model that is 100 percent. This is an indication that there is a need for future improvements to come up with appropriate algorithm that can help address the issue [22]. The result also demonstrates that each of the techniques used by company to integrate IoT with blockchain chain faces unique challenges and opportunities that they should attempt to address [23]. The challenges that are unique to each of the architectures are regarded as the main factor that contributes to the differences in the levels of accuracy [21]. As a result, it is appropriate that research studies on IoT and blockchain focus in addressing the loophole s that might compromise the functionality of blockchain and IoT devices and systems as suggested in [41].

The research also compared the proposed model with other model that has been in use by other firms. The comparison of the proposed model with the other models can help determine its appropriateness for use to improve the accuracy of the IoT and blockchain functionality [40]. The proposed model for this research study is the decentralized architecture, which is compared to the system architecture as shown in the table below.

Table 2: Comparison of the Proposed Model with another model

Number	Model	Accuracy

1	Decentralized architecture(proposed)	87 %
2	System architecture	82 %

Conclusion & Recommendations

The finding of the research study demonstrates that IoT plays a critical role in connecting various system and devices across different sectors in the economy. With the emergence of blockchain technology as one of the disruptive innovation, it is becoming important to improve it accuracy as the number of people using the blockchain as a means of transactions continue to rise. The increase in the number of transactions through a blockchain platform exposes it to certain challenges that can compromise its performance. The proposed model, decentralized architecture can help improve the accuracy of the blockchain online network as compared to the other alternatives. It recorded the highest level of accuracy at 87 %. Given that there is model that guarantees 100 % accuracy, it is recommended that future research studies should emphasize on improving the reliability of these standards models to ensure that there is trust and accountability between the parties involved in the transactions. Also, the future research study should focus on increasing the sample size to collect adequate data and information for analysis.

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DOES INFORMATION TECHNOLOGY COMPETENCIES AND FLEET MANAGEMENT PRACTICES LEAD TO EFFECTIVE SERVICE DELIVERY? EMPIRICAL EVIDENCE FROM E- COMMERCE INDUSTRY

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Abstract

Competency Model requires knowledge, skills, and abilities needed for fleet and distribution management for ecommerce industry to maintain successful movement of materials between parties within their supply chain to achieve high levels of reliability and cost-efficiency. This research aims to investigate the relationship and impact of information technology competencies and fleet management practices to achieve effective service delivery. A quantitative approach used to examine the model validation. The methodology of this research follow the descriptive correlational design. A real data records used to collect empirical from e-Commerce industry. Results of analysis proved the relationship and impact of information technology competencies and fleet management practices to achieve effective service delivery, as a result of analyzing the data the hypotheses. Some recommendations regarding information technology competencies and its dimensions should be enhanced, also, incorporating the latest innovations to facilitate fleet management.

Keywords: Information Technology, Fleet Management, IT Competencies, e Service Delivery

1. INTRODUCTION

Effective service delivery is at the center of logistics as it reflects the physical movement of materials between points in a supply chain environment. High customer expectations and lesser tolerance for inadequate performance creates a competitive environment for operating a highly effective Market place, which eventually forces organizations to achieve high levels of customer experience and cost-efficiency. (Giaglis et al., 2007). In order to achieve that we have an underlying dependency on the fleet management practices which is basically the function that oversees, coordinates and facilitates various touchpoints within the supply chain right from the period when customer apply for the order till it reaches his delivery location (the last mile journey). (Joerss, M et al.,2016). Effective fleet management practices aim at reducing and minimizing overall costs through maximum, cost effective utilization of resources and better customer satisfaction results. Some of the capabilities that are important to be noted are: customer service, asset management and accurate and timely data reporting

For this paper, we have taken the online e-commerce website "Boutiqaat.uae" which is an online makeup showroom offering a mix of beauty and fashion items from over 700 international brands, exclusive local brands, where consumers can find personal suggestions from the most famous celebrities in the Middle East and shop their choices on-the-way. "Boutiqaat" (2019). After a successful inception and initial success, Boutiqaat is experiencing increased Customer Complaints, about their orders not delivered on time, returns are increasing, which affects the cost, Sales & Reputation of the organization. In this research we will look at how precisely the influence the independent variables will be having over the dependent variables, as this will help us to iron out the root cause of why it is happening and what can be done by the organization to improve the situation. (Kommi, 2019).

2. THEORETICAL FRAMEWORK

2.1 Information Technology Competencies

The IT Competency Model identifies the knowledge, skills, and abilities needed for workers to perform successfully in the field of information technology (IT). (Employment and Training Administration, 2012)

Personal Effectiveness Competencies

Show skills to collaborate with people from different backgrounds. Displaying recognized habits in culture and life and maintain a positive attitude on the job. Also, showing a desire to work and revealing the ability to adjust to recent, different or altering requirements. demonstrating responsible attitude at work and showing a desire to learn and apply new skills and expertise. (Employment and Training Administration, 2012)

Academic Competencies

Interpreting written paragraphs in job-related documents and collecting information using standard English, then composing written reports. Often, use mathematics to convey ideas and solve problems, applying logic, reasoning, and evaluating to resolve issues. In addition, pay full attention to what someone says, and communicate very well in English to be understood by everyone. (Employment and Training Administration, 2012)

Workplace Competencies

Awareness of the basics of business, patterns and economics. Working with others in partnership to complete job assignments and create innovative solutions. In addition, organizing and prioritizing assignments to efficiently control the time and execute assigned tasks. Moreover, the application of logical thinking skills to solve problems through the development, assessment and implementation of solutions. (Employment and Training Administration, 2012)

Technical Competencies

Using technology to monitor and safeguard data collection, management, configuration, preparation and distribution. The processes, hardware, and software used to improve communication among individuals, computer systems, and devices. The method of writing, checking, troubleshooting, and managing an organization's computer program source code. (Employment and Training Administration, 2012)

2.2 Fleet Management

Fleet management's problems are shifting beyond cost-effectiveness toward superior customer satisfaction, versatility and sensitivity to requirements that differ at an unimaginable time scale even a decade ago. Classical fleet management approaches have struggled extensively with cost efficiency concerns over the past 40 years by creating routing plans in a wide variety of practical problems. (Giaglis et al., 2007)

Scheduling &Tracking

However, the use of an initial schedule, although it is not appropriate to resolve incidents that are likely to occur during the implementation of the schedule and have a substantial effect on the performance of the program. Typical examples are customer orders that arrive in real time and should be served by vehicles already on route as well as disturbances due to traffic delays, Breakdowns. The ability to deal with these cases in a satisfactory manner is essential for the profitability of logistics and transport related operations. (Giaglis et al., 2007)

Operation Management & Route Optimization

In taking advantage of recent developments in satellite and mobile networking technology,

the crucial problems of complex fleet management can be tackled in realistic systems. In particular, satellite location recognition systems using the Global Positioning System (GPS) and mobile terrestrial communication networks, such as Terrestrial Trunked Radio (TETRA). Allow fleet operators to track plan implementation and manage operations in real time, thereby enhancing fleet performance. (Olson)

2.3 Efficient Service Delivery

Good distribution management is the backbone for ecommerce companies to succeed, and those with a successful solution in place are the ones who are likely to prosper.

Customer Retention

Loyalty to customers is important for all forms of companies, whether you are selling clothing, furniture or TVs. keeping the customers you have worked so hard to acquire is crucial to long-term growth. (Payne & Frow, 2015)

Improve Business Reputation

Organizations with a reliable and timely delivery process are the ones who would have a number of favorable feedbacks on the website and are likely to be recommended to family and friends. (Payne & Frow, 2015)

Increase Efficiency

Getting a clear and organized distribution plan in place helps improve the company's productivity and reduce the time you spend handling packages. (Payne & Frow, 2015)

Customer Satisfaction

Many people want to purchase products from ecommerce companies because of the ease provided by the online shopping. Customers are not required to leave their home to purchase items, rather they can remain indoors, purchase it from the comfort of their own sitting room and have it shipped in few days, sometimes even sooner, to their front doors. Moreover, if problems occur and online shopping becomes tougher than visiting the high street, customers do not hesitate to purchase their items from another store. (Payne & Frow, 2015)

2.4. Operational Definitions

2.4.1 Information Technology Competencies

Knowledge of IT (fundamental principles, frameworks, platforms, tools, and technologies), IT (hardware, applications, and services), extensive use of IT in other fields, and specific positions of IT professionals. (Employment and Training Administration, 2012)

Personal Effectiveness Competencies

Set of skills to collaborate with people from different backgrounds and show a willingness to work. Displaying responsible attitude at work and showing a desire to learn and apply new skills and expertise. (Employment and Training Administration, 2012)

Academic Competencies

Understand the details of written documents and write reports using correct language that are easily understandable. Using suitable mathematical equations, methods and apply basic scientific concepts to work-related issues. (Employment and Training Administration, 2012)

Workplace Competencies

Establish constructive relationships with staff and define team goals. Find new ways to coordinate work area or organizing tasks more efficiently and effectively to achieve tasks. (Employment and Training Administration, 2012)

Technical Competencies

The employee's abilities to perform tasks in a specific industry like integration of system and software components. (Employment and Training Administration, 2012)

Technology has a major effect on industrial processes, from physical elements to information and interconnection networks, contributing to extensive industry digitalization. Logistics is actively engaged in the digital transformation that is revolutionizing globalization and transforming the supply chain with creative technologies that facilitate the change to a modern business model that is more effective and sustained. This development evolves into new programs that guarantee production customized to the type of business and customer, with a view to reducing stocks and storage in pursuit of more effective management according to demand, optimizing transport routes and to improve coordination between all involved teams.

2.4.2 Fleet Management

The physical movement of materials between points in a supply chain to achieve high levels of reliability and cost-efficiency. A qualified fleet manager has to ensure that there is no interference between different activities on the fleet. (Gitahi & Ogollah, 2014)

Scheduling &Tracking

Scheduling is to identify which vehicle is to be allocated to new facilities as well as the new route for the chosen vehicle. In addition, tracking is knowing the vehicle status and location and aid with the implementation of new emergency calling plans for vehicle assignments. (Giaglis et al., 2007)

Operation Management & Route Optimization

Route optimization is an algorithm that runs for the duration of a time period on the current static problem to accommodate as many customers as possible while reducing running costs and allowing dispatchers to direct emergency vehicles to emergency calls. In addition, operation management is the ability to generate a collection of routes that are slack enough to satisfy the immediate demands while the routes are being performed. Also, Determine the number and types of vehicles needed and operate the vehicles at different locations. (Giaglis et al., 2007)

Companies are always aiming for a better way to transfer their products to distribution outlets or consumer delivery points from any manufacturing hubs.

Successful fleet management allows you to maximize customer satisfaction with improved last mile delivery experience, and on-time delivery to your customers. Reduce overhead costs and improve delivery efficiency with automated package sorting and integrated route planning system to increase e-commerce supply chain optimization. Electronic proof of delivery (EPOD) for consumer burden reduction and process digitization. (Locus, 2020)

2.4.3 Effective service delivery

Effective Service delivery refers to the actual delivery of a service and products to the customer or clients. It is therefore concerned with "where, when, and how" a service product is delivered to the customer. The Effective service concept defines the "how" and the "what" of service design, and helps mediate between customer needs and an organization's strategic intent. (Martins & Ledimo, 2015)

Due to competition in the business, Organizations are forced to find new innovations method which in turn open the organizations to adopt new ideas through the latest technologies, resources, skills & Systems. In other words, Effective service delivery means the overall process of developing new and efficient service offerings to the customers. (Martins & Ledimo, 2015)

Customer Retention

When developing the relationship with a client, there is greater shared understanding and cooperation, creating efficiencies that reduce the operating costs. Pleased consumers are more likely to refer to others, because the cost of attracting these new customers is significantly reduced, which facilitates profit generation. (Payne & Frow, 2015)

Business Reputation

Information on the overall brand image and the valuation of the brand which creates an exceptional asset in terms of their customers 'lifetime value. The attitudes of customers towards the brand thus have a major effect on the company. (Payne & Frow, 2015)

Efficiency

Efficiency is minimizing the cost of materials and optimizing the use of resources while maintaining the necessary level of service. Eventually, an increase in efficiency generates a dramatic and positive effect on profitability to improve its competitiveness. (Begashaw & Temesgen, 2018)

Customer Satisfaction

Customer satisfaction is a measure of how an enterprise's goods and services meet or surpass consumer standards that decide whether the partnership is continuing or not. When consumers are more happy and secure in their partnership with a supplier, they are more likely to give a greater share of their business or wallet to the supplier. (Payne & Frow, 2015)

According to the latest statistics from the United Nations Conference on Trade and Development (UNCTAD, 2020), if there is one thing that is crucial to the fate of the logistics business, it is the growth of e-commerce, an industry whose global revenues grew 13% in the year of 2017 reaching a turnover of around 29 billion dollars. “The illuminating data show the sustained growth of E-commerce and the existence of a supply for digital consumption that it is increasingly varied and innovative, where logistics functions as an enabler and catalyst,” stated García. (Technology Transforms Industrial Mobility, 2019)

E-commerce disruption has forced the logistics industry to reinvent itself, introducing fast resupply solutions, tools that require high productivity in warehouse operating processes, transport management systems (TMS), etc. Along these lines, García appears to believe that the industry's biggest logistical challenge is urban freight delivery (UFD), as the increase in online demand is combined with new, more stringent mobility regulations for the most polluting vehicles in big cities. The quest for creative technological solutions is therefore essential to adapting to this changing environment and to maintaining efficient service is an "asset for business development." (Technology Transforms Industrial Mobility, 2019)

2.4.4 e-Commerce Companies

Ecommerce refers to commercial transactions conducted online which means we can buy and sell commodities or Services using the Internet. There are various types of E-Commerce: B2B (Business to Business), B2C (Business to Consumer), C2C (Consumer to Consumer), C2B (Consumer to Business), B2A (Business to Administration), C2A (Consumer to Administration). E-Commerce are used extensively in Business transactions such as mobile commerce, electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange (EDI), inventory management systems, and automated data collection systems. (Qin, 2009). In 2017, e-commerce deals in Kuwait come to an assess of US$ 670 million and e-commerce entrance was 53%. In spite of the fact there can be a tremendous retail showcase, it is still behind in terms of e-commerce. Mall culture is still predominant and there's a common need of believe in online shopping as a entire. The tall rate of smartphone entrance within the nation—240%—is one of the most reasons for e-commerce development in Kuwait. The versatile administrators in Kuwait offer one of the foremost progressed portable systems within the Center East and 100% of arrive range and population is secured by versatile organize. In show disdain toward of that, e-commerce remains predominately restricted to online managing an account and budgetary brokerage administrations, as most Kuwaiti companies don't conduct online B2B and B2C exchanges. Paying bills online is the foremost common action and in 2017, 53% of e-commerce clients in Kuwait made cash exchanges over the Web. Indeed, although 97% of Kuwaitis utilize credit and charge cards, many of the consumers prefer to pay through cash over other payment means. (Commerce in Kuwait)

Boutiqaat – An E-Commerce Business Giant in Gulf

Boutiqaat is an online makeup showroom offering a mix of beauty and fashion items from over 700 international brands, exclusive local brands, where consumers can find personal suggestions from the most famous celebrities in the Middle East and shop their choices on-the-way. (Boutiqaat, 2019). Designed by a young Kuwaiti entrepreneur in 2015, Boutiqaat distinguishes itself from its peer e-commerce sites by adding a social element: it features Gulf and Arab celebrities and social media influencers who recommend goods, enabling customers to shop directly from the virtual shops of these influencers within Boutiqaat. (Boutiqaat, 2019)

3. LITERATURE REVIEW

In order to analyze the importance of the application of information systems to the management of the fleet used by the Kuwait based E- Commerce company , this study presents a theoretical view on Technology impact on Services offered , Technology impact on Fleet Management and Monitoring systems by which the customer satisfaction was increased.

In today's world, every single thing that happens in human life is made easier, thanks to technology, from ordering groceries or furniture in a single click right from your living room to travelling between two continents for a nice meal! An important point in the supply chain is how logistics services are managed, whether made through internal management or even by logistics service providers. Whether one or the other managerial model is adopted, transportation management stands out, not only because of the operating cost it represents, but also because it directly affects the level of service intended to maintain with suppliers and customers. In this line of digital evolution, Information and Communication Technology (ICT) has introduced several tools that help in the management of transportation, such as routing systems, freight and fleet management, cargo and vehicle tracking. The existing systems were too basic for Operations, Call Center and the business itself to understand the underlying issues that were affecting the customers

despite of the business growing at multiple folds. The business believed that most of the customers were getting served within the promised time but as complaints grew the business had to do a Root Cause Analysis (RCA) which suggested the lack of system help. (Vivaldini et al., 2012)

The logistics management system (LMS) helped the fleet management with proper utilization of the fleet and ensuring maximum capacity. The customers are also informed via trackable links where they could not only track their orders but also set an expectation as to when the orders will be delivered to them. (Vivaldini et al., 2012)

Technology continues to remain one of the most important aspects in supply chain organization. It acts as a driving force and helps in fulfilling orders efficiently and speedily. Organizations that manage fleets or a mobile sales force as well as field service organizations are facing many challenges. These challenges include improving compliance and organizational communications, reducing costs, and improving customer satisfaction. As a result, fleet management systems are perceived in terms of how they are able to benefit companies by realizing efficiency and profitability. (Begashaw & Temesgen, 2018)

In the knowledge-based economy of today, the rapidly changing and uncertain environment means that transport firms are facing their biggest challenge in how to address the current situation and capture a competitive advantage. Customers had no information as to when the driver would be there to deliver their orders. This not only lead the drivers to come back with high number of orders as reschedule but giving the customers time to change their mind to cancel their orders. With the help of the system the customer could manage his/her expectations and also reschedule their delivery time which helps the fleet management to plan their deliveries accordingly. (Begashaw & Temesgen, 2018)

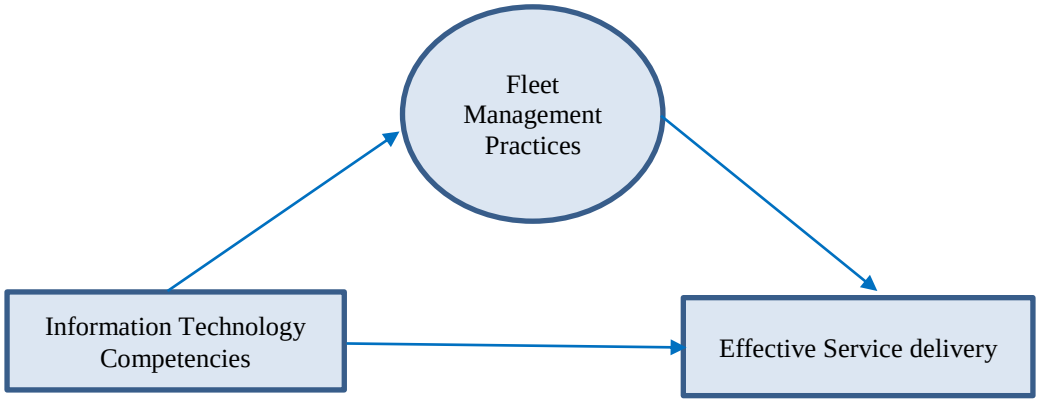
Transportation continues to be a key element as it represents the physical movement of materials between different points in a supply chain. Higher expectations and lower tolerance from consumers force the supply chain organizations to maximize reliability and cost efficiency. The drivers had a challenge with the route planning and had to do it manually. This lead not only lead to drivers delaying the orders but also with commitments to the customers. The orders were getting

delayed and, in many cases, this led to cancellation and returns. The increasing competence in the market is an important factor that drives the adoption of new technologies and innovation, as companies tend to search for new opportunities to cut costs by improving process efficiency or by developing new products. It also prevents any sort of thefts, which gives a peace of mind to both suppliers and consumers. (Gitahi & Ogollah, 2014) (Wilson et al., 2015)

3.1 Research Problem Statement

We have collected the data about the ecommerce website directly through the company and one of the main reasons is that we are going to understand whether the deliveries of the order are happening to the consumers/customers within the expected period or not. We found the following obstacles in organization of supply chain management and are working as soon as possible to fix these challenges and streamline our operations. Such as customer complaints are increasing, delivery behind schedule, returns are increasing, decreasing costs, non-availability of real-time tracking of shipment, capacity of vehicle to maximize order deliveries in a single shot, very poor performance in last mile delivery, inefficient delivery provider, sales & reputation is at stake. These challenges were taken as motivation and made us realize that faster responses to these challenges could maximize our sales and rake up profits. From the other hand, revenues are impacted by 20% in the past 6 months and should this continue in next 12 months then company will have to raise the capital. Inventory hold is high. Loss of customers & Reputational loss is major impact.

3.2 Research Model



3.3 Research Hypothesis

H_{O1}: Information Technology Competencies and Fleet Management Practices have no impact to Received Orders on Effective e-Delivery Lead-time at e-Commerce Industry.

H_{O2}: Information Technology Competencies and Fleet Management Practices have no impact to Invoiced Orders on Effective e-Delivery Lead-time at e-Commerce Industry.

H_{O3}: Information Technology Competencies and Fleet Management Practices have no impact to Shipped Orders on Effective e-Delivery Lead-time at e-Commerce Industry.

3.4 Research Methodology

Descriptive research methodology was followed. An empirical method of data was applied. The data is collected from Boutiqaat – an E-Commerce Company for Ladies apparels, Cosmetics & Perfumes. We are using Regression analysis for this study, which helps us to examine and analyze the relationship between the dependent variable and one or more independent variables. Reason for selecting the independent variables. Received Orders – Customers Placed the orders in the online portal however yet to be reconfirm by the Call center agents. Invoiced – Orders are forwarded to the warehouse for picking the item, Passed QC test, packed in order and ready for shipping after generating the Invoice. Shipped – This Stage is called Last Mile delivery (LMD) where the Orders are picked up by the shipping company along with the Invoice in order to deliver at the customer premises

3.5 Population and Sample

The research collected the empirical data from the Kuwait E-Commerce Industry. In 2020, e-commerce deals in Kuwait come to an assess of US$ 670 million and e-commerce entrance was

53%. In spite of the fact there can be a tremendous retail showcase, it is still behind in terms of e-commerce. Mall culture is still predominant and there's a common need of believe in online shopping as an entire. The tall rate of smartphone entrance within the nation —240% —is one of the most reasons for e-commerce development in Kuwait. The versatile administrators in Kuwait offer one of the foremost progressed portable systems within the Center East and 100% of arrive range and population is secured by versatile organize. In show disdain toward of that, e-commerce remains predominately restricted to online managing an account and budgetary brokerage administrations, as most Kuwaiti companies don't conduct online B2B and B2C exchanges. Paying bills online is the foremost common action and in 2017, 53% of e-commerce clients in Kuwait made cash exchanges over the Web. Indeed, although 97% of Kuwaitis utilize credit and charge cards, many of the consumers prefer to pay through cash over other payment means. (Commerce in Kuwait)

The sample was taken from a leading ecommerce company based out of Kuwait serving the GCC market. The sample is taken for a single country in which they operate (Kuwait) where they do the last mile delivery themselves as well as have other third-party delivery and shipping partners working with them. Which is known as “Boutiqaat –An e-Commerce Business Giant in Kuwait”

A total of 28,569 orders were taken as sample set which constitute to around 10% of the total orders from the operating country. This sample set was further used for RCA and to move the average closer to the target promised to the customer. (Kommi, 2019)

Received to Confirmed – From the total number of orders placed in a day by customers, how many orders have the Call Center team able to confirm with the customers over a call since 80% of the orders are COD and may require some details that are missing.

Confirmed to Invoiced – The process in warehouse where warehouse would take for picking, QC and Invoicing.

Confirmed to Shipped – The time taken by the Logistics team to ship out an order since the time of confirmation received from the customer.

The commitment to the customer within Kuwait was Same Day delivery and Next Day Delivery. The impact on revenue due to the complaints received from the customers were increasing and hence an RCA had to be done on the ASIS process.

The target respondents are

1-the Call Center (Total Orders – Numbers Vs Time taken),

2-the Warehouse (Total Orders – Numbers Vs Time Taken for processing), and

3-the Logistics (Total Orders – Numbers Vs Time Taken)

4. DATA ANALYSIS AND DISCUSSION OF RESULTS

The shown data were collected from (Boutiqaat – E-Commerce Company) from 01-Aug 2020 to 11-Aug 2020 as a sample data.

Days	Received Orders	Invoiced	Shipped	< 12 hours
01-Aug	2621	1139	1131	193
02-Aug	3008	1084	1081	180
03-Aug	1301	852	846	142
04-Aug	2946	1813	1803	303
05-Aug	3821	1720	1712	93
06-Aug	3128	1716	1708	154
07-Aug	2912	3193	3163	280
08-Aug	2991	1586	1487	61
09-Aug	2934	1365	1256	64
10-Aug	1420	1221	968	28
11-Aug	1487	872	288	17
Total	28569	16561	15443	1515

4.1 Impact of (Received Orders) on (delivery Time)

Regression Statistics								
Multiple R	0.35138467							
R Square	0.12347118							
Adjusted R Square	0.02607909							
Standard Error	94.9761715							
Observations	11							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	11435.92345	11435.9235	1.26777424	0.289311946			
Residual	9	81184.25836	9020.47315					
Total	10	92620.18182						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	30.7396128	99.24085778	0.30974755	0.76380476	-193.7588044	255.23803	-193.7588	255.23803
Received Orders	0.04119317	0.036585104	1.12595481	0.28931195	-0.041568081	0.12395443	-0.0415681	0.12395443

The regression analysis was done on (time) and (Received Orders) to observe the performance of the model and get the important information to build up the model equation. Based on the results, we infer the following

$$time = (30.739) + (0.04119)\ Received\ Orders + U,\ \ R^2 = 0.12$$

t-test : (0.31) (1.13)

P-value: (0.76) (0.29)

Independent variable	Calculated P-value	Action	Cause & Effect
Received Orders	0.29	Do-not Reject Null Hypothesis	Insignificant

The intercept coefficient is 30.7 is the starting point of the model. The hypothesis for regression is

Null Hypothesis: More Than 50% of Orders are delivered in 12 Hours

Alternate: Actual Delivery Happens More Than 12 Hours

The t-test value for (Received Orders) is 1.13 and the probability value is 0.29, this value is higher than the level of significance value of 5%, therefore we do not reject the Null Hypothesis, and this has insignificant impact on (time).

The coefficient of determination (R^2) is equal to 0.12 which shows that the model is not suitable and 12% of the variations in (time) is explained by (Received Orders).

4.2 Impact of (Invoiced Orders) on (Delivery Time)

Regression Statistics								
Multiple R	0.5716336							
R Square	0.32676497							
Adjusted R Square	0.25196108							
Standard Error	11.8931644							
Observations	11							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	617.8828545	617.882854	4.36828836	0.066178502			
Residual	9	1273.026236	141.44736					
Total	10	1890.909091						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.00160427	9.36843554	0.00017124	0.9998671	-21.19126929	21.1944778	-21.191269	21.1944778
Invoiced	0.01201512	0.005748736	2.09004506	0.0661785	-0.000989427	0.02501966	-0.0009894	0.02501966

The regression analysis was done on (time) and (Invoiced) to observe the performance of the model and get the important information to build up the model equation. Based on the results, we infer the following

$$time = (0.0016) + (0.0120)\ Invoiced + U,\ \ R^2 = 0.33$$

t-test : (0.0001) (2.09)

P-value: (0.9998) (0.066)

Independent variable	Calculated P-value	Action	Cause & Effect
Invoiced	0.066	Do-not Reject Null Hypothesis	Insignificant

The intercept coefficient is 0.0016 is the model starting point. The hypothesis for regression is

Null Hypothesis: Manage the Capacity Planning and Fulfillment Achieve at 100%

Alternate: Capacity Planning is Not 100%

The t-test value for (Invoiced) is 2.09 and the probability value is 0.066, this value is higher than the level of significance value of 5%, therefore we do not reject the Null Hypothesis, and this has insignificant impact on (time).

The coefficient of determination (R^2) is equal to 0.33 which shows that the model is not suitable and 33% of the variations in (time) is explained by (Invoiced).

4.3 Impact of (Shipped) on (Time)

Regression Statistics								
Multiple R	0.65548913							
R Square	0.429666							
Adjusted R Square	0.36629556							
Standard Error	76.6118926							
Observations	11							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	39795.74301	39795.743	6.78022702	0.028555609			
Residual	9	52824.43881	5869.38209					
Total	10	92620.18182						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	17.1525194	51.74742673	0.33146613	0.74788032	-99.90829264	134.213331	-99.908293	134.213331
Shipped	0.08588501	0.032983389	2.60388691	0.02855561	0.011271405	0.16049862	0.01127141	0.16049862

The regression analysis was done on (time) and (Shipped) to observe the performance of the model and get the important information to build up the model equation. Based on the results, we infer the following

$$time = (17.153) + (0.0858)\, Shipped + U,\ \ R^2 = 0.42$$

t-test : (0.33) (2.60)

P-value: (0.75) (0.029)

Independent variable	Calculated P-value	Action	Cause & Effect
Shipped	0.029	Reject-Null Hypothesis	Significant

The intercept coefficient is 17.1 is the starting point of the model. The hypothesis for regression is

Null Hypothesis: Ontime Delivery and Effective Services

Alternate: Negative Customer Experience and Loss of Customers, High returns, Loss of opportunity

The t-test value for (Shipped) is 2.60 and the probability value is 0.029, this value is less than the level of significance value of 5%, therefore we reject the Null Hypothesis because (Shipped) has a significant impact on (Time). This means one unit increase in (Shipped) will increase the (time) by 0.0858

The coefficient of determination (R^2) is equal to 0.42 which shows that the model is fairly suitable and 42% of the variations in (time) is explained by (Shipped).

11.4 Impact of (Received Orders) & (Shipped) on (Time)

Regression Statistics								
Multiple R	0.65689458							
R Square	0.43151049							
Adjusted R Square	0.28938811							
Standard Error	81.1276785							
Observations	11							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	2	39966.58009	19983.29	3.03618965	0.104445521			
Residual	8	52653.60173	6581.70022					
Total	10	92620.18182						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	27.5756824	84.78414987	0.32524573	0.75333821	-167.9369178	223.088283	-167.93692	223.088283
Received Orders	-0.0062302	0.038670599	-0.1611098	0.87600116	-0.095404773	0.08294435	-0.0954048	0.08294435
Shipped	0.08998646	0.043220556	2.08202929	0.0708912	-0.009680317	0.18965324	-0.0096803	0.18965324

The regression analysis was done on (time) and both (Received Orders) & (Shipped) to observe the performance of the model and get the important information to build up the model equation. Based on the results, we infer the following

$$time = (27.575) - (0.0062)\ Received\ Orders + (0.0899)\ Shipped + U,\ \ R^2 = 0.44$$

t-test :	(0.33)	(-0.16)	(2.08)
P-value:	(0.75)	(0.88)	(0.07)

Independent variable	Calculated P-value	Action	Cause & Effect
Received Orders	0.88	Do-not Reject Null Hypothesis	Insignificant
Shipped	0.07	Do-not Reject Null Hypothesis	Insignificant

The intercept coefficient is 27.5 is the starting point of the model. The hypothesis for regression is

Null Hypothesis: Customer Expectations are Poor

Alternate: Customer Experiences are Good

The t-test value for (Received Orders) is -0.16 and the probability value is 0.88, this value is higher than the level of significance value of 5%, therefore we do not reject the Null Hypothesis, and this has insignificant impact on (time).

The t-test value for (Shipped) is 2.08 and the probability value is 0.07, this value is higher than the level of significance value of 5%, therefore we do not reject the Null Hypothesis, and this has insignificant impact on (time).

The coefficient of determination (R^2) is equal to 0.44 which shows that the model is fairly suitable and 44% of the variations in (time) is explained by (Received Orders) & (Shipped).

5. CONCLUSION AND RECOMMENDATIONS

The introduction of new technological measure can improve supply chain agility, make it efficient and probably even reduce operating costs! It tries to integrate new technology with the help of existing technology and processes and can be a key element in increasing customer service, reducing operation costs and make the business model streamlined and more efficient. With the help of LMS the customers were now well informed as to when their orders will be at their doorstep. The fleet management could set the right expectations with the customers and also that the customers would plan their deliveries for a different time if they had inconvenience with their current schedule. This was a win-win situation for both the fleet and the customers. This reduced the total number of cancellations. For returning/replacing an item, the customers could schedule through a link and the information would be send to the fleet management.

The cause of increasing Customer Complaints in Boutiqaat is verified statistically through regression analysis. The examination shows that the lack of effective services and delayed deliveries is generating customer dissatisfaction and a substantial number of returns. As a result, a huge potential of losing both customers and opportunities. Moreover, by analyzing all three variables, which are Information Technology Competencies, Fleet Management Practices, and Effective Service Delivery, that include all hypotheses linked to customer expectations were proven as proposed.

Some recommendations could be useful in this regard, information technology competencies and its dimensions should be enhanced, also, incorporating the latest innovations to facilitate fleet

management. Moreover, strategic customer management plan should be developed. These recommendations should be taken seriously to improve the sales and maintain the organization's reputation in the Middle East.

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THE BEST PRACTICE OF TEACH COMPUTER SCIENCE STUDENTS TO USE PAPER PROTOTYPING

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Abstract

The importance of understanding the repercussions of effective user interface (UI) design is critical for future Computer Science (CS) professionals, given the ubiquity of interfaces on computer devices. Through a paper prototyping activity, this article explains how to teach rapidly and successfully CS students about "fit," a Human-Computer Interaction (HCI) concept. Despite its simplicity, the concept of "fit" can be difficult to grasp without much practice. In practice, designing "fit" into UIs can be prohibitively expensive because workable prototypes are generally beyond the technical capabilities of students. As a result, we illustrate how to use paper prototyping to demonstrate "fit" in a hands-on class exercise based on active learning concepts. To guide students through the process of "fit" in UI design, we provide extensive step-by-step directions for planning, setting up, and presenting the exercise. Students will be better equipped to apply both theoretical and practical applications of "fit" in UI design and execution as a result of this assignment; this exercise can be used in any course that covers user interface design, such as concepts of human-computer interaction, systems analysis and design, software engineering, and project management.

Keywords: Paper Prototyping, Best Practice, Computer Science, Students To Use of Teach.

INTRODUCTION

Given the prevalence of computing devices in practically every part of our lives, how people interact with these devices is vital to all computing fields. In fact, failing to account for interface usability can result in a variety of issues ranging from minor annoyances to outright disasters. Common computing interfaces, such as Windows, Apple devices (particularly Apple Watch and Apple Maps), Smart TVs, and social media, have been noted as having poor usability (Ahmad, Al-Sa'di, & Beggs, 2020; Al-Sa'di, 2018; Burton, 2016; Pogue, 2016). Poor design, apart from small annoyances, can have devastating repercussions. For example, in 1988, the US Navy shot down an Iranian civilian jet owing to a poor visual display (Pogue, 2016); while in 2003, Space Shuttle Columbia burned up upon re-entry, partly due to a poorly designed PowerPoint presentation (Park, 2015).

The study of "how humans engage with technology for a variety of reasons" is known as Human-Computer Interaction (HCI) (Zhang and Li, 2005, p. 228). The core phenomenon of interaction is the user interface (UI), which integrates human objectives with computing resources. The practical goal of HCI is to "provide high usability for users of computer-based systems" (Hartson, 1998, p. 103). In connection to a goal or desired outcome, usability is defined as the amount of satisfaction, efficiency, and effectiveness that an information system (or its components) provides to a user (Al-Sa'di, 2018; International Organization for Standardization, 1998). To build and assess "better, more effective" technologies (Cooper et al., 2014, p. XXIII) that minimise dissatisfaction (or even disaster) and encourage well-being, it is critical to understand how people's talents and limits affect interface usability. While people who work in the field of information systems (IS) should know better, given the prevalence of badly designed interfaces, all computer professionals might benefit from learning more HCI ideas.

Chan, Wolfe, and Fang (2002) emphasise the importance of teaching HCI and usability-related issues in IS, claiming that graduates must have a complete grasp of these topics. Working alongside developers to build efficient and effective systems, for example, CS students must grasp how crucial UI design is, as well as how to choose and appraise current tools to "fit" and facilitate operations. As a result, students should learn basic HCI concepts through training that allows them to practise "methods and skills to grasp present users, experience non-use, and imagine future users" (Faiola, 2007). (Churchill, Bowser, and Preece, 2016, p. 70). Practical

training in UI design and assessment, on the other hand, is frequently overlooked. HCI, for example, is solely an option in the 2010 CS Model Curriculum (Janicki, Cummings, and Healy, 2015).

The empathic element of systems design and implementation is perhaps not one of the more notable aspects of the CS curriculum, with a significant focus on technical features of technology and other essential business-oriented topics such as project management (Al-Sa'di & Parry, 2017). The interaction between designers and users may be mentioned in passing during the requirements engineering and validation phases of the systems development life cycle, but HCI concepts like UI design are unlikely to be stressed to, let alone practised by, students (Al-Sa'di, Parry, & Carter, 2014). As a result, we are concerned that many CS students have a poor understanding of basic usability concepts, and that professors have little opportunity to teach them.

A mandatory 100 or 200-level HCI course would be beneficial in an ideal CS degree programme; however, we acknowledge that this is not always possible (especially in light of the Model Curriculum).

To that end, we present a problem-based scenario activity in which students create and test paper-based UI prototypes. The activity includes aspects of both designs (requiring reflection on HCI concepts) and implementation (through role-play that highlights how users employ these designs) in which students create and test UI prototypes (Al-Sa'di, Parry, & Carter, 2018).

Students were expected to perform the exercise during an HCI class without the use of outside materials such as textbooks or digital sources in our implementation. We imposed these limitations in order to encourage consistency and creativity, as students could only use their own knowledge and ideas. While these circumstances fitted our learning aims for the specific class (mainly due to the notion of "fit" that we discuss later in this paper), we propose that other teachers modify this exercise as appropriate.

Given the limited resources and time restrictions that many teachers experience, our activity may be utilised at any point in the CS curriculum, from Introduction to MIS to Advanced Systems Analysis and Design — everywhere students need to learn and apply usability concepts. Students do not need any prior technical abilities, such as coding or wire-framing, to

put up this project because the resources are readily available (e.g., paper and pens). As a result, the activity is widely available, and the materials are very affordable when compared to the hardware and software resources required to create a working digital prototype. This activity can be simply customised for any CS course and may be used to get K-12 children excited in computing. We describe how it was used in an introductory HCI course to underscore the significance of usability in this article.

BACKGROUND CONCEPTS

This activity is based on the Constructionist pedagogical theory. This approach, according to Papert (1991, p. 2), "boils down to asking that everything be understood by being made." The core premise is that when students create artefacts, they apply theory, concepts, and ideas in a way that is meaningful to them, making them active participants in their own learning. In other words, they construct to comprehend.

Rather of acting as a "sage on the stage," the instructor becomes a facilitator who consults, clarifies, encourages, and supports students in need through this pedagogical perspective. We provide background knowledge on paper prototyping, the concept of "fit," and a few suggested prerequisite concepts to prepare students to maximise their learning from this activity, given the shortage of HCI training in CS curriculum, and for those instructors who wish to brush up on this subject.

Paper Prototyping

Most CS professors are aware with the notion of prototypes, but they may be less so with how to put them into practise in the classroom. A prototype may be thought of as a hypothesis in the form of a rough design for a problem, which is then put to the test by how consumers interact with it (Pernice, 2016). Prototypes may be used in software development to get user feedback while also saving money since "it's 100 times cheaper to make a change before any code has been written than it is to wait until after the implementation is complete" (Nielsen, 2003, para 6).

During the 1980s, IBM promoted paper prototyping, often known as low-fidelity prototyping (Rettig, 1994) or trash prototyping (Vijayan and Raju, 2011). It is "creating prototypes on paper

and testing them with real users" in its most basic form (Rettig, 1994, p. 1). Despite their crude appearance, research has shown that the feedback they enable is of nearly equal quality and quantity to that provided by computer-based prototypes (Alkhaldi & Al-Sa'di, 2018; Sefelin, Tscheligi, and Giller, 2003). Figure 1 shows an example of a paper prototype made by one of our students as a point of reference.

Figure 1: Paper prototyping

In the classroom, paper prototyping helps students to show their comprehension of fundamental topics by creating and evaluating fast, disposable user interfaces. This technique may be used to teach excellent design ideas like usability and "fit," as well as to assess understanding of these topics (lkhaldi & Al-Sa'di, 2016). When students use paper prototyping, they create an interface, test it rapidly, and then remark on what worked and what didn't. Furthermore, using paper prototyping at various times in a lesson allows you to track students' understanding and progress throughout the semester.

Key Concepts in Human-Computer Interaction

In the field of human-computer interaction, usability is frequently characterised in terms of affordances and restrictions. Affordances are "design features of an object that imply how it should be utilised; a visual indication to its purpose and use" (Chamberlain, 2010, p.169; quoting Norman (1988)). and constraints are the "limitations of the activities that may be performed based on the appearance of the object" (Norman, 1988). For example, a keyhole's affordance is that the opening begs something to be entered; nevertheless, its limitation is that its tiny size and narrow breadth limit the range of what may be placed (Chandran, Al-Sa'di, & Ahmad, 2020). A text field on a user interface, for example, encourages the user to enter character data (affordance), although its size and meta-properties might limit input possibilities

to specific types and lengths of characters, such as a 4-digit pin number (constraint). In order to grasp "fit," students must first have a basic concept of affordances and restrictions.

Te'eni, Carey, and Zhang (2005) describe "fit" as a core notion in usability that is defined based on three distinct but connected dimensions: physical fit, cognitive fit, and affective fit. The input/output mechanics of technology in relation to human physiology are addressed by physical fit. This idea is like ergonomics and, to a lesser extent, accessibility. Physical fitness, in theory, should reduce physical effort while increasing output (Te'eni, Carey, and Zhang, 2005). Users may execute tasks successfully and efficiently when the UI and its feedback mechanisms are congruent with their past experiences, skill sets, and mental models. "The issue representation and the task both stress the same sort of information," in other words (Vessey and Galletta, 1991, p. 67). Finally, affective fit evaluates how functional (an item that a user interacts with) or non-functional (non-interactable features such as colour, typeface, etc.) UI design attributes might impact positive affect, negative affect, or another desirable emotional state (Avital and Te'eni, 2009). The purposeful design of affordances and limitations is sometimes (but not always) used to show these three sorts of "fit."

Paper prototyping, as a Constructionist exercise, allows students to experience establishing affordances and restrictions before experimenting with the many aspects of "fit." We embedded our activity's difficulty into a framework that would inspire learners to reflect, particularly on users' prospective physical, cognitive, and emotive states, to reinforce this link between the activity and the three components of "fit."

PAPER PROTOTYPING ACTIVITY

For two study semesters, we repeated this practise twice every semester (the justification for which is explained in the next section). Each execution of the exercise is designated Exercise Iteration 1 (EI1) and Exercise Iteration 2 (EI2), and each semester is designated Term 1 (T1) and Term 2 (T2) (T2). Because each iteration resulted in a paper prototype, each student received two prototypes every semester. Prototype Version 1 (PV1) and Prototype Version 2 (PV2) are the terms we use to describe these prototypes (PV2).

We began each iteration by showing a brief video of a testing session to introduce (or reintroduce) students to paper prototyping. In the video, one person interacts with the prototype

(as a user) while another manipulates bits of paper (as a computer) (Sarsam, Al-Samarraie, & Al-Sadi, 2020; Yun, 2007). The students were then given the task of designing a device interface utilising paper-based, hands-on materials. They were told there would be no grades, but they would be required to participate. The following rules were developed based on Snyder's (2001) guidelines:

• After the prototypes were completed, students were to form pairs.

• While in the "computer" role, a student presented his or her prototype to the "user"

• The "user" could click/tap on paper objects with his or her fingers while the "computer" manipulated the prototype accordingly to simulate interface behaviour

• The "user" could simulate inputting character text however they wanted (pretending to type, speaking/voice, selecting an option)

• The "computer" was not permitted to talk or make gestures indicating how to utilise the prototype; their job was limited to simulating or facilitating operation.

Students were then shown a PowerPoint slide (Figure 2) with instructions to design an urgent care check-in kiosk.

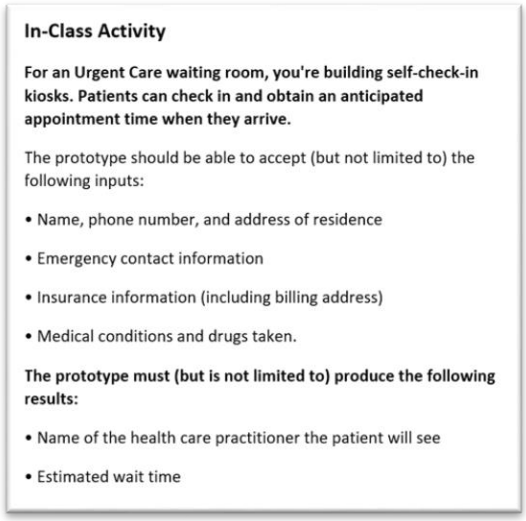

Figure 2:In-class Activity

We found the following materials to be sufficient for our needs, however amounts may vary depending on class size: Sticky notes and/or labels, index cards (x100), no. 2 pencils with erasers (plus extra erasers), coloured pencils, scotch tape, glue sticks, paper clips, binder clips, and scissors. 11x17" cardstock paper, 8.5x11" printer paper, 3x5" notepad paper, sticky notes and/or labels, index cards (x100), no. 2 pencils with erasers (plus extra erasers), coloured pencils, scotch

Although students were not informed which materials to use to prevent accidentally influencing their designs, instructors should be aware of several typical practises. Due of its sturdiness, card stock was frequently used to portray major "screens." Sticky notes were useful for huge buttons or dialogue boxes, and scissors were useful for changing the sizes and forms of screen elements. Colored pencils helped distinguish things on the "screen" by highlighting them.

Students spent roughly 55 minutes working on their prototypes throughout the course hours in which our activities were done, during which time the teacher mediated and observed how the activity played out, helping and encouraging students as required. After that, students alternated playing the roles of computer and user with numerous peers. Each couple tested their prototypes for around five minutes before forming fresh pairings to test them again. During EI1 of T1, role-playing was restricted to the remaining class time, limiting students' ability to interact with a diverse group of peers. Prototype testing was relocated to the following class session in T2, providing for 40 to 45 minutes of testing time. The updated activity's timeframe

is summarised in Table 1. Our schedule is based on two 75-minute classes, but it may easily be changed to three 50-minute sessions.

Table 1: Lesson Schedule of Paper Prototyping Activity

Activity Steps	Approximate Duration
Class Period #1	
Step 1: Introduction Play a sample video, explain the issue, and give students time to gather materials and equipment (scissors, pencils, tape, etc.)	5-10 minutes
Step 2: Construct Prototype Students construct prototypes on their own with limited assistance from the teacher.	55-60 minutes
Step 3: Construction Wrap-Up Students finish prototypes and return toolsand unused materials	5-10 minutes
Class Period #2	
Step 4: Computer/User Roleplay Students team up with different classmates several times to play "user" (testing a peer's prototype by simulating how they would interact with a digital version of the design) and "computer" (manipulating their own prototypes based on the "user's" interaction to simulate how it would behave as a digital artefact).	40-45 minutes
Step 5: Class-Wide Discussion The instructor leads reflective discussionabout the activity	30 minutes

Students were taken through a 30-minute face-to-face conversation after role-playing to reflect on and communicate what they learned, as well as to appreciate the importance of their experience. We did not provide students access to their PV1 before or throughout the construction of PV2 to verify that they were just using their current understandings of "fit." They were, however, permitted to go through both PV1 and PV2 following the role play portion of EI2 to make sure they were well-informed enough to talk about their paper prototyping experiences.

The questions we posed to foster this dialogue are listed below. Questions 1, 2, and 5 can be asked at any time during the exercise, whereas 3 and 4 should be asked after EI2.

1. What elements affected the design of your first prototype? To put it another way, why did you create your prototype the way you did? Students frequently cite prior experiences as (at least part of) the inspiration for their work. Instructors should question students about why such designs succeeded in prior UIs and whether or not they are still relevant for this challenge.

2. Did the "usability tests," whether on your prototype or on a peer's prototype, teach you anything useful? This emphasises the importance of feedback in UI design, as students uncover beneficial methods that their classmates employed that they hadn't considered.

3. Describe any changes you made to your redesigned prototype, as well as why you made them. This stresses how information, iterative design, and assessment may help to enhance and inform "fit." The instructor should now challenge them to explain what they modified to improve the "fit" of their design.

4. Do you have any ideas for a third prototype that you didn't think of in the prior iterations? This encourages students to think about and reflect on features and functions that they were unable to implement owing to time restrictions, material limits, or other constraints (s).

5. What did you learn from this activity, if anything? This is meant to let students take a step back and consider how much significance they discovered in prototyping, design, and assessment. This encourages debate on how designer goals do not always align with user expectations, emphasising the value of prototyping and testing.

EVIDENCE

We ran two iterations of the exercise (one at the beginning and one at the conclusion of the semester) to see how much students' application (and hence assumed comprehension) of "fit"-related concepts changed. Despite the fact that this is not a research study, we have proof that paper prototyping is successful. As a result, we provide our insights from both T1 and T2 in this section, as well as synthesise pertinent student comments from focus groups and course assessments.

Instructor Observations

As predicted, the majority of the work generated for EI1 in both terms did not reflect anything about the background of the problem. Although a few students evaluated potential physical restrictions, most students did not account for the user's probable physical, psychological, or emotional states at an urgent care clinic. Despite having an injury or condition that might limit movement, most PV1s required data to be entered via touch-based devices (such as a digital

keyboard) or a mouse. A standard keyboard and mouse Meanwhile, PV1 showed some indication of affordances as functional hints (typically considered a measure of cognitive "fit").

After learning about the many forms of "fit," design concepts, and evaluation methodologies, students participated in EI2 during the last week of class. In general, pupils in PV2 showed a greater knowledge of the problem's background. Multiple kids' work demonstrated an accelerated check-in procedure, which was a considerable improvement. Users might, for example, supply important information later or request quick, emergency assistance on some prototypes. By speeding up the check-in procedure, these choices should lessen physical exertion, cognitive strain, and/or anxiety.

Another typical innovation was rapid input to reduce physical effort, such as dialogue windows for selecting nation and state (rather than having to write them out) or using an external reader to swipe one's insurance card (which would automatically populate related fields). Furthermore, students in the EI1 discussion leant significantly on prior experiences to express what affected their ideas; in the EI2 discussion, they did so as well, but were considerably more likely to frame their comments within the three dimensions of "fit."

Focus Group and Course Survey

Following EI2 of T2, a 30-minute focus group was convened during class time without the presence of the teacher to obtain honest, frank input from students to gain insight into their experiences. This was conducted by a colleague outside of the author's department in the hopes that students would feel comfortable being themselves with her.

According to one student, after taking this course,

"Every time I use any kind of technology or interface and come across something that I don't believe works or looks good, I'm going to remember what we learned and what I might do to repair it or improve it for someone, whether it's a website, an operating system, or anything else. I'll always find minor things I don't like about it now that I know how to do things correctly. So, I believe that will be the case for quite some time."

"Which activities or tasks did you think were the most beneficial or important?" they were asked. a different student replied

“Prototyping, I believed, was the most informative, especially at the beginning, because it established the tone for the session and gave us a sense of what we'd be learning about. The prototyping at the end also provided us with a concrete representation of our development and what we learnt during the course.”

"Cognitive fit, affective fit, and bodily fit...," one student said when asked what they would remember about the course in five years. That is not something I believe can be easily forgotten. Because you think about those things, but now that we have the technical terminology for them and what to search for, we can really look for them."

Finally, during the first semester, students gave the course an average rating of 5.5 out of 6 (81.2 percent response rate; n=13) and 5.6 (82.4 percent response rate; n=14).

We use these end-of-semester course assessments as at least partial evidence of the exercise's utility and success. This conclusion is based on the fact that paper prototyping was the most popular exercise in class, and it was meant to incorporate all of the course's primary themes.

Although the three dimensions of "fit" were not introduced until after the EI1 (around the third week of class), the course's first few lessons focused on usability in general, with the goal of introducing basic concepts like affordance and constraint in order to establish a foundation of vocabulary for the subsequent lessons on "fit." The next 6-7 weeks were devoted to "fit," with the remaining weeks devoted to computer-assisted cooperative work, ethical design, and usability testing methodologies. The importance of "fit" was emphasised throughout these sessions.

Given that our prototyping exercise was designed to elicit designs that account for "fit," given that "fit" is a cornerstone of our HCI course and given that the exercise was used as bookends around the majority of our classes, we believe that the focus group and course evaluation results can provide complementary, albeit anecdotal, evidence to support the degree to which paper prototyping succeeded.

DISCUSSION

If you're thinking about using paper prototyping in your classroom, we have a few options that aren't included here. We begin by discussing other alternative courses in which paper prototyping may be used, followed by some basic recommendations for putting it into practise, and lastly, some extra student-oriented concerns.

Other Potential Subjects for Adaptation

Over the course of two semesters, we piloted this experiment in an Introduction to HCI elective course. Students in this class were Computer Science and/or Information Systems majors or minors. We feel that this exercise would be relatively productive in any course that touches on usability or interface design, based on the evidence of success mentioned in the preceding section and the authors' teaching skills. For example, when covering Design and Implementation as a phase in the Systems Development Life Cycle, this activity may be used in a Systems Analysis and Design course (SDLC). Prototypes, in particular, are mentioned as one design tool for assessing usability and making improvements after gathering and organising requirements in the Planning and Analysis phases (Sarsam et al., 2021; Valacich and George, 2017).

Students might be given functional and non-functional criteria and then asked to develop and test paper prototypes as part of an exercise. Not only may such an exercise help with practising and understanding usability ideas, but it could also lead to new insights on the need of clear and non-conflicting requirements documentation. Furthermore, it might emphasise that the SDLC is a unified process rather than a series of discrete phases.

A variant of this activity, for example, may be used in a Project Management (PM) course. Typical subjects in PM include SWOT analysis and feasibility evaluations, which are used to determine benefits and risks. Prototyping can be used to test the strengths and limitations of a software-based solution or as a rough draught to assess the technical (and financial) viability of building and deploying the system.

Furthermore, we feel that this exercise gives valuable knowledge that can be used throughout the whole IS curriculum, and that it might be utilised to teach HCI principles in a MIS 101

course. Students may understand that human-based interactions (such as collaborative connections, trust, and social capital (Skammelsen, Xiang, Aakarsh, & Kuppusamy, 2020; Kumar, van Dissel, and Bielli, 1998)) are typically crucial to IS design and implementation through role-playing computer and user. To put it another way, the activity might highlight the importance of contact between IT experts and end users.

Tips for instructor

Although we created and implemented our prototype exercise with the purpose of students working autonomously, we discovered that minimal teacher involvement benefited them. We propose that, while the instructor is supposed to be a facilitator, he or she does not have to be a mute observer, which is in line with Constructionism. During the creative process, students might be motivated by praise or gently critical support. Comments like "oh, you're not using coloured pencils?" or "what does this mean?" might pique students' interest or encourage them to relate the activity to course material.

In addition, the instructor's insights are useful in the discussion that follows the exercise. The teacher can find typical misconceptions or chances to discuss with the class by watching what students do during the exercise in both of the roles provided. If a crucial construct isn't seen as a design feature, for example, this might indicate that the build needs to be defined or enhanced in a following lesson or activity.

Finally, during testing times, the teacher should remind students (and correct conduct) if the rules for the roles of "computer" and "user" are not followed correctly. Because the "computer" depicts and manipulates their own design, it may be tempted to provide the "user" suggestions in the form of vocal explanations or non-verbal cues such as sighs, looks, or gestures. This is understandable since the student wants their prototype to succeed, and the functionality makes sense to them because they designed it from their own perspective.

We also didn't evaluate the activity since we wanted pupils to be as creative as possible and feel free to take risks rather than being constrained by a rubric's requirements. We believe that reminding the "computer" that this activity was not being graded helped to put them at ease and, as a result, they were less likely to provide the "user" hints.

Considering Different Contexts, Skillsets, and Tools

We asked students to construct their prototypes in class because we wanted to guarantee that (1) the materials they used were consistent, (2) they did not collaborate with others, and (3) their work was not impacted by looking for and borrowing from comparable interfaces. The final two aspects, we considered, were critical in ensuring that students' artefacts reflected their own thoughts and understandings. However, mandating in-class design work meant that students who were unable to attend those sessions missed out on the opportunity to create an artefact, and that students' work was confined (or even hurried) due to a lack of class time.

We want to allow students to create their prototypes from home in the future, despite fears that they may conspire or use unapproved resources for advice. We believe the potential advantages will exceed the drawbacks since students will have more time to dwell on the challenge and consider possible solutions, which will allow them to express their creativity and usability perspectives. We will offer explicit instructions, as with every assignment, to alleviate our anxieties as much as possible, recognising that any implementation will have its own set of perks and cons.

Each term we used the exercise, there were around 15 students, virtually all of them were Juniors and Seniors in CS or Computer Science majors, with 2 or 3 students in each class who were Sophomores or minors in the aforementioned disciplines. This group was mostly conversant with the foundations of computing technology and had no reservations about the physical needs of using paper-based materials.

However, we acknowledge that this exercise presupposes that kids are physically capable of handwriting, sketching, and paper-based craftwork. Students with physical restrictions or less comfort might design their UIs with digital tools (such as PowerPoint or wireframing software) and then produce a printout to bring to class, given our notion that prototyping could happen from home.

Regardless of the tools and limits used in this exercise, one of the primary goals of paper prototyping is to produce a valuable learning experience that is accessible to almost everyone. As a result, regardless of a priori technical abilities or expertise, we urge teachers to conduct the activity in whichever way allows them to reach the greatest possible spectrum of pupils.

Such "unplugged" activities have the potential to create democratised, meaningful opportunities for students in computing-oriented classrooms to gain knowledge across a spectrum of skill sets, expectations, and goals, regardless of major, colour, or gender.

CONCLUSION

We wrote about and remarked on our usage of a paper prototyping activity to teach the notion of "fit" in this article. While research has shown that paper prototypes can produce similar critical feedback in terms of quantity and quality to computer-based prototypes (Sefelin, Tscheligi, and Giller, 2003), there is little, if any, empirical work to guide CS instructors in using paper prototyping in the classroom to our knowledge.

We think that implementing and monitoring a paper prototyping activity across two terms of an HCI course is a realistic way for students to obtain hands-on experience applying ideas of "fit" to an artefact that can be shared and debated. Students may be more aware of the importance of people while building, deploying, and assessing information systems if they have a better grasp of "fit" and the practise of designing UIs based on that understanding. User concerns are crucial to successful and efficient interactions with hardware and software as computers becomes increasingly widespread in the industrialised world (Janicki, Cummings, and Healy, 2015)

As a result, CS curricula must continue to emphasise the importance of "fit" in successful UI design through instructional initiatives like the one described in this study.

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COVID-19 DETECTION FROM CBC USING MACHINE LEARNING TECHNIQUES

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ABSTRACT:

Covid-19 pandemic has seriously affected the mankind with colossal loss of life around the world. There is a critical requirement for timely and reliable detection of Corona virus patients to give better and early treatment to prevent the spread of the infection. With that being said, current researches have revealed some critical benefits of utilizing complete blood count tests for early detection of COVID-19 positive individuals. In this research we employed different machine learning algorithms using full blood count for the prediction of COVID-19. These algorithms include: "K Nearest Neighbor, Radial Basis Function, Naive Bayes, kStar, PART, Random Forest, Decision Tree, OneR, Support Vector Machine and Multi-Layer Perceptron". Further, "Accuracy, Recall, Precision, and F-Measure" are the performance evaluation measures that are utilized in this study.

Keywords—Machine Learning, Data Mining, COVID-19 Prediction, CBC Test

INTRODUCTION

In the last months of 2019, a new infectious disease, COVID-19, was reported, which quickly spread all over the world. This fatal disease is caused by the virus SARS-CoV-2. In order to contain this disease many efforts have been made everywhere for its initial screening as well as timely treatment. “Reverse Transcription Polymerase Chain Reaction (RT-PCR)” is a test that is developed for the diagnosis of covid-19 disease with DNA sequencing and identification [1, 2]. Despite its popularity, this test has some flaws. It is time consuming, costly, specific laboratory apparatus is needed and it has approximately false-negative rate of 20% [3]. Moreover, a shortage has always been observed of RT-PCR test kits worldwide. Just like RT-PCR, IgM/IgG antibodies tests have their own disadvantages with sensitivity and specificity being as low as 18.8% and 77.8% respectively in initial screening of COVID-19 [4]. Although CT scans and chest X-rays images based on Machine learning [5] have shown positive results, however these tests are not much useful due to high dosage of radiation. Recently some studies [6-11] have been conducted, which revealed that COVID-19 patients' blood features alter immensely so recognizing and working with these parameters can help in early detection of the virus. Machine learning is very resourceful in observing and separating different patterns in the attributes of blood examinations. The machine learning framework designed with blood examinations samples for covid-19 initial screening is speedy, easy to handle and cheap in comparison with high priced and slow tests. A model like this will have a huge influence in countries that cannot afford expensive tests like RT-PCR etc. and lack appropriate equipment and specialized laboratories.

RELATED WORK

Machine learning algorithms are being focused by the many researchers to recognize the hidden patterns as well as to mine the valuable information from raw data. Some of the research fields in which machine learning played a vital role, include: sentiment analysis [12-18], rainfall prediction [19-20], and network intrusion detection [21-22], software defect prediction [23-32], health and medical data mining [33-40]. Moreover, a lot of researchers have focused on the use of machine learning techniques to detect covid-19 patients by exploring the patterns in CBC test results, some of the related studies are discussed here. Researches in [41] developed a machine learning model

using the complete blood test samples. This model, named as ER-CoV, and used for early detection of covid-19 infected individuals. In the proposed technique, three algorithms are employed, including: "Support Vector Machine, SMOTE Boost and Ensemble". This model provided 70.25% sensitivity, 85.98% specificity and 86.78% AUC. For covid-19 detection a LASSO Logistic Regression Model was developed by [42] by using blood test results. The dataset was divided into a ratio of 80:20 and contained 110 samples. 15 important attributes were chosen by implying m RMR algorithm that were further reduced to 7. This framework showed 98% sensitivity and 91% specificity. Researchers in [43] employed the techniques including: "Decision Tree, Extremely Randomized Trees, K Nearest Neighbors, Logistic Regression, Naive Bayes, Random Forest and Support Vector Machine" for the prediction of covid-19 disease using blood samples. Random Forest algorithm was tuned to improve the results. These algorithms accomplished an accuracy of 82%–86% and a sensitivity of 92%–95%. Researchers in [44] developed a framework to diagnose covid-19 patients with the help of machine learning techniques using blood samples from emergency care unit. "Neural Networks, Gradient Boosting Trees, Random Forest, Logistic Regression and Support Vector Machine" were employed for detection of this virus. Support Vector Machine outperformed with 68% sensitivity, 85% specificity and 85% AUC. Researchers of [45] designed a machine learning based model using blood test results to detect covid-19. This framework employed following algorithms: Bayesian Networks, Random Forest, Support Vector Machines, Multilayer Perceptron and Naive Bayes. The dataset contained 5644 test samples which were acquired from Albert Einstein Hospital in Brazil. Class imbalance problem was resolved and feature selection was done. The model showed positive results with 96.8% sensitivity, 93.6% specificity and 95.159% accuracy. Researchers in [46] came up with four frameworks utilizing machine learning algorithms, including Artificial Neural Networks, Random Forest, and Lasso-elastic-net Regularized Generalized Linear Network and Linear Regression. These models were used to predict covid-19 infected patients on the basis of blood samples. These frameworks accomplished an AUC of 80–86%, sensitivity of 43–65%, specificity of 81–91% and accuracy of 81–87% with 14 chosen attributes.

MATERIALS And METHODS

The dataset used in this research was made available publicly by Kaggle. The full dataset contains record of 5644 patients collected from "Albert Einstein Israelita Hospital located in Sao Paulo, Brazil" [47]. We have taken only those records which have values in CBC parameters. These patient records were obtained from March 28, 2020 till April 3, 2020. The attributes that were chosen to work with in this study include: "red blood cells (RBC), lymphocytes, mean corpuscular hemoglobin concentration (MCHC), leukocytes, basophils, hematocrit, hemoglobin, platelets, mean platelet volume (MPV), mean corpuscular hemoglobin (MCH), eosinophils, mean corpuscular volume (MCV), monocytes and red blood cell distribution width (RBCDW)". Pre-processing activities including cleaning and normalization are performed before classification (Fig 1). The dataset chosen for this research has a dependent attribute which contains either the value of 'Y' or 'N'. 'Y' depicts that patient is covid-19 positive and 'N' shows that the patient is covid-19 negative. The dependent attribute is targeted attribute which we are going to predict/classify and independent attribute is the one which is utilized to predict the dependent attribute. The data was split into 70% training and 30% test data. For classification following algorithms are used: "K Nearest Neighbor, Radial Basis Function, Naive Bayes, kStar, PART, Random Forest, Decision tree, OneR, Support Vector Machine and Multi-Layer Perceptron". The tool used for this experimentation is Weka", which was developed at the University of Waikato, New Zealand for data mining tasks.

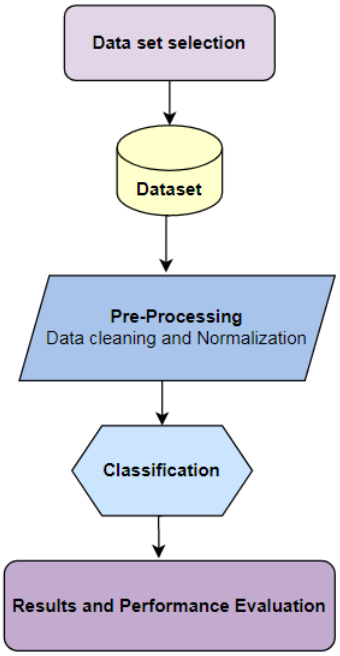

Fig: 1 Prediction of Covid-19 Patients using CBC Results

RESULTS AND DISCUSSIONS

In this section we will see how the selected machine learning algorithms performed in predicting the covid-19 disease. Accuracy evaluation is an important element and an ultimate goal of performance analysis [12-40], [48-50]. The used classification algorithms are analyzed by using the measures, such as: “precision, recall, f measure and accuracy”. All of these measures are extracted by the parameters of confusion matrix. The parameters reflected by the confusion matrix are discussed below [21-25]:

“True Positive (TP): Instances which are actually positive and also classified as positive”.

“False Positive (FP): Instances which are actually negative but classified as positive”.

"False Negative (FN): Instances which are actually positive but classified as negative".

"True Negative (TN): Instances which are actually negative and also classified as negative".

The calculation formulas of used performance measures are given below [21-28]:

$$Precision = \frac{TP}{(TP + FP)}$$

"Recall is defined as the ratio of True Positive (TP) instances with respect to the total number of instances that are actually positive" [21-28].

$$Recall = \frac{TP}{(TP + FN)}$$

"F-measure provides the average of Precision & Recall" [21-28].

$$F - measure = \frac{Precision \times Recall \times 2}{(Precision + Recall)}$$

"Accuracy reflects that how much the prediction is accurate" [21-28].

$$Accuracy = \frac{TP + TN}{(TP + TN + FP + FN)}$$

All these measures of performance are provided by Weka tool. The training results for each class Y and N are given in Table 1 and testing results for both the classes are provided in Table 2. In case of class imbalance problem, a question mark '?' symbol is displayed as these accuracy measures are sensitive to this issue. Highest accuracy achieved during training is 100 % by three algorithms KNN, kStar, and RF. In testing, the maximum accuracy achieved is 88% by OneR.

Table 1: Training Results

Classifier	Class	Precision	Recall	F-measure	Accuracy
NB	Y	0.447	0.667	0.535	84.2482
	N	0.943	0.870	0.905	
MLP	Y	0.960	0.842	0.897	97.3747
	N	0.976	0.994	0.985	
RBF	Y	0.500	0.018	0.034	86.3962
	N	0.866	0.997	0.927	
SVM	Y	?	0.000	?	86.3962
	N	0.864	1.000	0.927	
KNN	Y	1.000	1.000	1.000	100
	N	1.000	1.000	1.000	
kStar	Y	1.000	1.000	1.000	100
	N	1.000	1.000	1.000	
OneR	Y	0.630	0.298	0.405	88.0668
	N	0.898	0.972	0.934	
PART	Y	0.757	0.930	0.835	94.9881
	N	0.989	0.953	0.970	
DT	Y	0.959	0.825	0.887	97.136
	N	0.973	0.994	0.984	
RF	Y	1.000	1.000	1.000	100
	N	1.000	1.000	1.000	

Table 2: Testing Results

Classifier	Class	Precision	Recall	F-measure	Accuracy
NB	Y	0.410	0.667	0.508	82.6816
	N	0.943	0.852	0.895	
MLP	Y	0.444	0.333	0.381	85.4749
	N	0.901	0.935	0.918	
RBF	Y	0.000	0.000	0.000	82. 1229
	N	0.860	0.948	0.902	
SVM	Y	?	0.000	?	86. 5922
	N	0.866	1.000	0.928	
KNN	Y	0.261	0.250	0.255	80. 4469
	N	0.885	0.890	0.887	
kStar	Y	0.355	0.458	0.400	81. 5642
	N	0.912	0.871	0.891	
OneR	Y	0.636	0.292	0.400	88. 2682
	N	0.899	0.974	0.935	
PART	Y	0.375	0.625	0.469	81. 0056
	N	0.935	0.839	0.884	
DT	Y	0.444	0.500	0.471	84. 9162
	N	0.921	0.903	0.912	
RF	Y	0.538	0.292	0.378	87. 1508
	N	0.898	0.961	0.928	

CONCLUSION:

Initial screening of covid-19 disease is crucial for timely treatment and for preventing the disease from spreading. Blood test samples have proven to be effective for early diagnosis of this disease. In this study we used several machine learning techniques like “K Nearest Neighbor, Radial Basis Function, Naive Bayes, kStar, PART, Random Forest, Decision Tree, OneR, Support Vector Machine and Multi-Layer Perceptron” to predict covid-19 with the help of complete blood count test results. Measures which were used to evaluate the performance, include: “Accuracy, Recall, Precision, F-Measure and ROC”.

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TREATMENT RESPONSE PREDICTION IN HEPATITIS C PATIENTS USING MACHINE LEARNING TECHNIQUES

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ABSTRACT:

The proper prognosis of treatment response is crucial in any medical therapy to reduce the effects of the disease and of the medication as well. The mortality rate due to hepatitis c virus (HCV) is high in Pakistan as well as all over the world. During the treatment of any disease, prediction of treatment response against any particular medicine is difficult. This paper focuses on predicting the treatment response of a drug: "L-ornithine L-Aspartate (LOLA)" in hepatitis c patients. We have used various machine learning techniques for the prediction of treatment response, including: "K Nearest Neighbor, kStar, Naive Bayes, Random Forest, Radial Basis Function, PART, Decision Tree, OneR, Support Vector Machine and Multi-Layer Perceptron". Performance measures used to analyze the performance of used machine learning techniques include, "Accuracy, Recall, Precision, and F-Measure".

Keywords—Treatment Response Prediction, Hepatis C, Machine Learning, Medical Data Mining

INTRODUCTION

Hepatitis is a dangerous and transmissible disease [1-4]. The virus of this disease can spread from one infected person to another healthy human being. This disease has already infected almost 17 million people in all over the world and the numbers are getting increased day by day [2-6]. The virus of hepatitis c needs to be treated as early as possible to control and reduce the effects of the disease. A proper and complete medical therapy is needed in order to bring down the effects of this disease. However, not one medical therapy is good for all the patients. Same medicine may have different effects on different people due to other known or hidden medical reasons of the patients [5-10]. This paper explores the importance of machine learning techniques to predict the treatment response of a drug: "L-ornithine L-Aspartate (LOLA)" in hepatitis c patients. Various machine learning techniques are used in this study for the prediction of treatment response, including: "K Nearest Neighbor, kStar, Naive Bayes, Random Forest, Radial Basis Function, PART, Decision Tree, OneR, Support Vector Machine and Multi-Layer Perceptron". Performance of used machine learning techniques is analyzed and evaluated by various measures, including: "Accuracy, Recall, Precision, and F-Measure".

RELATED WORK

Many researchers have used machine learning and data mining techniques in order to predict the treatment response. Researchers in [11] has built a hybrid framework to examine the similarity of drugs response using advanced K-means clustering. Researchers in [12] predict the response of Clozapine; a drug used for the treatment of psychiatric disease. They used a machine learning approach to predict the response of drug. In [13], a machine learning supported framework built by the team of researchers on post-marketing dataset for predicting the Anti-PD-1 treatment response. In [2], treatment response prediction is performed using the Artificial Neural Network and Decision Tree. In [14], researchers used Decision Tree (DT) to predict the early diagnosis of hepatitis C in the diabetic patients using the routine laboratory tests. In [15], researchers used different machine learning techniques to predict the drugs toxicity and its side effects, these side effects weaken the quality of life, which needs to be addressed on priority bases. In [16], researchers presented a machine learning based prediction for HIV medication resistance with a set of mutant features. The proposed algorithm first identify the protein structure then classify it

based on sparse representation using Artificial Neural Network, Support Vector Machine and Regression. In [17], the researchers explored that the deep learning techniques played a vital role in cancer patients for identification the drugs response. The researchers critically examined the cancer cell in order to predict the drug response on them. Researchers in [18] uses Bayesian Network for predicting the esophageal disease which is an adverse effect, present in the disease of liver cirrhosis.

MATERIALS AND METHODS

This study explores the effectiveness of machine learning techniques in the prediction of treatment response in hepatitis c patients. Machine learning and data mining techniques have been widely and effectively used by many researchers in various domains and fields including: Sentiment/Polarity analysis [19-25], Rainfall/Weather Prediction [26-27], and Network Intrusion Detection/Network Security [28-29], Software Defect Prediction [30-38], Medical and Health data mining [39-47]. Machine learning techniques included in this study for the prediction of treatment response are: "K Nearest Neighbor, kStar, Naive Bayes, Random Forest, Radial Basis Function, PART, Decision Tree, OneR, Support Vector Machine and Multi-Layer Perceptron". The machine learning techniques are used on the patient's dataset collected from a hospital in city of Lahore, Pakistan. The dataset consists of various attributes regarding the medical information of the patient. The attribute which is predicted on the basis of medical information is the response, which consists of two categorical values: Respondent or Not Respondent. This attribute reflects that the particular patient is showing response against LOLA therapy or not. The used dataset is pre-processed before the classification. The pre-processing activities include: cleaning and normalization (Fig 1).

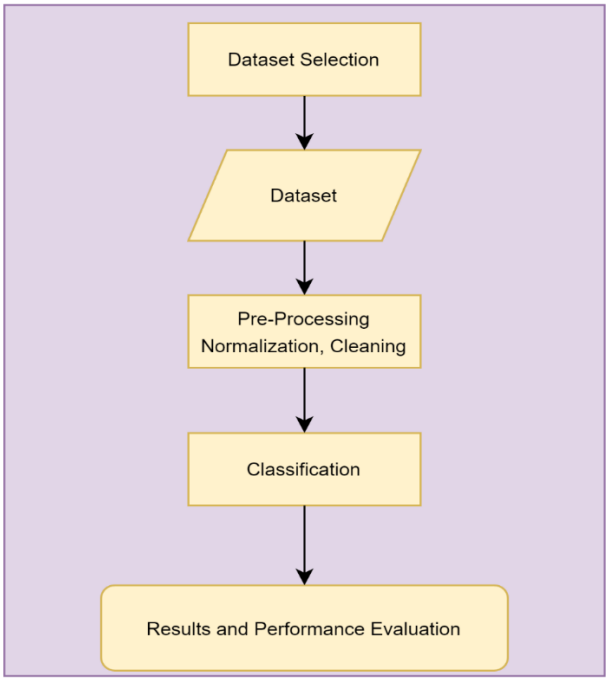

Fig 2 Treatment Response Prediction using Machine Learning Techniques

RESULTS AND DISCUSSIONS

Evaluating the performance of used machine learning techniques is a crucial stage where we have to compare the accuracy measures of used algorithms in order to select the best one for future use [48-50]. Performance of used machine learning techniques is analyzed and evaluated by various measures, such as: "Accuracy, Recall, Precision, and F-Measure". The parameters used in the formulas of performance measures came from the confusion matrix (Fig 2), which is the ultimate result of classification/prediction. The Parameters used in the confusion matrix are: TP, FN, TN and FP [30-38].

The formulas of the TP, FN, TN and FP has given below.

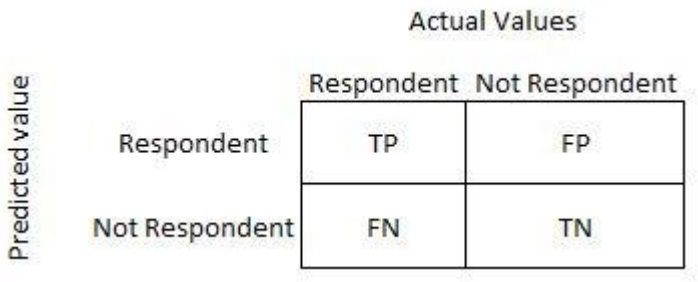

Fig 2 Confusion Matrix

$$Precision = \frac{TP}{(TP+FP)}$$

$$Recall = \frac{TP}{(TP+FN)}$$

$$F\text{-}Measures = \frac{Precisin*Recall*2}{(Precisin+Recall)}$$

$$Accuracy = \frac{TP+TN}{TP+TN+FP+FN} \quad (4)$$

The Weka tool is used to conduct the experiments. All of the used performance measures are provided by the WEKA tool. Table 1 reflects the results on training dataset with all of the used classification algorithms.

Table 1: Results with Training Dataset

Classifier	Class	Precision	Recall	F-Measure
NB	Respondent	0.893	0.895	0.894
	Not Respondent	0.622	0.618	0.62
MLP	Respondent	0.914	0.953	0.933
	Not Respondent	0.803	0.681	0.737
RBF	Respondent	0.878	0.922	0.9
	Not Respondent	0.661	0.542	0.595
SVM	Respondent	0.89	0.922	0.906
	Not Respondent	0.68	0.59	0.632
KNN	Respondent	0.963	0.901	0.931
	Not Respondent	0.712	0.875	0.785
K*	Respondent	0.924	0.944	0.934
	Not Respondent	0.782	0.722	0.751
OneR	Respondent	0.892	0.911	0.901
	Not Respondent	0.654	0.604	0.628
PART	Respondent	0.931	0.913	0.922
	Not Respondent	0.708	0.757	0.732
DT	Respondent	0.692	0.625	0.657
	Not Respondent	0.898	0.922	0.91
RF	Respondent	0.931	0.936	0.933
	Not Respondent	0.766	0.75	0.758

Table 2 shows the results on testing dataset. It can be seen that the accuracy measures are different

on both the datasets.

Table 2: Results with Testing Dataset

Classifier	Class	Precision	Recall	F-Measure
NB	Respondent	0.885	0.865	0.875
	Not Respondent	0.552	0.597	0.574
MLP	Respondent	0.873	0.865	0.869
	Not Respondent	0.531	0.548	0.54
RBF	Respondent	0.882	0.91	0.896
	Not Respondent	0.636	0.565	0.598
SVM	Respondent	0.873	0.932	0.902
	Not Respondent	0.681	0.516	0.587
KNN	Respondent	0.9	0.811	0.853
	Not Respondent	0.5	0.677	0.575
K*	Respondent	0.898	0.874	0.886
	Not Respondent	0.588	0.645	0.615
OneR	Respondent	0.888	0.932	0.91
	Not Respondent	0.706	0.581	0.637
PART	Respondent	0.9	0.851	0.875
	Not Respondent	0.554	0.661	0.603
DT	Respondent	0.889	0.937	0.912
	Not Respondent	0.72	0.581	0.643
RF	Respondent	0.895	0.883	0.889
	Not Respondent	0.6	0.629	0.614

Accuracy of the training dataset and testing dataset is reflected in Table 3. The accuracy in the training dataset is highest in KNN, K* and Random Forest. On the other hand, Decision Tree shows the highest accuracy in the test dataset.

Table 3: Accuracy Comparison

Classifier	Training Accuracy	Test Accuracy
NB	83.4598	80.6338
MLP	89.3778	79.5775
RBF	83.915	83.4507
SVM	84.9772	84.1549
KNN	89.5296 (Highest)	78.169
K*	89.5296 (Highest)	82.3944
OneR	84.3703	85.5634
PART	87.8604	80.9859
DT	85.736	85.9155 (Highest)
RF	89.5296 (Highest)	82.7465

CONCLUSION:

This paper presented a comparative analysis of various machine learning techniques on the prediction of treatment response in hepatitis c patients. The machine learning techniques used in this study include: “K Nearest Neighbor, kStar, Naive Bayes, Random Forest, Radial Basis Function, PART, Decision Tree, OneR, Support Vector Machine and Multi-Layer Perceptron”. The performance of these algorithms is measures by different evaluation measures such as “F-measures, Precision, Accuracy and Recall”. It is observed that in the accuracy measure, training data, KNN, K* and RF performed well where as in test data DT performed well.

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STUDENTS` PERSPECTIVES ON THE USE OF INNOVATIVE AND INTERACTIVE TEACHING METHODS AT THE UNIVERSITY OF NOUAKCHOTT AL AASRIYA, MAURITANIA: ENGLISH DEPARTMENT AS A CASE STUDY

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Abstract

This study was carried to inspect students` views on the use of innovative and interactive teaching methods used in the English studies major at the University of Nouakchott Al Aasriya, Mauritania. This was a corollary of the fact that innovation in teaching, regardless the nature of the course or subject, has become a buzz word in the academic institutions. A quantitative research methodology was used and the data were collected from 101 students from the English Department. The collected data were analyzed using SPSS as an attempt to provide descriptive statistics to verify the students` perception of the use of innovative and interactive teaching methods. The findings of the study revealed that 91.1% of the students believe that their teachers do use some of the innovative and interactive teaching methods in their classes; still, 70.3% of the respondents were in favor of continuous trainings for teachers on the use of innovative and interactive teaching methods, which is a very alarming percentage. Also, the findings of this study have some significant implications such as the necessity to move from teaching to learning as an attempt to make learning an enjoyable and memorable experience. The results of this study contribute to literature by concentrating on the use of innovative and interactive teaching methods in Mauritanian higher education institutes.

Keywords: Innovative, Interactive, Teaching Methods, Students, Higher Education, Mauritania

INTRODUCTION

Teaching and learning are two facets of a coin with untarnished affinity. This lustrous affinity makes it clear that the two terms are a mirror image of each other. Nowadays, the term innovation has recently become a synonym for the term learning. Therefore, it becomes vital for teaching effectiveness committees and educators across the globe to think about the most effective, innovative and interactive teaching methodologies that can boost students` learning and impact their performance.

Innovative and interactive teaching methods can be defined as strategies of learning used to improve students` learning and skills through different ways of engagements inside and outside the classroom. To put it crudely, innovative and interactive teaching methods are techniques/activities used to create a sort of interaction between students and the teacher and more importantly make the learning an enjoyable and memorable experience. This emanates from the fact that the new generation is no longer adaptive to the traditional teaching and learning methods due to many reasons. One of these reasons might be the disruption created by the digital age which may have changed class dynamics.

In 21st century, innovative and interactive teaching methods have been seen as very essential tools to move from teaching to learning. However, the fact that Mauritania is one of the developing countries with limited teaching facilities and resources makes it a bit difficult to implement most of the interactive and innovative teaching methods. This urges higher education committees to work on very clear strategic plans in which the efforts should be made in unraveling ways to expose university students to the current innovative and interactive teaching methods to improve their performances, rather than sticking to the old teaching methods which might somehow be obsolete. As a result, this latter calls for studies that test students` perception of the use of innovative and interactive teaching methods as an attempt to take teaching and learning to the next level. Significantly, the study is guided by following research questions:

1. Is it important to use innovative and interactive teaching methods in order to improve students` learning?

2. What types of innovative and interactive teaching methods do the faculty members use?
3. How many teachers use innovative and interactive teaching methods in their classes?
4. Do teachers struggle to make learning a memorable experience?
5. Do you think that teachers at the English department need to be trained on how to make learning a memorable experience through innovative and interactive teaching methods?

Literature Review

Numerous studies have dealt with the aforementioned topic due to its importance in to teaching and learning when it comes to enhancing students'` performance. Now, universities started emphasizing the significance of recruiting lecturers with innovative traits such as humility, courage, impartiality, open-mindedness, empathy, enthusiasm, judgement and imagination (Hare, 1993; cited in Wickramasinghe & Upeksha, 2016). It has been proved in many studies that distinguished teaching awards in most cases go to those innovative teachers (Lunde & Wilhite, 1996).

Of course, teachers differ in their teaching strategies. Therefore, they use different teaching methods depending on what type of courses, what type of students, number of the students and the equipment available in the classroom (Wickramasinghe & Upeksha, 2016). Though, there are many teaching strategies and methods; however, not all of them can guarantee an interactive and innovative teaching atmosphere. This includes student-centered-learning, learning by doing, gamification, think-pair-share, group discussion, learning stations, flipped classroom and role play. Additionally, the implementation and execution of these innovative and interactive teaching methods in classrooms will surely improve the quality of education and more importantly make learning an enjoyable experience for the students (Wickramasinghe & Upeksha, 2016).

Furthermore, it has been argued that education is a considerable instrument for social change and transformation; and innovative and interactive teaching methods are the only ways to boost the quality of education (Nicolaides, 2012) . As a result, it becomes almost mandatory for the academics to be innovative in the way they deliver their courses and impart new skills and prepare the students for the challenges of the 21st century (Bawuro, 2018) . Specifically, education is in a

critical situation that requires varieties of alternatives and solutions to surmount the challenges (Abu Yazid, 2016) ; and that will not be possible unless we take innovative teaching methods into consideration.

As Zhang Shuguo (2012) argued that education should be characterized by innovative ideas and teaching practices of innovation which are meant to change and reform the old teaching ways and models and establish a new innovation-oriented education in order to realize the objectives. Generally, the teaching strategy includes some practices and activities implemented by the faculty members to enhance students` learning. However, the teaching methods that the teacher is going to use should take into consideration the subject and nature of the course as well as the leaners. (Hashim et al., 2019)

Additionally, there are many factors that can impact the teaching methods that the faculty members used in their teaching. For example, class strength, the nature of teachers` contract, school location and the academic background and gender of the faculty member (Shinn, 1007). Still, some faculty members are very traditional in their teaching, following the conventional methods of teaching and learning. For instance, students come and take the course materials and memorize the necessary information which is an old-fashioned teaching methods (Azman et al., 2018).

Innovation and students` engagement are very much required in modern teaching not only as a way of following the pace of globalization, but rather to improve teaching and learning. For example, student-centred-learning method, gamification, group discussion, learning stations, role play, learning by doing have been proved to be very effective in teaching and learning. There is a growing evidence that student-centered approach is very effective and has a great impact on students' performance. Handelsman et al (2004), in their article entitled: *Scientific Teaching*, argued that "there is mounting evidence that supplementing or replacing lectures with active learning strategies and engaging students in discovery and scientific process improves learning and knowledge retention". (pp., 521-522)

In their research on student-centered-learning, researchers have tried to discuss and question the balance of power between student and the teacher as an attempt to decipher the best practices that

can improve students` learning (Bacon, 1983; Bell, 1993; Estes & Tomb, 1995; Priest & Gass, 1997; Vokey, 1987). Some have also argued that when instructors impose their opinions on their students, rather than providing an enjoyable experience, they are putting their students on the periphery in terms of learning. Brown (2002a, 2002b) argued that teacher usually imposed the teacher-centered behavior when he or she (a) assesses his or her students whether their answers are right or wrong, (b) when he/she frames the students` comments to be acceptable by stating what the students meant, (c) when he/ she gives the students the chance to talk, (d) when he/she instructs the students to talk to him/her rather giving the students the chance to talk to each other. Weimer (2002) in her *Learner-centered teaching: Five key changes to practice*, recommended that the faculty members should start sharing the power with the students, giving them the chance to choose some of the class activities and assignments that they prefer to do. This is one way to empower students and involve them in the learning process.

Another innovative and interactive teaching method which is used by most of the innovative teachers is gamification. Hamari et al. (2014) stated that "during the last couple of years, gamification has been a trending topic and a subject to much hype as a means of supporting user engagement and enhancing positive patterns in service use, such as increasing user activity, social interaction, or quality and productivity of actions. (p. 1) Furthermore, another teaching strategy that has been discussed and studied by many researchers is the *Think-Pair-Share* strategy. Researchers argued that think-pair-share is very effective when it comes to students` speaking skills. According to Lyman (1987), think-pair-share is a strategy designed to improve students' collaborative skills and share their ideas and thoughts with other students.

To analyze the significance of teaching strategies in students` retention, Uqwuanyi et al. (2020) argued that flipped classroom strategies is very effective when it comes to enhancing the achievement and retention of physics students: "it was recommended among others that state government in synergy with the school authorities should provide good flipped classroom facilities which will aid students' achievement and technological development to compete with the world at large" (Uqwuanyi et al., 2020). Additionally, there are many other learning strategies proposed by Milada Broukals such as scanning, skimming for details and making inferences and drawing conlusion that enhance students' autonomy and communication skills when it comes to English

learners (Eli, 2016). Thus, it becomes clear through the literature review that innovative and interactive teaching methods that this paper addresses are very important since the world is going through a considerable transformation at all the domains and education is one of them.

METHODOLOGY

In this research paper, a quantitative research design was used where data were collected as per the availability and convenience of the respondents. Closed-ended questions were distributed to the students via google form document which was the main instrument for the data collection along with 3 class representatives who were encouraging students to participate in the survey. Finally, 101 responses were collected. In the questionnaire, students were asked to read and give answers that best describe their opinions on the use of innovative and interactive teaching methods in courses taught at the English department. Students talked about innovation and their understanding of the overall idea of innovation in teaching, including what faculty members should do in order to improve teaching and learning. Then, data were examined using SPSS (Statistical Package for the Social Sciences).

DATA ANALYSIS

This part of the paper will try to expose the findings of the data obtained from the closed-ended questionnaire. The findings of this study are divided into two sections. Section one is mainly about the demographic of the participants and the second section is on the use of innovative and interactive teaching methods in Mauritanian higher institutes.

1. **The demographic of the study sample**

1.1 Students Gender

Respondents were asked to identify their gender. Table 1 shows that a total of 58 (57.4%) of the respondents were males, while 43 of them (42.6%) are female students.

Table 1: Respondents Gender

Student Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	58	57.4	57.4	57.4
Female	43	42.6	42.6	100.0
Total	101	100.0	100.0	

1.2 Students Age

Respondents were asked to indicate their category. Table 2 reveals that most of the respondents 83 (82.2%) belong the category (18-24) years old, and 18 respondents (17.8%) belong to the category (25-30) years old.

Table 2: Students Age

Students Age	Frequency	Percent	Valid Percent	Cumulative Percent
18-24 years	83	82.2	82.2	82.2
25-30 years	18	17.8	17.8	100.0
Total	101	100.0	100.0	

1.3 Level of the Study

Participants were asked to tick their level of study. Table 3 tells about the fact that 39 (38.6%) of the respondents are from the 1st year; 33 (32.7%) are from 2nd year; and 29 (28.9%) are from the 3rd year.

Table 3: Level of study

Level of Study	Frequency	Percent	Valid Percent	Cumulative Percent
1st Year (L1)	39	38.6	38.6	38.6
2nd Year (L2)	33	32.7	32.7	71.3
3rd Year (L3)	29	28.7	28.7	100.0
Total	101	100.0	100.0	

2. Research Questions: *Students` Perspectives on the Use of Innovative and Interactive Teaching Methods*

2.1 Research question One: Is it important to use innovative and interactive teaching methods in order to improve students` learning?

Students were asked to identify the best options that describe their views on the importance of innovative teaching methods in the classroom. Table 4 shows that 41 (40%) answered with strongly agree; 55 (50.5%) with agree; 5 (5.0%) were neutral; 2 (2.0%) with disagree; 2 (2.0%) with strongly disagree.

Table 4: Students` responses on the importance of the innovative and interactive methods.

Importance of IITM in classroom	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	2	2.0	2.0	2.0
Disagree	2	2.0	2.0	4.0
Neutral	5	5.0	5.0	8.9
Agree	51	50.5	50.5	59.4
Strongly Agree	41	40.6	40.6	100.0
Total	101	100.0	100.0	

2.2 Research question two: What types of innovative and interactive teaching methods do the faculty members use?

Respondents were asked to indicate the types of innovative and interactive teaching methods used by the faculty members. Table 5 reveals that 38 (37.6%) answered with group discussion; 32 (31.7%) with learning by doing; 12 (11.9%) with student-centered-learning; 4 (4.0%) with thin-pair-share; 3 (3.0%) with gamification; 2 (2.0%) with learning stations, flipped classroom and just usual learning; 6 (5.9%) answered with none.

Table 5: Types of innovative and interactive teaching methods used by the faculty members.

Types of IITM used by the teachers	Frequency	Percent	Valid Percent	Cumulative Percent
Student-Centered-Learning	12	11.9	11.9	11.9
Learning by Doing	32	31.7	31.7	43.6
Gamification	3	3.0	3.0	46.5
Think Pair Share	4	4.0	4.0	50.5
Group Discussion	38	37.6	37.6	88.1
Learning Stations	2	2.0	2.0	90.1
Flipped Classroom	2	2.0	2.0	92.1
Just Usual Learning	2	2.0	2.0	94.1
None	6	5.9	5.9	100.0
Total	101	100.0	100.0	

2.3 Research question three: How do you see the success of the use of interactive and innovative teaching methods used by your teachers?

Respondents were asked about the success of innovative and interactive methods used by the teachers. Table 6 indicates that 9 (8.9%) answered with excellent; 20 (19.8) with very good; 43 (42.6%) answered with good; and 11 (10.9%) with poor.

Table 6: Students' views on the success of innovative teaching methods.

Students` views on the success of IITM	Frequency	Percent	Valid Percent	Cumulative Percent
Excellent	9	8.9	8.9	8.9
Very Good	20	19.8	19.8	28.7
Good	43	42.6	42.6	71.3
Fair	11	10.9	10.9	82.2
Poor	18	17.8	17.8	100.0
Total	101	100.0	100.0	

2.4 Research question four: Do teachers struggle to make learning a memorable experience?

Participants were asked to choose the best options that describe their opinions. Table 7 shows that 50 (49.5%) answered with Yes; 40 (39.6%) with No and 11 (10.9%) with 'some of them.

Table 7: respondents` views on whether teachers struggle to make learning a memorable experience.

Students` views on teachers` effort to use IITM	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	50	49.5	49.5	49.5
No	40	39.6	39.6	89.1
Some of them	11	10.9	10.9	100.0
Total	101	100.0	100.0	

2.5 Research question Five: Do you think that teachers at English department need to be trained on how to make learning a memorable experience through innovative and interactive methods?

Students were asked to identify the best options that describe their views on whether training for teachers on how to use innovative and interactive teaching methods is needed. Table 8 indicates that 71 (70.3%) answered with Yes; 6 (5.9%) with No; and 24 (23.8%) with maybe.

Table 8: Students` views on whether teachers should be trained on the use of innovative and interactive teaching methods or not.

Students` views trainings needed	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	71	70.3	70.3	70.3
No	6	5.9	5.9	76.2
Maybe	24	23.8	23.8	100.0
Total	101	100.0	100.0	

DISCUSSION OF THE FINDINGS

Result in table 4 on students` responses regarding the importance of the innovative and interactive methods revealed positive responses in favor of the use of these innovative and interactive methods. The total number of the strongly agree/agree exceeds 91.1% of the total number of the respondents. Also, the use of the innovative and interactive teaching methods by the teachers is very promising, but the types of these methods used need a thorough analysis. For example, group discussion which is not the most innovative teaching method in comparison with student-centered-learning, flipped classroom and gamification, got the highest percentage as it can be seen in table 5. Furthermore, table 6 indicates that students have positive impressions on the innovative and interactive teaching methods used by the teachers.

Additionally, result in table 7 is very problematic since the total number of those who believe that the teachers strive to make learning an enjoyable experience is very close to who answered with No. This suggests that more efforts need to done by the faculty members to minimize this gap. Moreover, the fact that 10.9% of the respondents think that only some teachers struggle to make learning a memorable experience remains an issue of concern. Result in table 8 is very alarming since 70.3% of the students believe that teachers need to be trained on the use of innovative and interactive teaching methods in the classrooms.

CONCLUSION AND IMPLICATIONS

Innovative and interactive teaching methods are very essential in satisfying the needs of the new generation of students whose fascination with innovation, technology and new ways of life is immense. Based the survey conducted, it is clear that interactive and innovative teaching methods are vital in creating a better environment for students and make their learning an enjoyable experience. To conclude, the findings of this study suggest the following implications:

1. Emphasis should be on the current innovative and interactive teaching methods not on the traditional ones such as group discussion as stated by the students. It`s high time to move from teaching to learning;

2. The faculty members should select the most recent and suitable methods for their students;

3. Faculty members should involve the students in the selection of the class activities as a way of implementing the student-centered-learning;

4. The university/institutions should help the faculty members and give them the necessary tools to come up with creative ideas and implement them in the classrooms;

5. Professional skills development programs need to be initiated to enable knowledge sharing among the faculty members. Each can come with some propositions to improve teaching.

All in all, in a country like Mauritania a lot of efforts need to be done in terms of the implementation of innovative and interactive teaching methods. Additionally, the faculty members on the other hand, need to be aware of the needs and aspirations of the new generation. Also, the institution needs to provide the necessary materials to enable the faculty members to be creative and do the job in an innovative manner.

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